A SURVEY OF ANTIBIOTIC PRESCRIBING PATTERNS AND *IN-VITRO* ANTIBIOTIC SUSCEPTIBILITY PATTERNS AT THE UNIVERSITY TEACHING HOSPITAL, LUSAKA, ZAMBIA, 1998.

BY

CHILESHE LUKWESA

In partial fulfillment of the Masters degree in Public Health, at the University of Zambia, Lusaka, 1998.

DEDICATION

This work is affectionately dedicated to my beloved husband, Tennyson Musyani, who has given me all the encouragement and support, and to the Lukwesas - mum, dad, my brothers and sisters, who have been a great inspiration to me in my professional and personal growth.

And,

in memory of my late brother and sisters Mabula, Mukobe and Mwamba.

DECLARATION

No part of this work in this thesis has been submitted in support of another degree or qualification of this or any other University or Institution of learning.

SIGNED:.....19/4/99

APPROVED BY:.....Dr. K. S. Baboo

SUPERVISING LECTURER:

DR K.S. Baboo
(MBBS, Mmed, FRSH)
Senior Lecturer
Department of Community Medicine
University of Zambia.

STATEMENT

I hereby certify that this study is entirely the result of my own independent investigation. The VARIOUS sources to which I am indebted, are clearly indicated in the text and the References.

SIGN:.....

ACKNOWLEDGEMENTS

I gratefully acknowledge the vital assistance of:

- Dr K S Baboo, Supervisor - who was always available to correct, critisize and suggest.
- Dr J C L Mwansa, Medical Microbiologist - for all the contributions and suggestions.
- Mr E Mulwazi, Medical Laboratory Technologist - for being so dedicated in assisting with the data collection.
- Ministry of Health - for funding.
- University Teaching Hospital Board - for authority.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

The development of drug resistance to common pathogens, has generated much concern in the medical community. The absence of an antibiotic policy at the University Teaching Hospital (UTH), has resulted in a high frequency of antibiotic prescription and probable inappropriate use. This may have contributed to the increase in antibiotic resistance at the institution.

The survey revealed a high frequency of 73 percent, with the four specialities: Medicine, Paediatrics, Surgery and Obstetrics and Gynaecology, 67 percent, 74 percent, 90 percent and 64 percent, respectively. Multiple antibiotic prescriptions was common (61 percent), adding to the cost of care. The most common antibiotic prescribed was Gentamicin and the common combination was Gentamicin-Penicillin. Common sites of infection were the lower respiratory tract, abdominal and wounds. Antibiotic resistance was high in the readily available cheaper antibiotics, namely Ampicillin (26%, 70%), Cotrimoxazole (56%, 67%), Tetracycline (59%, 72%), and Chloramphenicol (8%, 50%) in Gram-positive and Gram-negative organisms, respectively, and as low as zero percent in the expensive ones, i.e. Cefotaxime (19%, 2%) and Ciprofloxacin (0%, 1%), respectively.

There is not much utilization of laboratory data and services in deciding on antibiotic use. Surveillance of bacterial resistance will provide health authorities, physicians, and even pharmaceutical companies, with data on which the use of antibiotic may be rationalised.

Key words: Antibiotic, prescribe, resistance.

DEFINITION OF TERMS

1. **'Antibiotic'** - in this paper, it signifies all antibacterial drugs of natural or synthetic origin.
2. **Enterobacteria** - refers to Gram-negative aerobic rods found in the intestine, which are members of the family Enterobacteriaceae.
3. **Antibiotic resistance *in-vitro*** - a susceptible strain is one that is consistently inhibited by a particular low concentration of a given antibiotic. An organism is resistant when it tolerates a concentration of antibiotic significantly higher than that which inhibits the growth of susceptible strains of the same species *in-vitro*.

   In-vitro predictions generally serve as a useful guide for clinical purposes, though the clinical outcome may sometimes vary for a number of reasons.

CHAPTER 1

1.0 INTRODUCTION

Awareness over the development of drug resistance by common pathogens, has generated much concern in the medical community worldwide, as decreased susceptibility of bacteria to antibiotics is presumed to decrease the effectiveness of treatments for infections, possibly leading to spread of infection.

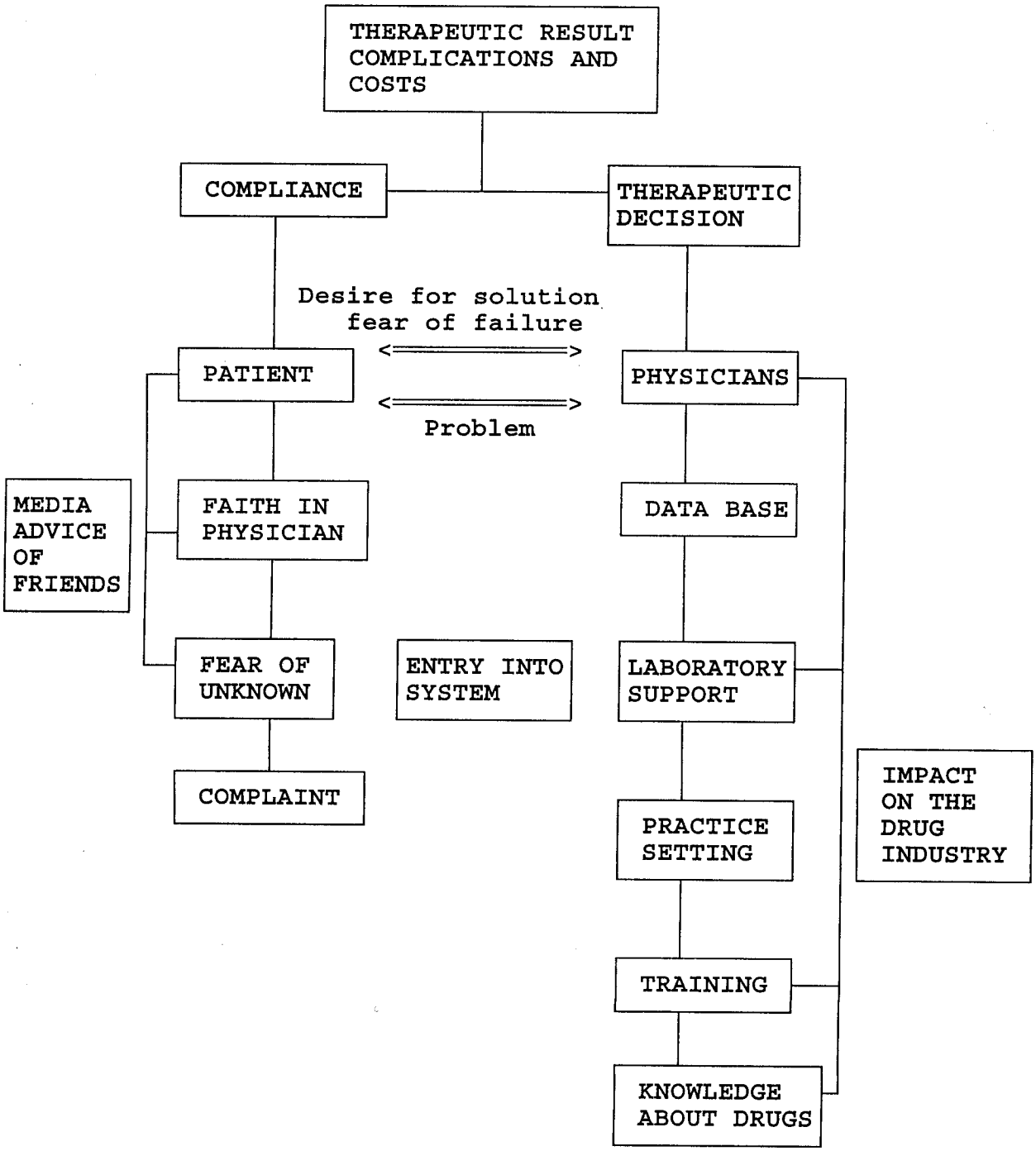
The therapy of infectious diseases requires the selection of antimicrobial agents that inhibit the growth of, or kill the micro-organisms responsible for infection in a particular patient. Successful chemotherapy must be rational and rational treatment demands a diagnosis. The treatment chosen should be based on explicit assumptions of the nature of the disease process. Antibiotics widely used to treat infectious diseases, are costly, and effective use is essential. Misuse may cause unnecessary morbidity and mortality, bacterial resistance, high infection rates and drugs rapidly becoming useless, even expensive drugs reserved for severe infections. A constant relation between antibiotic usage and resistance of organisms has been established. (Mcgowan 1988).

1.1 Factors contributing to antibiotic resistance

The size of the antibiotic market in developing countries is double that in developed countries. There are several reasons: more infections, poor prescribing practices, drugs available over the

FIGURE 1

Outline of the elements and complex interrelationships which influence the patient and physician to use drugs. (Kunin 1978).



counter, all of which encourage inappropriate antibiotic use. (Rodriguez 1993). Inappropriate antibiotic therapy occurs whenever an antibiotic is given unnecessarily. The antibiotic is inappropriate or the dosage and duration are wrong. These may be attributed to:

1. poor clinical diagnosis,
2. inadequate use of laboratory, often coupled with poor laboratory support,
3. ignorance of the type of bacteria most likely to cause particular infections,
4. lack of information about the current susceptibility of suspected causal agent to the antibiotic,
5. inadequate knowledge about the pharmacokinetic of antibiotics. (WHO 1981).

Figure 1 outlines some social factors that influence drug use.

1.2 Administration of antibiotics

The decision to administer antibiotics to patients is taken by a physician or one who is licenced to prescribe them or an executive board of relevant health institutions responsible for their care. In hospitals, however, attempts have been made to influence such decisions by the development of an antibiotic policy agreed upon by the heads of the clinical care and microbiologists. Antibiotic

treatment is based on a precise clinical diagnosis of the nature of the infective process. It is directed against specific pathogens identified by culture or when this is not practicable, inferred from the site and nature of infection and epidemiology. Selection of an appropriate dose of an antimicrobial agent, is based on information such as site of infection and identity, and known or presumed antibiotic susceptibility of the infecting organism, dose related toxicity, and the patient's ability to eliminate the drug. (Robert 1990).

Antibiotic Combination

Clinical use of synergistic combinations of antibiotics, may have beneficial result, but inappropriate use of antimicrobial combinations, may have important adverse effects which include antagonism. Concurrent administration of **two or more antimicrobial** agents, each of which blocks a different step in bacterial metabolism, is justified to some extent. This may be employed rationally in the following situations:

a) prevention or delaying the emergence of resistant micro-organisms, especially in chronic infections such as tuberculosis or mycoses;

b) emergency treatment of suspected serious infections (e.g. Sepsis in an immunodeficient host) before laboratory studies have revealed an etiologic agent;

c) infections known to be caused by two or more different micro-organisms of different susceptibilities;

d) achieving bactericidal synergism. The mechanism being either by:

   i) simultaneous block of several steps in a metabolic sequence, such as occurs with Sulfonamides and Trimethoprim; and

   ii) enhancement of penetration of one drug (e.g., Aminoglycoside) by a second drug (e.g., cell wall inhibitor, such as Penicillin). These combined effects have been particularly beneficial when bactericidal action is required (e.g., infective endocarditis, sepsis in an immuno-deficient host). (Jawetz 1980).

However, antibiotic combination should not be a regular practice when single agent would be adequate. (Khan, 1988). It can add greatly to the cost of the patient's illness. In general, antimicrobial agents have little toxicity with the exception of *aminoglycosides* and some third generation cephalo-sporins (but others may show toxicity where patient has underlying disease. (Leigh 1989). However, it has been estimated that five percent of patients receiving a given antibiotic in the hospital, will experience

some sort of adverse reaction. (Morse 1986). These include hyper-sensitivity and direct toxic effect without therapeutic effects.

Route of administration

In general, the oral route of administration is chosen for those infections that are mild and can be treated on an out-patient basis. The intra-muscular route is used for agents that are ineffectively absorbed from the gastrointestinal tract and for the treatment of patients with serious infections in whom a high serum concentration of antimicrobial agent is required. In life-threatening infections, especially in the presence of shock, intravenous administration is preferred. (Gerald 1990).

Dose and Duration

It is advantageous if the dose can be small and the frequency of prescription low. In addition, the length of treatment should be as short as possible to avoid development of adverse reactions or bacterial resistance. Most hospital infections rarely require more than five days therapy, and a limit will encourage junior medical staff to assess the need for repeated prescriptions. Surgical prophylaxis can usually be restricted to a 1 or 3 dose schedule in uncomplicated cases, although in specialised units more prolonged therapy will be necessary. (Leigh 1989).

Prophylaxis

Antibiotic prophylaxis in surgery refers to the administration of antibiotic agents to patients without evidence of established infection, to reduce subsequent post-operative septic complications. (Nichols 1980). Use of prophylactic antibiotics should be limited to those surgical procedures associated with high post-operative infection rate in which, prophylaxis is of proven value and those in which a post-operative infection may result in a catastrophe. No one antibiotic agent or combination can be relied on for effective prophylaxis in the various clinical setting. The agent employed should be chosen primarily on the basis of their efficacy against the micro-organisms that usually cause the infectious complications.

TABLE 1

Organisms Against which Prophylaxis is Directed when indicated
(Jawetz 1980)

Operative procedure	Aerobes	Anaerobes
Gastrointestinal Mouth	Streptococci	Bacteroides (other than *B. fragilis*), Peptostrepto-Fusoba-cteria.
Esophagus	As above	As above.
Stomach	Enteric-gram negative bacilli, Streptococci.	As above.
Biliary tract	Enteric gram-negative bacilli, group D Streptococci.	Clostridia, *B. fragilis*
Distal ileum	Enteric gram-negative bacilli.	*B. fragilis*, Peptostrepto-cocci, Clostridia.
Colon	As above	As above.
Gynaecologic	As for colon	As for colon.
Orthopedic	Streptococci, Staphylococci.	
Thoracic	Streptococci, Pneumococci.	Bacteroides (other than *B. fragilis* Peptostrepto-cocci.
Cardiovascular	Staphylococci, Streptococci.	
Urology	Enteric gram-negative bacilli, group D Streptococci.	

Therefore, an appropriate choice of prophylactic antibiotics requires understanding of the polymicrobial nature of the indigenous microflora at each site. (Table 1). Lack of understanding may lead to abuse of the antibiotic prophylaxis, which may alter the hospital environment that favours the development of bacterial strains resistant to commonly employed antibiotics.

About 25% of hospital in-patients will receive antimicrobial therapy worldwide (WHO 1981), and groups of high risk patients, i.e. those with leukaemia, immuno-compromised, malignancy, who are highly susceptible to the bacterial infections, create a major demand for parenteral treatment, often over prolonged periods. There are now numerous studies in representative hospital populations that document that antimicrobial agents are used wrongly in nearly 50% of cases. The findings show that, though the criteria for justification or acceptance differ, the results are generally the same. (Gerald 1990).

1.3 Antibiotic susceptibility testing

The problem of antimicrobial resistance has interfered with the selection of appropriate antimicrobial agents and has also led to more expensive treatment and longer hospitalisation. The following statement was made by the W.H.O. Expert Committee on Antibiotics (W.H.O. 1969):

> "Bacterial resistance to antibiotics is the principle obstacle to their successful therapeutic use. When resistance develops during the course of treatment, it may deprive an antibiotic, of its proper therapeutic effect in the patient being treated. More important in the long run, is the effect on the general community since the elimination of sensitive strains and the dissemination of resistant ones, leads to a situation in which many infections are resistant *ab initio* and alternative treatment must be adopted. For this reason, the estimation of bacterial sensitivity or resistance to antibiotics, has assumed great importance. Such estimations are an essential pre-requisite for the rational use of antibiotics and for preserving the efficacy of this important group of therapeutic substance."

Since antimicrobial therapy is often initiated on an empiric basis in patients with serious infections, the results of cultures permit more precise selection of agents and doses. Those drugs which are toxic, for example, may be replaced by less toxic ones when *in-vitro* susceptibility test results indicate that agents in the latter group, are active against the organism or organisms isolated. Agents with little or no activity, may be replaced with those showing activity as determined by *in-vitro* susceptibility tests.

The continued loss of effectiveness even to the new classes of antibiotics such as cephalosporins and quinolones, has mainly been attributed to the misuse of agents, but there is little specification on the precise nature of abuse. Therefore, information is required in order to establish policies to control the availability of antibiotics and to promote their appropriate use.

1.4 The problem of antibiotic use in Zambia

Almost in all countries, there are laws and regulations for essential and general administration of drugs. According to the Medical Council of Zambia, there are different categories of health workers who either have the licence to administer or instruct the administration of these drugs. There are other categories who merely follow instruction as they do not have the power to prescribe certain drugs and anti-biotics. This is ably supported by the government through the Drug Enforcement Commission, which procecutes persons using or selling such drugs.

Ever since the advent of Primary Health Care (PHC) in 1972, these rules have been relaxed as has been observed that Clinical Officers, the Nursing staff and Junior Doctors, prescribe almost all drugs. By Law and Code of Ethics, antibiotics should not be prescribed without a proper diagnosis and probably drug sensitivity test. This fallacy is mostly due to lack of manpower and poor laboratory support, forcing prescription without confirmation. Sometimes, it is in an effort to cut short on time and try to exhibit to the consumer, one's clinical ability.

Zambia, like any other developing country, has a high prevalence of infectious diseases which require appropriate antimicrobial chemotherapy. The increasing use of antibiotics has contributed to the

selection of resistant bacteria and the cost of care. Diseases have become resistant to the most common antibiotics (UTH Laboratory Records) used to treat them and the advent of major new drugs like 4 quinolones, cephalosporins, gentamicin and new penicillins, may have produced a problem of excessive and inappropriate use of these valuable drugs adding unnecessary economic burden to an already overflated medical care system. It is now difficult to find antibiotics to treat life-threatening and hospital acquired infections. Diseases such as tuberculosis, pneumonia, meningitis and gonorrhoea, can no longer be treated effectively with a wide array of drugs. With the advent of HIV-associated and immunosuppression/compromisation conditions, such as patients with leukaemia, under intensive care, etc, there is need for repeated or protracted periods of therapy or prophylaxis. The patients find themselves in a situation where only the cheaper antibiotics are available to them and these drugs have become progressively less effective. A report given at the Second Drug Selection Workshop in Lusaka (22-24 April, 1996) indicated that about 50% of all prescriptions in Zambia, are for antibiotics. And Khan, in an article entitled 'Abuse and Misuse of antibiotics: 'a Zambian viewpoint' in Africa Health journal of 1988, expressed fears of all antibiotics becoming inactive in therapy, leaving us without anything to defend ourselves with.

This was after observing that there was easy accessibility of antibiotics without prescription from pharmacies and drug stores, selling the drugs without licence on the open market, and inappropriate use by physicians.

The Microbiology laboratory at the University Teaching Hospital (UTH), the referral hospital in the country, has recorded as high as 80% *in-vitro* resistance in Gram negative organisms against the readily available cheaper antibiotics (Ampicillin, Tetracycline, Chloramphenicol and Cotrimoxazole) (UTH Laboratory Records). The overuse of antibiotics in and outside hospital and free access to almost all antibiotics in pharmacies and in shops, may have caused change in the ecology of hospital infections to a predominance of Gram negative enteric bacteria. This may have devastating effects such as epidemics or outbreaks of diseases that are resistant to antibiotics, and a rise in the cost of medical care.

The UTH has a daily average of 1,300 in-patients with an average stay of about four days, and out-patient attendance of over 1,000 patients per day. About one third of the total expenditure of drugs is on antibiotics (Health Information Systems, UTH, 1996). The hospital has no antibiotic policy and hence, the probability of antibiotic overuse.

With the emphasis in the Health Reform Programme on the use of available resources for the provision of quality health care, it is appropriate to carry out an audit on the usage of antibiotics, in order to establish whether there is overuse and inappropriate use of antibiotics, which may have led to the increase in antibiotic resistance. Precise data on antibiotic use in the hospital, is not available, but consumption appears to be rising on a large scale. An audit would provide data which would assist in proper formulation of an appropriate antibiotic policy, and would also be useful for the health administrators and others responsible for the formulation of health policies governing the use of antimicrobial drugs in order to bestow both health and economic benefits.

1.5 Prescribing patterns in other countries

Since the first antibiotic, Penicillin, the antibiotics have been widely used. The more frequent use of antibiotics has presented the medical community and the public, with a set of hazards that should be approached by some new administration of educational measures. (Finland, 1959). The general problem of appropriate use of drugs has existed for a long time. There is a wide range of antibiotics each with its own special benefits and demerits of economic, toxic and ecologic costs. In 1959, Finland *et al*, documented the increasing occurrence of serious bacterial

infections since the introduction of antibacterial agents. Reiman and D'Ambola in 1966, conducted one of the first surveys on the appropriate use of antibiotics and clearly demonstrated that antibiotics were often used inappropriately.

Studies have shown that a quarter (25%) to a third (67%) of all patients on the general medical or surgical wards, receive an antibiotic during hospital stay. (WHO 1981).

Surveys in North America and Britain, indicate that about one quarter (25%) of all patients, receive **one or more course(s)** of antibiotics whilst in hospital. Furthermore, chart reviews have revealed many of the treated patients (30%-60%), especially on surgical wards, had no clear-cut evidence of infection. About one third (33%) of all courses of antibiotics are given for **prophylaxis** in Britain. (WHO 1981). A similar situation exists in other advanced countries. For prescriptions where culture and sensitivity tests were obtained, inappropriate antibiotic was often chosen and therapy continued by the attending clinician. (Henry 1974). A W.H.O. working group in 1981, accepted that the administration of antibiotics to the human population, was a major cause of the accumulation of resistant bacteria in its flora. The resistance was no longer confined to the urban hospitals, but were encountered increasingly in the general population.

Brazil has one of the highest rates in the world of resistance in Gram positive bacteria, to almost all therapeutically useful antibiotics. The problem is so severe that in 1980, fifty percent (50%) of all hospital admissions, (about 1.7 million patients), had nosocomial infection. It cost 1.2 (US$) billion to treat them and 30,000 patients died of the infections. (WHO 1989).

Table 2 shows the top ten drug resistant microbes that have been identified:

TABLE 2

Top Ten Drug-resistant Microbes

	Microbes	Diseases caused	Drugs resisted
1.	*Enterobacteriaceae*	Bacteremia, pneumonia, urinary tract, surgical wound infections.	Aminoglycosides, Beta-Lactam antibiotics, Chloramphenicol, Trimethoprim.
2.	Enterococcus	Bacteremia, urinary tract, surgical wound infections.	Aminoglycosides, Beta-Lactams, Erythromycin, Vancomycin.
3.	*Hemophilus influenzae*	Epiglottis, meningitis, otitis media, pneumonia, sinusitis.	Beta-Lactams, Chloramphenicol, Tetracycline, Trimethoprim.
4.	*Mycobacterium tuberculosis*	Tuberculosis.	Aminoglycosides, Ethambutol, Isoniazid, Pyrazinamide, Rifampin.
5.	*Neisseria gonorrhoeae*	Gonorrhoea.	Beta-lactams, Spectinomycin, Tetracycline.
6.	*Plasmodium falciparum*	Malaria.	Chloroquine.
7.	*Pseudomonas aeruginosa*	Bacteremia, pneumonia, urinary tract infections.	Aminoglycosides, Beta-lactams, Chloramphenicol, Ciprofloxacin, Tetracycline, Sulfonamides.

continued.

	Microbes	Diseases caused	Drugs resisted
8.	*Shigella dysenteriae*	Severe diarrhoea.	Ampicillin, Trimethoprim, Sulfamethoxazole, Chloramphenicol, Tetracycline.
9.	*Staphylococcus aureus*	Bacteremia, pneumonia, surgical wound infection.	Chloramphenicol, Ciprofloxacin, Gentamicin, Erythromycin, Beta-lactams, Rifampin, Tetracycline, Trimethoprim.
10.	*Streptococcus pneumoniae*	Meningitis,	Aminoglycosides, Chloramphenicol, Erythromycin, Penicillin.

Source: Infectious Diseases - Child Health Issues: Global Child Health News and Review No. 2 1993.

The current threat of increase in antibiotic resistance include:

1. Vancomycin resistance in Enterococci (VRE).
2. Quinoline resistance in *Pseudomonas aeruginosa* and methicillin resistant *Staphylococcus aureus* (MRSA).
3. Third generation Cephalosporin resistance among Gram negative bacteria which is on the increase.
4. Ampicillin resistance in *Haemophilus influenzae*, first reported in 1974.
5. The constant increase in the isolation of penicillin resistant strains of pneumococcus e.g. children are either dead or brain damaged due to resistant pneumococcus that could have been cured before, according to Dr Stuart Levy (child Health, 1992) of the Tufts University School of Medicine in Boston. (At UTH, despite the low *in-vitro* resistance to Penicillin, Pneumococcal meningitis patients are said not to have responded well to penicillin treatment.) Multiple drug resistant strains of mycobacteria are just reminders that the struggle to treat infectious diseases in the future, is going to be a tough one. (Chagla 1997).

Chagla urges everybody to pool resources together and deal effectively with the threat of these emerging infections.

A number of studies have been done to survey the antibiotic prescribing patterns in different countries and institutions. A prospective survey of antibiotic prescribing patterns in six Ministry of Health General Hospitals in Malaysia, revealed a great diversity in antibiotic regimens employed. (Laguna 1996). In a hospital emergency department in Madrid, a study on the quality of antibiotic prescriptions to know the frequency of antibiotic prescriptions, the conditions that motivate their usage, and evaluation on the quality of therapies, detected errors in choosing antibiotic therapy and antibiotic course duration.

In an evaluation of antibiotic use in a University Hospital Centre in Luasanne, Geneva, in the departments of medicine, general surgery and traumatology, it was calculated that the inappropriate use of antibiotic accounted for approximately seven percent of the total costs of all antibiotics used. (Parret 1993). There has been evidence that the overuse of antibiotics favours the spread of resistant species. This was illustrated by Price and Sleigh in 1970, from a neuro-surgical ICU in which *Klebsiella aeruginosa* infection was endemic and had caused numerous chest and urinary infections, and eight deaths from meningitis. The occurrence of these infections was abruptly halted by stopping all antibiotic treatment both therapeutic and

prophylactic; the antibiotic largely used for prophylaxis of both chest and wound infections had been ampicillin. Restricted use was resumed four months later. A comparable achievement was the elimination of a highly carbenicillin-resistant strain of *Pseudomonas aeruginosa* from a burns unit by stopping the use of this antibiotic. (Price 1970).

In Zambia, apart from the audit of prescriptions in different districts in the country, which revealed fifty percent of every prescription, contained antibiotic, no study has been done to establish the precise nature of the use or abuse of antibiotics. The survey is intended to define the magnitude of the use of antibiotic and suggest ways of improving the prescription habits.

CHAPTER 2

2.0 OBJECTIVES

2.1 General objectives

To determine the prescribing patterns of antibiotics, their use in relation to *in-vitro* antibiotic susceptibility patterns and to establish whether poor prescribing may be contributing to resistance.

2.2 Specific objectives

i. To find out the antibiotics commonly prescribed.

ii. To investigate whether the dose, frequency, and route of administration and duration of treatment are appropriate.

iii. To determine the frequency of antibiotic prescription.

iv. To determine whether antibiotic therapy/-prophylaxis is necessary.

v. To determine the antibiotic susceptibility pattern of the different classes of the prescribed drugs and whether they correspond to the prescribing pattern.

vi. To provide a basis of proper formulation of an antibiotic policy and make recommendations.

CHAPTER 3

3.0 METHODOLOGY

3.1 Research setting

The survey was carried out at the University Teaching Hospital (UTH), the referral and teaching hospital in Lusaka, the capital city of Zambia. The hospital is a 1,238 bed, 50 cots and 46 incubator hospital capacity. The hospital has seven major departments, namely, Medicine (414 beds), Obstetrics (247 beds, 130 cots), Surgery (330 beds, 55 cots) which includes E.N.T. and Eye (54 beds, 2 cots), Paediatrics (76 beds, 226 cots), Gynaecology (97 beds), Neonatology (107 cots, 46 incubators). The Out-patient department (OPD) has an average attendance of over 1,000 patients per day (OPD includes paediatrics, casualty, adult filter clinic, specialist clinics, gynaecology, antenatal, postnatal and family planning (UTH Health Information System department, 19).

3.2 Sample size

The sample population consisted of a total of 1,031 beds (beds plus cots) of which 200 beds were sampled. Sample size was calculated using EPI-Info software at 95% confidence level.

3.3 Selection criteria

Every second bed in each department was sampled, the first of which was selected at random using the

table of random numbers. In wards where the number of patients were few, all of them were sampled.

3.4 Study design

The study is a descriptive cross-sectional survey done over a period of five months, from January to June, 1998. The Study was conducted on the prescriptions of in-patients in the department of medicine, surgery, obstetrics and gynaecology, and paediatrics.

3.5 Data collection

A questionnaire was used to collect information on the type of antibiotic, dose route of administration, from the drug charts/files and by verbal communication from the prescriber during the ward-round. The clinical diagnosis or indication and intended duration of the antibiotic therapy or prophylaxis were also recorded.

Antibiotic susceptibility patterns were determined by *in-vitro* susceptibility testing in the UTH Microbiology laboratory, using the Kirby-Beaur Disc Diffusion method, which was performed during the study period.

The appropriate use of antibiotics was judged in each case by reviewing specific recent literature and consultation. Permission was sought from the University Teaching Hospital authorities and prescribers to obtain information on antibiotic prescriptions.

4.0 RESULTS

4.1 Prescribing patterns

Of the 191 patients sampled, 73% (139) were prescribed antibiotics in the four departments: medicine, paediatrics, surgery, and obstetrics and gynaecology, with 67%, 90%, 64% and 74% prescriptions, respectively. The proportion of patients receiving these drugs was more in the under-five age group, 32%, ranging from 1% of those above sixty-five years of age. Table 3. The proportion of patients prescribed antibiotics in four specialities are shown in Figure 2.

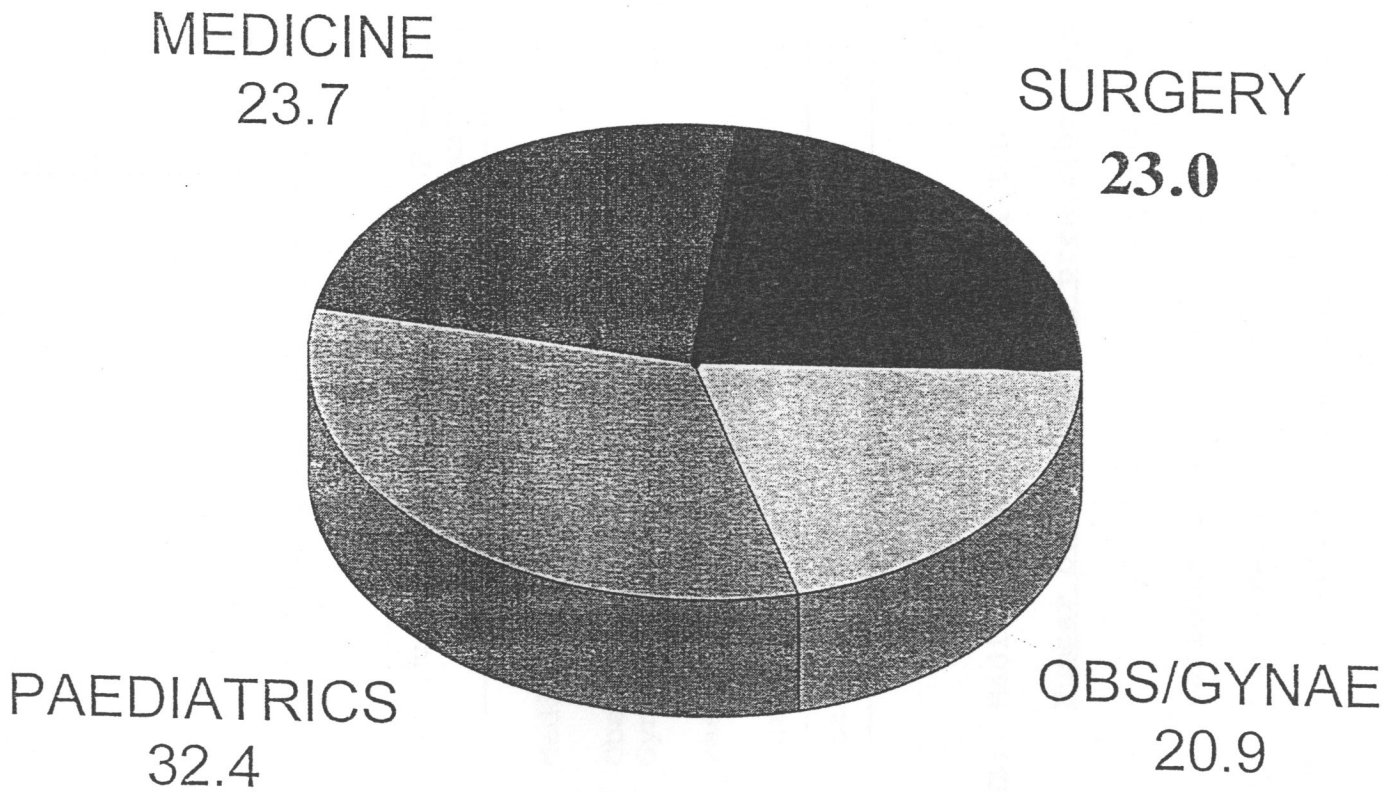
Table 3

Ages of patients admitted to hospital and who were prescribed antibiotics during the survey period.

Age (years)	Prescribed antibiotics
< 5	45 (32%)
5-15	10 (07%)
16-25	21 (15%)
26-35	25 (18%)
36-45	16 (12%)
46-55	8 (06%)
56-65	3 (02%)
66+	1 (01%)
Unknown	10 (07%)
Total	**139 100%**

Figure 2

Proportion of patients who were prescribed antibiotics in the four departments



Frequency of antibiotic prescriptions

There was a significant difference in the frequency of prescriptions for the antibiotics between departments

X^2 = 24.8 P value <0.01. Table 4.

Table 4

Patients from different departments who were prescribed antibiotics

Department	Number of patients	Frequency of prescribed antibiotics
Medicine	49	33 (67%)
Obstetrics and Gynaecology	41	29 (74%)
Paediatrics	51	45 (90%)
Surgery	50	32 (64%)
Total	**191**	**139 (73%)**

NB: Medicine includes 29% anti-Tuberculosis treatment.

Number of antibiotics prescribed per patient

Combination of antibiotics were prescribed for patients, ranged from two to four combinations. Of the prescribed antibiotics, 39% were for single courses while the combination courses were 40%, 19% and 2% for the two, three and four courses, respectively. (Table 5).

Table 5

Antibiotic combinations prescribed during admission

Antibiotic combinations	Number of patients
Single	54 (39%)
Two	56 (40%)
Three	27 (19%)
Four	2 (2%)
Total	**139 100%**

Types of antibiotics prescribed

Nineteen (19) types of antibiotics were prescribed during the survey period. Overall, the commonest prescribed antibiotics were Gentamicin (19%), followed by Penicillin (15%), Ampicillin (11%), Cotrimoxazole (9%). Some antibiotic groups were prescribed more in a department, with department of **Medicine** prescribing more of anti-TB drugs (29%), **Obstetrics** and Gynaecology and Surgery, more of Gentamicin (31%, 18%) and Penicillin (33%, 24%), and Paediatrics, more of Gentamicin (25%) and Ampicillin (25%). There was no significant difference of the total number of antibiotics prescribed by the different departments. (Medicine 12 types, Paediatrics 13, Obstetrics and Gynaecology 10, and Surgery 8). (X^2 = 2.76, P >0.2). Table 6. The antibiotics prescribed were therapeutic 83% and 17%, prophylactic (mainly in surgery and obstetrics/gynaecology).

Table 6

Types of antibiotics prescribed by the different departments

Antibiotic/Dept.	Medicine		Obs & Gynae			Paediatrics			Surgery			TOTAL
No. of Patients	33		29			45			32			139
	T	P	T	P	NI	T	P	NI	T	P	NI	
Amoxycillin	2	-	3	3	2	2	1	2	-	1	1	17(6.8%)
Ampicillin	-	-	-	1	-	21	-	4	-	3	-	29(11.1%)
Ampiclox	1	-	-	-	-	5	-	2	-	-	-	8(3.2%)
Cefotaxime	-	-	1	-	-	3	-	2	-	-	-	6(2.4%)
Chloramphenicol	1	1	1	-	-	2	-	2	1	5	-	13(5.2%)
Ciprofloxacin	-	-	1	-	-	-	-	-	-	-	-	1(0.4%)
Cloxacillin	-	-	-	-	1	2	-	2	3	-	-	8(3.2%)
Cotrimoxazole	5	-	-	-	-	6	1	4	2	4	-	22(8.7%)
Doxycycline	-	-	1	-	-	-	-	-	-	-	-	1(0.4%)
Erythromycin	4	-	-	1	-	-	-	-	2	4	-	11(4.4%)
Ethambutol	14	-	-	-	-	-	-	-	-	-	-	14(5.6%)
Gentamicin	2	-	6	2	5	21	-	4	5	2	1	48(19.1%)
Nalidixic acid	-	-	-	-	-	-	-	-	-	-	-	0(0.0%)
Nitrofurantoin	1	-	-	-	-	-	-	-	-	-	-	1(0.4%)
Norfloxacin	1	-	-	-	-	-	-	-	-	-	-	1(0.0%)
Oxacillin	-	-	-	-	-	-	-	1	-	-	-	1(0.0%)
Penicillin	8	-	7	2	5	4	-	1	5	5	1	38(15.1%)
Pyrazinamide	13	-	-	-	-	3	-	-	-	-	-	16(6.4%)
Rifampin/ Isoniazid	14	-	-	-	-	3	-	-	-	-	-	17(6.8%)
Streptomycin	-	-	-	-	-	1	-	-	-	-	-	1(0.4%)
TOTAL	**66**	**1**	**20**	**9**	**13**	**73**	**2**	**24**	**18**	**24**	**3**	**253**

T = Therapeutic P = Prophylactic NI = Not indicated

Clinical diagnosis which antibiotics were prescribed

In the department of Medicine, of the most prescribed antibiotic including anti-TB which were the most frequent, Gentamicin was prescribed for pneumonia and in malaria; in Paediatric department, for respiratory tract infections, diarrhoea, pneumonia, septicaemia, tetanus, meningitis, malnutrition and osteomyelitis; in Surgery department, for fractures, amputation, Hepatic abscess, and after laparotomy, while in Obstetrics and Gynaecology department it was prescribed in cancer of the cervix, acute pelvic inflammatory disease, peritonitis in malaria, enraptured ectopic pregnancy, uterus perforation, and after a laparotomy.

Penicillin was prescribed more in the departments of Obstetrics and Gynaecology (33%) and this was for PID, peritonitis, arthritis and total abdominal hysterectomy. Ampicillin was commonly prescribed in Paediatrics department (25%) in 64% of all the diagnoses identified. No Ampicillin was prescribed in the department of Medicine, and Co-trimoxazole was prescribed in 32% of the diagnosis in Paediatrics department. Obstetrics and Gynaecology department did not prescribe any Co-trimoxazole. Tables 7a, b, c and d, show the diagnoses for which antibiotics were prescribed in the different specialities.

Table 7a

Diagnoses for which antibiotics were prescribed in the department of Medicine - (33 patients)

Diagnosis /indication	No. of patients	Antibiotics prescribed
Pneumonia	5	Penicillin (1), Erythomycin (2) Penicillin + Gentamicin (1) Penicillin + Amoxycillin(1)
Pulmonary tuberculosis with malaria	1	Co-trimoxazole (1)
Pulmonary tuberculosis	12	Rifampin + Streptomycin + Pyrazinamide (12)
Abdominal tuberculosis	1	Rifampin + Streptomycin + Pyrazinamide (1)
Tuberculosis meningitis	1	Rifampin + Streptomycin + Pyrazinamide (1)
Meningitis	2	Penicillin (1), Penicillin + Chloramphenicol (1)
Congested cardiac failure with ?TB	1	Amoxycillin (1)
Pyelonephritis	1	Nitrofurantoin + Norfloxacin (1)
Malaria	1	Gentamicin (1)
Fever with Splenomegaly	1	Penicillin + Chloramphenicol (1)
Chronic gastroenteritis	2	Cotrimoxazole + Penicillin (1) + Cotrimoxazole (2)
Pleural effusion with Kaposis sarcoma	1	Cotrimoxazole + ampicloxacillin (1)
Tonsillitis	1	Penicillin (1)
Cavitation in chest	1	Erythromycin (1)
Chronic respiratory tract infection	1	Co-trimoxazole (1)
Pyrexia of unknown origin	1	Chloramphenicol (1)

Table 7b

Diagnoses for which antibiotics were prescribed in the Paediatrics department (45 patients)

Diagnosis /indication	No. of patients	Antibiotics prescribed
Diarrhoea	3	Co-trimoxazole (1), Ampicillin + Gentamicin (2)
Malnutrition	6	(Cefotaxime + Cloxacillin) (Ampicillin + Chloramphenicol), (Ampicillin + Gentamicin), (Ampicillin + Co-trimoxazole + Gentamicin), (Ampicillin + Cefotaxim + Gentamicin + Co-trimoxazole)
Respiratory tract infection	1	Ampicillin + Gentamicin (1)
Respiratory tract infection in malnutrition	2	Ampicillin + Gentamicin (1) Ampicillin + gentamicin + Chloramphenicol (1)
Diarrhoea in malnutrition	6	Amoxycillin (1), (Ampicillin + Cotrimoxazole + Gentamicin) (1), (Ampicillin + Gentamicin) (2) Co-trimoxazole, (1) Amoxycillin + Co-trimoxazole + Gentamicin (1)
Pneumonia	3	Penicillin (1), Co-trimoxazole (1) Ampiclox + Co-trimoxazole (1)
Pneumonia in malnutrition	3	Ampicillin + Cloxacillin + Gentamicin, (1) Ampicillin + Amoxycillin + Chloramphenicol, (1) Ampicillin + Cefotaxime + Gentamicin (1)
Upper respiratory tract infection + diarrhoea	1	Cotrimoxazole (1)
Diarrhoea	1	Co-trimoxazole + Ampicillin + Gentamicin (1)

Continued

Diagnosis /indication	No. of patients	Antibiotics prescribed
Osteomyelitis in malnutrition	1	Ampicillin + Gentamicin + Cloxacillin (1)
Meningitis in malnutrition	1	Ampicillin + Gentamicin + Chloramphenicol (1)
Pneumonia with CS otitis media	1	Ampicillin + Cloxacillin (1)
Malnutrition with ? PTB	1	Ampicillin + Gentamicin (1)
Septicaemia with diarrhoea	1	Ampicillin + Cefotaxime (1)
Septicaemia	1	Penicillin + Gentamicin (1)
Upper respiratory tract infection	1	Gentamicin + Ampicillin + Amoxycillin (1)
Atypical pneumonia	2	Penicillin + Gentamicin (1) Penicillin + Ampiclox (1)
Staphylococcal dermatitis	1	Ampiclox (1)
Septicaemia with Diphtheria	1	Ampicillin + Chloramphenicol (1)
Septicaemia with Pneumonia	1	Ampiclox + Co-trimoxazole(1)
Rash on scalp	1	Ampiclox (1)
Tetanus	1	Gentamicin + Penicillin (1)
Septicaemia with meningitis	1	Ampicillin + Gentamicin + Cefataxime (1)
TB meningitis	2	(Rifampin + Pyrazinamide) (1), Streptomycin + Rifampin + Pyrazinamide (1).
Measles	1	Co-trimoxazole + Ampiclox(1)
Measles with ?PTB	1	Ampiclox + Rifampin + Pyrazinamide (1)
Diagnosis not indicated	1	Ampicillin + Cloxacillin + Gentamicin (1)

Table 7c
Diagnoses for which antibiotics were prescribed in Surgery department (32 patients)

Diagnosis /indication	No. of patients	Antibiotics prescribed
Fractures of limbs	9	Penicillin + Gentamicin (3) Penicillin (1), Erythromycin (3), Amoxycillin (1), Amoxycillin + Co-trimoxazole (1)
Head injury	2	Chloramphenicol + Penicillin (1), Gentamicin (1)
Amputation of limbs	2	(Chloramphenicol + Ampicillin) (1), Gentamicin + Ampicillin (1)
Burns	2	Erythromycin (1)
Intestinal obstruction	1	Chloramphenicol + Penicillin (1)
Acute Osteomyelitis	1	(Cloxacillin)
Septic ulcer	2	Cloxacillin + Gentamicin (1), Erythromycin (1)
Infected wound	2	Penicillin (1), Chloramphenicol (1)
Hepatic abscess	1	Penicillin + Gentamicin (1)
Fistula	1	Co-trimoxazole (1)
Spleenectomy	1	Penicillin + Chloramphenicol (1)
Necrosis of labia	1	Penicillin + Gentamicin (1)
Laparotomy	2	Co-trimoxazole (1), Gentamicin + Penicillin (1)
Bed-sore	1	Co-trimoxazole (1)
Pre-prostate operation	1	Co-trimoxazole (1)
Rodent necrosis	1	Co-trimoxazole (1)
Appendicular mass	1	Chloramphenicol + Ampicillin (1)
Trauma of limb	1	Cloxacillin (1)

Table 7d

Diagnoses for which antibiotics were prescribed in the Obstetrics and Gynaecology department (29 patients)

Diagnosis /indication	No. of patients	Antibiotics prescribed
Pelvic inflammatory disease (PID)	5	Penicillin (1), Doxycycline (1), Amoxycillin (1), Gentamicin + Penicillin (2)
Malaria	2	Gentamicin + Penicillin (1), Ampicillin (1)
Infected laparotomy wound	2	Cefotaxime (1), Ciprofloxacin (1)
DVT in puerperium	1	Cloxacillin (1)
Hip joint pain	1	Amoxycillin + Gentamicin (1)
Cancer of the cervix	2	Gentamicin + Penicillin (1) Amoxycillin (1)
Ruptured ectopic pregnancy	2	Amoxycillin (1), Penicillin (1)
Fibroids	3	Amoxycillin) (2), Erythromycin (1)
Upper respiratory tract infection	1	Amoxycillin (1)
Peritonitis	1	Gentamicin + Penicillin (1)
Peritonitis + Appendectomy	1	Gentamicin + Penicillin (1)
Peritonitis + ruptured ectopic pregnancy	1	Gentamicin + Penicillin (1)
Arthritis	1	Penicillin (1)
Enraptured ectopic pregnancy	1	Gentamicin + Penicillin (1)
Uterus perforation	1	Gentamicin + Chlora-mphenicol
Total abdominal hysterectomy (TAH)	3	Gentamicin + Penicillin (3)
Post evacuation	1	Amoxycillin (1)

Table 8

Sites of infection for which antibiotics were prescribed

Site	Med.	Obs & Gynae	Paed.	Surgery	Total	Percentage
Lower respiratory tract	20	0	15	0	35	(23.3%)
Upper respiratory tract	0	1	3	0	4	(2.8%)
Circulatory	1	0	6	0	7	(4.9%)
Skin and Soft tissue	0	0	2	2	4	(2.8%)
Ear, Nose & Throat	1	0	1	0	2	(1.4%)
Urinary tract	1	0	0	0	1	(0.7%)
Wound	0	1	1	25	27	(18.8%)
Genital tract	0	7	0	1	8	(5.6%)
Central nervous system (CNS)	3	0	4	0	7	(4.9%)
Pleural pulmonary	1	0	0	0	1	(0.7%)
Abdominal	2	17	0	4	23	(16.0%)
Gastro-intestinal tract	2	0	11	0	13	(9.0%)
Not specific	2	3	7	0	12	(8.2%)
TOTAL	**33**	**29**	**50**	**32**	**144**	**100%**

The commonest sites for which antibiotics were prescribed were the lower respiratory tract (23%), most of which were tuberculosis and pneumonia cases from Medicine and Paediatrics departments. Wounds were seen in the Surgery department as is expected (19%) and abdominal sites in the Obs/Gynae department (16%). Gastro-intestinal infections were more in Paediatrics department (9%). Table 10.

Antibiotic combinations prescribed

The hospital prescribed more than one type of antibiotic for a patient in 61% of the time. 28 different combinations were prescribed of which the most prescribed was the Gentamicin-Penicillin combination 28% of the time. This was followed by recommended anti-Tuberculosis regimen. The combinations are as shown in Table 8.

Table 9

Antibiotic combinations prescribed during the survey period

Antibiotic Combination	No. of prescriptions
1. Amoxycillin-Co-trimoxazole	1
2. Amoxycillin-Gentamicin	1
3. Amoxycillin-Penicillin	1
4. Ampicillin-Cefotaxime	1
5. Ampicillin-Chloramphenicol	3
6. Ampicillin-Cloxacillin	1
7. Ampicloxacillin-Cotrimoxazole	4
8. Ampicloxacillin-Penicillin	1
9. Ampicloxacillin-Pyrazinamide	1
10. Cefotaxime-Cloxacillin	1
11. Chloramphenicol-Gentamicin	1
12. Chloramphenicol-Penicillin	5
13. Gentamicin-Cloxacillin	1
14. Gentamicin-Penicillin	21
15. Nitrofurantoin-Norfloxacin	1
16. Penicillin-Cotrimoxazole	1
17. Pyrazinamide-Rifampin	2
18. Amoxycillin-Ampicillin-Chloramphenicol	1
19. Amoxycillin-Ampicillin-Gentamicin	1
20. Amoxycillin-Cotrimoxazole-Gentamicin	2
21. Ampicillin-Chloramphenicol-Gentamicin	2
22. Ampicillin-Cefotaxime-Gentamicin	3
23. Ampicillin-Cloxacillin-Gentamicin	2
24. Ampicillin-Co-trimoxazole-Gentamicin	2
25. Ampicillin-Gentamicin-Oxacillin	1
26. Pyrazinamide-Rifampin-Streptomycin	13
27. Amoxycillin-Ampicillin-Cotrimoxazole-Gentamicin	1
28. Erythromycin-Pyrazinamide-Rifampin-Streptomycin	1
TOTAL	**76**

Table 10

Number of antibiotic combinations prescribed in the four departments

DEPARTMENT DEPARTMENT	NUMBER OF ANTIBIOTIC COMBINATIONS				TOTAL
	1	2	3	4	
Medicine	12(36.4%)	8(24.2%)	12(36.4%)	1(3.0%)	33
Obs/Gynae	16(55.2%)	13(44.8%)	0(0)	0(0)	29
Paediatrics	8(17.8%)	21(46.7%)	15(33.3%)	1(2.2%)	45
Surgery	18(56.2%)	14(43/8%)	0(0)	0(0)	32

The department of Medicine, Paediatrics, Obstetrics and Gynaecology, and Surgery, prescribed more than one type of antibiotic per patient, 64%, 82%, 45% and 44% of the time, (Table 7 and 9) and 20, 3 and 6 types of combinations respectively.

Antibiotic administration

In 60% of the cases, the antibiotics were administered on the date of admission, while 40%, after a stay ranging from **one day to fifty days** after admission, after a modal stay of one day.

Routes

The routes of administering the antibiotics were intravenous, intramuscular and oral, 45%, 18% and 37% respectively.

Reasons for Alternative treatment

In cases where an alternative antibiotic was prescribed, the drug was prescribed due to lack of response to the first antibiotic in 10% of the patients, due to bacteriological or other test results in two percent, due to allergy or toxicity of the drug in 2%. The departments did not provide adequate reasons for prescribing an alternative antibiotic in 86% of cases. In most cases (71%) antibiotics were prescribed without requesting for a bacteriological test. Bacteriological tests were requested for 29% of the patients who were prescribed antibiotics.

4.2 Microbiology

Of the 3,902 samples examined during the survey period (January - March) to determine the commonly isolated pathogens and, 618 micro-organisms were identified in the Bacteriology laboratory. Bacteria, Yeasts and Protozoa, were identified, 73%, 26% and 1%, respectively, from different specimen-types. There was a high incidence of the yeast, *Cryptococcus neoformans* (56%) and *Streptococcus pneumoniae* (17%) from Cerebral Spinal Fluids (CSF). Blood samples yielded mainly *Salmonella sp* (20%), *Klebsiella sp* (35%) and *Staphylococcus aureus* (20%). From urine samples, *Candida sp* (30%), *Escherichia coli* (26%) and *Salmonella sp* (15%), were commonly isolated, while stool yielded *Salmonella sp* (60%) and *Shigella sp* (40%). Other specimens which included pus swabs and fluids from normally sterile sites other than CSF, yielded *Candida albicans* (25%), mainly from high vaginal swabs; and *Staphylococcus aureus* (22%). (Table 11).

Antibiotic Resistance

Resistance of the bacterial micro-organisms to different antibiotics were generally lower in the Gram positive (plus *N. meningitidis* and Haemophilus sp. The Gram negative bacilli which are the most common bacterial isolates (78%), were less resistant to the expensive reserved antibiotics, Cefotaxime (2%) and Ciprofloxacin (1%), but more resistant to Gentamicin (60%).

Higher resistance was recorded for the readily available, cheaper antibiotics, Ampicillin, Co-trimoxazole, Tetracycline and Chloramphenicol. Tables 12, 13.

Table 11

Micro-organisms isolated from different specimens at UTH Microbiology Laboratory (JAN - MARCH 1998)

SPECIMEN /ORGANISM	CSF	BLOOD	URINE	STOOL	OTHER	TOTAL
Salmonella sp	12(8.0)	52(34.0)	7(4.4)	26(60.5)	1(0.9)	98(15.9)
Klebsiella sp	3(2.0)	54(35.3)	23(14.5)	-	6(5.3)	86(13.9)
Cryptococcus neoformans	84(56.4)	-	-	-	-	84(13.6)
Candida sp	-	-	48(30.2)	-	28(24.8)	76(12.3)
Staph. aureus	2(1.3)	31(20.2)	3(1.9)	-	25(22.1)	61(9.9)
E. coli	1(0.7)	5(3.3)	41(25.8)	-	9(8.0)	56(9.1)
Proteus sp	1(0.7)	1(0.6)	11(6.9)	-	14(12.4)	27(4.4)
Str. pneumoniae	25(16.8)	-	-	-	-	25(4.0)
Streptococcus sp	6(4.0)	3(2.0)	4(2.5)	-	9(8.0)	22(3.5)
Pseudomonas sp	-	3(2.0)	3(1.9)	-	14(12.4)	20(3.2)
Enterobacter sp	-	4(2.6)	8(5.0)	-	6(5.3)	18(2.9)
Shigella sp	-	-	-	17(39.5)	-	17(2.7)
T. vaginalis	-	-	9(5.7)	-	-	9(1.4)

Continued

SPECIMEN /ORGANISM	CSF	BLOOD	URINE	STOOL	OTHER	TOTAL
Hemophilus sp	8(5.4)	-	-	-	-	8(1.3)
N. meningitidis	5(3.3)	-	-	-	-	5(0.8)
Actinetobacter sp	1(0.7)	-	1(0.6)	-	1(0.9)	3(0.5)
Morsxella sp	1(0.7)	-	-	-	-	1(0.2)
Citrobacter sp	-	-	-	-	-	1(0.2)
Serratia sp	-	-	1(0.6)	-	-	1(0.2)

NB: "Others" include: Pus swabs from wounds, vagina and other sites, normally sterile fluids other than CSF.

- Percentages in parenthesis.

TABLE 12

Percentage Antibiotic resistance of Gram positive organisms, *N. meningitidis, Haemophilus sp.* (1998)

ORGANISM /ANTIBIOTIC	CIP	CTX	AMP	SXT	TE	C	AML	OX	E	P	CN	OB
Staph. aureus	0 (14)	9 (12)	37 (27)	59 (27)	77 (13)	20 (20)	- (0)	13 (31)	83 (31)	56 (34)	- (1)	0 (4)
Streptococcus sp	0 (3)	25 (4)	30 (10)	80 (10)	60 (5)	0 (8)	- (0)	0 (7)	1 (11)	0 (9)	- (0)	0 (1)
Str. pneumoneae	- (0)	0 (5)	0 (7)	33 (12)	0 (2)	0 (14)	- (0)	16 (19)	0 (4)	0 (19)	- (0)	0 (2)
N. meningitidis	- (0)	0 (2)	0 (2)	0 (1)	0 (1)	0 (4)	- (0)	- (0)	0 (18)	0 (3)	- (0)	- (0)
Haemophilus	- (0)	- (3)	14 (7)	- (0)	- (1)	0 (6)	0 (2)	- (1)	0 (3)	67 (3)	- (0)	- (0)
Total	0 (17)	19 (26)	26 (53)	56 (50)	59 (22)	8 (52)	0 (2)	12 58)	19 (67)	30 (67)	0 (1)	0 (7)

Number of isolates tested in parenthesis:

CIP = Ciprofloxacin CTX = Cefotaxim AMP = Ampicillin SXT = Co-trimoxazole
TE = Tetracycline C = Chloramphenicol OX = Oxacillin E = Erythromycin
P = Penicillin CN = Gentamicin OB = Cloxacillin.

TABLE 13
Percentage Antibiotic Resistance of Gram negative bacilli (1998)

ORGANISM /ANTIBIOTIC	CIP	CTX	AMP	SXT	TE	C	AML	CN	NA	F
Salmonella sp	2 (49)	1 (76)	77 (48)	67 (12)	74 (34)	13 (46)	- (0)	75 (68)	16 (19)	0 (7)
E. coli	0 (4)	0 (10)	57 (7)	75 (8)	75 (4)	25 (8)	(0) (1)	0 (14)	2 (41)	0 (38)
Klebsiella sp	0 (44)	0 (38)	66 (32)	80 (10)	67 (24)	91 (34)	0 (9)	71 (35)	6 (18)	12 (16)
Proteus sp	0 (40)	0 (15)	100 (4)	14 (7)	100 (5)	100 (7)	- (0)	42 (12)	0 (18)	12 (8)
Pseudomonas sp	0 (37)	- (0)	- (0)	- (0)	- (0)	0 (1)	- (0)	100 (3)	- (0)	- (0)
Acinetobacter /Moraxella	0 (2)	0 (3)	0 (1)	0 (1)	0 (1)	100 (2)	- (0)	33 (3)	- (0)	- (0)
Enterobacter sp	0 (6)	22 (9)	75 (4)	80 (5)	33 (3)	57 (7)	- (0)	50 (8)	0 (8)	0 (8)
Citrobacter	- (1)	- (1)	- (0)	- (0)	- (0)	- (0)	- (0)	- (1)	- (0)	- (0)
Shigella sp	33 (3)	0 (11)	33 (3)	100 (2)	100 (10)	50 (6)	- (0)	36 (11)	0 (15)	- (0)
Total	1 (152)	2 (163)	70 (98)	67 (45)	72 (71)	50 (111)	100 (10)	60 (155)	4 (109	4 (77)

Number of isolates tested in parenthesis:

CIP = Ciprofloxacin CTX = Cefotaxime AMP = Ampicillin SXT = Co-trimoxazole
TE = Tetracycline C = Chloramphenicol AML = Amoxycillin CN = Gentamicin
NA = Nalidixic acid F = Nitrofurantoin.

5.0 DISCUSSION

World-wide, it is noted that at least 25% of patients admitted to hospitals are prescribed antibiotics (WHO, 1981). The proportion (73%) of patients prescribed antibiotics in this survey, therefore, raises much concern. The Paediatric department prescribed more antibiotics (90%) most of which were multiple prescriptions (82%). These were mainly for lower respiratory infections and gastrointestinal infections (diarrhoea), which require more of rehydration than antibiotic therapy. The greater proportion of these patients receiving this therapy were under the age of five, most of whom had an underlying condition of malnutrition. Hence, solving the problem of nutrition would make the children less susceptible to infection, reducing the need for antibiotic therapy.

Antibiotic prescriptions in specialities

The high frequency of antibiotic prescriptions in the department of Medicine was due to the number of patients being treated for tuberculosis. This is also due to the fact that the Outpatient Chest Clinic which caters for tuberculosis patients falls under the department of Medicine and these patients end up being admitted. This was also revealed in an audit conducted in the University Teaching Hospital for bed occupancy (Mwale MPH thesis), which showed that almost 45% of admissions were due to tuberculosis. The majority of these were relapse cases.

The high antibiotic prescription frequency in the departments of Obstetrics and Gynaecology (74%), and Surgery (64%), suggest that they have high infection rates. Like the other departments, the aminoglycoside Gentamicin is commonly prescribed even despite the 60% *in-vitro* resistance in Gram-negative organisms recorded at the University Teaching Hospital. Gentamicin seems to be the ideal choice where other drugs have failed, and has been the best known drug used in saving the patient's life specifically in post-operative infections. But it should be noted that Gentamicin is one of the drugs that needs to be administered under proper nursing care. Even though Gentamicin, in some cases, can be oto and nephrotoxic, paediatricians have not hesitated and have taken the risk of putting their children under this treatment.

Use of Aminoglycosides

The use of aminoglycoside is a world-wide concern, and was discussed by a group of experts in Medicine and Microbiology, from different parts of the world (WHO, 1989). These experts made recommendations on antibiotic use and examined the usage in diarrhoea, respiratory tract infections, urinary tract infections and prophylaxis of post-operative wound infections. This meeting was triggered by findings of World Health Organization's Programme for Quality of Care and Technologies on wide variation in frequency of multi-resistant strains in different countries with a strong correlation with aminoglycoside use. Of interest was the discovery that

aminoglycosides were among the drugs of first choice to treat common infectious diseases in many countries. There was also a strong association of deafness with high aminoglycoside usage. One of the important conclusions from the meeting was that, there is no role for aminoglycosides in general practice in the treatment of infectious diseases.

However, this study only looked at prescriptions and not prescribers. Perhaps then, the logic of liberal use of Gentamicin could have been investigated. But prescribers should always bear in mind that Gentamicin is not only expensive but requires special care and monitoring of serum levels when it is administered through intravenous infusion.

Microbiology

This study showed that there was infrequent use of the Cephalosporin, Cefotaxime and the Fluoroquinolone, Ciprofloxacin and the *in-vitro* resistance was relatively low, about 10% and 0% respectively, though the 10% in Cefotaxime was quite worrying. These are also expensive antibiotics and should be continued to be reserved for life-threatening conditions to avoid development of resistance. At present, Ciprofloxacin is said to be the only oral therapy for multiresistant bacteria and can be an alternative or possibly, replace treatment with beta-lactamase resistant Cephalosporins and Penicillins. (Leigh 1989). The cheaper readily available antibiotics show (Tetracycline, Cotrimoxazole, Ampicillin and Chloramphenicol) high resistance rates especially in the Gram-negative bacilli.

Unless antibiotic therapy is directed against specific pathogens, there shall continue to be overuse of antibiotics, and this can only be achieved by the use of laboratory data. In this study, bacteriological tests were requested in only 29% of cases. This is probably the reason why a wide range of antibiotics are used. This is evidenced by these drugs being prescribed on the same day of admission, even in conditions which are not life threatening. Different antibiotics were also prescribed for the same type of diagnosis. From the microbiological results, it has been shown that the infecting organism is not always bacterial, but also Fungal as has been seen in Cryptococcal meningitis, Upper Respiratory Tract Infection, due to Candida albicans, also found in vaginal samples. These patients may have received antibacterial drugs as laboratory services have not been utilized resulting in unnecessary use of antibiotics.

It is difficult to estimate the authenticity of the prescriptions, and clinical diagnosis and treatment is debatable as it is based on assumption since the clinical impression is not confirmed by laboratory diagnosis before prescribing.

Combined therapy

Looking at the classification of diseases, it is realised that the disease pattern has totally changed and become complex from what it used to be in the late 60s and early 70s. Today a patient admitted in hospital is not treated for one particular disease, and so more than one

antibiotic is used due to resistance or mixed infections. A physician is compelled to look at possibilities of combined treatment especially in HIV-related infections which would require combined antibiotic treatment. Combined drug treatments have proved to be successful in tuberculosis, leprosy and HIV infections. However, combined drug regimens should be prescribed by experienced practitioners as this study has shown that the cost of the patient's illness is greatly increased due to the use of antibiotic combinations in 61% of cases.

Antibiotic Administration

Hospital studies show that parenteral therapy accounts for about 70% usage (Leigh 1980) which is in agreement with the University Teaching Hospital practice of 63%, indicating that therapy is mostly parenteral which require facilities for administration, as is expected of hospitalised patients who need more acute care. This increases the cost of treatment. In general the duration of treatment is short ranging from 2 days to 14 days with a mode of 5 days. This helps avoid development of adverse events or bacterial resistance. According to Leigh, therapy of not more than 5 days encourage junior medical staff to assess the need for repeated prescriptions.

6.0 CONCLUSION

The results of this study do raise concern because of the very high frequency of antibiotic prescribing (73%) in hospitalised patients compared to the 25% documented by WHO. It is very clear that there is no definite criteria of antibiotic prescribing in the University Teaching Hospital and therefore, the need for an antibiotic policy. Some of the important expensive drugs which may have serious implications need not be handled at the lowest level. There is no association between the laboratory data and the prescribing pattern resulting in the wide range of antibiotics used. There appears to be a lot of freedom among prescribers who prescribe antibiotics of their choice without hesitation. This is seen by the fact that different antibiotics are prescribed for the same diagnosis without even considering ethical issues involved if at all the patients know the treatment received and its implications.

Therefore, it cannot be over-emphasised that there is need for information on antibiotic use and surveillance of bacterial resistance with a view of providing health authorities, physicians, and even pharmaceutical companies, with data, on which the use and future development of antibiotic may be rationalised. A good laboratory service will, therefore, do much to improve the quality of antibiotic prescribing.

7.0 RECOMMENDATIONS

1. The findings of the study greatly emphasises on the need of a prescription policy which should include training of the prescribers on the national formulary and diagnosis along with laboratory confirmation.
2. The University Teaching Hospital should embark on workshops for health workers of various categories, who are responsible for prescribing medications, during which the therapeutic effects and toxicity of drugs need to be emphasised.
3. The dangerous and ordinary drugs should be categorised regarding its use, and the status of the prescriber to prescribe which drugs. This will help maintain clarity in drug administration both to the giver and the recipient.
4. From time to time, orientation programmes or workshops should be conducted regarding new drugs and their use, even against new diseases.
5. There should be continuous surveillance of resistance in bacterial pathogens in order to assemble information about resistance, which should be readily available from the clinical laboratory. Therefore, need for laboratory support.
6. It needs to be ensured that there is good communication between physicians, microbiologists and pharmaceutical representatives, to discuss and decide on antibiotic use.

7. There is need for surveys on treatment of infections at specific sites in order to make it possible to obtain a greater and more precise insight into the reasoning of the prescriber, and to the sources of error in antibiotic prescribing.

8. Similar studies should be carried out in other health institutions to obtain information which will help decide on common prescription patterns to avoid the spread of antibiotic resistance.

9. Medical training need to emphasize management of infectious diseases and specialities at post-graduate level.

The quality of prescriptions will reflect on the ability of the prescriber and the standard of the institution to which one belongs.

It is hoped that the findings of this study will help maintain good standards of prescribing, reflecting on the knowledge of formulary, medication and medicine.

"A prescription in need is a decision indeed." KSB.

APPENDIX 1

Guide to Empirical antibacterial therapy - (Sandford 1997)

Central Nervous System

MENINGITIS

Neonate < 1 month)

The usual etiological agents are Group B, D Streptococci, Enterobacteriaceae and Listeria. The suggested regimens are:

Primary

Ampicillin + Gentamicin

Alternative

Ampicillin + Cefotaxime or Ceftriaxone, Amikacin if resistance in greater than 10% isolates.

In low birth weight infants, antipseudomonal amino-glycoside antibiotic levels are unpredictable and should be monitored. Cefotaxime-resistant strains may emerge when used in closed population such as neonatal ICU. Cefotaxime and Ceftriaxone are not effective against listeria or group D streptococci, hence ampicillin should be added. Chloramphenicol + Ampicillin are antagonistic *in-vitro* against group B streptococci.

Infant 1-3 months

Etiological agents are *S. pneumoniae, Meningococci, H. influenzae* plus neonatal pathogens. Antibiotic regimens are:

Primary - Ampicillin + (Cefotaxime or Ceftriaxone)
Alternative - Chloramphenicol + Gentamicin
Comments are as in the neonate < 1 month group.

Infant > 3 months to child > 7 years

Streptococcus pneumoniae, Meningococci and H. influenzae, are the usual pathogens and treatment is by:

Primary-Cefotaxime or Ceftriaxone, (Some recommend adding Vancomycin).
Alternative - Severe Penicillin allergy: Chloramphenicol + Vancomycin.

Child 7-17 years and adults, Low prevalence of drug-resistant S. pneumonae (< 2%)

S. pneumoniae, Meningococci, Listeria Monocytogenes and rarely in older patients, Enterobacteriaceae.

Suggested treatment is:

Primary

Cefotaxime or Ceftriaxone + Ampicillin
Some authorities recommend + Vancomycin.

Alternative

Severe penicillin allergy:
Chloramphenicol + Co-trimoxazole.

Cephalosporins are not effective against L. Monocytogens. While Vancomycin is recommended for drug-resistant Streptococcus pneumoniae (DRSP), failure rate is high (36%), and so, requires CSF Vancomycin levels to be monitored. Ref. AAC.

Child 7-17 years and adults high prevalence of drug-resistant *S. pneumoniae.*

Primary

In children - Vancomycin.
In adults - Vancomycin + Cefotaxime or Ceftriaxone + Rifampin + Ampicillin.

Alternative

Chloramphenicol is not bactericidal for high-level drug-resistant *S. pneumoniae*.

Clinical studies with cephalosporins and Rifampin are limited. Vancomycin should be discontinued if *S. pneumoniae* is susceptible to Cefotaxime/-Ceftriaxone.

EAR

Acute Otitis media with effusion in infants children and adults.

The usual etiological agents are Pneumococci (25-50%). *H. influenzae* (non-typable 15-30%). M. Catarrhalis (3-20%). Group A Streptococci (2%), Staph. aureus (1%) Enterobacteriaceae (1%) "sterile" (35%) - presumably viral.

Recommended treatment is:

Primary

Amoxicillin, Co-trimoxazole.
Amoxycillin/Clavulanate (Augmentin, oral 2nd or 3rd.

Generation Cephalosporin, Ceftriaxone.

Alternative

Erythromycin - sulfisoxazole, Clarithromycin, Azithromycin. Ampicillin is the drug of choice of many experts. For persistent, prolonged or recurrent otitis media, the usual aetiological agents are the same, but suggested regimens are:

Primary

Augmentine, Cefuroxime, Axetil, Cefixime.

Alternative

Oral 2nd/3rd generation cephalosporins.

GASTRO-INTESTINAL

Gastroenteritis

Infants

Enteropathogenic E-coli is the usual pathogen and is treated with neomycin and colistin as an alternative. It must be noted that most "traditional" enteropathogenic strains i.e. 055, 0111, are not toxigenic, invasive, enterohemorrhagic or enteroagrregative but alter the microvillous membrane.

Gastroenteritis where laboratory studies are not performed or culture, microscopy and toxin results are not available

For mild diarrhoea (</- 3 unformed stools/day) due to bacterial pathogens, only fluids need be given while for moderate diarrhoea (>/= 4 unformed stools/day), antimotility agents should be given e.g. Imodium.

In severe diarrhoea (>/= 6 unformed stools/day with high temperature and blood orfecalleucocytes, the causative bacterial pathogens could be Shigella, Salmonella, Campylobacter, Jejuni, E. coli 0157:H7, toxin positive e. difficile.

Primary therapy

Fluoroquinolones, Ciprofloxacin or Norfloxacin.

Alternative

Co-trimoxazole (resistance is common throughout the tropics. In case of c. difficile toxin colites, metronidazole or vancomycin.

There is increased risk of Hemolytic uremic syndrome (Hus) with in-effective treatment of *Shigella dysenteriae*. In children, there is risk if infected with *E. coli* 0157:H7 of about 8-10%. Treatment with Co-trimoxazole increases the risk of HUS.

Gastroenteritis when results of culture, toxin assay are available

SHIGELLA

Ciprofloxacin or Norfloxacin is recommended, the alternative is Cotrimoxazole.

SALMONELLA

If the patient is asymptomatic or illness is mild, antimicrobial therapy is not indicated. But if illness is severe, patient is septic or immunocompromised, or patient is ill enough to be hospitalised, antimicrobial agents are indicated. The primary suggested regimen is Ciprofloxacin or Norfloxacin and the alternatives are Co-trimoxazole and, Chloramphenicol. Other alternatives are Ceftriaxone and Cefotaxime. Primary treatment of enteritis is fluid and electrolyte replacement.

CAMPHYLOBACTER JEJUNI

The primary regimen is Erythromycin Stearate and alternatives are Criprofloxacin or Norfloxacin. (Quinoline resistance has increased especially in Netherlands, UK, Finland and USA.

VIBRIO CHOLERAE

Primary treatment is fluid replacement. The antibiotics used are Doxycycline or Ciprofloxacin and alternatively Co-tromoxazole (0139 strain is sensitive to Tetracycline but resistant to Co-trimoxazole).

***E. coli* 0157:H7** - no antimicrobial treatment is recommended.

GENITAL TRACT

Pelvic inflammatory disease (PID), Salpingitis, tubo-ovarian abscess

The usual bacteriological agents are *N. gonorrhoea*, Chlamydia, Bacteroides, Enterobacteriaceae, Streptococci.

Primary regimen

Ceftriaxone + Doxycycline or Ofloxacine + Clindamycin or Metronidazole.

Alternative

Cefoxitin + Probenecid + Doxycycline Clindamycin + Gentamicin in hospitalised patients.

JOINT

Septic arthritis (in adults)

The usual etiological agents are *Staph. aureus* (40%). Group A Streptococci (27%), enterobacteriaceae (27%).

Treatment is by:

Primary

Penicillinase-resistant synthetic penicillins (PRSP) or first generation cephalosporins + antipseudomonal aminoglycosidic antibiotics (APAG) or ciprofloxacin or ticarcillin/clavulanate (Timetin) or peperacillin-tazobactam, or ampicillin/sulbactam (AM/SB).

Alternative:

Vancomycin for PRSP, Ciprofloxacin + Rifampin. Initial choice should be based on results of Gram stain. Adult with possible STD contact, N. gonorrhoeae, should be considered, and Staph. aureus, Streptococci and Enterobacteriaceae in rheumatoid arthritis.

KIDNEY, BLADDER

Acute uncomplicated pyelonephritis

Usually women 18 - 40 years.

Organisms involved are Enterobacteriaceae (most likely E. coli), Enterococci.

Suggested regimens are:

Primary

Fluoroquinolones (Ciprofloxacin, Norfloxacin, Ofloxacin, Lomefloxacin, Enexacin).

Alternative

Amoxicillin/Clavulanate, Cephalosporins in hospitalised patients.

Primary

Fluoroquinolones, Ampicillin + Gentamicin 3rd generation Cephalosporins, Antipseudomonal Beta-lactamase susceptible Penicillins: Carbenicillin, Ticarcillin, Mezlocillin, Azlocillin and Piperacillin.

Alternative

Ticarcillin/Clavulanate, Ampicillin/Sulbatam or Piperacillin-Tazobactam.

LIVER

Hepatic abscess

Usual etiological agents are Enterobacteriaceae, Bacteroides, Enterococci (and Entamoeba histolytica).

Primary regimen

Ampicillin + Antipseudomonal aminoglycosidic antibiotics + Metronidazole. This has been traditional and effective but Ampicillin-resistant Enterobacteriaceae has increased), alternatively 3rd generation Cephalosporins or cefoxitin or Ticarcillin/Clavulanate, Piperacillin/Tazobactam or Ampicillin/Sulbactam or Fluoroquinolones.

Alternative

Metronidazole + Imipenem or Meropenem.

LUNG

Pneumonia

Infants/children (1 month - 5 years).

The mild and moderate Pneumonia, a usually viral. Serious, life-threatening are due to Strep. pneumoniae, H. influenzae, Staph-aureus (uncommon).

Primary regimen

Ceftriaxone, Cefotaxime.

Alternative

Penicillin-resistant synthetic Penicillins + antipseudomonal amino-glycosidic antibiotics.

Adult any age, community acquired, hospitalised but not severe pneumonia

Usual etiological agents are Strep. pneumoniae, H. influenzae, Polymicrobial (includes anaerobes), aerobic Gram negative bacilli, Legionella sp, S. aureus, C. pneumoniae, (+ respiratory viruses).

Primary regimen

Erythromycin + 2nd/3rd generation Cephalosporins.

Alternative

Amoxillin/Sulbactum or Piperacillin - Tazobactam or Ticarcillin/Clavulanate.

Adult, any age, community acquired, hospitalised severe pneumoniae

Strep. pneumoniae, Legionella sp, aerobic Gram-negative bacilli, M. pneumoniae (and respiratory viruses) are the usual pathogens.

Primary regimen

3rd generation Cephalosporins + Erythromycin +/- Vancomycin.

Alternative

Imipenem or Meropenem or Piperacillin-Tazobactam (PIP/TZ) or Ticarcillin-/Clavulancile (TC/CL) + Erythromycin +/- Vancomycin.

Adult, any age, hospital-acquired

(Nosocomial or ventilator acquired).

Aerobic Gram-negative bacilli (Enterobacter, Klebsiella, Acinetobacter, Pseudomonas sp.), Legionella sp. enterococci are usual etiological agents.

Primary regimen

Imipenem or Meropenem or antipseudomonal Beta-lactamase susceptible Penicillins (AP Pen) + antipseudomonal aminoglycosidic antibiotics (APAG) or 3rd generation (Cephalosporins + APAG) or (TC/CL) + APAG or (PIP/TZ + APAG) and add Erythromycin if Legionella is suspected.

Alternative

Azlteonam can substitute for AP Pen or 3rd generation Cephalosporin or TC/CL or PIP/TZ in Penicillin allergic patients. Add Erythromycin if Legionella is suspected.

PERITONEUM

Peritonitis

Primary (spontaneous bacterial peritonitis SBP)

Enterobacteriaceae in 63%, S. pneumoniae (15%), Enterococci 6-10% and anaerobes < 1%.

Primary regimen

Cefotaxime if life-threatening or TC/CL or PIP/TZ or AM/SB.

Alternative

Ceftriaxone.

Secondary (bowel perforation, ruptured appendix, diverticular)

Enterobacteriaceae, Enterococci, Bacteroides, Pseudomonas aeruginosa (3 - 15%).

Multiple regimens are effective which must cover Gram-negative anaerobes and enterobacteriaceae. If the infection is mild/moderate, Monotherapy is satisfactory. Anti-anaerobic agents include Clindamycin, Metronidazole, Cefoxilin, Imipenem, Meropenem, TC/CL, PIP/TZ, AM/SB. Antiaerobes include APAG, AM/SB, TC/CL, PIP/TZ, 2nd, 3rd and 4th generation Cephalosporins, AP Pen, Imipenem, Meropenem, Aztreonam.

SKIN

Rat bite

Usual etiological agent is Streptobacillus moniliformis.

Primary regimen

Amoxycillin/Clavulanate.

Alternative

Doxycycline.

Burns

Burn wound infection

Staph. aureus, Pseudomonas sp, Enterobacteriaceae, Serratia sp, Providencia sp, (and Aspergillus, Herpes simplex, Cytomegalovirus).

Suggested regimen

Vancomycin + Amikacin + Piperacillin (serum levels need to be monitored).

Infected wound - Post-trauma

Infection is usually polymicrobic, which includes Staph. aureus, Group A and anaerobic Streptococci, Enterobacteriaceae, Cl. perfringens, cl. tetani (if water exposure, Pseudomonas sp).

Primary regimen

Amoxycillin/clavulanate or 1st generation Cephalosporins.

Alternative

Erythromycin or Clarithromycin or Azithromycin or Clindamycin.

If febrile with sepsis:

Primary regimen

AM/SB or TC/CL or PIP/TZ or Imipenem or Meropenem.

Alternative

PRSP (Nafcillin or Oxacillin) + APAG + Clindamycin.

Wound cleansing and debridement should be done. Gram stain may enable rapid diagnosis of Clostridia and staphylococci.

NECROTIZING FASCITIS

("Flesh-eating bacteria")

Post-surgery, Trauma, Streptococcal skin infections.

Streptococci group A, C, G; Clostridia sp; Polymicrobic; aerobic + anaerobic.

All require prompt surgical debridement as well as antibiotics.

Infected wound-post operative

Surgery not involving Gastrointestinal or female genital tract (with and without sepsis)

Staph. aureus, Group A Streptococcus, Enterobacter-iaceae, Pseudomonas sp.

Without sepsis

Primary regimen

1st generation Cephalosporin.

Alternative

Fluoroquinolones (not Norfloxacin, Enoxacin), Ciprofloxacin.

With sepsis

Primary regimen

Imipenem or Meropenem or TC/CL or (PRSP + APAG) or PIP/TZ.

Alternative

(1st generation Cephalosporin + APAG) or Clindamycin + Ciprofloxacin.

SURGERY INVOLVING GASTROINTESTINAL TRACT (includes oropharynx, esophagus) or female genital tract

Organisms involved are as above + Bacteroides sp. Other anaerobes, enterococci, Group B, C Streptococci.

Primary regimen

Cefoxitin or Clindamycin + APAG, or Imipenem or Meropenem or TC/CL or PIP/TZ or AM/SB or 2nd and 3rd generation Cephalosporin + Metronidazole.

Where MRSA is prevalent, Vancomycin should be substituted for PRSP.

TETANUS

Caused by C. tetani. Treatment should be by Metronidazole. Morbidity is less with Metronidazole as compared to Penicillin G.

ANTIBIOTIC PRESCRIBING AND THE *in vitro* ANTIBIOTIC SUSCEPTIBILITY PATTERNS AT THE UNIVERSITY TEACHING HOSPITAL, LUSAKA, ZAMBIA

CONSENT FORM

Dear prescriber

The increasing use of antibiotics has contributed to selection of resistant bacteria and the cost of care. This has made it difficult to find antibiotics to treat life-threatening and hospital acquired infections. Patients have found themselves in a situation in which only the cheaper antibiotics are available to them and these agents have become progressively less effective. This has necessitated this study to determine the frequency of antibiotic use, the commonly prescribed, their administration and the antibiotic susceptibility patterns at UTH. This will provide information that will be useful in the formulation of an appropriate antibiotic policy which will help in quality management of the patient.

I understand the objectives of your study and agree to provide information on antibiotic prescriptions of my patients.

CONSENT (Name) _____ SIGN _____

DATE _____/_____/_____

CHILESHE LUKWESA
MPH STUDENT

ANTIBIOTIC PRESCRIBING AND THE *in vitro* ANTIBIOTIC SUSCEPTIBILITY PATTERN AT THE UNIVERSITY TEACHING HOSPITAL, LUSAKA, ZAMBIA.

QUESTIONNAIRE CONCERNING PATIENTS RECEIVING ANTIBIOTICS

Fill in or tick [✓] in the appropriate space provided

1. Patient serial number _____

2. Department ☐ medicine ☐ general surgery ☐ obs. & gyne. ☐ pediatrics

3. Date of Birth [___/___/___]
   DD MM YY

4. Sex ☐ Female ☐ Male

5. Date of admission [___/___/___]
   DD MM YY

6. Diagnosis _____

7. Site of infection
   ☐ Upper respiratory tract
   ☐ CNS
   ☐ Abdominal & gastrointestinal tract
   ☐ Circulatory System
   ☐ Skin & soft tissue
   ☐ ENT
   ☐ Lower respiratory tract
   ☐ Urinary tract
   ☐ Wound
   ☐ Genital tract
   ☐ Pleuropulmonary & bronchial infections

8. Was any antibiotic prescribed? ☐ Yes ☐ No

9. If 'Yes' please specify the antibiotic prescribed.

	FIRST ANTIBIOTIC	SECOND ANTIBIOTIC	THIRD ANTIBIOTIC
9.1 Trade name			
9.2 Generic name			
9.3 Daily dosage: **Start dosage**			
Maintenance			
9.4 Route of administration			
Oral			
Intramascular			
Intravenous			
Other			
9.5 Antibiotic was given for	☐therapy ☐ prophylaxis	☐therapy ☐ prophylaxis	☐therapy ☐ prophylaxis
9.6 Date of first day of treatment	[___/___/___]	[___/___/___]	[___/___/___]
9.7 Duration of treatment (days)	[___]	[___]	[___]

10. Reasons for introduction of second antibiotic

☐ Lack of response to first antibiotic
☐ Due to results of bacteriological test or other diagnostic test.
☐ Allergy toxicity
☐ Other reasons
☐ NA (Not applicable)

11. Did the diagnosis include a bacteriological test ☐ Yes ☐ No

12. If "Yes" please write the date.

a) When the sample was taken [____/____]
DD MM

b) When the test results were received [____/____]
DD MM

13. Specify the test done and the bacteriological strains demonstrated.

_____

_____

_____

14. Indicate the susceptibility test if any

_____

_____

_____

_____

REFERENCES

1. Chagla A.H., 1997, The treat of emerging infections. *Postgraduate Doctor Africa*. **17**:2, pp.39-41.

2. Ferraz E.M., 1989, Changing antibiotic usage in Brazil. APUA Newsletter. **7**:1: p.1.

3. Finland M., Jane W.F., Barnes M.W. (1959). Occurrence of serious bacterial infections since the introduction of antibacterial agents. *JAMA*. **170**:84.

4. Friis H., Mortensen W., Pinholt H., Schmidt K., Schouenborg P., Waarst S. 1989. Regional variation in the use of antibiotics in four Danish hospitals. *Infection*, May-June **17**(3), pp.139-41.

5. Gerald L.M., Gordon R.D., Bennet J.E. (1990). *Principal and Practices of Infectious Diseases*, 3rd ed., Churchill Livingstone.

6. Health Information Systems Department, University Teaching Hospital (Board of Management), 1996.

7. Henry R.S., Paul D.S. (1974). Trends and consequences of antibiotic use in the United States. *J. Am. Med. Ass.*; **227**:1023.

8. Jawetz E. (1980). Antimicrobial Drugs: Mechanisms and factors influencing their action. *Antimicrobial Therapy*, 3rd ed. Saunders W.B. Co., p.3-10.

9. Khan I.Z., 1988, Abuse and Misuse of antibiotics: a Zambian viewpoint. *Africa Health* Feb/March **10**:3, pp.29-30.

10. Kunin C.M. 1978. Evaluation of antibiotic Usage: A Comprehensive look at alternative approaches. *Principles and practices of infectious diseases* Churchill Livingstone 1990, pp.127-137.

11. Laguna P., Moya M.S., Garcia F., Salgado R., Calabrese S. (1996). Utilisation of antibiotics in a hospital emergency department, Quality of Prescriptions. *Revista Clinica Espanola*, July; **196(7)** 431-6.

12. Leigh D.A. (1989). Economic implications of oral treatment replacing parenteral therapy. A publication of Department of Microbiology, Wycombe General Hospital, UK.

13. Lim V.K., Cheong Y.M., Suleiman A.B. (1993). Pattern of antibiotic usage in Malaysia. *Singapore Medical Journal* Dec.; **36(6)**:525-8.

14. Mcgowan J.E. jr.(1988). Antimicrobial resistance in hospital organisms and its relation to antibiotic use. *Rev. Infect. Dis.*; **5**:103.

15. Morse S.A., Johnson S.R., Biddle J.W. (1986). High-level Tetracycline resistance in Neisseria gonorrhoeae is the result of acquisition of streptococcal tet M determinant. *Antimicrob Agents Chemother* 1986; **30**:664-70.

16. Mwale A. A bed census at the University Teaching Hospital. MPH Thesis, 1998.

17. News and Review, (1993). Global Child Health . Drug-resistant infections on the rise. Infectious Diseases No. 2, p.39.

18. Newsletter, 1989. WHO Symposium on The Use and Abuse of Antibiotics World-wide, APUA/4, Spring, **7**:1.

19. Nichols R.L., Condon R.E. (1980). Prophylactic Antibiotics in Surgery. *Antimicrobial Therapy 3rd ed.* Saunders W.B. Co., p.350-360.

20. Parret T., Schneider R., Rime B., Saghafi L., Pauntier A., Francoli P. (1993). Evaluation de l'utilisation des antibiotiques: une etude prospective dans un centre hospitalier universitaire. *Journal Suisse de Medecine*, March 13; **123(10)**:403-13.

21. Price D.J.E., Sleigh J.D. (1970). Control of infection due to *Klebsiella aerogenes* in a neuro surgical unit by withdrawal of all antibiotics, *Lancet* **2**:1213.

22. Reimann H.A., D'Ambola J. (1966). The use and cost of anti-microbics in hospitals. *Arch. Environ. Health* **13**:631.

23. *Report of Scientific Working Group Antimicrobial Resistance.* Geneva, 23-27 Nov., 1981. WHO/BVI/PHA/ANT/82.1.

24. Robert C., Moellering Jr. (1990). Principles of anti-infective therapy. Principles of infectious diseases 3rd ed., Churchill Livingstone, p.206-217.

25. Rodriguez-Noriega E., Morfin-Otero R., Esparza-Ahumada S. (1993). The use of quinolones in developing countries. *Drugs Suppl.* **3**:42-5.

26. Sandford J.P., Gibert D.N., Sande M.A. (1997). *Guide to Antimicrobial Therapy*, 1997, Pfizer.