A survey of antibiotic usage at Holy Trinity Medical Centre.

By

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DECLARATION

I hereby declare that this submission is my own work towards the MSc. and that, to the best of my knowledge, it contains no material previously published by another person nor material

which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

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Certified by:

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Supervisor(s) Name Signature Date

Certified by:

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Head of Dept. Name Signature Date

DEDICATION

To my dear husband Ebenezer, whose encouragement has been a source of strength for the completion of this work. And also our two lovely boys Prince and Ebow; wonderful gifts I received during the period of this course.

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ABSTRACT

Exposure to antibiotics is the principal risk factor in the emergence and selection of antibiotic resistant bacteria. The casual relationship between the emergence of antibiotic resistance and the

widespread use of antibiotics cannot be disputed. The emergence of antibiotic resistance is primarily due to excessive and often unnecessary use of antibiotics in humans and animals. Antibiotic prescribing patterns was studied in the Greater Accra Region of Ghana at the Holy Trinity Medical Centre which is a private health facility. Clinical records of 140 adult patients prescribed antibiotics over a 7day period at the general Out-Patient department were studied. Respiratory tract infections and urinary tract infections accounted for a greater percentage of antibiotic prescriptions. The average number of antibiotics prescribed in the above two sconditions was 1.09(SD=0.33) and 1.22(SD=o.42) respectively. The commonest antibiotics prescribed were penicillins (55.4%), macrolides (29.3%), cephalsoporins (10.8%), quinolones (2.7%), aminoglycosides (1.4%) and clindamycin (1.4%). Other antibiotics included tetracyclnes, chloramphenicol, nitrofurantoin and co-trimoxazole. In the management of the various disease conditions standard treatment guidelines in most cases were not being followed and many more interventions should have been considered than what was recorded.

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CHAPTER ONE

INTRODUCTION

Antimicrobial agents have been one of the most important and successful groups of therapeutic agents introduced. Initially these agents were discovered and developed empirically (for example; sulphonamides and penicillins). The search for new antibiotics then involved screening of biological materials such as sewage and soil specimens to look for antimicrobial substances produced by organisms.[1]

Since the introduction of antimicrobial agents, there has been an association between antibiotic use and the development of antimicrobial resistance. Antibiotic therapy eradicates not only pathogenic organisms but also the protective normal flora. This so-called "selective pressure" results in colonization with bacteria that are resistant to the original therapy. The result has been an increase over the past two decades in antibiotic resistance among common bacterial causes of outpatient infections.

Several studies have demonstrated that a substantial portion of antibiotics prescribed in the outpatient setting are given for viral illnesses or bacterial diseases where the benefit of antibacterial therapy is marginal. The reasons for prescribing antibiotics in these situations are related to medical and social factors.[2]

While their use in the treatment of diseases is essential and unavoidable, it is widely acknowledged that there is also substantial unnecessary use of these agents. Similarly prophylactic antibiotic treatment may be given where it is of no proven value as in the prevention of urinary catheter-associated infections.[3]

When antibiotics are prescribed to large numbers of persons in a population, resistant bacteria may become the predominant organisms in that community. This situation is occurring with respiratory-tract pathogens that were once universally susceptible to antibiotics.[4]

1.1 DEVELOPMENT OF RESISTANCE

Resistance to an antibiotic can be the result of

- Failure to reach the target site, for example because impaired permeability causes a failure to penetrate the outer bacterial membrane(e.g. Penicillins in Gram-negative bacteria)
- Enzyme inactivation (e.g. B-lactamase enzymes)
- Alteration of the target site (e.g. single point mutations in *E.coli* or a penicillin-binding protein in *Strept. Pneunoniae*) leading to acquired resistance.

The development or acquisition of resistance to antibiotic by bacteria invariably involves either a mutation at a single point in a gene or transfer of genetic material from another organism. Larger fragments of DNA may be introduced into a bacterium either by transfer of 'naked' DNA or via a bacteriophage (a virus) DNA vector. Both the former (transformation) and the latter (transduction) are dependent on the integration of this new DNA into the recipient chromosomal DNA. This requires a high degree of homology between the donor and recipient

chromosomal DNA. Finally, antibiotic resistance can be transferred from one bacterium to another by conjugation, when extra chromosomal DNA (a plasmid) containing the resistance factor(R factor) is passed from one cell into another during direct contact. Transfer of such R

factor plasmids can occur between unrelated bacterial strains and involve large amounts of DNA and often codes for multiple antibiotic resistance.

Transformation is probably the least clinically relevant mechanism, whereas transduction and R factor transfer are usually responsible for the sudden emergence of multiple antibiotic resistance in a single bacterium. Increasing resistance to many antibiotics has developed as shown in the table 1 below.[5]

Table 1. Some bacteria that have developed resistance to common antibiotics.

PATHOGEN	**PREVIOUSLY FULLY SENSITIVE TO**
Streptococcus pneumoniae	Penicillin, erythromycin, cefotaxime
Streptococcus pyogens	Erythromycin, tetracycline
Staphylococcus aureus	Penicillin, methicillin, ciprofloxacin
Neisseria gonorrhoeae	Penicillin, ciprofloxacin
Haemophilus influenza	Amoxicillin, chloramphenicol
Enterobacter	Amoxicillin, trimethoprim, ciprofloxacin, gentamicin
Salmonella spp	Amoxicillin, sulphonamides, ciprofloxacin
Shigella spp	Amoxicillin, trimethoprim, tetracycline
Psecdomonas aeruginosa	Gentamicin

1.2 SPREAD OF RESISTANT BACTERIA

Risk factors for the spread of resistant bacteria in hospitals and in the community can be summarized as excessive antibiotic use in humans and animals, overcrowding, lapses in hygiene or poor infection control practices. Increasing antibiotic resistance in bacteria has been exacerbated by the slow pace in developing newer antibiotics.

Methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococci (VRE) and multiresistant Gram-negative bacteria are spread primarily by direct or in-direct person-to-person contact. Independent risk factors for MRSA include the use of broad spectrum antibiotics, the presence of decubitus ulcers and prosthetic devices while that for VRE include prolonged hospitalization and treatment with glycopeptides or broad spectrum antibiotics. For the spread of resistant Gram-negative bacteria risk factors include urinary catheterization, excessive use of antibiotics and contamination of humidifiers and nebulizers.

The spread of penicillin-resistant pneumococci (PRP) and drug-resistant and multidrug-resistant tuberculosis (MDRTb) is due to airborne transmission. Risk factors for the spread of PRP include overcrowding, tracheostomies and excessive use of penicillins for viral respiratory infections. For MDRTb they include poor compliance, convergence of immunosuppressed patients, delayed diagnosis or treatment and poor or inadequate ventilation and isolation facilities.[3]

1.3 PREVENTING THE SPREAD OF ANTIBIOTIC RESISTANCE

The ideal means of controlling the spread of antibiotic resistance is by preventing its emergence in the first place. It is however a complex scientific and sociopolitical issue which requires the co-operation of many agencies and groups including the government, farmers, doctors,

veterinarians and patients. Understandably there are conflicting priorities for these agencies and these can be difficult to resolve.

Within hospitals it is inevitable that patients will need to be treated and that antibiotic resistance will emerge in some cases, but the proper implementation of antibiotic policies and guidelines will prevent much unnecessary and indiscriminate antibiotic treatment. Prevention of spread of antibiotic-resistant organisms is achieved by paying attention to hospital hygiene and infection control practices. These include isolation or segregation of patients carrying resistant organisms and assiduous environmental and personal hygiene by health care workers; early and accurate identification of resistant organisms in microbiology laboratories, efficient communication, and awareness and education of all staff are all essential prerequisites for the above measures.[6]

An antibiotic policy is a reasonable choice out of a number of nearly equivalent therapeutic possibilities and options whereby a distinction is made between indications for antibiotic prophylaxis, empiric and therapeutic use. The objectives of the antibiotic policy are to provide the patient with the safest and most effective antimicrobial agent, to decrease the emergence of resistance and to control costs. The antibiotic formulary is also an important tool in this respect. It is a limited and limiting list of antimicrobial drugs that are available for daily use in the hospital. The choice of an antibiotic is based upon microbiological data, clinical efficacy, toxicity and risk for the selection of resistance.[7]

1.4 ANTIBACTERIAL DRUGS

1.4.1 THE B-LACTAM ANTIBIOTICS

These are the penicillins and cephalosporins whose basic structure includes a four-membered B-lactam ring. Resistance is commonly due to bacterial enzymes called B-lactamases (penicillinases and cephalosporinases) which can cleave the ring and inactivate the antibiotic. Resistance may also be due to other mechanisms such as inability of the antibiotics to penetrate the cell wall. Penicillin-resistant pneumococci and meningococci and methicillin-resistant Staphylococci (MRSA), which are also resistant to cloxacillin are increasing problems in many countries.[1]

THE PENICILLINS

All penicillins are bactericidal, killing bacteria by interfering with their cell wall synthesis processing. The range of activity is wide as both Gram-positive and certain Gram-negative organisms are sensitive to individual penicillins. Their most important adverse effect is hypersensitivity. This may take the form of urticaria and pyrexia or an acute anaphylactic reaction which may occasionally prove fatal. Although penicillin is otherwise a safe antibiotic, its accumulation in patients with renal failure may lead to encephalopathy. In these patients dosage must be modified and guided by blood levels. In severe infections penicillin should be given intravenously; it should never be given intrathecally due to risk of seizure. Examples include; benzyl penicillin, phenoxymethylpenicillin, cloxacillin, flucloxacillin, temocillin, ampicillin amoxicillin, ticarcillin e.t.c.[1]

THE CEPHALOSPORINS

The cephalosporins have an advantage over the penicillins in that they are resistant to Staphylococcal penicillinases (but are still inactive against methicillin-resistant staphylococci) and have a broader range of activity that includes both Gram-negative and Gram-positive organisms, but excludes enterococci and anaerobic bacteria. These potent broad-spectrum antibiotics are useful for the treatment of serous systemic infections, particularly when the precise nature of the infection is unknown. They are commonly used for serious sepsis in postoperative and immuno-compromised patients, particularly during cytotoxic chemotherapy of leukaemia and other malignancies. Toxicity is similar to the penicillins but is less common. [1]

They have been developed over many years and the historical classification by ‘generations’ is normally used. Examples of first generation include cephradine and cephalexin. Second generation include; cefuroxime, cefaclor and cefixime. Third generation include; cefotaxime and ceftriaxone. Then fourth generation include; cefipime and cefprirome.[1]

THE MONOBACTAMS

Aztreonam is currently the only member of this class available. Its spectrum of activity is limited to aerobic Gram-negative bacilli. It is a useful alternative to aminoglycosides in combination therapy, largely for the treatment of intra-abdominal sepsis. Its toxicity is similar to the other *B*-lactam antibiotics.[1]

THE CARBAPENEMS

These are semisynthetic *B*-lactams and include imipenem, biapenem and meropenem. They are currently the most broad spectrum of antibiotics being active against the majority of Gram-positive and Gram-negative as well as anaerobic bacterial pathogens. They are used for serious nosocomial infections when multiple-resistant Gram-negative bacilli or mixed aerobe and anaerobe infections are suspected. Toxicity is similar to that of the other *B*-lactam antibiotics.[1]

1.4.2 THE TETRACYCLINES

These are bacteriostatic drugs possessing a four-ring hydronaphthacene nucleus. They inhibit bacterial protein synthesis by interrupting ribosomal function. They are active against Gram-positive and Gram-negative bacteria but their use is now limited, partly owing to increasing bacterial resistance. Tetracyclines are generally safe drugs, but they may enhance established or incipient renal failure, although doxycyline is safer than others in this group. They can cause brown discoloration of growing teeth, and thus are not given to children or pregnant women. Examples include doxycycline, tetracycline, monocycline and oxytetracycline.[1]

1.4.3 THE AMINOGLYCOSIDES

These antibiotics are polycationic compounds of amino sugars. They interrupt bacterial protein synthesis by inhibiting ribosomal function. Examples include streptomycin which is rarely used except for the treatment of tuberculosis, neomycin which is used only for topical treatment of eye

and skin infections and in the management of portosystemic encephalopathy, gentamicin and tobramycin which are highly effective against many Gram-negative organisms including *Pseudomonas spp* and then amikacin and netilmicin whose use should be restricted to gentamicin-resistant organisms. Toxicity is dose-related. They are nephrotoxic and ototoxic, particularly in the elderly. Therapeutic drug monitoring is important in ensuring therapeutic and non-toxic drug concentrations.

1.4.4 THE MACROLIDES

These inhibit protein synthesis by interrupting ribosomal function. They have a broad spectrum of activity that includes Gram-negative organisms, mycobacteria and *Toxoplasma gondii*. Examples include erythromycin, azithromycin, clarithromycin and roxithromycin.

1.4.5 THE QUINOLONES

The quinolone antibiotics, such as ciprofloxacin, norfloxacin, ofloxacin and levofloxacin, are useful oral broad spectrum antibiotics, related structurally to nalidixic acid. The quinolone group of bactericidal drugs inhibit bacterial DNA synthesis by inhibiting topoisomerase IV and DNA gyrase, the enzyme responsible for maintaining the super helical twists in DNA. They are useful in Gram-negative septicaemia, skin and bone infections, urinary and respiratory tract infections, meningococcal carriage, in sexually transmitted diseases like gonorrhea and non-specific urethritis due to Chlamydia trachomatis. Gastrointestinal disturbances, photosensitivity rashes and occasional neurotoxicity can occur.[1]

1.4.6 OTHER ANTIBIOTICS

CHLORAMPHENICOL

Chloramphenicol is the only naturally occurring antibiotic containing nitrobenzene. It acts by competing with messenger RNA for ribosomal binding and also inhibits peptidyl transferase. It is rarely used in developed countries. In developing countries it has been invaluable in the treatment of severe infections caused by *Salmonella typhi* and *S. paratyphi* (enteric fevers) and *H. Influenza* (meningitis and acute epiglottitis) which are still prevalent in countries where *Haemophlus influenza* type b (Hib) vaccination has not been introduced. It is also used topically for the treatment of purulent conjunctivitis. Drug resistance is currently eroding the efficacy of chloramphenicol. Severe irreversible bone marrow suppression is rare but now restricts the usage to only the severely ill patient. It should not be given to premature infants or neonates because of their inability to conjugate and excrete this drug; high blood levels lead to circulatory collapse and the often fatal 'grey baby syndrome'.[1]

FUSIDIC ACID

It is a potent inhibitor of bacterial protein synthesis. It is mainly used for penicillinase-producing *Staph. aureus* infections such as osteomyelitis or endocarditis, and for other staphylococcal infections accompanied by septicaemia. It may occasionally be hepatotoxic but it is generally a safe drug and if necessary can be given during pregnancy.

SULPHONAMIDES AND TRIMETHOPRIM

Sulphonamides block thymidine and purine synthesis by inhibiting microbial folic acid synthesis whiles trimethoprim prevents the reduction of dihydrofolate to tetrahydrofolate. Trimethoprim alone is used for urinary tract infections and acute-on-chronic bronchitis. It is used in combination with sulphamethoxazole (co-trimoxazole) strictly in the treatment and prevention of *Pneumocystis carnini* infection and listeriosis in developed countries.

OXAZOLIDINONES

These are a novel class of antibacterial agents of which linezolid is the first to become available. They inhibit protein synthesis and are active against a variety of Gram-positive pathogens including vancomycin-resistant *Enterococcus faecium*, methicillin-resistant *Staphylococcus aureus* and penicillin-resistant *Streptococcus pneumonia.*

GLYCOPEPTIDES

The glycopeptide antibiotics are active against Gram-positive bacteria by inhibiting cell wall synthesis. Example is vancomycin which is given intravenously for methicillin-resistant *Staph. aureus* and other multiresistant Gram-positive organisms. Vancomycin can cause ototoxicity and nephrotoxicity and thus serum levels have to be monitored. Teicoplanin is another glycopeptides which is less toxic and has more favourable pharmacokinetic properties, allowing once-daily dosage.

CLINDAMYCIN

This is active against Gram-positive cocci including some penicillin-resistant staphylococci. It is also active against anaerobes, especially bacteroides. It is well concentrated in bone and used for osteomyelitis.

QUINUPRISTIN AND DALFOPRISTIN

A combination of these streptogramin antibiotics is used for Gram-positive bacteria which have failed to respond to other antibacterials.

NITROFURANTOIN

This is indicated mainly in the management of urinary tract infections. Its main side effect is nausea and vomiting which are very common.

1.5 PRINCIPLES OF USE OF ANTIBIOTICS

The principles involved in the selection of an antibacterial, must allow for a number of variables including changing renal and hepatic function, increasing bacterial resistance and new information on side-effects. Duration of therapy, dosage and route of administration depend on site, type and severity of infection and response.[8]

In the majority of infections there is no firm evidence that bactericidal drugs (penicillins, cephalosporins, and aminoglycosides) are more effective than bacteriostatic drugs, but it is generally considered necessary to use the former in the treatment of bacterial endocarditis and in

patients in whom host defence mechanisms are compromised, particularly in those with neutropenia.[5] Combination of drugs are occasionally required for reasons other than providing broad-spectrum cover. Synergistic inhibition is achieved by using penicillin and gentamicin in enterococcal endocarditis or gentamicin and ceftazidime in life-threatening pseudomonas infections.

To be successful, sufficient antibiotic must penetrate to the site of the infection. Difficult sites include the brain, eye and prostate, while loculated abscesses are inaccessible to most agents. Many mild-to-moderate infections can be treated effectively with oral antibiotics provided that the patient is compliant. Parenteral administration is indicated in the severely ill patient to ensure rapid high blood and tissue concentrations of the drug. Some antibiotics can only be administered parentrally such as the aminoglycosides and extended spectrum cephalosporins. Parenteral therapy is also required in those unable to swallow or where gastrointestinal absorption is unreliable.

According to the NICE Clinical Guideline in relation to the prescribing of antibiotics for self limiting respiratory tract infections, the following recommendations are given. It is recommended that:

1. At the first face-to-face contact in primary care, adults and children presenting with a history suggestive of the following conditions should be offered a clinical assessment.
    - Acute otitis media
    - Acute sore throat/acute pharyngitis/acute tonsillitis
    - Common cold
    - Acute rhinosinusitis

- Acute cough/acute bronchitis

The clinical assessment should involve a history (presenting symptoms, use of over the counter or self medications, previous medical history, relevant risk factors, relevant co-morbidities) and if indicated, an examination to identify relevant clinical signs.

2. Patients or parents/carers concerns and expectation should be determined and addressed when agreeing to the use of the three antibiotic prescribing strategies(no prescribing, delayed prescribing and immediate prescribing)
3. A no prescribing strategy or a delayed antibiotic prescribing strategy should be agreed for patients with the following conditions.
    - Acute otitis media
    - Acute sore throat/acute pharyngitis/acute tonsillitis
    - Common cold
    - Acute rhinosinusitis
    - Acute cough/ acute bronchitis
4. For all antibiotic prescribing strategies, patients should be given advice

a. About the usual natural history of the illness including the average total length of the illness(before or after seeing the Doctor)
    - Acute otitis media: 4days
    - Acute sore throat/acute pharyngitis/acute tonsillitis: 1week
    - Common cold: 1.5weeks
    - Acute rhinosinusitis: 2.5weeks
    - Acute cough/acute bronchitis: 3weeks

b. About managing symptoms including fever.

5. When the no antibiotic prescribing strategy is adopted, patients should be offered
    - Reassurance that antibiotics are not needed immediately because they are likely to make little difference to the symptoms and may have side effects such as diarrhoea, vomiting and rash.
    - A clinical review if the condition worsens or becomes prolonged.
6. When the delayed antibiotic prescribing strategy is adopted, patients should be offered
    - Reassurance that antibiotics are not needed immediately
    - Advice about using the delayed prescription if symptoms are not starting to settle in accordance with the expected course of the illness or a significant worsening of the symptoms occurs.
7. An immediate antibiotic prescription and/or further appropriate investigations and management should only be offered to patients in the following situation
    - If the patient is systemically very unwell
    - If the patient has symptoms and signs suggestive of serious illness and/or complications(particularly pneumonia, mastoiditis, peritonsilar abscess, peritonsilar cellulitis, intraorbital and intracranial co-morbidities)
    - If the patient is older than 65years with acute cough and two or more of the following criteria

    I. Hospitalization in the previous year

    II. Type 1 or Type 2 diabetes

    III. History of congestive heart failure

    IV. Current use of oral glucocorticoides.

For these patients the no antibiotic prescribing strategy and the delayed antibiotic prescribing strategy should not be considered.[9]

AIM: To conduct a survey on the trend of antibiotic usage at Holy Trinity Medical Centre.

OBJECTIVES

1. To determine the various conditions in which antibiotics are prescribed.

2. To determine the frequency of multiple antibiotic prescriptions and the disease conditions in which they are prescribed.

3. To determine the various classes of antibiotics prescribed and the average number of antibiotics prescribed for each condition.

4. To determine whether the antibiotics prescribed were in the correct dose.

5. To determine whether laboratory investigations were done either before or after the prescribing of antibiotics.

6. To bring to light any Pharmacist interventions regarding the prescribing of antibiotics.

7. To find out if there is the need for an antibiotic policy and formulary for the medical centre.

CHAPTER TWO

METHODOLOGY

2.0 INTRODUCTION

This chapter discusses how the fieldwork was organized, how the various data sources were handled and the techniques adopted for the relevant data analysis. The study was retrospective. Additionally, the process ensured the gathering of relevant and reliable data and the application of appropriate statistical techniques in the analysis of the data.

2.1 STUDY AREA

The study was conducted in Accra, the capital city of Ghana at specifically the Holy Trinity Medical Centre located in North Kaneshie. This is a private medical facility and was chosen because of its large clientele base which made it convenient to be chosen as a site for this study.

2.2 SAMPLING AND SAMPLE SIZE.

In investigating drug use in health facilities, in order to obtain a more reliable result in one facility, a sample of at least 100 prescriptions should be examined. Examining additional encounters may be a good activity in which to involve facility staff, since self-assessment is a powerful long-term strategy to improve performance. [10] Therefore 140 antibiotic prescriptions were assessed in this study.

On the average, the total number of adult patients visiting the general Out Patient Department (OPD) who are prescribed antibiotics in a day is about 20. All these patients were therefore included in the sample size.

2.3 INCLUSION CRITERIA.

There are different types of patient encounters sometimes taking place within the same health facility. In addition to general medical visits for acute or chronic illnesses, there can be separate clinics for well-child visits, pre-natal and post-natal visits, dental visits, specialist consultations and so forth. Treatment practices for these different types of encounters can be quite different.

A study which mixes different types of encounters in an unsystematic way will produce results that are difficult to interpret. Indicators studies should be restricted to a sample of general illnesses encounters representing a mix of health problems and ages.[10]

All adult patients visiting the general OPD who are prescribed antibiotics were therefore included in the study.

2.4 EXCLUSION CRITERIA.

All children below 12years of age, adult in-patients and those attending pre-natal or post-natal clinics, dental clinics and other specialist clinics were excluded from the study. This was to ensure that the results produced give a clear picture of antibiotic usage at the general OPD.

2.5 DATA COLLECTION.

At the medical centre all patient records including lab investigations and drug prescriptions are in the patient folders. All data needed in this study was therefore taken from the patient folders.

Approximately 20 folders of adult patients visiting the general OPD who were prescribed antibiotics were assessed on a daily basis and the required data recorded over a 7 day period.

Data collected included patient name, age, sex, diagnosis, antibiotic prescribed (this included name, number, class, dose, route of administration, duration), lab investigations requested (whether before or after antibiotic prescribed) and any Pharmacist interventions.

The definition of antibiotics in this study was based on the classification scheme for the common classes of anti-infective drugs derived from the WHO Model List of Essential Drugs as shown below.

Table 2.1 Antimicrobial classification for prescribing indicators.

Count as antibiotic	**Code in WHO Model List**	**Class**
	6.1.3	Antifilarials
	6.1.4	Antischistosomals
Yes	6.2.1	Penicillins

Yes	6.2.2	Other antibacterials
	6.2.3	Antileprosy drugs
	6.2.4	Antituberculosis drugs
	6.3	Antifungals
	6.4.1	Antiamoebic & antigiardiasis drugs
	6.4.2	Antileishmaniasis drugs
	6.4.3	Antimalarials
	6.4.4	Antitrypanosomal drugs
Yes	13.2	Anti-infective dermatological drugs
Yes	21.1	Anti-infective ophthalmological agents
Yes	*	Antidiarrhoeal drugs with streptomycin, neomycin, nifuroxazide or combinations

*Not on WHO Model List of Essential Drugs.[10]

The correct dose was defined as prescribed for at least 5days and prescribed at the correct number of times a day for that antibiotic. The correct number of times a day was defined for common antibiotics as four times a day for ampicillin, benzyl penicillin, chloramphenicol, flucloxacillin and tetracycline; three for amoxicillin and two for co-trimoxazole, cefuroxime and one for procaine penicillin.[11]

2.6 OUTCOMES TO BE EXPECTED.

*Respiratory tract infections , were expected to take the greater percentage of disease conditions in which antibiotics were prescribed followed by Urinary tract infections, Gastroenteritis, skin and skin structure infections, arthritis, ear infections, Peptic ulcer disease, Pyrexia of unknown origin and others.

*Penicillins and cephalosporins were the classes of antibiotics expected to be prescribed in higher percentages as compared to macrolides, quinolones, aminoglycosides etc.

*It was expected that a greater percentage of antibiotics prescribed will be in the correct dose and that in cases of prescription errors, the equivalent Pharmacist interventions will be done.

2.7 DATA ANALYSIS PLAN.

Table 2.2 Data Analysis Plan

	Objective	**Variable name needed for analysis.**	**Variable type**	**Descriptive/ inferential analysis required.**
1	To determine the various conditions in which antibiotics are prescribed.	Diagnosis	Nominal	Percentages/descriptive numbers
2	To determine the frequency of multiple antibiotic prescriptions and the disease conditions in which they are prescribed.	Number of multiple antibiotic prescriptions. Diagnosis	Nominal	Cross tabulation
3	To determine the classes of antibiotics prescribed and the average number of antibiotic prescribed per patient.	Classes of antibiotics and number prescribed per patient.	Nominal	Percentages Descriptive numbers
4	To determine whether the antibiotics prescribed were	Dose, frequency and	Nominal	Percentages

	in the correct doses.	duration of antibiotic prescribed		
5	To determine whether laboratory investigations were done either before or after the prescribing of antibiotics.	Number of laboratory investigations	Nominal	Percentages
6	To bring to light any Pharmacist Interventions regarding the prescribing of antibiotics.	Number of Pharmacist interventions.	Nominal	Percentages
7	To find out if there is a need for an antibiotic policy and formulary for the medical centre.			

CHAPTER THREE

RESULTS

A total number of 140 antibiotic prescriptions given to adult patients visiting the general out-patient department of the medical centre over a seven day period were obtained from the study. Majority (97.14%) of the antibiotics prescribed were to be administered orally with only 2.86% of the antibiotics prescribed; given as injectables. Forty six percent (46%) of the patients were males and Fifty four percent (54%) were females. The minimum age was 12years and the maximum age was 62years. The mean age was 32.59 (SD=13.27)

3.1 CONDITIONS FOR WHICH ANTIBIOTICS WERE PRESCRIBED.

The frequently reported condition for which antibiotics was prescribed was respiratory tract infections (Fig 3.1). Others as indicated in the chart below include disease conditions such as enteric fever, pyrexia of unknown origin, cholecystitis and conjunctivitis. Respiratory tract infections include tonsillitis, phargyngitis, sinusitis, pueumonia e.t.c.

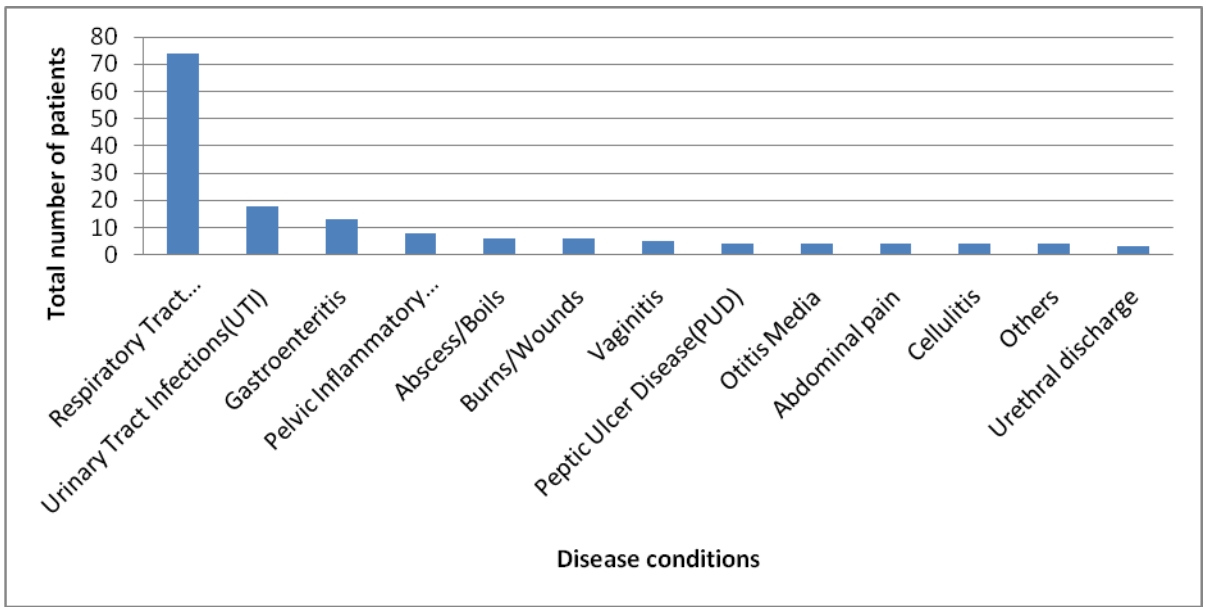

Figure 3.1 Conditions for which antibiotics were prescribed.

3.2 PRESCRIBING PATTERN OF ANTIBIOTICS.

3.2.1 CLASSES OF ANTIBIOTICS PRESCRIBED.

The frequently prescribed class of antibiotics was the penicillin (Fig.3.2). 'Others' indicated in Fig3.2 include antibiotics such as the tetracyclines, chloramphenicol, nitrofurantoin and co-trimoxazole whose frequency of use was low.

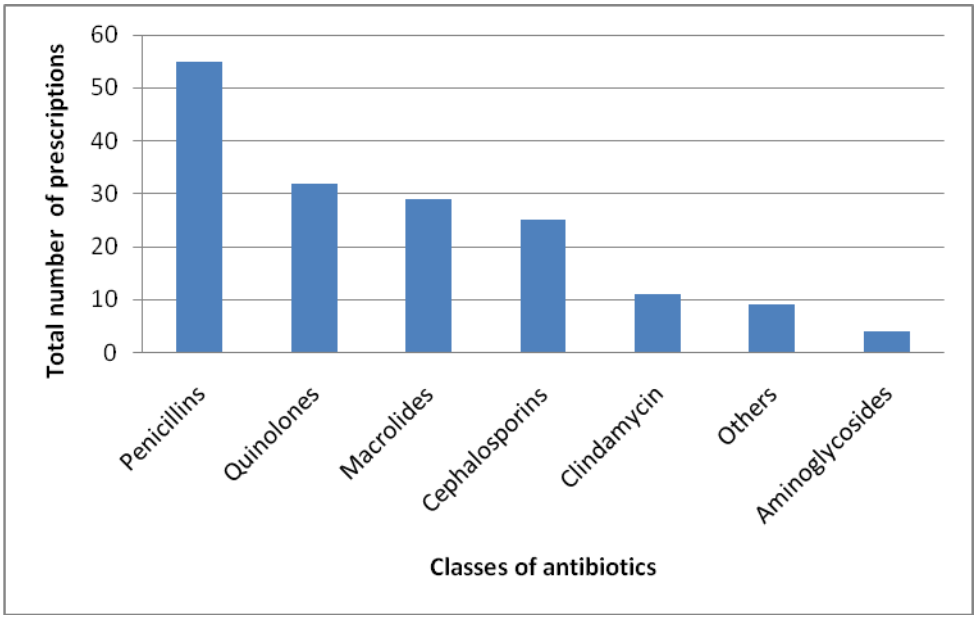

Figure 3.2 Classes of antibiotics prescribed.

3.2.2 ANTIBIOTICS PRESCRIBED FOR THE MANAGEMENT OF RESPIRATORY TRACT INFECTIONS (RTI's).

The frequently prescribed antibiotic for the management of RTI's were the penicillins (Fig 3.3). In the management of this condition, it was observed that the minimum number of antibiotic prescribed per patient was 1 and the maximum was 3 (the incidence of multiple antibiotic prescribing). The average number of antibiotics prescribed in RTI was 1.09 (SD=0.33).In 3 instances(4.05%) the dose of the antibiotic(azithromycin) had to be corrected from 500mg twice daily to 500mg daily or 250mg twice daily.

Amoxycillin, Amoxycillin+clavulanic acid (eg. Amoksiklav), Cloxacillin+ Ampicillin (eg. Ampiclox) were the penicillins which were prescribed. Cefuroxime was the cephalosporin prescribed while ciprofloxacin and levofloxacin were the quinolones prescribed. Azithromycin,

clarithromycin and erythromycin were the macrolides prescribed with gentamicin being the only aminoglycoside prescribed in respiratory tract infections.

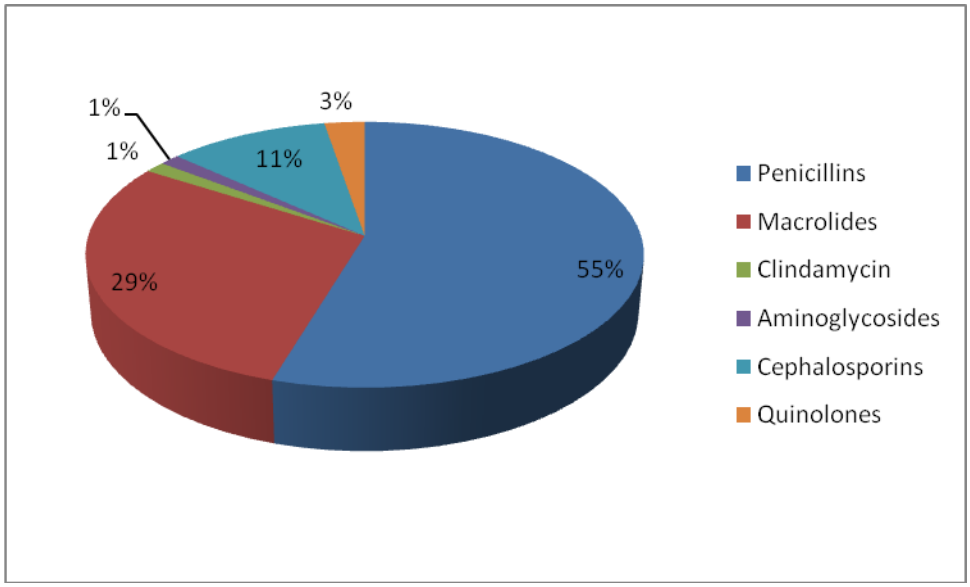

Figure 3.3 Pie chart showing the classes of antibiotics used in RTI's.

3.2.3 ANTIBIOTICS PRESCRIBED FOR THE MANAGEMENT OF URINARY TRACT INFECTIONS (UTI's).

The frequently prescribed antibiotic for the management of UTI's was the cephalosporins (Fig 3.4).In the management of UTI, the minimum number of antibiotic prescribed per patient was 1. However there were cases of multiple antibiotic prescribing whereby 2 different classes of antibiotics were prescribed for patients presenting with this condition. The average number was 1.22 (SD=0.42).Correct doses of the antibiotics were prescribed.

Among the macrolides and cephalosporins, azithromycin and cefuroxime were the antibiotics that were prescribed respectively. Quinolones that were prescribed were levofloxacin and ciprofloxacin.

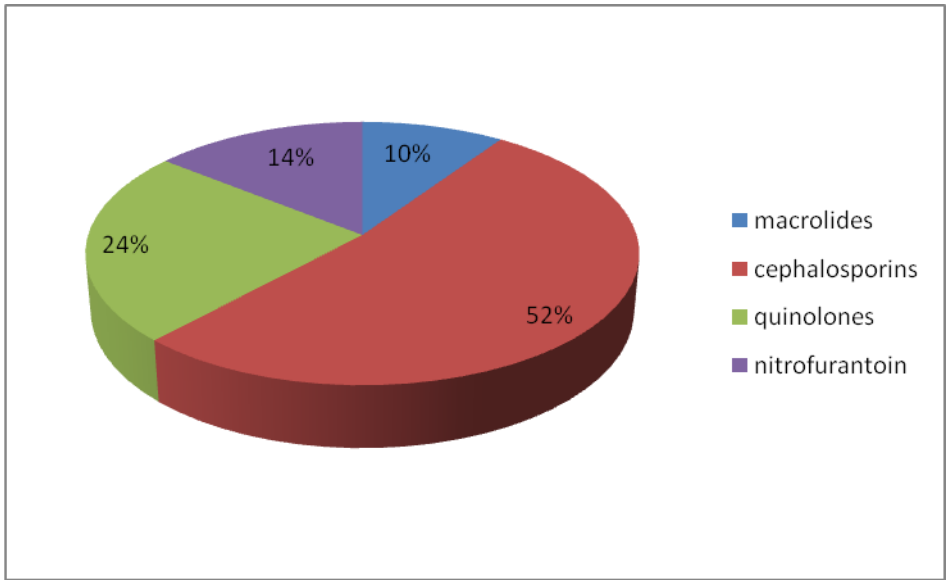

Figure 3.4 Antibiotics prescribed for the management of UTI

3.2.4. ANTIBIOTICS PRESCRIBED FOR THE MANAGEMENT OF GASTROENTERITIS.

The commonly prescribed antibiotic for the management of gastroenteritis was the Quinolones (Fig 3.5). In the management of gastroenteritis, the minimum number of antibiotic prescribed was 1.There were cases of multiple antibiotic prescribing whereby 2 antibiotics were prescribed for some patients. Thus the average number prescribed was 1.08(SD=0.24). The antibiotics were prescribed in the right doses. Quinolones included ciprofloxacin; macrolide prescribed was azithromycin and the cephalosporin prescribed was cefuroxime.

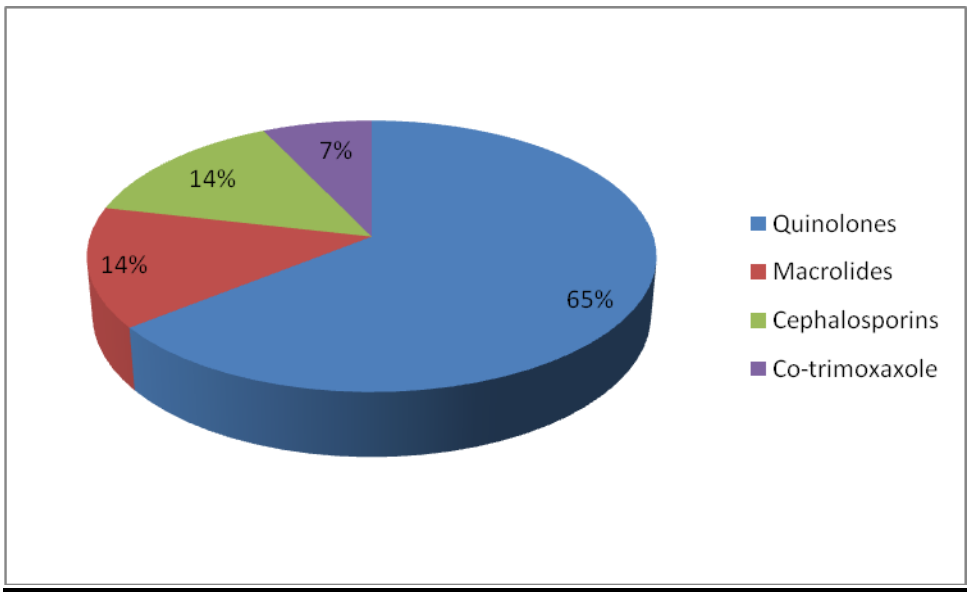

Figure 3.5 Antibiotics prescribed for the management of Gastroenteritis

3.2.5 ANTIBIOTICS PRESCRIBED FOR THE MANAGEMENT OF PELVIC INFLAMMATORY DISEASE (PID).

The minimum number of antibiotic prescribed per patient was 1. However multiple antibiotic prescriptions were given which included 2 or 3 different antibiotics. The average number of antibiotic prescribed was 1.38 (SD=0.69) and the commonly prescribed antibiotic for the management of PID was the Quinolones(Fig 3.6).

The doses of the antibiotics were correct. Ciprofloxacin, azithromycin, ceftriazone and cefuroxime were the quinolones, macrolides and cephalosporins prescribed respectively. Doxycycline was the tetracycline prescribed whilst amoxicillin was the penicillin prescribed.

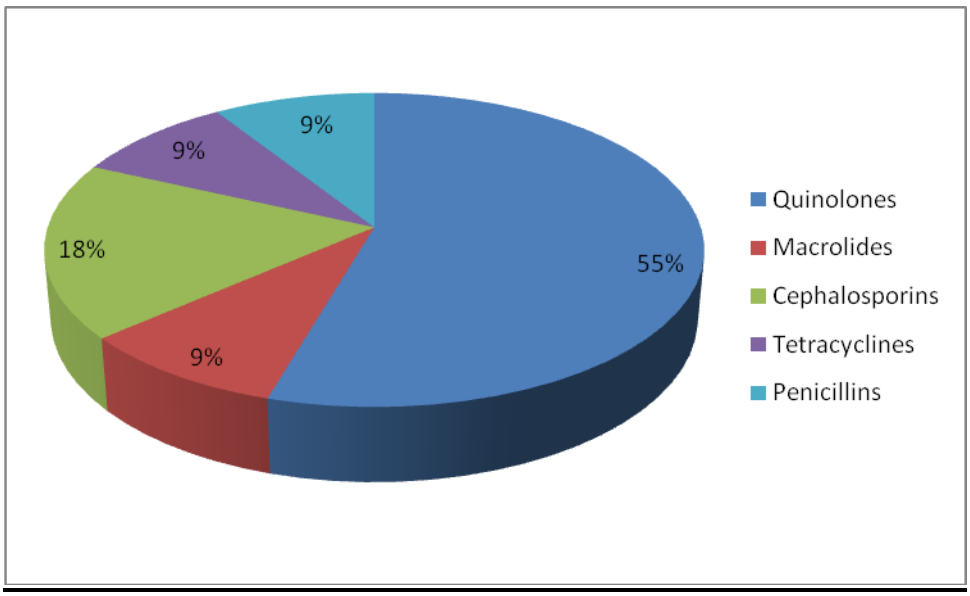

Figure 3.6 Antibiotics prescribed for the management of Pelvic inflammatory diseases.

3.2.6 ANTIBIOTICS PRESCRIBED FOR THE MANAGEMENT OF ABSCESS/BOILS.

The minimum number of antibiotic prescribed was 1. In some cases 2 different antibiotics were prescribed and the frequently prescribed antibiotic were the penicillins (Fig 3.7). The average number prescribed was 1.17(SD=0.36) .The doses of the antibiotics were correct. Among the penicillins, flucloxacillin was prescribed. The macrolides prescribed were erythromycin and azithromycin and the cephalsoporins prescribed was cefuroxime.

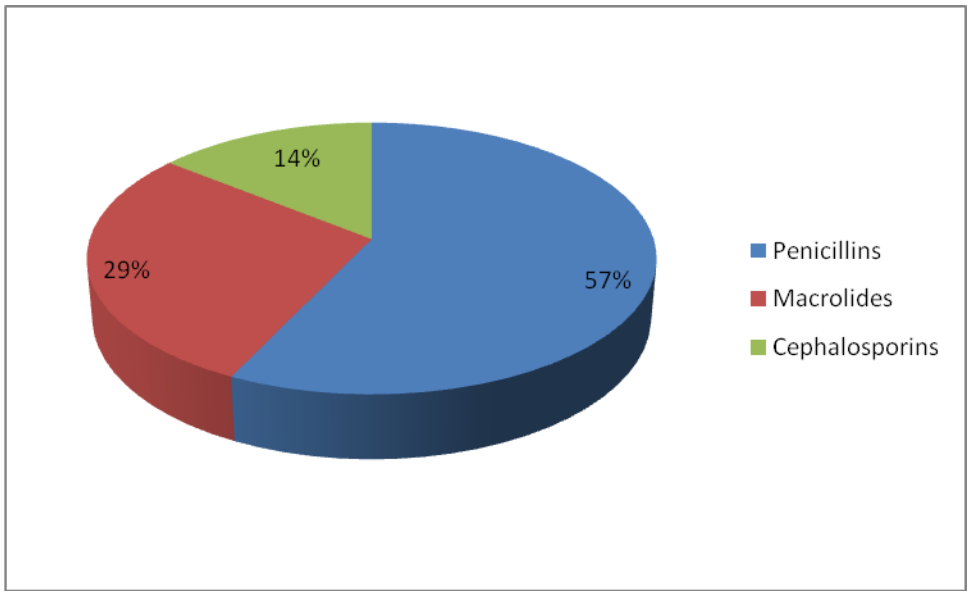

Figure 3.7 Antibiotics prescribed for the management of Abscess/boils

3.2.7 ANTIBIOTICS PRESCRIBED FOR THE MANAGEMENT OF OTITIS MEDIA.

Minimum number of antibiotic prescribed was 1. Here again 2 different antibiotics were prescribed for some patients. The commonly prescribed antibiotic were the penicillins (Fig 3.8). The average number prescribed was 1.5(SD=0.5)

The doses of the antibiotics were correct. Azithromycin was the macrolide prescribed. Among the penicillins; amoxicillin+clavulanic was prescribed. The cloramphenicol prescribed was in the form of an ear preparation.

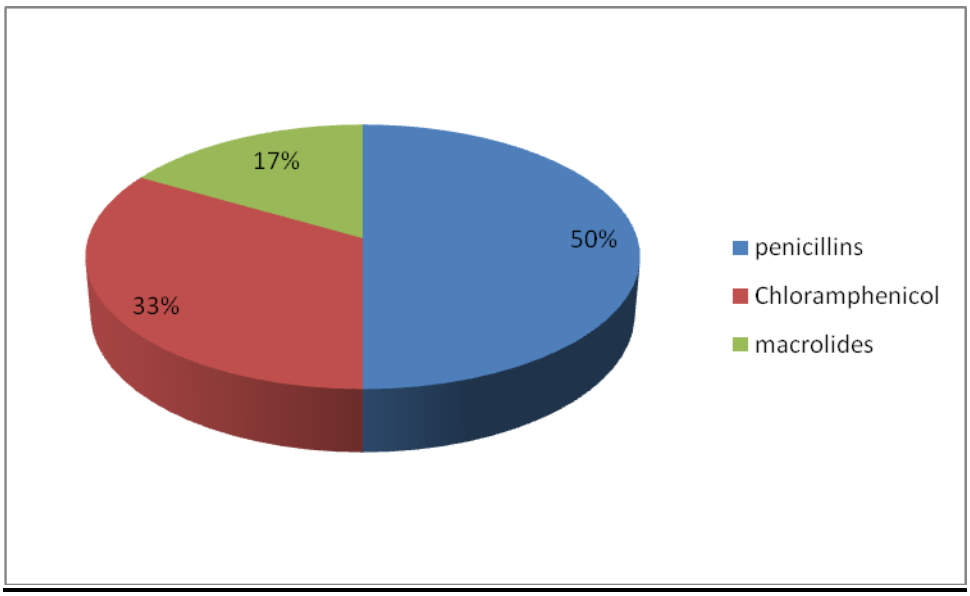

Figure 3.8 Antibiotics prescribed for the management of Otitis media.

3.2.8 ANTIBIOTICS PRESCRIBED FOR THE MANAGEMENT OF VAGINAL DISCHARGE.

The minimum and maximum number of antibiotics prescribed per patient was 1 and 3 and the frequently prescribed antibiotic was the Quinolones (Fig 3.9). The average number prescribed was 1.4(SD=0.8).The dose of clindamycin in two instances (40%) had to be corrected from being prescribed twice daily to the correct four times daily dose. Examples of quinolones are ciprofloxacin and levofloxacin. Doxycycline was the tetracycline prescribed and gentamicin was the aminoglycoside prescribed.

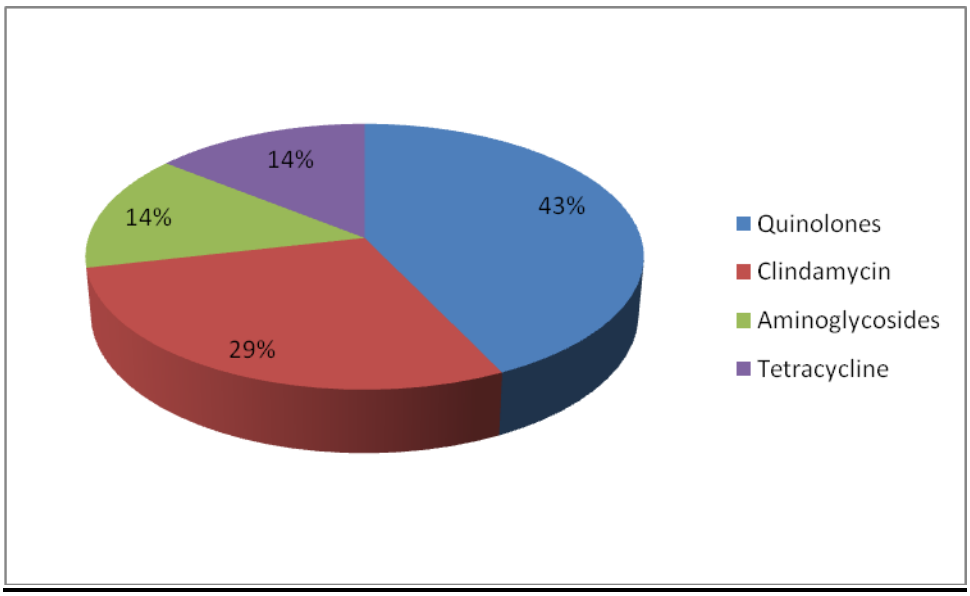

Figure 3.9 Antibiotics prescribed in vaginal discharge.

3.2.9 ATIBIOTICS PRESCRIBED FOR THE MANAGEMENT OF BURNS/WOUNDS.

The minimum and maximum number of antibiotic prescribed per patient was 1 and 2 and the frequently prescribed antibiotic was clindamycin (Fig 3.10). Average number prescribed was 1.17(SD=0.36).

Correct doses were prescribed. The penicillin prescribed was flucloxacillin. Levofloxacin and ciprofloxacin were the quinolones prescribed.

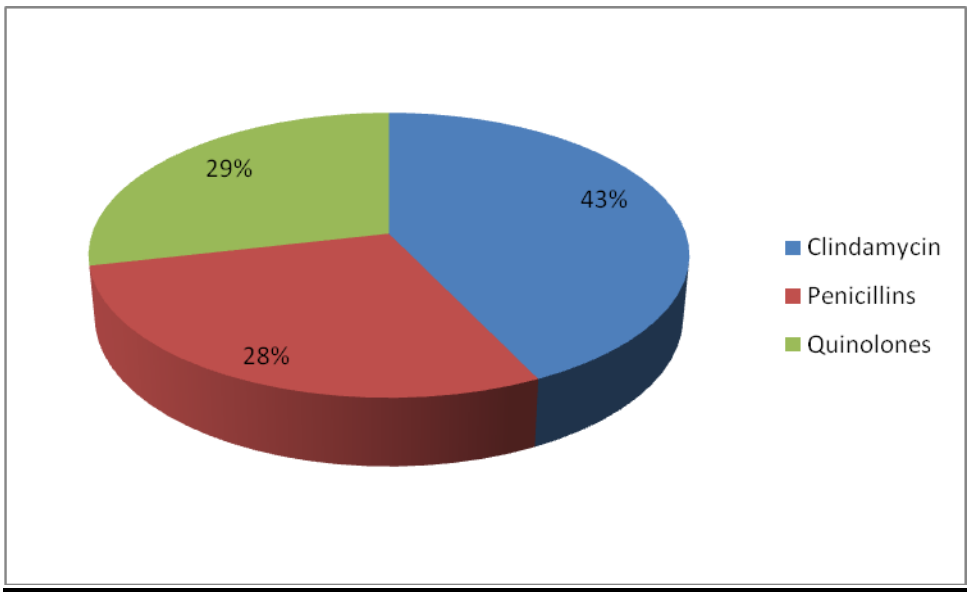

Figure 3.10 Antibiotics prescribed for the management of Burns/wounds.

3.2.10 ANTIBIOTICS PRESCRIBED FOR THE MANAGEMENT OF ABDOMINAL PAIN.

The frequently prescribed antibiotics for the management of abdominal pain were the Quinolones and the Cephalosporins (Fig 3.11). The minimum and maximum number of antibiotic prescribed per patient was 1 and 2 respectively. Average number prescribed was 1.5(SD=1.32).

Correct doses were prescribed. Macrolide prescribed was erythromycin, cephalosporin prescribed was cefuroxime, quinolone prescribed was levofloxacin and ciprofloxacin and the tetracycline prescribed was doxycycline.

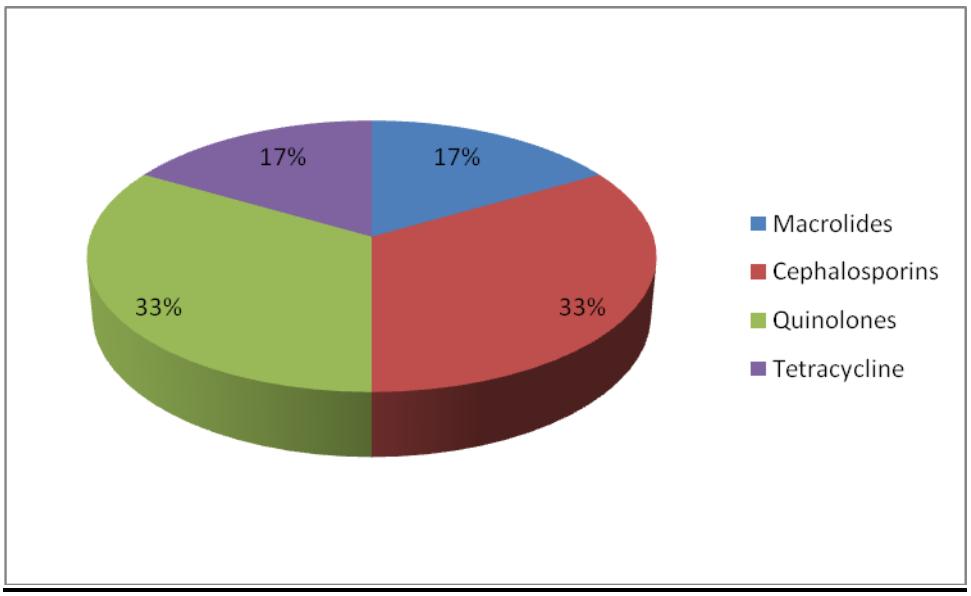

Figure 3.11 Antibiotics prescribed for the management of Abdominal pain

3.2.11 ANTIBIOTICS PRESCRIBED FOR THE MANAGEMENT OF CELLULITIS.

The minimum and maximum number of antibiotic prescribed per patient was 1 and 2 respectively. Clindamycin was the antibiotic that was frequently prescribed in the management of cellulitis (Fig 3.12). Average number of antibiotic prescribed was 1.5(SD=0.5)

Correct doses were prescribed. Flucloxacillin was the penicillin prescribed.

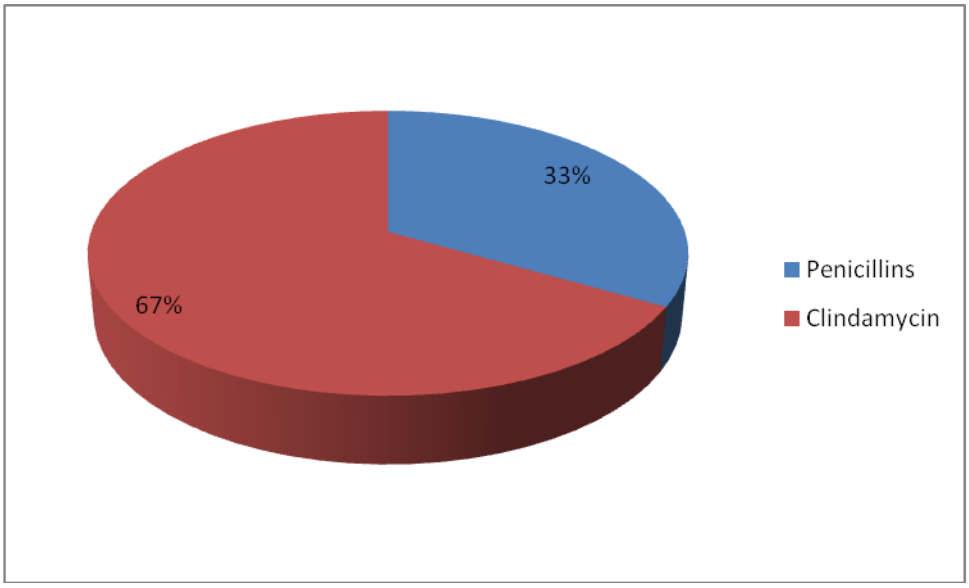

Figure 3.12 Antibiotics prescribed for the management of Cellulitis.

3.2.12 ANTIBIOTICS PRESCRIBED FOR THE MANAGEMENT OF URETHRAL DISCHARGE.

The minimum and maximum antibiotic prescribed per patient was 1 and the commonly prescribed antibiotic was the cephalosporins (Fig 3.13).

Correct doses were prescribed. Cefuroxime and ceftriaxone were the cephalosporins given. Levofloxacin was the quinolone prescribed and gentamicin the aminoglycoside prescribed as well.

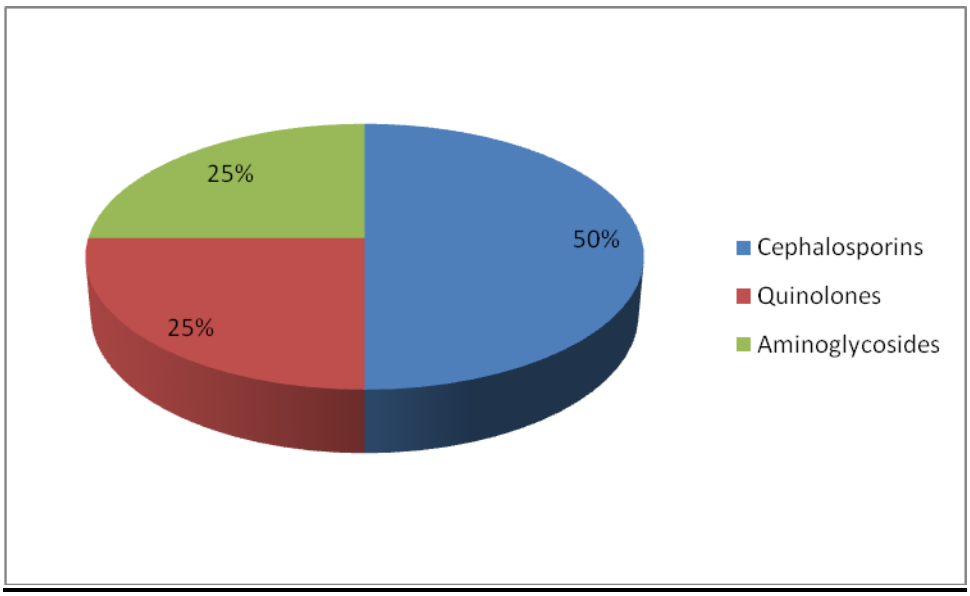

Figure 3.13 Antibiotics prescribed in Urethral discharge.

3.2.13 ANTIBIOTICS PRESCRIBED FOR THE MANAGEMENT OF PEPTIC ULCER DISEASE (PUD).

The minimum and maximum antibiotic prescribed per patient was 1. In addition, the frequently prescribed antibiotic was the penicillins (Fig 3.14). .Correct doses were prescribed. Amoxycillin was the penicillin prescribed, ciprofloxacin was the quinolone given and clarithromycin was the macrolide prescribed.

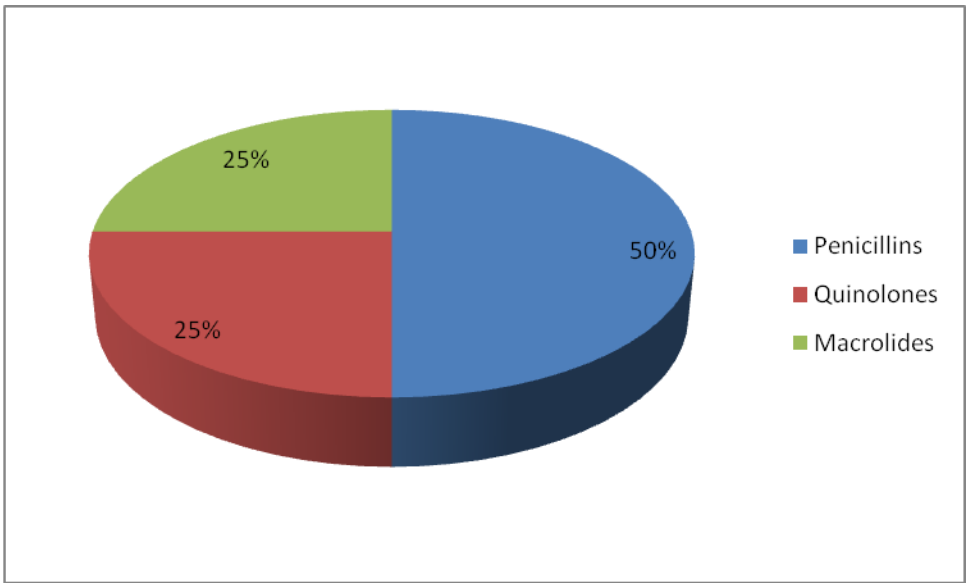

Figure 3.14 Antibiotics prescribed for the management of Peptic Ulcer Disease (PUD).

3.2.14 MULTIPLE ANTIBIOTIC PRESCRIPTIONS.

Table 3.1 Frequency of antibiotic combinations.

Antibiotic combinations	**Frequency(number of patients)**	**Disease conditions**
Amoxicillin/clavulanic+Azithromycin	2	RTI
Cloxacillin + Ampicillin	1	RTI
Amoxicillin/clavulanic+Gentamicin	1	RTI
Erythromycin+Cefuroxime	3	RTI, Abscess/Boils, Abd. Pain

Levofloxacin+Cefuroxime	2	UTI
Cefuroxime+Nitrofurantoin	1	UTI
Ciprofloxacin+Cefuroxime	1	UTI
Clindamycin+Ciprofloxacin	1	Burns/Wounds
Co-trimoxazole+Ciprofloxacin	1	Gastroenteritis
Doxycycline+Levofloxacin	1	Abdominal pain
Ciprofloxacin+Amoxycillin	1	PID
Flucloxacillin+Clindamycin	2	Cellulitis
Amoxycillin/clavulanic+Chloramphenicol	2	Otitis media
Ampicillin+Cloxacillin+Azithromycin	1	RTI
Doxycycline+Gentamicin+Levofloxacin	1	Vaginal discharge
Ceftriaxone+Doxycycline+Ciprofloxacin	1	PID

3.3 LABORATORY INVESTIGATIONS.

From the study, it was noted that out of the 140 patients, 30 of them were given requests for laboratory investigations which accounted for 21%. Out of the 30 patients, 14 of them were prescribed antibiotics after the laboratory results had been obtained whilst 16 of them were prescribed antibiotics before obtaining their laboratory results accounting for 46.67 % and 53.33%respectively.

Table 3.2 Frequency of antibiotic prescriptions before/after obtaining lab results.

Disease condition.	Frequency of antibiotic prescriptions before obtaining lab results.(Number of patients)	Frequency of antibiotic prescriptions after obtaining lab results.(Number of patients)
Urethral discharge	3	0
Respiratory tract infections	5	0
Gastroenteritis	2	4
Urinary tract infections	3	4
Pelvic inflammatory diseases	1	3
Cellulitis	1	3
Abdominal pain	1	0

3.4 PHARMACIST INTERVENTIONS.

A total of 6 (3.6%) interventions were done in relation to antibiotic prescriptions given over the study period. 5 cases out of the 6 (83.33%) involved dosage correction whiles 1 (16.67%) involved a change of antibiotic.

CHAPTER FOUR

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

4.0 DISCUSSION

The principles involved in the selection of an antibacterial must allow for a number of variables including changing renal and hepatic function, increasing bacterial resistance and new information on side-effects. Duration of therapy, dosage, and route of administration depend on site, type and severity of infection and response. The prescribing of the so-called 'standard dose' in serious infections may result in failure of treatment or even death of the patient; therefore it is important to prescribe a dose appropriate to the condition.

Antibiotics have a wide range of use in the treatment of various disease conditions. The study done showed a wide range of use in various conditions indicated in figure 3.1. Respiratory tract infections as was earlier on expected had the highest frequency followed by urinary tract infections, gastroenteritis, and pelvic inflammatory disease e.t.c. In a similar study on antibiotic prescribing pattern in the Wassa west district of Ghana, respiratory tract infections was among the commonest indications for antibiotic use. Other conditions included malaria, soft tissue infections and diarrhoeal diseases.[12] Respiratory tract infections are therefore a major condition in which antibiotics have and are prescribed over the years. Its proper management is therefore very important in ensuring that resistance to the antibiotics used in the management of this condition does not occur. All the disease conditions noted in this study have a wide range of causative organisms responsible for the particular infection or condition. It is therefore important that a fair knowledge of the various likely causative organisms in the particular disease condition

is known in order that the correct antibiotic is prescribed for the patient. This will reduce the incidence of resistance to many antibacterial agents in use today. It is important that the severity of the condition as well as the causative organism is considered since most of the RTI's are viral and therefore the use of antibiotics have no effect; leading to antibiotic resistance.

Respiratory tract infections as stated earlier accounted for a major percentage of the disease conditions seen to at the medical centre. As to whether all these cases required immediate antibiotic prescriptions will be difficult to conclude since the study did not consider the medical history of the patients or other co-morbidities related. However there is the likelihood that some of the cases may have needed the 'no antibiotic prescribing strategy' and the 'delayed antibiotic prescribing strategy'.

This therefore implies that important interventions need to be made by the Pharmacist in classifying the patients that are served antibiotic prescriptions. If this is not being checked by the Prescribers then it is important that every antibiotic prescription is screened by the Pharmacist to ensure that the patient in question really needs the 'immediate antibiotic prescribing strategy'. This will go a long way in reducing the abuse of antibiotics in self limiting respiratory tract infections.

In the standard treatment guidelines, the first choice in the management of RTI's e.g. Otitis media, pharyngitis, tonsillitis and acute sinusitis are the penicillins. Erythromycin which is a macrolide is indicated when a patient is allergic to the penicillins. Doxycycline; a tetracycline is also an alternative to the penicillins e.g. amoxicillin in the management of acute sinusitis.[13]

The penicillins was the group of antibiotic used frequently in the management of RTI's. It may therefore be assumed that the prescribers are in the majority of the cases prescribing according to

the standards. However this might not be entirely accurate since other antibiotics not indicated in the standard treatment guide lines have been recorded as being prescribed in RTI's even though in literature they may have an indication in the management of RTI's. Examples of such antibiotics are clindamycin, levofloxacin, gentamicin, ciprofloxacin, cefuroxime and clarithromycin (figure 3.3). These antibiotics come with a greater cost of treatment as compared to those indicated in the standard guidelines. Since it is difficult to rule out the use of the above mentioned antibiotics, it will however be advised that in areas or health facilities where the majority of patients rely on the National Health Insurance Scheme, antibiotics indicated on the Essential Drug List for the management of the various RTI's be prescribed to ensure cost effective treatment.

Therapeutic objectives in the management of urethral discharge indicate that treatment must be effective for both gonococcal and non-gonococcal urethritis. Thus the need to treat both gonorrhea and Chlamydia urethritis. Antibiotics of choice include ciprofloxacin, oral, 500mg as a single dose or ceftriaxone, IM 250mg single dose plus doxycycline 100mg 12hrly for 7days or tetracycline 500mg 6hrly for 7 days or erythromycin 500mg 6hrly for 7 days.[13] The standard guideline above shows the need for combination therapy in the effective treatment of urethral discharge. However from the study, in the management of urethral discharge (fig 3.13), only one antibiotic was prescribed for the patients in that category. The antibiotics prescribed were cefuroxime 500mg 12hrly for 5days, ceftriaxone 2g stat, levofloxacin 500mg daily for 10 days and gentamicin 240mg stat; one for each of the patients. Comparing the standard regimen with the study results clearly shows the discrepancies in the management of urethral discharge at the medical centre. Most importantly the absence of dual therapy since only one agent might not effectively treat the condition which can lead to further complications. Once again this brings to

light the importance or necessity of relevant interventions which need to be made by the Pharmacist in ensuring that antibiotic prescriptions are just not being correctly dispensed according to the prescribers specifications but also to ensure that at the end of the day the patient is dispensed the correct treatment regimen for his or her condition.

Standard treatment guidelines in the management of vaginal discharge indicate the need to treat for vaginitis and cervicitis if indicated. Vaginitis alone calls for the use of antifungal agents to treat candidiasis. An indication of cervicitis calls for the use of antibiotic agents in treating both gonorrhea and Chlamydia infections. Here again dual therapy of antibiotic agents used in urethral discharge discussed earlier on is also indicated for use in cervicitis. Figure 3.9 shows the antibiotics prescribed in the management of vaginal discharge during the study period. Table 3.1 shows the antibiotic combinations prescribed in the various disease conditions. In vaginal discharge only one patient (20%) was prescribed an antibiotic combination therapy consisting of doxycycline 100mg 12hrly for 7days+ Levofloxacin 500mg daily for 7days+ Gentamicin 240mg stat. Here again 80% of the patients went home with only one antibiotic agent which will definitely not be adequate in treating the condition. This will definitely lead to frequent re-occurrence of the condition in these patients since they are not being prescribed the optimal treatment regimen for the illness. The rate of development of resistance in these patients then becomes faster and poses a threat in future treatment encounters.

Urinary tract infections especially in women generally present as either cystitis or acute pyelonephritis. In cystitis, trimethoprim, a commonly used first line therapy; is effective against around 70% of urinary pathogens. Nitrofurantoin and oral cephalosporins are alternate first line drugs. Resistance of urinary pathogens to nitrofurantoin is around 15%, and to oral cephalosporins generally less than 10%.[14] Amoxicillin is unsuitable for empirical therapy as

around 50% of urinary pathogens are amoxicillin-resistant. Up to 90% of urinary pathogens are sensitive to co-amoxiclav, an alternate for infections caused by bacteria resistant to trimethoprim.[14] The 4-quinolones ciprofloxacin, norfloxacin and ofloxacin are effective in cystitis because only around 5% of pathogens are resistant.[15] The resistance rate is likely to increase the more these drugs are used in the community. To preserve their efficacy, the 4-quinolones should not be used as first-line therapy unless the urinary infection is complicated or caused by organisms known to be resistant to other antibiotics. The standard treatment guidelines however still state the use of amoxicillin 500mg 8hrly for 7 days and then to change to the appropriate antibiotics based on the culture and sensitivity results. Figure 3.4 and Table 3.1 show the various antibiotics prescribed and the combinations prescribed for the management of UTI. Cephalosporins or to be exact cefuroxime was the most frequently prescribed followed by ciprofloxacin and levofloxacin. Effective management of Urinary tract infections is based on the right choice of antibacterial agent. Culture and sensitivity test results are a necessity in ensuring this. Table 3.2 shows the conditions in which laboratory test results were either obtained or not before antibiotics were prescribed. Even though in the management of UTI most of the antibiotics were prescribed after laboratory test results were obtained (57.14%), this study did not delve deep into the type of laboratory tests which were requested. It is therefore difficult to conclude whether a urine culture and sensitivity test was done or a simple urine examination was done.

Treatment regimens in the treatment of abdominal pain especially in women are related to that of pelvic inflammatory diseases since the former is a symptom of the latter. Once again it involves dual therapy for the treatment of gonorrhea and Chlamydia infections as noted in the management of urethral and vaginal discharge. From the study, the management of abdominal

pain and pelvic inflammatory disease at the Medical centre needs to be addressed since ideally all the patients in these two categories should each have been prescribed more than one antibiotic for effective treatment.

In the effective management of gastroenteritis, in-line with standard procedures it is important to try and obtain a stool culture and sample for routine examination if possible in order to determine whether the diarrhoea is bacterial based or caused by amoebiasis or giardiasis.[13] Even though 4 out of 6 (66.7%) obtained laboratory results before the prescribing of antibiotics, the study did not detail the exact tests which were requested or done. It will therefore be difficult to conclude on the exact type of diarrhoea that was being treated.

The management of other disease conditions such as abscess/boils, cellulitis, burns/wounds and many others that were not really highlighted in this study such as enteric fever, pyrexia of unknown origin e.t.c are all potential study areas which can be looked at individually for further research.

From the study, the prescribing of antibiotics at the medical centre covers almost all the classes of antibiotics known. This can be seen in figure 3.2. The penicillins are used most frequently followed by the quinolones, macrolides and cephalosporins. In the survey of antibiotic prescribing pattern in the Wassa west district of Ghana, the commonest antibiotics prescribed were procaine penicillin, co-trimoxazole, benzyl penicillin, metronidazole and amoxicillin.[12] The penicillins thus were the frequently prescribed antibiotic. Thus in comparing with this current study done, penicillins have over the years been the major class of antibiotic used frequently in the country. With the frequent use of these agents; especially the penicillins, there may be the development of resistance in patients visiting the medical centre with similar disease conditions

in which these agents are used or in the same patient who visits the medical centre with the same disease in the near future. It will therefore be necessary for patients medical records to be viewed before the prescribing of any antibiotic to ensure that the same antibiotic is not prescribed to the same patient over and over again as this can lead to resistance.

20% of the patients in the study received more than one antibiotic. Antibiotic combinations even though not frequently encouraged are necessary in some conditions where there may be more than one causative pathogen and thus the use of a single agent will not effectively cure the disease. An example is in the treatment of severe community-acquired pneumonia in which cefuroxime or cefotaxime needs to be combined with erythromycin for effective treatment or in the treatment of ulcer caused by *Helicobacter pylori* were two antibiotics are needed in the treatment regimen or in the management of urethra discharge, vaginal discharge and pelvic inflammatory diseases as discussed above.

It was observed that majority of the patients of whom laboratory investigations were requested, were prescribed antibiotics before the laboratory results were obtained. The cases in this category included urinary tract infections, pelvic inflammatory diseases, gastroenteritis, lower abdominal pain and respiratory tract infections. This goes to indicate that most of the antibiotics are prescribed empirically and thus is important that broad spectrum antibiotics are chosen in order to cover a wide range of the likely pathogens causing the infection. However it is important that in some cases results from laboratory tests are obtained before antibiotics are prescribed. This is very necessary in re-occurring cases of UTI or PID where there is the possibility of resistant pathogens.

This study concentrated on the antibiotic use at the general OPD thus as was seen from the results, majority of the antibiotics were to be administered orally with only 4 (2.86%) of the patients prescribed injectables. Three of the patients were prescribed gentamicin which does not have an oral dosage form and the other prescribed ceftriaxone which also does not have an oral dosage form.

In order to ensure the rational use of drugs it is important that the right antibiotic is prescribed for the right condition in the right dose and for the appropriate duration. This study sought to address issues of correct dosing of the antibiotics prescribed. It was expected that the antibiotics prescribed would be at the correct dose and duration. Six main interventions were done over the study period. Five of which had to do with dose correction and one was the actual change of the antibiotic.

Majority of the antibiotics therefore were prescribed in the correct dose. The few corrections were centered mainly on the correct dosing interval where for example clindamycin prescribed to be given 3 times daily was corrected to 4 times daily. Ciprofloxacin which was prescribed as part of the triple therapy for ulcer treatment was changed to a more appropriate clarithromycin for effective treatment.

However as discussed earlier on, far more Pharmacist interventions should have been done than what was recorded from the study.

This brings to light the fact that the practice of Pharmacy goes beyond dispensing the ‘correct’ antibiotic in the ‘correct’ dose and quantity (according to the prescription); but looks further at the patient’s condition first and foremost together with other related co-morbidities and then

secondly the prescription written; screening it effectively to ensure that at the end of the day the patient leaves the health facility with medications that will effectively treat his/her condition.

Various limitations of this study; some of which have been mentioned earlier include:

- The study failed to look at the exact laboratory tests that were requested for the various diseases conditions and comparing of the results obtained with the choice of antibiotic in those patients who received the laboratory results before being prescribed antibiotics.
- The study failed to do a follow up on patients who did not receive their laboratory results but were prescribed antibiotics: as to whether a change of antibiotic was done on receiving the laboratory results or not.
- The study failed to look at the Prescribers opinion or specialty in relation to their choice of antibiotics in the various disease conditions since this would address the issues that significantly influence antibiotic prescribing.
- The study failed to look at the availability of the essential antibiotics or the availability of diagnostic facilities or the availability of reference materials since these all influence antibiotic prescribing.
- The study failed to look at the staff strength of the dispensary or pharmacy department and the related qualifications of the staff available. This is important since if the human resource is adequate and highly qualified and trained, then prescriptions in general will be effectively screened and the necessary interventions made.
- The study also failed to take into consideration patient's perception on antibiotic prescriptions (whether received or not) since this can also affect the demand on the Prescribers and affect their prescribing habits.

The limitations mentioned above are all potential areas for further research in this area of antibiotic prescribing habits. Each of the conditions can be individually researched into; taking into consideration the laboratory investigations or any other tests that might be done which when looking at a single disease condition can easily be followed up and addressed. Research into prescriber and patient views on antibiotic use is also a very important area that can be discussed.

4.1 CONCLUSION

Antibiotics are very effective agents and are used very widely generally in the treatment of various conditions. Holy Trinity Medical Centre is no exception and as was seen from the study, their use covers a wide range of disease conditions attended to at the general out-patient department. It was observed that a wide range of antibacterial agents covering all the major classes of antibiotics are available and are used at the medical centre in the treatment of the various disease conditions observed. Of these agents majority were prescribed in the correct doses with only a few dosage errors. However it was observed that many more interventions should have been done than what was recorded in the study (6 interventions). Laboratory investigations were requested but however majority of the antibiotics were prescribed before the laboratory results were obtained.

4.2 RECOMMENDATIONS

- The various disease conditions have various causative pathogens responsible. It is therefore recommended that treatment protocols for the various disease conditions be made readily available. This will ensure that the appropriate agents are used at all times limiting the likelihood of resistance.
- A special antibiotic formulary can be formulated specifically for the medical centre in relation to the trend of disease conditions attended to at the centre.
- Training and refresher courses need to be organized for both the Prescribers and pharmacy staff on effective antibiotic therapy regimens for the common diseases that are seen to at the Medical Centre.

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DATA COLLECTION TOOL

Patient no …….. Age …….. Sex M / F Diagnosis …….

Name of Antibiotic prescribed	Strength	Dosage	Duration of Therapy

Laboratory Investigation

Investigation done before prescribing antibiotics	Investigations done after prescribing antibiotics

Pharmacist interventions

1. Did the pharmacist make any intervention to the antibiotic prescription Yes ☐ No ☐

1a) if yes what was the intervention that was made?

*Antibiotic changed ☐

*Antibiotic dose corrected ☐