

**ASSESSMENT OF ANTIBIOTIC UTILIZATION PATTERN IN
HASIYA BAYERO PAEDIATRIC HOSPITAL, KANO STATE,
NIGERIA**

BY

ZAKARIYA 'U BALARABE HARUNA

**DEPARTMENT OF CLINICAL PHARMACY AND PHARMACY
PRACTICE,
AHMADU BELLO UNIVERSTY, ZARIA- NIGERIA.**

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BY

Zakariya'u Balarabe HARUNA, B.PHARM (ABU), 2011
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FACULTY OF PHARMACEUTICAL SCIENCES
AHMADU BELLO UNIVERSTY, ZARIA
NIGERIA

NOVEMBER, 2017

DECLARATION

I declare that the work in this Dissertation entitled ‘Assessment of Antibiotic Utilization Pattern in Hasiya Bayero Paediatric Hospital, Kano State, Nigeria’ has been carried out by me in the Department of Clinical Pharmacy and Pharmacy Practice. The information derived from the literature has been duly acknowledged by me in the text and a list of references provided. No part of this dissertation was previously presented for another degree or diploma at this or any other institution.

.....
Haruna Zakariya’u Balarabe

.....
Date

CERTIFICATION

This dissertation entitled ‘ASSESSMENT OF ANTIBIOTIC UTILIZATION PATTERN IN HASIYA BAYERO PAEDIATRIC HOSPITAL, KANO STATE, NIGERIA’ by Zakariya’u Balarabe HARUNA meets the regulations governing the award of the degree of Master in Clinical Pharmacy and Pharmacy Practice of the Ahmadu Bello University, and is approved for its contribution to knowledge and literary presentation.

.....
Prof. N.M. Danjuma
Chairman, Supervisory Committee

.....
Date

.....
Prof. S.S. Gyang
Member, Supervisory Committee

.....
Date

.....
Dr. Shafiu Mohammed
Head of Department

.....
Date

.....
Prof. S.Z. Abubakar
Dean, School of Postgraduate Studies

.....
Date

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ABSTRACT

The inappropriate use of antibiotics in children predisposes them to the adverse effects of these drugs. So it is important to carry out drug use study in children in order optimize antibiotic use. The aim of this study was to assess the utilization pattern of antibiotics in Hasiya Bayero Paediatric Hospital, Kano state, Nigeria. Prescriptions issued to outpatients were collected prospectively and used to assess the World Health Organization (WHO) core drug use indicators based on WHO methodology. Educational intervention was provided to management, non-professional health care workers and parents/caregivers. The average number of drugs per prescription for the non-professional health care workers was 2.4, but this reduced to 2.1 after intervention. The percentage encounter with antibiotics was high (95%) for the non-professional health care workers before intervention, but this improved to 65% after intervention. About 44.2% of antibiotics were prescribed in generic name by the non-professional health care workers before intervention, but this value increased to 54.3% after intervention. The average consultation time for the non-professional health care workers was 8.4 minutes pre-intervention, which increased to 9.8 minutes post-intervention. The average dispensing time for the non-professional health care workers was 6.0 minutes and 4.5 minutes before and after intervention respectively. About 58.9% of patients attended by the non-professional health care workers were able to recall dosage schedule correctly before intervention, but this markedly improved to 80.4% after intervention. Copies of the EML were not sighted with the non-professional health care workers until after intervention. The average numbers of days that key antibiotics were out of stock decreased from 5 days to 3 days. Drug utilization 90% (DU 90%) analysis showed that cefixime was the most prescribed and utilized antibiotic by the non-professional health care workers. Amoxicillin/clavulanic acid was the most prescribed and utilized antibiotic by the

professional health care workers. ABC (Always, Better, Control) analysis revealed that class A which consists of 6 antibiotics accounted for 74.75% of total antibiotic expenditure, class B consists of 6 antibiotics which accounted for 20.21% of antibiotic expenditure, while class C which had the most number of antibiotics (13) accounted for only 5.04% of antibiotic expenditure. VED (Vital, Essential, and Desirable) analysis revealed that group V consists of 7 antibiotics which accounted for 28.97% of expenditure; group E which consists of 10 antibiotics accounted for 28.97% of expenditure; while group D which consists of 8 antibiotics accounted for the highest antibiotic expenditure (50.91%). Inappropriate antibiotic use and high expenditure on less essential antibiotics may be related to lack of professional health care personnel and non-compliance to the basic principles of prescribing and dispensing. Provision of continuous education, establishment of drug and therapeutic committee and employment of more professional health care personnel can help ameliorate the set back.

TABLE OF CONTENTS

Cover page	i
Fly leaf	ii
Title page	iii
DECLARATION	iv
CERTIFICATION	v
ACKNOWLEDGEMENT	vi
ABSTRACT.....	vii
TABLE OF CONTENTS.....	ix
LIST OF TABLES	xiii
LIST OF ABBREVIATIONS.....	xv
LIST OF APPENDICES.....	xvii
CHAPTER ONE	1
1.0 INTRODUCTION	1
1.1 Background of the Study	1
1.2 Rational Use of Medicines.....	2
1.3 Drug Use Indicators	3
1.4 Drug Utilization Studies	4
1.5 Statement of Research Problem.....	6
1.6 Justification for the Study	7
1.7 Study Hypothesis	8
1.8 Aim and Objectives of the Study	8
CHAPTER TWO	10
2.0 LITERATURE REVIEW	10
2.1 The ABC/VED Analysis as a Method of Inventory Control.....	12

CHAPTER THREE	15
3.0 MATERIALS AND METHOD	15
3.1 Materials	15
3.2 Study Site	15
3.3 Sample Size.....	16
3.4 Sampling Technique	16
3.5 Study Design.....	16
3.6 Inclusion and Exclusion Criteria.....	18
3.7 Data Collection	18
3.7.1 Pre-intervention stage	18
3.7.2 Calculation of drug utilization 90% (DU 90%)	21
3.7.3 ABC/VED analysis	21
3.7.4 Intervention stage.....	22
3.7.5 Post-intervention stage.....	23
3.8 Statistical Analysis.....	23
3.9 Ethical Consideration.....	24
CHAPTER FOUR.....	25
4.0 RESULTS	25
4.1 Demographic characteristics of patients in the study	25
4.2 Presence/Absence of Vital information on Outpatient Prescriptions	27
4.3 Dosage Form of Antibiotics Prescribed.....	29
4.3 Reasons for Outpatient Antibiotic Prescriptions Written by Professional Health Care Workers in Hasiya Bayero Paediatric Hospital, Kano.....	29
4.3 Reasons for Outpatient Antibiotic Prescriptions Written by Non-Professional Health Care Workers in Hasiya Bayero Paediatric Hospital, Kano	31

4.4 Drug Use Indicators for Professional Health Care Workers.....	33
4.4.1 Prescribing indicators.....	33
4.4.2 Patient care indicators.....	35
4.4.3 Facility indicators.....	37
4.5 Pre-intervention and Post-Intervention Drug Use Indicators for Non-Professional Health Care Workers in Hasiya Bayero Paediatric Hospital, Kano.....	39
4.5.1 Prescribing indicators.....	39
4.5.3 Facility indicators.....	43
4.6 Drug Utilization 90% (DU 90%).....	45
4.6.1 Drug utilization 90% for professional health care workers.....	45
4.6.2 Drug Utilization 90% for Non-professional Health Care Workers.....	47
4.7 Monthly Purchase of Antibiotics in Hasiya Bayero Paediatric Hospital, Kano.....	49
4.7.1 Monthly Purchase of Antibiotics in Hasiya Bayero Paediatric Hospital for the Month of January, 2017.....	49
4.7.2 Monthly Purchase of Antibiotics in Hasiya Bayero Paediatric Hospital for the Month of December, 2016.....	51
4.7.3 Monthly Purchase of Antibiotics in Hasiya Bayero Paediatric Hospital for the Month of November, 2016.....	53
4.8 Record of Medicine Purchase in Hasiya Bayero Paediatric Hospital, Kano from November, 2016 to January, 2017.....	55
4.9 ABC/VED Analysis of Antibiotics in Hasiya Bayero Paediatric Hospital, Kano.....	57
4.9.1 ABC Analysis.....	57
4.9.2 VED analysis.....	59
4.10 ABC-VED Matrix Analysis of Antibiotics in Hasiya Bayero Paediatric Hospital, Kano.....	61

CHAPTER FIVE	63
5.0 DISCUSSION	63
CHAPTER SIX.....	76
6.0 SUMMARY AND CONCLUSION	76
6.1 Summary	76
6.2 Conclusion	77
6.3 Limitations of the study	78
6.4 Recommendations.....	78
6.5 Contributions of the Study to Knowledge	78
REFERENCES	80
APPENDICES	85

LIST OF TABLES

Table 4.1: Demographic Characteristics of Outpatients in Hasiya Bayero Paediatric Hospital, Kano.	26
Table 4.2: Presence/Absence Vital Information on Outpatients' Prescriptions in Hasiya Bayero Paediatric Hospital, Kano.....	28
Table 4.3: Reasons for Outpatient Antibiotic Prescription by Professional Health Care Workers in Hasiya Bayero Paediatric Hospital, Kano.....	30
Table 4.4: Reasons for Outpatient Antibiotic Prescriptions Written by Non-Professional Health Care Workers in Hasiya Bayero Paediatric Hospital, Kano.....	32
Abdominal Bloating.....	32
Table 4.5: Prescribing Indicators for Professional Health care Workers in Hasiya Bayero Paediatric Hospital, Kano.	34
Table 4.6: Patient Care Indicators for Professional Health Care Workers in Hasiya Bayero Paediatric Hospital, Kano.	36
Table 4.7: Facility Indicators for Professional Health Care Workers in Hasiya Bayero Paediatric Hospital, Kano	38
Table 4.8: Prescribing Indicators for Non-professional Health Care Workers in Hasiya Bayero Paediatric Hospital, Kano.....	40
Table 4.9: Patient Care Indicators for Non-professional Health Care Workers in Hasiya Bayero Paediatric Hospital, Kano.....	42
Table 4.10: Facility Indicators for Non-professional Health Care Workers in Hasiya Bayero Paediatric Hospital, Kano.....	44
Table 4.11: Utilization of Antibiotics in Hasiya Bayero Paediatric Hospital Expressed as Percentage, Number of DDD/1000 Patients/Day for Professional Health Care Workers.....	46

Table 4.12: Utilization of Antibiotics in Hasiya Bayero Paediatric Hospital Expressed as Percentage, Number of DDD/1000 Patients/Day for Non-professional Health Care Workers.....	48
Table 4.13: Monthly Purchase of Antibiotics in Hasiya Bayero Paediatric Hospital, Kano (January, 2017).	50
Table 4.14: Monthly Purchase of Antibiotics in Hasiya Bayero Paediatric Hospital, Kano (December, 2016).	52
Table 4.15: Monthly Purchase of Antibiotics in Hasiya Bayero Paediatric Hospital, Kano (November, 2016).	54
Table 4.16: Monthly Purchase of Antibiotics in Hasiya Bayero Paediatric Hospital, Kano (November, 2016 to January, 2017)	56
Table 4.17: ABC Analysis of Antibiotics in Hasiya Bayero Paediatric Hospital, Kano. .	58
Table 4.18: VED Analysis of Antibiotics in Hasiya Bayero Paediatric Hospital, Kano ...	60
Table 4.19: ABC-VED Matrix Analysis of Antibiotics in Hasiya Bayero Paediatric Hospital, Kano	62

LIST OF ABBREVIATIONS

ABC	Always, Better, Control
Admin	Administration
AIDS	Acquired Immune Deficiency Syndrome
Amp	Ampoule
ARD	Acute Respiratory Disease
ARI	Acute Respiratory Infection
ATC	Anatomic Therapeutic Classification
Clav	Clavulanic Acid
DDD	Defined Daily Dose
Dec	December
DMCSA	Drugs and Medical Consumables Supply Agency
DU	Drug Utilization
EML	Essential Medicine List
HBPH	Hasiya Bayero Paediatric Hospital
HIV	Human Immunodeficiency Virus
Inj	Injection
Ivf	Intravenous Fluid
Jan	January
MSH	Management Sciences for Health
Nov	November
Oint	Ointment
Ophth	Ophthalmic
Qty	Quantity
RTI	Respiratory Tract Infection

Sign	Signature
STG	Standard Treatment Guidelines
Susp	Suspension
Tab	Tablet
UTI	Urinary Tract Infection
VED	Vital, Essential, Desirable
VEN	Vital, Essential, Needed
WHO	World Health Organization
%	Percentage

LIST OF APPENDICES

APPENDIX I	85
APPENDIX II	86
APPENDIX III.....	87

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

Infectious diseases are among the commonest causes of morbidity and mortality in most developing countries of the world (WHO, 2008). The prevalence of disease, resulting from diverse groups of organisms are becoming alarming, especially in the continent of Africa, either singly or as co-morbidity (WHO, 2008). Antimicrobial drugs used to treat disorders caused by bacteria, viruses, protozoa, and fungi evidently require huge prescriptions in African nations.

The remarkable discovery of penicillin by Sir Alexander Fleming in 1928 was the beginning of antibiotic revolution, which changed the course of modern medicine (Rubin, 2007). Antibiotics are substances that kill or inhibit the growth of microorganisms. Antibiotics either kill microorganisms (bactericidal) or retard their growth (bacteriostatic) so that the body's own immune system can overcome the infection. The first antibiotics were produced by and isolated from microorganism but subsequent knowledge of these agents has been used to synthesize chemotherapeutic agents. Biochemical differences between the host and the pathogen have also been exploited to produce drugs with selective toxicity (Rubin, 2007).

Antibiotics are the most commonly prescribed drugs in hospital set up (Lesar and Briceland, 1996). Antibiotics have increased life expectancy especially where they have been rationally and appropriately used. However, excessive and inappropriate use of antibiotics has led to increased antibiotic resistance (Park, 2012). For this reason, the rational use of antibiotics is a major health concern.

The study of the pattern of antibiotic prescription infers to monitor, evaluate and suggest modifications to the health practitioners' prescription and utilization habits so as to make patient care reasonable and effective.

1.2 Rational Use of Medicines

Rational use of medicines requires that the patient receives medications appropriate to their clinical needs, in doses that meet their own individual requirements, for an adequate period of time, and at the lowest cost to them and their community (WHO, 1985). Irrational or non-rational use of medicines is the use of medicines in a way that is not compliant with rational use as previously defined. Globally, more than 50% of all medicines are prescribed, dispensed, or sold inappropriately, while more than 50% of patients fail to take them correctly (WHO, 2008). Moreover, about one-third of the world's population lacks access to essential medicines (WHO, 2002). Common types of irrational use of medicines include:

- i. The use of too many medicines per patient (polypharmacy);
- ii. Inappropriate use of antimicrobials, often inadequate dosages, for non-bacterial infections;
- iii. Over-use of injections when oral formulations will be more appropriate;
- iv. Failure to prescribe in accordance with clinical guidelines;
- v. Inappropriate self-medication, often of prescription-only medicines (WHO, 2008).

Lack of access to medicines and inappropriate doses result in serious morbidity and mortality, particularly in childhood infections and chronic diseases such as hypertension, diabetes, epilepsy and mental disorders (WHO, 2002). Inappropriate use and over-use of medicines waste resources-often out-of pocket payments by patients-and result in

significant patient harm in terms of poor patient outcomes and adverse drug reactions (WHO, 2002).

Furthermore, over-use of antimicrobials is leading to increased antimicrobial resistance and non-sterile injections to the transmissions of hepatitis, HIV/AIDS and other blood-borne diseases (WHO, 2002). Irrational or over-use of medicines can stimulate inappropriate patient demand, and can lead to reduced access and adherence rates due to medicine stock-outs and loss of patients' confidence in the health system (WHO, 2002).

1.3 Drug Use Indicators

Drug use indicators are sets of objective measures that can define the drug use situation in a country, region or individual health facility. In its effort to promote rational use of drugs, the WHO introduced the following drug use indicators:

- i. Prescribing indicators, such as average number of medicines prescribed per patient encounter, percentage of medicines prescribed by generic name, percentage encounters with antibiotics prescribed, percentage encounter with an injection prescribed, percentage medicines prescribed from essential medicines list or formulary (WHO, 2002).
- ii. Patient care indicators, such as average consultation time, average dispensing time, percentage of medicines actually dispensed, percentage of medicines adequately labeled, percentage of patients with knowledge of correct doses (WHO, 2002).
- iii. Facility indicators, such as availability of essential medicines list or formulary to practitioners, availability of clinical guidelines, percentage key medicines available (WHO, 2002).

- iv. Complementary drug use indicators, such as average medicines cost per encounter and percentage prescriptions in accordance with clinical guidelines (WHO, 2002).

1.4 Drug Utilization Studies

Drug utilization (DU) is defined as the marketing, distribution, prescription, and use of drugs in a society, with special emphasis on the resulting medical, social and economic consequences. DU is an essential part of pharmacoepidemiology as it describes the extent, nature and determinants of drug exposure (WHO, 2003). Drug utilization and pharmacoepidemiology together provide insights into the following aspects of drug use and prescribing:

- i. Pattern of use: this covers the extent and profiles of drug use and trends in drug use over time.
- ii. Quality of use: this is determined using audits to compare actual use to national prescription guidelines or local drug formularies. Indicators of quality of drug use may include choice of drug, drug cost, drug dosage, awareness of drug interactions and adverse drug reactions, and proportion of patients who are aware or unaware of the costs and benefits of the treatment.
- iii. Determinants of use: these include user characteristics (socio-demographic characteristics and attitudes towards drugs), prescriber characteristics (e.g. specialty, education and factors influencing therapeutic decisions) and drug characteristics (e.g. therapeutic properties and affordability).
- iv. Outcomes of use: these are the health outcomes (i.e. the benefits and adverse effects) and the economic consequences (WHO, 2003).

DU research also provides insight into the efficiency of drug use, i.e. whether a certain drug therapy provides value for money and the results of such research can be used to help set priorities for the rational allocation of health care budgets (WHO, 2003).

The principal aim of DU research is to facilitate rational use of drugs in populations (WHO, 2003). For the individual patient, it implies the prescription of a well documented drug at an optimal dose, together with the correct information, at an affordable price. Without knowledge of drugs are being prescribed and used, it is difficult to initiate a discussion on rational drug use or to suggest measures to improve prescribing habits (WHO, 2003).

The ultimate goal of any drug utilization (DU) research must be to assess whether drug therapy is rational or not (WHO, 2003). To reach this goal, methods for auditing drug therapy towards rationality are necessary and correct interpretation of data on DU requires investigation at the patient level. DU research can provide answers to the following questions: why drugs are prescribed; who the prescribers are; for whom the prescribers prescribed; whether patients take their medications correctly; and what the benefits and risks of the drugs are (WHO, 2003).

There are several well established methods at measuring the type and degree of irrational use. Aggregate medicine consumption data can be used to identify expensive medicines of lower efficacy or to compare actual consumption versus expected consumption (from morbidity data) (WHO, 2011). Anatomical therapeutic classification (ATC)/ Defined Daily Dose (DDD) methodology can be used to compare drug consumption among institutions, regions and countries (WHO, 2002). WHO drug use indicators can be used to identify general prescribing and quality of care problems at primary health care facilities (WHO, 2002). Drug utilization 90% (DU 90%) can be used in the application of quality

indicators of drug utilization (WHO, 2003). The DU 90% reflects the number of drugs that account for 90% of drug prescriptions and the adherence to local or national prescription guidelines in this segment (WHO, 2003). DU 90% can be applied at different levels (e.g. individual prescriber, group of prescribers, hospitals, region or country) to obtain a rough estimate of the quality of prescribing (WHO, 2003).

The knowledge of antibiotic utilization patterns is necessary for a constructive approach to problems that arise from multiple antibiotic usages. It is very necessary that institutions and hospitals should have antibiotic policy and ensure that the best choices are made by prescribers. A representative data will aid the prescribers and dispensers in rational antibiotic use and improve the quality of patient care.

1.5 Statement of Research Problem

The Lack of access to medicines and inappropriate doses result in serious morbidity and mortality, particularly in child-hood infections and chronic diseases such as hypertension, diabetes, epilepsy and mental disorders (WHO, 2002).

Neonates and children form a particular group of patients called 'high risk' or vulnerable group'. In practice, antibiotics are unnecessarily prescribed to children for high temperature, throat inflammation and diarrhoea caused by viral infections (Bajcetic and Jovanovic, 2012).

Empirical use of antibiotics is also a major reason for the emerging alarming trends in antibiotic resistance. Empirical use is justified only when the patients' life is endangered e.g. in immunocompromised patients with severe systemic diseases, septicemia etc. (Bajcetic and Jovanovic, 2012). Empirical use is also justified when there is not enough

time to isolate and identify the cause of infection and resource constrained settings where access to laboratory facilities is poor (Bajcetic and Jovanovic, 2012).

When choosing an antibiotic it is essential to consider the type, location, source and intensity of infection (Gambo, 2011). Most drugs prescribed for children have not been tested in paediatric population due to the difficulties in carrying out clinical research in children and ethical issues in the children not being able to make their own decisions to participate in a clinical trial (Nimbagiri *et al.*, 2014). To add, many drugs prescribed for children are not available in suitable dosage forms (Nimbagiri *et al.*, 2014).

Hence it is imperative to carry out study on the use of antibiotics in children in order to ascertain the level of rational use, and may be subsequently, implore measures to curtail or minimize such.

1.6 Justification for the Study

Drug utilization (DU) studies provide a sound pharmacoeconomic basis for marketing better healthcare decisions (Banerjee *et al.*, 2014). Drug use indicators such as prescribing indicators, patient care indicators and facility indicators are core drug use indicators which have been assigned standard values and have been used by researchers worldwide to assess rational use of drugs in hospitals, regions and countries. Current variations in prescribing pattern, concerns over adverse drug reactions and escalation of drug prices make DU studies more important (Banerjee *et al.*, 2014). Periodic auditing of DU pattern is necessary for promoting rational use of drugs by increasing the therapeutic efficacy while decreasing the occurrence of untoward effects (Banerjee *et al.*, 2014) and development of resistance.

The ABC/VED analysis can be applied to pin point drugs needing strict management control for effective utilization of hospital funds and elimination of out-of-stock situations in the pharmacy. ABC (Always, Better, Control) and VED (Vital, Essential, Desirable) analysis is an inventory control for drugs and medical consumables. The ABC-VED matrix analysis includes both factors of monetary value (ABC) and criticality (VED).

The understanding of prescribing patterns can inform development of interventions to promote appropriate use of medicines, to ensure safe and effective treatment. The data from this research work can aid policy makers, prescribers and ‘medication managers’ (pharmacists) towards rational use of antibiotics to improve the quality of patient care, especially in paediatric population. The result will also help in developing strategies to ameliorate the consequences that may arise from irrational use.

1.7 Study Hypothesis

The utilization of antibiotics in Hasiya Bayero Paediatric Hospital is consistent with WHO specified standards.

1.8 Aim and Objectives of the Study

The study is aimed at evaluating the utilization of antibiotics in Hasiya Bayero Paediatric Hospital, Kano State, Nigeria. The specific objectives of the study include:

- i. To assess the availability of vital information on prescriptions in Hasiya Bayero paediatric hospital.
- ii. To determine the most frequently prescribed class of antibiotics in the facility
- iii. To assess drug (antibiotic) use indicators in conformity with WHO specifications in the facility.
- iv. To assess drug utilization using DU 90% (drug utilization 90%).

- v. To carry out the ABC/VED analysis of the pharmacy store of Hasiya Bayero Paediatric Hospital.

CHAPTER TWO

2.0 LITERATURE REVIEW

Over prescribing, multi-drug prescribing, misuse of drugs, use of unnecessary expensive drugs and overuse of antibiotics and injections are the most common problems of irrational drug use by prescribers and consumers (Grand *et al.*, 1999)

Rational drug use study undertaken in nine health centers and nine health stations in Ethiopia, showed that the most often prescribed drugs were anti-infectives and analgesics (Desta *et al.*, 1997). Studies have demonstrated that antimicrobial drugs are the most used drugs in Turkey accounting for 22% of all prescribed drugs (Kurt, 2003). Studies in Turkey (Usher *et al.*, 2005) and western Nepal (Sharkar *et al.*, 2003) showed that 30.6 % and 50.2% of patients received one or more antimicrobials. A study in a secondary health facility in Ilorin Nigeria on the prescription pattern showed that antibiotics were the third most prescribed drugs (Akande and Ologe, 2007). Prescription studies showed that antibiotics constituted 71.8% and 58% of public prescriptions in Tunisia and Islamic Republic of Iran respectively (Salam *et al.*, 2000).

Although antimicrobial agents are appropriate treatment for acute, severe, persistent, or progressive infectious diseases (Thompson and Wright, 1998), their use is known to be a major determinant in the development of resistance (Gyssens, 2001). It has been reported that 14-50% of antimicrobial use in humans were questionable, unnecessary or inappropriate (Guyen and Uzum, 2003).

Antimicrobials have been used for infections of various types and locations. The most common reasons for treatment were found to be lower respiratory tract, urinary tract, surgical wound infections and febrile neutropenia (Usher *et al.*, 2005). Among the six

different antimicrobials prescribed for respiratory tract infection in Nepal, the most commonly used therapeutic group were the penicillins followed by tetracyclines, macrolides, quinolones and cephalosporins (Dawadi *et al.*, 2003). A study in Nigeria showed that antibiotics were contained in more than half of all the prescriptions and erythromycin and cephalosporins were the antibiotics of choice (Fehintola, 2009). The common antibiotics prescribed by hospital doctors were amoxicillin, cloxacillin, erythromycin and trimethoprim-sulphamethoxazole, but the most frequent antimicrobials reported in a Tertiary Hospital were amoxicillin, ampicillin and ciprofloxacin (Dumo *et al.*, 1999). In a Hospital in Dubai, United Arab Emirates, amoxicillin-clavulanate was the most common antibiotics prescribed (Sharif *et al.*, 2008). A survey on the prescription of antimicrobial drugs in ambulatory patient care in Finland showed that antimicrobial drugs were prescribed 594 times, with tetracyclines being the most commonly prescribed, followed by penicillin (Hemminki *et al.*, 1974). The antimicrobial drugs were prescribed for infections of the upper respiratory tract in remarkable proportion and broad-spectrum antibiotics were most favored (Hemminki *et al.*, 1974). Antibiotics are the frequently prescribed drugs in Hospital Emergency Departments, most of which were broad-spectrum penicillins, followed by quinolones, and urinary antiseptics (Laguna *et al.*, 1996). A pharmacy based prescription audit undertaken in the medical emergency unit of a tertiary care hospital to determine the frequency of prescription of parenteral anti-infective agents, showed that of the 45.2% of patients who received parenteral anti-infective agents, cephalosporins, aminoglycosides and metronidazole accounted for about 70% of total antimicrobial use (Gupta *et al.*, 2004).

Older generation of antimicrobials are predominantly used in the intensive care unit in Western Nepal and 61.9% of the antimicrobials are administered through the parenteral route (Shankar *et al.*, 2003). A pharmacy based prescription audit undertaken in the

medical emergency unit of a tertiary care hospital that parenteral antinfective agents, cephalosporins, aminoglycosides and metronidazole accounted for about 70% of total antimicrobial use (Shankar *et al.*, 2003). In Western Nepal, older generation of antimicrobials are predominantly used in the intensive care unit, and 61.9% Of these antimicrobials are administered through the parenteral route (Shankar *et al.*, 2003). A study in a secondary healthcare facility in Ilorin, Nigeria on prescription pattern showed that antibiotics were the third most prescribed drugs (Akande and Ologe, 2007).

Most of the dosage forms of drugs prescribed for paediatric patients are in liquid form (suspensions or syrups) as reported in some studies. In an outpatient department of a tertiary care hospital in India, 72 % of all medicines were prescribed as syrup, 16.1% as tablet while other dosage forms accounted for only 5.8% (Dinesh *et al.*, 2011). Prescribing in generic name in South Indian paediatric population is 19.1% (Nimbagiri *et al.*, 2014). On the patient care indicators, average consultation time and dispensing time were 6-8 minutes and 9-12 minutes respectively while 75.6% of patients had knowledge of correct dosage in Indian paediatric population (Nimbagiri *et al.*, 2014).

2.1 The ABC/VED Analysis as a Method of Inventory Control

It is a fact that inventory and efficient management can result in meaningful savings in a hospital's expenditure (Kumar and Chakravarty, 2014). Two factors considered important in medical logistics management are cost and criticality of the item (Kumar and Chakravaty, 2014). Among various selective inventory control techniques, two methods are most commonly used, which are the Always, Better, Control (ABC) and Vital, Essential and Desirable (VED) analyses (Kumar and Chakravarty, 2014).

ABC analysis is a very useful approach to material (for example, drugs and consumables) management based on Pareto's principle of 'vital few and trivial many' (Gupta *et al.*,

2007) and involves classifying items or activities according to their usage value in monetary terms (Gandhi and Basir, 2000). According to Pareto's theory, 10% of items consume about 70% of budget (Group A), the next 20% consume 20% of budget (Group B) and the remaining 70% items account for just 10% of budget (Group C) [Gupta *et al.*, 2007]. Therefore, ABC analysis has been conceptualized to on the universal observation of a small number of items accounting for a large share of the total budget while a comparatively larger number involving an insignificant share (Kumar and Chakravarty, 2014).

However, health is considered to be priceless and hence medical stores (a good example is a pharmacy store) are further classified on the basis of their criticality into Vital, Essential and Desirable items (VED) [Gandhi and Basir, 2000]. Vital items are those, without which a hospital cannot function (Gupta *et al.*, 2007) and they are life saving drugs or items (Moore *et al.*, 1997). Essential items are those without which a hospital can function but may affect the quality of services (Gupta *et al.*, 2007) and include drugs that are effective for the treatment of less life threatening, but still severe diseases (Moore *et al.*, 1997). Desirable items are those items which when not available will not affect the functioning of the hospital (Gupta *et al.*, 2007). Desirable items or drugs are used for the treatment of mild diseases and for symptomatic therapy (Moore *et al.*, 1997).

Some studies have reported the outcome of ABC/VED analysis in different hospitals. In the ABC analysis of a pharmacy store of a tertiary institution in Northern India, 42 (11.23%), 92 (24.6%) and 282 (75.4%) of items were in the A, B and C categories respectively while the VED analysis showed that 46 (12.3%), 230 (61.5%) and 98 (26.2%) of items were grouped into V, E and D categories respectively (Singh *et al.*, 2015).

In The ABC-VED analysis of expendable medical stores in a tertiary care hospital in India, the ABC analysis revealed that category A items include 6.77% (104) expendable items consuming 70.03% of the total stores expenditure, B category contains 19.27% (296) accounting for 19.98% of expenditure, while about 73.95% (1136) of items were found to belong to category C (Kumar and Chakravarty, 2014). The VED analysis showed that 13.14% (201), 56.37% (866) and 30.4% (469) of items belong to group V, E and D respectively (Kumar and Chakravarty, 2014).

CHAPTER THREE

3.0 MATERIALS AND METHOD

3.1 Materials

Materials used in the study include hand-held stop clock, calibrated spoons, droppers, oral syringe and WHO standardized data collection form.

3.2 Study Site

Kano State located in Northwestern Nigeria ($11^{\circ} 30^{\circ} \text{N}$, $8^{\circ} 30^{\circ} \text{E}$), has a total area of 20,131 km² and is the most populous state in Nigeria, with a population of about 10,000,000 people (NPC, 2006).

The study site, Hasiya Bayero Paediatric Hospital (HBPH), is an 85 bed paediatric specialist hospital and one of the General Hospitals situated in Kano Municipal Local Government in the central senatorial district of Kano State. It is a secondary health care facility established solely to cater for the paediatric populace in Kano State (excluding neonates and pre-term babies). The hospital attends to patients from infancy to 18 years on outpatient and in-patient bases. An estimated number of at least 500 patients per day attend the out-patient and in-patient departments of the hospital daily.

There are 14 Physicians, out of which only four are full-time staff while the remaining 9 are either House Officers or Medical Doctors on NYSC. The workforce of the Pharmaceutical Services Department consists of only three (3) pharmacists, one (1) pharmacist on NYSC, and ten Pharmacy Technicians during the study period. The nursing department has fifty six (56) nurses, out of which eleven (11) are prescribing nurses. The Primary Health Care Department has fifty three personnel out of which forty

seven (47) are either Senior Community Health Extension workers (CHEWS) or Junior Community Health Extension workers (JCHEWS), the remaining six (06) personnel consist of four (4) Dental Technicians and two (2) Dental Assistants. Out of the 47 CHEWS/JCHEWS, thirty three (33) of them prescribe medications to out- patients.

3.3 Sample Size

Based on WHO recommendation, at least 600 encounters were included in the study. The Study was carried out from November, 2016 to July, 2017.

3.4 Sampling Technique

Patients were recruited in the study by the use of convenient sampling. Only 605 of the total prescriptions surveyed were available for the study.

3.5 Study Design

The study was a prospective quantitative observational cross-sectional survey designed to evaluate prescription pattern and antibiotic drug utilization based on WHO core drug use indicators. The study consist of two stages; pre-intervention and post-intervention stages. At both stages, prospective cross-sectional observational design was used to evaluate the prescribing, patient care and facility based indicators. However, some facility indicators such as expenditure on antibiotics as a percentage of total medicines cost, ‘Always Better Control’ (ABC) analysis and ‘Vital Essential Desirable’ (VED) analysis were determined retrospectively. Antibiotics prescribed were noted including their dose, route, and dosage form, frequency of administration, indications and duration of therapy. Outpatient prescriptions were audited prospectively using the prescribing indicator form designed by WHO (WHO, 1993).This form was modified to include prescription pattern elements such as demographics of patients (Name, age, weight, sex & address) and identity of

prescriber (name, date of prescription, signature) as well as antibiotics prescribed, antibiotics dispensed, knowledge of correct dosage, knowledge of patients on correct dosage etc. Prescription elements were assessed by noting the adherence to prescription format such as identification of patient, presence of inscription, subscription and transcription. The prescribers were not told of their prescription audits in order to prevent Hawthorne effect. Prescriptions written by doctors were segregated from those written by primary health care personnel.

The forms filled were checked for correctness and then used to evaluate/analyze the pattern of prescription and core drug use indicators such as:

- i. **Prescribing Indicators:** Average number of drugs per encounter, percentage of encounters with antibiotics, number of antibiotics prescribed by generic name, percentage of encounter with antibiotics, percentage antibiotics prescribed that is consistent with EML, percentage encounter with antibiotics were calculated and recorded.
- ii. **Patient Care Indicators:** Average consultation time, average dispensing time, percentage of antibiotics actually dispensed, percentage of patients with knowledge of correct dosage, percentage of patients treated without drug (antibiotics) were also noted and recorded.
- iii. **Facility Based Indicators:** Percentage of antibiotic drugs prescribed from the Essential Medicines List, percentage key antibiotics in stock, number of days a set of key antibiotics were out of stock, and expenditure of antibiotics as a percentage of total hospital medicine cost were calculated and recorded.

3.6 Inclusion and Exclusion Criteria

According to recommendations by the WHO, general illness prescriptions of outpatients of either sex, aged 0-16 years, willing patients/parents were included in the study. Patients who presented to the facility for vaccination, unwilling patients/parents, patients on admission and patents over 16 years of age were excluded from the study.

3.7 Data Collection

Usually in this facility, patients/parents queue up outside the consultation and dispensing rooms. Both inpatients and outpatients queued up outside the Pharmaceutical Services Department with their handwritten prescriptions. One Pharmacist and one pharmacy technician were trained as research assistants to collect data on prescribing indicators while the lead researcher (Principal Investigator) collected data for patient care and facility indicators. For the drug use indicators, prescriptions written/dispensed by professional staff (doctors/pharmacists respectively) were segregated from those written by nurses and primary care personnel (CHEWS/JCHEWS). Analysis of data was carried out by the Principal Investigator.

3.7.1 Pre-intervention stage

During this stage, the baseline drug use indicators were assessed and some problems associated with drug use in the facility were identified. Data was collected on alternate days between 10 am and 12 noon and this was to make sure that results were not influenced by the rush to see patients at the beginning or end of clinic sessions or by the freshness or fatigue of health personnel.

The following data were collected and recorded in a modified WHO drug use indicator form:

- i. Patient's demographic data such as name, age, sex, weight and address
- ii. Complaints for which the patient sought medical attention or diagnosis/disease
- iii. Prescriber's name, signature and date
- iv. Dose, dosage forms and duration of therapy
- v. Antibiotics prescribed and antibiotics dispensed
- vi. Knowledge of patients on correct dosage
- vii. Consultation time
- viii. Dispensing time
- ix. Proportion of dispensed medicines adequately labeled
- x. Proportion of patients treated without antibiotics
- xi. Availability of Essential Medicines List (EML), indicated by a 'yes' or 'no'
- xii. Number of days a set of key antibiotics were out of stock at the facility
- xiii. Medicine expenditure during the study period especially as regards to antibiotics

3.7.1.1 Calculation of Drug Use Indicators

WHO core drug use indicators were calculated as follows:

3.7.1.2 Prescribing indicators

$$\text{Average number of drugs per encounter} = \frac{\text{Total number of drugs prescribed in all encounters}}{\text{Total number of encounters}}$$

$$\% \text{ antibiotics prescribed in generic name} = \frac{\text{Total number of antibiotics prescribed in generic}}{\text{Total number of antibiotics prescribed}} \times 100$$

$$\% \text{ of drugs prescribed from EML} = \frac{\text{Total number of antibiotics prescribed from EML}}{\text{Total number of antibiotics prescribed}} \times 100$$

$$\% \text{ encounter with antibiotics} = \frac{\text{Total number of patients prescribed antibiotics}}{\text{Total number of encounters}} \times 100$$

$$\% \text{ encounter with an injection} = \frac{\text{Total number of patients prescribed an injection}}{\text{Total number of encounters surveyed}} \times 100$$

3.7.1.3 Patient Care Indicators

$$\text{Average consultation time} = \frac{\text{Total time for a series of consultations}}{\text{Number of consultations}} \times 100$$

$$\text{Average dispensing time} = \frac{\text{Total time taken for series of dispensing}}{\text{Number of consultations}} \times 100$$

$$\% \text{ of drugs actually dispensed} = \frac{\text{Number of antibiotics actually dispensed}}{\text{Total number of antibiotics prescribed}} \times 100$$

$$\% \text{ of drugs actually labeled} = \frac{\text{Number of drugs adequately labeled}}{\text{Total number of antibiotics dispensed}} \times 100$$

3.7.1.4 Facility indicators

Availability of Essential Medicine List was indicated by a 'yes' or 'no'.

$$\text{Availability of key antibiotics} = \frac{\text{Number of key antibiotics actually in stock}}{\text{Number of key antibiotics that should be available}} \times 100$$

Average number of days that a set of key antibiotics is out of stock =

$$\frac{\text{Number of days that each key antimicrobial is out of stock}}{\text{Number of key antibiotics in review}}$$

Expenditure on antibiotics as a percentage of total hospital medicine cost =

$$\frac{\text{Total cost of all antibiotics purchased}}{\text{Total cost of all medicines purchased}} \times 100$$

3.7.2 Calculation of drug utilization 90% (DU 90%)

The Drug Utilization 90% (DU 90%) segment reflects the number of drugs that account for 90% of drug utilization. Defined Daily Dosage (DDD) was calculated using the Anatomical Therapeutic Classification (ATC) and DDD assignment (2016) as given by WHO collaborating centre for drug statistics methodology, Oslo, Norway. The formula is stated below:

$$\text{DDD/1000 patients/day} = \frac{\text{Total amount of drug used during the study period (mg)}}{\text{DDD X study period x sample size}} \times 100$$

3.7.3 ABC/VED analysis

The ABC/VED analysis of the antibiotics in the pharmacy store of HBPH during the study period was carried out as follows:

- i. A list of all antibiotics dispensed throughout the study period was prepared including the pack size, cost of each drug and total cost.
- ii. The number and percentages of each drug item was calculated and the cumulative percentage incurred on each drug was also calculated.
- iii. For the ABC analysis, each drug was categorized into A, B, or C by calculating the percentage of total hospital drug budget spent for each drug and the cumulative percentage of each drug. The Drugs were then rearranged according to their decreasing total cost.

- iv. For the VED analysis, the drugs were classified into three categories based on their criticality and utility to the patients by using the EML.
- v. The ABC-VED matrix analysis was done by cross-tabulating the results of ABC and VED analysis. This gave rise to nine different sub-categories as follows: AV, AE, AD, BV, CV, BE, BD, CE and CD. The first alphabet depicts its place in the ABC classification while the second alphabet depicts its place in the VED classification. This gave rise to three categories: I, II and III. Category I comprise of AV, AE, AD, BV and CV sub-categories; category III comprises BE, BD, and CE sub-categories while category III comprises the CD sub-category.

3.7.4 Intervention stage

The results of the pre-intervention stage were presented to the management and staff of the hospital at one of the regular meetings on continuing medical education (CME). The gaps identified in the drug use indicators were mainly on the part of the primary health care personnel (CHEWS/JCHEWS, Pharmacy Technicians); hence intervention was targeted at them. The problem was mainly lack of knowledge and unavailability of copies of the EML. Intervention was provided only for the WHO core drug use indicators which were reassessed after the intervention.

3.7.4.1 Intervention to health care personnel

Educational interventions during meetings were provided and copies of the EML made available to enhance rational use of drugs. Dispensers were trained on good medication labeling and drug administration techniques to promote rational use of drugs. Intervention was primarily provided to primary health care personnel, in whom some problems of drug use were identified.

3.7.4.2 Intervention to parents/care givers

Intervention was also provided to parents/caregivers and it involves the use of calibrated spoons, droppers, or oral syringe provided in the medication package as measuring device instead of household silverware. They were also made to understand the meanings of once daily, twice daily, thrice daily and four times daily in terms of hours, importance of adhering to dosage regimen and how to reconstitute the suspensions and to always shake the bottle before use.

3.7.4.3 Intervention to management

During a meeting with top management staff of the hospital, the formation/reactivation of Drugs and Therapeutic Committee (DTC) was advocated to enhance rational use of drugs. The provision, distribution and use of copies of the Kano State EML were also encouraged as a means of promoting rational antibiotic use. The management was also advised to reduce expenditure on antibiotics as a means of reducing the purchase of unnecessary antibiotics and making resources available for the purchase of other essential drugs.

3.7.5 Post-intervention stage

For the purpose of monitoring and documenting the impact of the intervention provided, the survey was repeated between May, 2017 and July, 2017 (3 months). The values of the various drug use indicators were determined as in the pre-intervention stage.

3.8 Statistical Analysis

The forms filled were checked for completeness of information and data entered into Microsoft Excel and analyzed using SPSS (Statistical Package for Social Science) version

22. Data analysis was carried out by using descriptive statistics: frequency, percentage, mean and standard deviation and results were presented in tabular form.

3.9 Ethical Consideration

The protocol of this study was presented to the Ethical Committee of the Kano State Ministry of Health and approval was obtained prior to commencement of the study (see appendix III).

CHAPTER FOUR

4.0 RESULTS

4.1 Demographic characteristics of patients in the study

About 544 (89.9%) of the patients within the age of 0-5years, 55 (9.1%) of the patients were within the age of 6-11years, and 6 (0.5%) of patients are within the age of 12-16 years. These age ranges are consistent with the fact that the site of study is a Pediatric Specialist Hospital. The mean age of patients in the study was 3.5 years with variance and standard deviations of 29.3 and 5.4 respectively. Out of a total of 605 encounters, male patients were the predominant paediatric population accounting for about 367 (60.7%) of patients, while 238 (39.3%) were female (table 4.1).

Table 4.1: Demographic Characteristics of Outpatients in Hasiya Bayero Paediatric Hospital, Kano.

Variable	Frequency (%)
Age	
0-5 years	544 (89.9)
6-11years	55 (9.1)
12-16 years	6 (1.0)
Total	605 (100)
Mean age	3.5
S.D	±5.4 years
Gender	
Male	367 (60.7)
Female	238 (39.3)
Total	605 (100)

4.2 Presence/Absence of Vital information on Outpatient Prescriptions

The Presence/absence of vital information is shown in Table 4.2. About 523 (86.4%) of prescriptions had names of patients written, while about 82 corresponding to 13.6% of prescriptions were without names. The age of patient was stated in 545 (90.1%) of prescriptions but was not stated in 60 (9.9%) of the prescriptions. The weight of patients was present in about 584 (96.5%) of prescriptions surveyed and absent in only 21 (3.5%) of prescriptions surveyed (table 4.2). The Address of patients was written in 578 (95.5%) of prescriptions and absent in 27 (4.5%) of prescriptions. During the course of this study, only 11 (1.8%) of prescriptions contained name of prescribers while 594 (98.2%) of prescriptions had no name of the prescriber written on them. The signature of prescriber was present in 444 (73.4%) of prescriptions and absent in 161 (26.6%) of prescriptions in the study. The date on which prescriptions were written was present in 570 (94.2%) of prescriptions and absent in 35 (5.8%) of the prescriptions surveyed. Dosage forms of prescribed drugs were present in 601 cases (99.3%) and absent in only 4 prescriptions (0.7%). The frequency of administration was mentioned in all prescriptions (100%) while the strength of drug was mentioned in 85.1% of all prescriptions surveyed.

Table 4.2: Presence/Absence Vital Information on Outpatients' Prescriptions in Hasiya Bayero Paediatric Hospital, Kano.

Variable	Present Frequency (%)	Absent Frequency (%)
Name of Patient	523 (86.4)	82 (13.6)
Age of Patient	545 (90.1)	60 (9.9)
Weight of Patient	584 (96.5)	21 (3.5)
Address	578 (95.5)	27 (4.5)
Prescriber's Name	11 (1.8)	594 (98.2)
Prescriber's Sign.	444 (73.4)	161 (26.6)
Date	570 (94.2)	35 (5.8)
Dosage form	601 (99.3)	4 (0.7)
Freq. of Admin	100 (100)	0 (0)
Strength of Drug	515 (85.1)	90 (14.9)

4.3 Dosage Form of Antibiotics Prescribed

About 509 (84.1%) of prescribed antibiotics during the course of the study were liquid dosage forms (suspensions and syrups), while solid dosage forms – tablets and capsules accounted for 51(8.4%) and 8 (1.3%) of dosage forms respectively. Injectable antibiotics were encountered 25 times (4.1%) while ophthalmic preparations were the least prescribed dosage form accounting for 0.7% of all prescriptions.

4.3 Reasons for Outpatient Antibiotic Prescriptions Written by Professional Health Care Workers in Hasiya Bayero Paediatric Hospital, Kano

The most common reasons for which antibiotics were prescribed to outpatients by professional health care workers were enteric fever, acute respiratory infection (ARI)/ acute respiratory disease (ARD)/ respiratory tract infection (RTI) which accounted for 25.2% and 16.9% of prescriptions respectively. Cough and catarrh, skin rash/itching, sepsis and urinary tract infection accounted for 13%, 10.7%, 8.7% and 7.0% of reasons for outpatient antibiotic prescriptions respectively. The least common reasons for outpatient antibiotic prescription were mumps and tonsillitis, both of which were prescribed once during the period of the study.

Table 4.3: Reasons for Outpatient Antibiotic Prescription by Professional Health Care Workers in Hasiya Bayero Paediatric Hospital, Kano.

Reason	Frequency (%)
Abdominal Distention	2 (0.8)
ARI/ARD/RTI	41(16.9)
Bronchiolitis	7 (3.0)
Cough & Catarrh	31(13.0)
Diarrhoea & Vomiting	9 (3.7)
Enteric Fever	61(25.2)
Fever	10 (4.1)
Mumps	1 (0.4)
Oral Thrush	2 (0.8)
Otitis Media	10 (4.1)
Redness of the Eye	3 (1.2)
Sepsis	21 (8.7)
Skin Rash/Itching	26 (10.7)
Tonsilitis	1 (0.4)
UTI	17 (7.0)
Total	242 (100)

4.3 Reasons for Outpatient Antibiotic Prescriptions Written by Non-Professional Health Care Workers in Hasiya Bayero Paediatric Hospital, Kano

The most common reason for which antibiotics were prescribed to outpatients by non-professional health care workers during the period of the study was cough and catarrh accounting for 80 (22%) of cases. This was closely followed by diarrhoea and vomiting which accounted for 69 (19%) of prescriptions and skin rash/itching which accounted for 52 (14.3%) of outpatient antibiotic prescriptions. The least common reasons for outpatient antibiotic prescriptions were chicken pox and abdominal bloating which respectively accounted for 2 (0.6%) of outpatient antibiotic prescriptions, while dispnoea, tonsillitis and urinary tract infection (UTI) respectively accounted for 0.3% of all antibiotic prescriptions (table 4.4).

Table 4.4: Reasons for Outpatient Antibiotic Prescriptions Written by Non-Professional Health Care Workers in Hasiya Bayero Paediatric Hospital, Kano.

Reason	Frequency (%)
Abdominal Bloating	2 (0.6)
Abdominal Distention	19 (5.2)
ARI/ARD/RTI	7 (1.9)
Chicken Pox	2 (0.6)
Circumcision	27 (7.4)
Constipation	3 (0.8)
Cough & Catarrh	80 (22.0)
Diarrhoea & Vomiting	69 (19.0)
Dispnoea	1 (0.3)
Enteric Fever	3 (0.8)
Fever	18 (4.9)
Fluid like Formation on the skin	2 (0.6)
Leg and Abdominal Swelling	16 (4.4)
Loss of Appetite	6 (1.7)
Malnutrition/Loss of Weight	11 (3.0)
Mumps	17 (4.7)
Oral Thrush	4 (1.1)
Otitis Media	3 (0.8)
Redness of the eye	3 (0.8)
Septic Umbilicus	6 (1.7)
Skin Rash/itching	52 (14.3)
Sore finger	10 (2.8)
Tonsilitis	1 (0.3)
UTI	1 (0.3)
Total	363 (100)

4.4 Drug Use Indicators for Professional Health Care Workers

The drug use indicators for professional health care workers are presented in the tables 4.12, 4.13 and 4.14 below:

4.4.1 Prescribing indicators

The number of drugs per encounter was 2.0, percentage encounter with antibiotics was 55%, there was also high tendency to prescribe in generic name (75.1%), but the percentage encounter with injectable antibiotics was low (4.2%). About 70.7% of antibiotics prescribed were listed in the EML.

Table 4.5: Prescribing Indicators for Professional Health care Workers in Hasiya Bayero Paediatric Hospital, Kano.

Prescribing Indicators (n=242)	Professionals	WHO Standards
Average number of drugs per encounter	2.0	1.6 – 1.8
Percentage encounters with an antibiotic prescribed	133 (55%)	20 -26.8%
Percentage of antibiotics prescribed by generic name	181 (75.1%)	100%
Percentage encounter with injections (antibiotics)	10(4.2%)	13.4-24.1%
Percentage of antibiotics prescribed on EML	171 (70.7%)	100%

4.4.2 Patient care indicators

The average consultation time and dispensing time for the doctors and pharmacists were 9.2 minutes and 10.0 minutes, while the average dispensing time was 4.3. The total number of antibiotics dispensed was 96%. The percentage of antibiotics adequately labeled was 81.2%, while about 78% of the patients or their care givers had knowledge of correct dosage.

Table 4.6: Patient Care Indicators for Professional Health Care Workers in Hasiya Bayero Paediatric Hospital, Kano.

Patient Care Indicators (n=242)	Professionals	WHO Standards
Average consultation time (minutes)	9.2	10.0
Average dispensing time (minutes)	4.3	≥ 3.0
Total number of antibiotics dispensed	232 (96%)	100%
Percentage of antibiotics adequately labeled	197 (81.2%)	100%
Percentage of patients with correct knowledge of dosage	189(78%)	100%

4.4.3 Facility indicators

As shown in table 4.7, a copy of essential medicine list (EML) was sighted with the professional health care workers. The percentage of key antibiotics in stock and number of days key antibiotics were out of stock were 88% and 5 days respectively, while the expenditure on antibiotics was 41%.

Table 4.7: Facility Indicators for Professional Health Care Workers in Hasiya Bayero Paediatric Hospital, Kano

Facility Indicators (n=242)	HBPH	WHO Standards
Availability of Essential Medicine List	Yes	Yes
Percentage of key antibiotics in stock	88%	100%
Average number of days key antibiotics were out of stock	5 days	0
Expenditure on antibiotics as a percentage of total medicines cost	41%	-

4.5 Pre-intervention and Post-Intervention Drug Use Indicators for Non-Professional Health Care Workers in Hasiya Bayero Paediatric Hospital, Kano

The pre-intervention and post-intervention drug use indicators for non-professional health care workers are shown in tables 4.8, 4.9 and 4.10 below.

4.5.1 Prescribing indicators

Before intervention was carried out for non-professional health care workers, the average number of drugs per prescription was 2.4 which reduced to 2.1 after intervention. Also, the percentage encounter with antibiotics reduced from 95% to 65%, whereas the percentage of antibiotics prescribed in generic name increased from 44.2% to 54.2%. The pre-intervention and post-intervention values for percentage encounter with injections were 4.1% and 3.1% respectively while the percentage of antibiotics prescribed in generic name increased from 66.7% before intervention to 75.3% after intervention, as shown in table 4.8 below.

Table 4.8: Prescribing Indicators for Non-professional Health Care Workers in Hasiya Bayero Paediatric Hospital, Kano.

Prescribing Indicators (n = 363)	Control	Pre-intervention	Post-intervention
Average number of drugs per encounter	1.6-1.8	2.4	2.1
% encounter with antibiotics	20-26.8%	345 (95%)	236 (65%)
% antibiotics prescribed in generic name	100%	160 (44.2%)	197 (54.3%)
% encounter with injections (antibiotics)	13.4-24.1%	15 (4.1%)	11 (3.1%)
% antibiotics prescribed in EML	100%	242 (66.7%)	273 (75.3%)

4.5.2 Patient Care Indicators

The average consultation time before and after intervention was 8.4 and 9.8 minutes respectively while the average dispensing time before and after intervention was 6.0 and 4.3 minutes respectively. The percentage of antibiotics dispensed at the time of the study was 92.17% and 94.17% before and after intervention respectively. About 58% of prescriptions were adequately labeled before intervention, but this value increased to 77.5% after intervention. About 58.9% of patients or their care givers had knowledge of correct dosage of antibiotics before intervention and this improved to 80.4% after intervention.

Table 4.9: Patient Care Indicators for Non-professional Health Care Workers in Hasiya Bayero Paediatric Hospital, Kano

Patient Care Indicators (n = 363)	Control	Pre-intervention	Post-intervention
Average consultation time (minutes)	10.0	8.4	9.8
Average dispensing time (minutes)	≥ 3.0	6.0	4.3
Percentage antibiotics dispensed	100%	335 (92.17%)	342 (94.2%)
Percentage antibiotics adequately labeled	100%	210 (58%)	281 (77.5%)
Percentage patients with knowledge of correct dosage	100%	214 (58.9%)	292 (80.4%)

4.5.3 Facility indicators

The non-professional health care workers had no copy of the EML before intervention but after intervention, the EML was sighted. The percentage of key antibiotics in stock at the time of the study was 88% and there was no change even after intervention, while the average numbers of days some key antibiotics were out of stock decreased from 5 days to 3 days. In the same vein, expenditure on antibiotics reduced from 41% to 35% during the period of the study.

Table 4.10: Facility Indicators for Non-professional Health Care Workers in Hasiya Bayero Paediatric Hospital, Kano.

Facility Indicators (n = 363)	Control	Pre-intervention	Post-intervention
Availability of EML	Yes	No	Yes
Percentage key antibiotics in stock	100%	88%	88%
Average number of days key antibiotics were out of stock	0	5 days	3 days
Percentage expenditure on antibiotics	-	41%	41%

4.6 Drug Utilization 90% (DU 90%)

4.6.1 Drug utilization 90% for professional health care workers

The DU 90% analysis expressed as defined daily doses per 1000 patients per day (DDDs/1000 patients/day) for professional health care workers shows that 11 antibiotics (amoxicillin/clavulanic acid, amoxicillin, cefixime, co-trimoxazole, ceftriaxone, cefpodoxime, azithromycin, cefuroxime, erythromycin, metronidazole and ciprofloxacin) accounted for within 90% drug utilization (DU 90%). The penicillins (Amoxicillin/clavulanic acid and amoxicillin) were the most utilized antibiotics with (5.2DDDs/1000 patients/day and 3.6DDDs/1000 patients/day), followed by cefixime a cephalosporin antibiotic with 2.4DDDs/1000 patients/day. The least utilized antibiotic was ampicillin/flucloxacillin with 0.004DDDs/1000 patients/day.

Table 4.11: Utilization of Antibiotics in Hasiya Bayero Paediatric Hospital Expressed as Percentage, Number of DDD/1000 Patients/Day for Professional Health Care Workers

ATC Code	Antibiotics Prescribed	Percentage	DDD/1000 Patients/Day
J01CR02	Amoxicillin+clavulanic acid	19.8	5.2
J01CA04	Amoxicillin	13.2	3.6
J01DD08	Cefixime	10.2	2.4
J01EE01	Co-trimoxazole	6.7	2.1
J01DD04	Ceftriaxone	9.8	2.1
J01DD13	Cefpodoxime	3.3	1.9
J01FA10	Azithromycin	4.1	1.8
J01DC02	Cefuroxime	7.3	1.5
J01FA01	Erythromycin	2.9	0.8
J01XD01	Metronidazole	2.1	0.6
J01MA02	Ciprofloxacin	6.9	0.3
► Within DU	90% Segment	86.3	22.3
J01CR50	Ampicillin+Cloxacillin	6.8	0.2
J01DB01	Cefalexin	3.5	0.2
S01AA09	Tetracycline	0.1	0.09
J01XE01	Nitrofurantoin	0.2	0.09
J01FF01	Clindamycin	1.3	0.06
J01BA01	Chloramphenicol	0.6	0.009
J01CE02	Phenoxymethyl Penicillin	0.1	0.009
J01CR50	Ampicillin+flucloxacillin	1.1	0.004
► Beyond	DU 90 % Segment	13.7	0.66
Total	Within DU 90% + Beyond DU 90%	100	22.9

4.6.2 Drug Utilization 90% for Non-professional Health Care Workers

The DU 90% analysis for non-professional health care workers as presented in table 4.12 shows that 9 antibiotics (cefixime, co-trimoxazole, amoxicillin/clavulanic acid, amoxicillin, cefuroxime, cefalexin and ciprofloxacin) accounted for 90% of drug utilization. Cefixime was the most utilized antibiotic (4.9DDD/1000 patients/day), followed by co-trimoxazole with 3.7DDD/1000 patients/day, while amoxicillin and amoxicillin/clavulanic acid had 1.02 DDD/1000 patients/day and 0.5DDD/1000 patients/day respectively. The least utilized antibiotic was chloramphenicol which had a value of 0.006DDD/1000 patients/day.

Table 4.12: Utilization of Antibiotics in Hasiya Bayero Paediatric Hospital Expressed as Percentage, Number of DDD/1000 Patients/Day for Non-professional Health Care Workers

ATC Code	Antibiotics Prescribed	Percentage	DDD/1000 Patients/Day
J01DD08	Cefixime	18.2	4.9
J01EE01	Co-trimoxazole	13.7	3.7
J01CR02	Amoxicillin+clavulanic acid	12.4	0.5
J01CA04	Amoxicillin	9.4	1.02
J01FA01	Erythromycin	9.1	1.0
J01CR50	Ampicillin+Cloxacillin	7.6	0.2
J01DC02	Cefuroxime	7.1	1.6
J01DB01	Cefalexin	5.3	0.3
J01MA02	Ciprofloxacin	4.9	0.5
► Within DU 90%	Segment	87.7	13.7
J01DD04	Ceftriaxone	3.5	0.2
J01FA10	Azithromycin	2.8	1.02
J01DD13	Cefpodoxime	2.1	0.6
J01XD01	Metronidazole	1.2	0.06
J01BA01	Chloramphenicol	1.0	0.006
J01CR50	Ampicillin+flucloxacillin	0.8	0.2
J01FF01	Clindamycin	0.3	0.03
S01AA09	Tetracycline	0.2	0.09
J01XE01	Nitrofurantoin	0.2	0.09
J01CE02	Phenoxyethyl Penicillin	0.2	0.009
► Beyond DU 90%	Segment	12.3	2.3
Total	within DU 90% + Beyond DU 90%	100	16

4.7 Monthly Purchase of Antibiotics in Hasiya Bayero Paediatric Hospital, Kano

4.7.1 Monthly Purchase of Antibiotics in Hasiya Bayero Paediatric Hospital for the Month of January, 2017

The monthly purchase of antibiotics in Hasiya Bayero Paediatric Hospital for January, 2017 is shown in table 4.13. About ₦524, 062.50, which accounted for 12.26% of the total cost of antibiotics was spent for the purchase of ceftriaxone/sulbactam, while about ₦420, 197.26 which accounted for 9.8% of the total cost of antibiotics was spent for the purchase of cefixime.

Table 4.13: Monthly Purchase of Antibiotics in Hasiya Bayero Paediatric Hospital, Kano (January, 2017).

Antibiotic Name, Strength Dosage Form, (Pack size)	Quantity	Total Cost of Antibiotic (₦)	% of Total Cost	Cumulative %
Amoxicillin 125mg/5ml (100ml)	243	78,367.50	1.83	1.83
Amoxicillin 500mg (vial)	50	8,062.50	0.19	2.02
Amoxicillin/clav. 228mg/5ml (100ml)	150	96,750	2.26	4.28
Ampicillin/cloxacillin 250mg/5ml	406	139,664	3.27	7.55
Ampicillin/cloxacillin 500mg (vial)	300	14,514	0.34	7.89
Ampicillin + sulbactam 500mg (vial)	50	29,294	0.69	8.58
Azithromycin 200mg/5ml (15ml)	90	73,530	1.72	10.30
Cefixime 100mg/5ml (60ml)	467	420,197.26	9.83	20.13
Cefalexin 100mg/5ml (100ml)	200	68,800	1.61	21.74
Ceftriaxone 1g (vial)	250	153,124	3.58	25.32
Ceftriaxone/sulbactam 500mg (vial)	650	524,062.50	12.26	37.58
Cefuroxime 125mg/5ml (100ml)	154	157,272.50	3.68	41.26
Erythromycin 125mg/5ml (100ml)	280	82,776.40	1.94	43.20
Co-trimoxazole 240mg/5ml (60ml)	320	27,520	0.64	43.84
Ciprofloxacin 500mg (10')	60	9,288	0.22	44.06
Chloramphenicol 5mg/ml (5ml)	50	5,514.90	0.13	44.19
Gentamicin 80mg/2ml (ampoule)	600	13,546.50	0.32	44.51
Fluconazole 10mg/ml (35ml)	40	28,380	0.66	45.17
Phenoxymethyl penicillin (10 x 12')	20	79,550	1.86	47.03
Total		2, 010, 213.56	47.03%	47.03%

Source: Pharmacy Department, Hasiya Bayero Paediatric Hospital, Kano

4.7.2 Monthly Purchase of Antibiotics in Hasiya Bayero Paediatric Hospital for the Month of December, 2016

The record of antibiotic purchase shows that a larger part of the total cost of antibiotic purchase (₦292, 428.50), accounting for 16.71% was consumed by cefixime, while chloramphenicol was the least with only 0.12% (₦ 3,225) of the total cost of antibiotic purchase for the month of December, 2016.

Table 4.14: Monthly Purchase of Antibiotics in Hasiya Bayero Paediatric Hospital, Kano (December, 2016).

Antibiotic Name, strength, (Pack size)	Dosage Form	Quantity	Total Cost of Antibiotic (₦)	% of Total Cost	Cumulative %
Amoxicillin/clav.228mg/5ml (70ml)	Susp	100	64,500	2.43	2.43
Ampicillin/cloxacillin 250mg/5ml (100ml)	Susp	107	36,808	1.38	3.81
Ampicillin/cloxacillin 500mg (vial)	Inj	200	9,676	0.36	4.17
Azithromycin 200mg/5ml (15ml)	Susp	50	40,850	1.54	5.71
Cefixime 100mg/5ml (60ml)	Susp	325	292,428.50	11.00	16.71
Cefuroxime 125mg/5ml (100ml)	Susp	100	102,125	3.54	20.55
Ceftriaxone 1g (vial)	Inj	240	69,600	2.62	23.17
Ceftriaxone/sulbactam 1.5g (vial)	Inj	100	80,625	3.03	26.20
Cefalexin 100mg/5ml (100ml)	Susp	100	34,400	1.29	27.49
Erythromycin 125mg/5ml (100ml)	Susp	100	23,650	0.89	28.38
Co-trimoxazole 240mg/5ml (60ml)	Susp	100	8,600	0.32	28.70
Ciprofloxacin 500mg (10)	Tab	50	6,450	0.24	28.94
Chloramphenicol 10mg/g (25g)	Oint.	30	3,225	0.12	29.06
Metronidazole 500mg (100ml)	Ivf	50	6,450	0.24	29.30
Phenoxymethyl penicillin 100,000 i.u (10 x 12)	Tab	10	39,775	1.49	30.79
Total			819,162.50	30.8	30.8

Source: Pharmacy Department, Hasiya Bayero Paediatric Hospital.

4.7.3 Monthly Purchase of Antibiotics in Hasiya Bayero Paediatric Hospital for the Month of November, 2016

About 9.95% (₦449, 890) of the total cost of antibiotic purchase for the month of November, 2016 was used to purchase cefixime, while only about 0.12% (₦ 5,482.50) of the total cost of antibiotic expenditure was used for the purchase of gentamicin.

Table 4.15: Monthly Purchase of Antibiotics in Hasiya Bayero Paediatric Hospital, Kano (November, 2016).

Antibiotic Name, Strength, (Pack size)	Dosage Form	Quantity	Total Cost of Antibiotic (₦)	% of Total Cost	Cumulative %
Amoxicillin 125mg/5ml (100ml)	Susp	250	80,625	1.78	1.78
Amoxicillin/clav. 228mg/5ml (70ml)	Susp	308	198,660	4.39	6.17
Ampicillin/cloxacillin 250mg/5ml (100ml)	Susp	250	86,600	1.90	8.07
Ampicillin/cloxacillin 500mg (vial)	Vial	300	22,575	0.50	8.57
Azithromycin 200mg/5ml (15ml)	Susp	50	40,850	0.90	9.47
Cefixime 100mg/5ml (60ml)	Susp	500	449,890	9.95	19.42
Cefuroxime 125mg/5ml (100ml)	Susp	100	102,125	2.26	21.68
Ceftriaxone 1g (vial)	Inj	500	274,125	6.06	27.74
Ceftriaxone/sulbactam 1.5g (vial)	Inj	300	241,875	5.35	33.09
Cefalexin 100mg/5ml (100ml)	Susp	100	21,500	0.48	33.57
Ceftadizime 1g (vial)	Inj	50	32,250	0.71	34.28
Erythromycin 125mg/5ml (100ml)	Susp	350	79,012.50	1.75	36.03
Cotrimoxazole 240mg/5ml (60ml)	Susp	400	55,900	1.24	37.27
Metronidazole 200mg/5ml (100ml)	Susp	210	25,962.30	0.57	37.84
Ciprofloxacin 500mg (100ml)	Ivf	50	6,181.50	0.14	37.98
Ciprofloxacin 500mg (10)	Tab	40	6,192	0.14	38.12
Amoxicillin/clav acid 625mg (14)	Tab	20	23,155.60	0.51	38.63
Gentamicin 80mg/2ml (ampoule)	Inj	300	5,482.50	0.12	38.74
Phenoxymethyl penicillin 100,000 i.u (10 x 12)	Tab	31	108,000	2.39	41.13
Fluconazole 10mg/ml (35ml)	Susp	10	7,095	0.16	41.29
Total			1,867,456.40	41.30	41.30

Source: Pharmacy Department, Hasiya Bayero Paediatric Hospital, Kano.

4.8 Record of Medicine Purchase in Hasiya Bayero Paediatric Hospital, Kano from November, 2016 to January, 2017

The record of medicine purchase shows that a total of ₦11, 452,075.03 was spent on the purchase of medicines from November, 2016 to January, 2017. Antibiotics took the largest part of the budget, consuming about ₦4, 696, 832.46 (41%) of total hospital medicine cost.

Table 4.16: Monthly Purchase of Antibiotics in Hasiya Bayero Paediatric Hospital, Kano (November, 2016 to January, 2017)

Month	Invoice No.	Supplier	Date of Purchase	Cost of Purchase	Total Cost
January, 2017	4568	Kano State DMCSA	03/01/2017	2,200,000.00	4,274,409.40
	4864	Kano State DMCSA	18/01/2017	2,074,409.40	
December, 2016	295	Kano State DMCSA	14/12/2016	1,980,435.75	2,657,784.25
	4374	Kano State DMCSA	16/12/2016	330,997.50	
	4382	Kano State DMCSA	17/12/2016	346,351.00	
November, 2016	3463	Kano State DMCSA	11/11/2016	2,367,167.97	4,519,881.38
	3953	Kano State DMCSA	29/11/2016	2,152,713.41	
Total					11,452,075.03

Source: Pharmacy Department, Hasiya Bayero Padiatric Hospital, Kano.

4.9 ABC/VED Analysis of Antibiotics in Hasiya Bayero Paediatric Hospital, Kano

4.9.1 ABC Analysis

The ABC analysis revealed three categories: A, B and C constituting about 6 (74.75%), 6 (20.21%) and 13 (5.04%) of the antibiotics respectively (table 4.17).

Table 4.17: ABC Analysis of Antibiotics in Hasiya Bayero Paediatric Hospital, Kano.

Antibiotic Name, Strength, (Pack size)	Dosage Form	Quantity	Total Cost of Antibiotic (₦)	% of Total Cost	Cumulative %
Cefixime 100mg/5ml (60ml)	Susp	1292	1, 162, 515.76	24.90	24.90
Ceftriaxone/sulbactam 1.5g (vial)	Inj	1050	846,562.50	18.13	43.03
Ceftriaxone 1g (vial)	Inj	990	496, 849	10.64	53.67
Cefuroxime 125mg/5ml (100ml)	Susp	354	361,522.50	7.74	61.41
Amoxicillin/clav acid 228mg/5ml (70ml)	Susp	558	359,910	7.71	69.12
Ampicillin/cloxacillin 250mg/5ml (100ml)	Susp	763	263, 072	5.63	74.75
Phenoxymethyl penicillin 100,000 i.u (10 x 12)	Tab	61	227, 325	4.87	79.62
Erythromycin 125mg/5ml (100ml)	Susp	350	185, 992.50	3.97	83.59
Amoxicillin 125mg/5ml (100ml)	Susp	493	158, 922.5	3.41	87.00
Azithromycin 200mg/5ml (15ml)	Susp	190	155, 230	3.32	90.32
Cefalexin 100mg/5ml (100ml)	Susp	400	124, 700	2.67	92.99
Co-trimoxazole 240mg/5ml (60ml)	Susp	820	92, 020	1.97	94.96
Ampicillin/cloxacillin 500mg (vial)	Inj	800	46, 765	1.00	95.96
Ceftazidime 1g (vial)	Inj	50	32, 250	0.69	96.65
Ampicillin/sulbactam 1.5g (vial)	Inj	50	29, 294	0.63	97.28
Metronidazole 200mg/5ml (100ml)	Susp	210	25, 962.3	0.56	97.84
Amoxicillin/clav. acid 625mg (14)	Tab	20	23,155.6	0.50	98.34
Ciprofloxacin 500mg (10)	Tab	150	21, 930	0.47	98.81
Gentamicin 80mg/2ml (ampoule)	Inj	900	19, 029	0.41	99.22
Amoxicillin 500mg (vial)	Inj	50	8, 062.5	0.17	99.39
Fluconazole 10mg/ml (35ml)	Susp	10	7,095	0.15	99.54
Metronidazole 500mg (100ml)	Ivf	50	6, 450	0.14	99.68
Ciprofloxacin 500mg (100ml)	Ivf	50	6,181.5	0.13	99.81
Chloramphenicol 5mg/ml (5ml)	Gutt	50	5, 514.9	0.12	99.93
Chloramphenicol 10mg/g (25g)	Oint.	30	3, 225	0.07	100
Total			4, 696, 052.96	100	

4.9.2 VED analysis

The VED analysis of the antibiotics as represented in table 4.18 below shows that V category contains 7 antibiotics; the E category contains 10 antibiotics where as the D category contains 8 antibiotics. The V, E and D categories constitute 28%, 40% and 32% of the antibiotics respectively.

Table 4.18: VED Analysis of Antibiotics in Hasiya Bayero Paediatric Hospital, Kano

VED Category	Antibiotic name, strength, pack size	Dosage form	Quantity	Cost of Antibiotic (₦)	% Total Cost	Cumulative %
D	Cefixime 100mg/5ml (60ml)	Susp	1292	1, 162, 515.76	24.90	24.90
D	Ceftriaxone/sulbactam 1.5g (vial)	Inj	1050	846, 562.50	18.13	43.03
V	Ceftriaxone 1g (vial)	Inj	990	496, 849	10.64	53.67
E	Cefuroxime 125mg/5ml (100ml)	Susp	354	361,522.50	7.74	61.41
V	Amoxicillin/clav. acid 228mg/5ml (70ml)	Susp	558	359, 910	7.71	69.12
V	Ampicillin/cloxacillin 250mg/5ml (100ml)	Susp	763	263, 072	5.63	74.75
E	Phenoxymethyl penicillin 100,000 i.u (10 x 12)	Tab	61	227, 325	4.87	79.62
E	Erythromycin 125mg/5ml (100ml)	Susp	350	185, 438.90	3.97	81.37
V	Amoxicillin 125mg/5ml (100ml)	Susp	493	158, 922.5	3.41	87.00
D	Azithromycin 200mg/5ml (15ml)	Susp	190	155, 230	3.32	90.32
D	Cefalexin 100mg/5ml (100ml)	Susp	400	124, 700	2.67	92.99
E	Co-trimoxazole 240mg/5ml (60ml)	Susp	820	92, 020	1.97	94.96
V	Ampicillin/cloxacillin 500mg (vial)	Inj	800	46, 765	1.00	95.96
D	Ceftazidime 1g (vial)	Inj	50	32, 250	0.69	96.65
D	Ampicillin/sulbactam 1.5g (vial)	Inj	50	29, 294	0.63	97.28
E	Metronidazole 200mg/5ml (100ml)	Susp	210	25, 962.3	0.56	97.84
D	Amoxicillin/clav acid 625mg (14)	Tab	20	23,155.6	0.51	98.34
E	Ciprofloxacin 500mg (10)	Tab	150	21, 930	0.47	98.81
V	Gentamicin 80mg/2ml (ampoule)	Inj	900	19, 029	0.41	99.22
V	Amoxicillin 500mg (vial)	Inj	50	8, 062.5	0.17	99.39
E	Fluconazole 10mg/ml (35ml)	Susp	10	7, 095	0.15	99.54
E	Metronidazole 500mg (100ml)	Ivf	50	6, 450	0.14	99.68
E	Ciprofloxacin 500mg (100ml)	Ivf	50	6, 181.5	0.13	99.81
E	Chloramphenicol 5mg/ml (5ml)	Ophth	50	5, 514.9	0.12	99.93
D	Chloramphenicol 10mg/g (25g)	Ophth	30	3, 225	0.07	100
Total				4, 696, 052.96	100	

4.10 ABC-VED Matrix Analysis of Antibiotics in Hasiya Bayero Paediatric Hospital, Kano

The ABC-VED matrix analysis as shown in table 4.19 below reveals three groups of antibiotics: I, II and III. Group I is represented by 12 (48%) of antibiotics; group II is represented by 9 (36%) of antibiotics where as group III contains 4 (16%) of antibiotics.

Table 4.19: ABC-VED Matrix Analysis of Antibiotics in Hasiya Bayero Paediatric Hospital, Kano

Category	Number of Antibiotics	% Antibiotics	Antibiotic Expenditure (₦)	% Expenditure
A	06	24	3,510,299.59	74.75
B	06	24	949,072.30	20.21
C	13	52	236,681.07	5.04
V	07	28	1,360,446.54	28.97
E	10	40	944,845.86	20.12
D	08	32	2,390,760.56	50.91
I	12	48	3,126,162.46	66.57
II	09	36	1,111,903.76	23.72
III	04	16	455,986.74	9.71

CHAPTER FIVE

5.0 DISCUSSION

The study site, Hasiya Bayero Paediatric Hospital, receive patients of either sex on outpatient and inpatient basis seven days a week. Majority of patients that visited the outpatient department of the hospital were within the age range of 0-5 years and this is consistent with the fact that the site of study is a paediatric specialist hospital. Out of a total of 605 encounters, 60.7% (367) were male patients while 39.3% (238) were female patients.

For a prescription to meet up to standard, it must meet certain criteria regarding the identification of patient (name, address, age, weight, sex, and diagnosis), inscription (body of the prescription which must contain name, strength, frequency and duration of therapy), identity of prescriber (name and signature), subscription and date on which prescription was written. Weight is particularly important for paediatric patients because it determines the strength of medications to be given (according to body weight i.e. mg/kg) and body surface area (mg/m^2) rather than age as in the case of adults. Therefore the absence of weight on any prescription portends serious consequences to the patients due to the risk of inadequate dosing (under-dosing or over dosing) of medications. For antibiotics inadequate dosing is a drug therapy problem (DTP) that can lead to the emergence of adverse effects, antibiotic resistance and treatment failure. The identification parameters such as name, weight, age and address of patient were stated in majority of the prescriptions. The name of patient was stated in 523 (86.4%) of patients, weight was stated in 96.5% of patients, while address was stated in 95.5% of patients.

The prescriber's name was mentioned only in 11 cases (1.8%); whereas prescriber's signature was present in 444 cases (73.4%). Therefore, the only prescriber identification

parameter which did not have good value was name of prescriber. This can be attributed to inadequate knowledge of standard format of prescription writing on the part of the prescribers and this call for routine in-service continuing medical education. The date of prescription is another element of good prescription writing. In this study, the date of prescription was mentioned in 94.2% (574) of the patients.

Even though the values of most prescription parameters were good, there is a need to evolve methods to check some inadequacies such as inadequate identification of prescriber. Some of these inadequacies may have resulted from lack of awareness on the need to have a standard prescription as a prerequisite for optimum patient care, overwork of medical personnel and inadequate health care professionals to man the healthcare system. The evolution of methods to tackle these inadequacies is necessary to avoid indiscriminate use of drugs, especially in children who are a particular vulnerable group of patients.

The use of drug indicators is a well-established method for assessing drug utilization patterns in health facilities. Before activities (such as interventions) are started to promote rational drug use, an effort should be made to describe and quantify the situation. The World Health Organization has introduced drug use indicators such as prescribing indicators, patient care indicators and facility indicators in an effort to promote rational use of drugs especially in developing countries. These quantitative indicators are now widely used as global standard for problem identification and solving having been used in over 30 developing countries (Desalegn, 2013).

In this study, the average number of drugs per prescription for the non-professional health care workers before intervention was found to be 2.4, but this reduced to 2.1 after intervention was carried out. This value is higher than ideal WHO standard which is less

than 2 (1.6-1.8) (Sisay *et al.*, 2017). The value obtained before intervention was also higher than the average number of drugs per encounter found in a study conducted in three selected hospitals in Eastern Ethiopia which was 2.34 (Sisay *et al.*, 2017), Hawassa University Teaching hospital which was 1.9 (Desalegn, 2013) and Jimma Hospital which was 1.59 (Abdullahi, 1997). However, the value in this study is lower in contrast to other studies carried out in different healthcare settings, such as 2.8 in Nigerian Army hospitals (Adebayo and Hussain, 2010), 2.6 in South Eastern Nigeria (Adimo *et al.*, 2009) and 3.7 in Indian health care settings (Reddy *et al.*, 2015). However, for the professional health care workers, the average number of drugs per encounter in this study is 2.0, a better value than the one obtained for the non-professional health care workers and the one obtained in Nigerian Army hospitals (Adebayo and Hussain, 2010). This indicator is used to measure the extent of polypharmacy in a facility. A high degree of polypharmacy may probably be due to lack of adequate knowledge and training of health professionals, empirical prescribing, symptomatic treatment approaches and perverse incentives by medical representatives and differences in the socio-economic status of the patients. Over-use of drugs (as evident in polypharmacy) can lead to drug-drug interactions which can lead to grave consequences like potentiation of adverse drug reactions or side effects, prolonged hospital stay, drug wastages, wastage of patient's out-of-pocket money, etc. This means increase in both direct medical and non-direct medical costs. Polypharmacy, unfortunately, is very common in Nigeria and other developing countries (Pavin *et al.*, 2003).

The percentage encounter with antibiotic was found to be 95% for the non-professional health care workers which reduced to 65% after intervention, but both values are higher than the standard range of 20.0- 26.8%. The percentage encounter with antibiotics for the professional health care workers was 55%, also higher than the WHO range of 20.0-

26.8%. The values for both non-professional (before and after intervention) and professional health care workers are also higher than that found in Hawassa University teaching hospital in Southern Ethiopia which was 58% (Desalegn, 2013). The high frequency of prescribing antibiotics observed in this study is similar to previous studies conducted in Nigeria (Chedi, 2012, Enwere *et al.*, 2006, Odusanya *et al.*, 2000, Olayemi *et al.*, 2006, Nwolisa *et al.*, 2005)

The percentage antibiotics prescribed in generic name before intervention was found to be 44.2% for the non-professional health care workers, which increased to 54.3% after intervention. The percentage of antibiotics prescribed in generic name for the professional health care workers was found to be 75.1%, which corroborates a study conducted in South Eastern Nigeria which found a value of 72.5% (Adibe *et al.*, 2009). All the values obtained are lower than the WHO recommended value of 100%, i.e.; all drugs should be prescribed in generic name. The values obtained for the non-professional health care workers before intervention (54.3%) and the professional health care workers (75.1%) in this study are better than those obtained in an earlier study in Nigerian Hospitals with a value of 49.3%, (Adebayo & Hussain, 2010), secondary care referral hospital in India with a value of 42.9% (Prasad *et al.*, 2015), etc. However, the value obtained for the professional health care workers corroborates a study in some health care settings in selected Ethiopian Hospitals (79.2%). For drugs to be rationally used, the WHO recommends that all prescriptions should be written in generic name. This will reduce confusion on the identity of the drug and hence, reduction in medication errors. Prescribing in generic name allows flexibility of stocking and dispensing various brands of a particular drug that are cheaper than and as effective as proprietary brands (Adibe *et al.*, 2009). High tendency to write prescriptions by proprietary or trade names may be

attributed to lack of knowledge and training of health care personnel as well as perverse medical incentives by pharmaceutical companies.

The patient care indicators are used to assess the quality of service rendered to patients in a health care facility. The average consultation time during the period of this study for the professional health care workers was found to be 9.2 minutes which is a little lower than the WHO standard of 10 minutes (WHO, 1993). However, the average consultation time for the non-professional health care workers before intervention was 8.4 minutes, which improved to 9.8 minutes after intervention. The result however, is better than results in two studies which are 4.61 minutes (Sisay *et al.*, 2017) and 4.7 minutes (Embaye, 1999), but lower than 11.5 minutes obtained in a study conducted in south eastern Nigeria (Adibe *et al.*, 2009). Generally, longer consultation time had improved patient satisfaction and more effective resource use (WHO, 2010) and patients are more able to use their resources (usually out-of pocket money) with good consultation times.

The average dispensing time for the professional health care workers was found to be 4.3 minutes, which is close to the WHO value of ≥ 3.0 minutes. For the non-professional health care workers, an average of 6.0 minutes was the dispensing time obtained from this study before intervention, which reduced to 4.5 minutes after intervention. The dispensing time obtained in this study is higher than that found in some studies such as in Northwestern Nigeria (Tamuno, 2011), South Eastern Nigeria (Adibe *et al.*, 2009) and Zimbabwe (Sisay *et al.*, 2017) which were 3.5 minutes, 2.8 minutes and 2.5 minutes respectively. Even though there was high turnover of patients in the study site, the long dispensing time found in this study may be attributed to availability of staff, mostly pharmacy technicians (Pharmacy staffing to patient ratio). However, longer waiting times can lead to lack of patients' satisfaction due to fatigue. On the other hand, optimum

waiting times give the pharmacist opportunity to offer pharmaceutical care services. This is more so especially because pharmacy practice is shifting towards patient-oriented rather than product-oriented profession, where pharmacists are “medication managers”. Low patient to pharmacist ratio generally leads to reduction in waiting times and better patient satisfaction.

During the period of this study, about 96% of antibiotics prescribed were dispensed to patients by the professional health care workers. Before intervention was given to non-professional health care workers, about 92.17% of prescribed antibiotics were dispensed, but this value increased to 94.2% after intervention. This value, even though good as it seems, is less than the WHO standard of 100%, but higher than the value obtained in selected hospitals of eastern Ethiopia which was 75.77% (Sisay *et al.*, 2017). The figures indicate that few patients may be prone to exorbitant cost of medications (margin may be more than 100%) and below the average care found in most private medicine outlets, due to stock out in the facility.

The percentage of patients that were able to correctly recall dosage schedule for drugs dispensed by the professional health care workers was 81.2%. However, only 58.9% of patients attended by the pharmacy technicians were able to correctly recall the dosage schedule mentioned to them before intervention, which increased to 80.4% after intervention. All the values are lower than the WHO value of 100%, but higher than the value of 57.3% found in a study conducted in South Eastern Nigeria (Adibe *et al.*, 2009). In Hasiya Bayero Paediatric Hospital, most information on the use of medicines is passed on to third party (parent/ guardian) who would then administer the medications to the patients, and this knowledge might fade away as time elapses (Sisay *et al.*, 2017) before

the end of treatment. Other factors for the low value may be communication gap or illiteracy and lack of adequate directions on the prescriptions.

The percentage of drugs actually labeled is also a factor that determines how well a given medication is properly administered during the course of therapy. In this study, the professional health care workers were able to label about 81.2% of outpatient antibiotic prescriptions correctly. However, only about 58% of antibiotics dispensed to patients were actually labeled by the non-professional health care workers before intervention, but this markedly increased to 77.5% after intervention. These values are less than the WHO standard of 100%, but better than the one found in selected hospitals of Western Ethiopia where only 3.3% of dispensed medicines were actually labeled (Sisay *et al.*, 2017). Poor labeling is a leading cause of medication errors. Factors responsible for wrong labeling of medications may include lack of adequate knowledge and skill, inadequate manpower (patient to staff ratio), overwork of health personnel especially during the rush hours, inadequate direction on prescriptions, etc.

The first Kano State Essential Medicines List (EML) was published in 2013. The existence and availability of such document as well as its use is one cornerstone for rational prescribing (WHO, 1993) and ensures that only authorized medicines will be prescribed and procured. This EML is a guide to the health care team on the best available drugs to be used since the drugs are selected with regards to disease prevalence, evidence based efficacy, safety, comparative cost-effectiveness, health system, personnel, equipment and financial resources available (Kano State Essential Medicines List, 2013). During the study period, copy of the EML was seen with the professional health care workers. The non-professional health care workers did not have a copy of the EML before intervention, but it was sighted after intervention.

The average number of days that a set of key antimicrobial was out of stock was found to be 5 days before intervention, but the period reduced to 3 days after intervention. This means that with continuous advocacy, the management of the hospital may use resources better in the purchase of key antibiotics. This indicator measures the probability that any of the key antimicrobials were out of stock during the period and assesses the hospital's capacity to procure and distribute medicines and maintain constant supply (MSH, 2012). In a study in three different hospitals in Eastern Ethiopia, the average number of stock out days was 30 days in a 12-month period (Sisay *et al.*, 2017). In a study carried out in Pakistan, the average number of days that a set of key antimicrobials was out of stock was 3.3 days in a month (Atif *et al.*, 2017). The supply of a set of key drugs should be maintained at anytime to prevent stock outs and ensure constant availability so that patients are not left to the mercy of quack medicine vendors, hawkers, counterfeit medications and exorbitant prices, which can predispose to non-adherence and antibiotic resistance.

The percentage key antibiotics in stock were the same for both the professional and non-professional health care workers (88%). The value of this parameter did not change even after intervention was given to the management. The percentage key antibiotics available during the study was better than the values obtained in other studies such as 66.7% in Eastern Ethiopia (Sisay *et al.*, 2017) and 83.3% in a Secondary health care facility in Lagos, Nigeria (Odusanya, 2004). This indicator measures the availability of key antimicrobials in the hospital and the management of hospital pharmacy medicine supply. If key antibiotics are not present in hospital stores, patients may not receive the drug of choice for their infections or may not receive treatment at all with increased risk of morbidity and mortality (MSH, 2012). All key antibiotics should be in stock at all times.

Analysis of prescriptions written by professional health care workers revealed that 11 antibiotics (amoxicillin/clavulanic acid, amoxicillin, cefixime, cotrimoxazole, ceftriaxone, cefpodoxime, azithromycin, cefuroxime, erythromycin, metronidazole and ciprofloxacin) were within 90% of DU, with amoxicillin/clavulanic acid being the most prescribed and utilized antibiotic, accounting for 19.8% of prescriptions and 5.2DDDs/1000patients/day. All of these antibiotics were listed in the EML. In contrast to this finding, a study carried out in three tertiary care hospitals of Southern Ethiopia found out that amoxicillin/amoxicillin + clavulanic acid was the most frequently prescribed antibiotic followed by ciprofloxacin (Sisay *et al.*, 2017). The result also differs from the result obtained at Hawassa teaching hospital, Southern Ethiopia which showed that amoxicillin, 138 (16.4%) was the most commonly prescribed followed by ampicillin 126 (15%) (Desalegn, 2013).

However, analysis of prescriptions written by non-professional health care workers reveals that 9 antibiotics (cefixime, co-trimoxazole, amoxicillin/clavulanic acid, amoxicillin, erythromycin, ampicillin/cloxacillin, cefuroxime, cefalexin and ciprofloxacin) accounted for 90% of DU. Cefixime was the most prescribed (18.2%) and most utilized antibiotic (4.9DDDs/1000 patients/day). cefixime was 4.8 times more utilized than amoxicillin and amoxicillin/clavulanic acid with 1.02DDDs/1000 patients/day and 0.5DDDs/1000 patients/day respectively. The least utilized antibiotic for this group of prescribers was phenoxymethyl penicillin (0.009DDDs/1000 patients/day). Even though cefixime was the most utilized antibiotic among the non-professional health care workers, it was not included in the last edition of the Kano State EML, and was only recently included in the WATCH group of antibiotics (antibiotics that should be prescribed only for specific indications, since they are at higher risk of bacterial resistance) in the 20th edition of the WHO EML published recently in March, 2017. The

WHO recommends that the WATCH and RESERVE (antibiotics that are last resort options) groups of antibiotics should be particularly targeted by antibiotic stewardship programmes at national and international levels. The second and third most prescribed and utilized antibiotics were co-trimoxazole (3.7DDDs/1000 patients/day) and amoxicillin/clavulanic acid (1.02DDDs/1000 patients/day) which accounted for 13.7% and 12.4% of all outpatient antibiotic prescriptions respectively during the study. Co-trimoxazole and amoxicillin/clavulanic acid were listed in the EML.

The reduction of healthcare cost is a top priority for policy makers, especially in developing countries such as Nigeria. Health policy has the potential to impact millions of people worldwide; hence a closer look at the expenditures associated with antibiotic prescriptions is needed. The hospital's expenditure on antibiotics as a percentage of total hospital medicines cost measures the relative expenditure as a portion of all medicines cost. The expenditure on antibiotics as a percentage of total hospital medicines cost in this study was found to be 41% and there was no improvement for this indicator even after intervention. This means that 41% of total hospital expenditure was used for the purchase of antibiotics. The class of antibiotics that accounted for the most antibiotic expenditure overall was the cephalosporins. This is high considering the fact that the hospital has to procure other drugs such as analgesics, antimalarials etc to meet the patients' demands. In a similar study at Hawassa University teaching hospital in Ethiopia, the value was found to be 33.7% (Desalegn, 2013). Higher percentages may indicate prescription of multiple antimicrobials, unjustified use of antimicrobials, or use of expensive, branded antimicrobials (MSH, 2012).

In the present health care environment, no hospital will have abundant resources and hence, optimal utilization of existing resources will be an essential component of

hospital's logistic management (Kumar and Chakravarty, 2014). In a hospital, adequate stock of all drugs and consumables will have to be maintained to sustain patient care activities. The ABC/VED analysis and the ABC-VED Matrix analysis are conducted with the purpose of reducing expenditures and increasing the effectiveness of drug utilization (Moore *et al.*, 1997). The analysis shows the structure of antibiotic expenditure in the hospital and allows for introduction of reforms in the drug purchasing policy (Moore *et al.*, 1997).

Hasiya Bayero Paediatric Hospital spent a total of N4, 696, 052.96 for the purchase of antibiotics from November, 2016 to January, 2017 (3 months). When placing these drugs according to the ABC category, it was found that the A category contains 6 antibiotics (cefixime, ceftriaxone/sulbactam, ceftriaxone, cefuroxime, amoxicillin/clavulanic acid and ampicillin/cloxacillin) accounting for 74.75% of total antibiotic expenditure. The B category also contains 6 antibiotics (phenoxymethyl penicillin, erythromycin, amoxicillin, azithromycin, cefalexin, and co-trimoxazole) accounting for 20.21% of antibiotic expenditure; while the C group was represented by the largest number of antibiotics (13) but accounted for only 5.04% of total antibiotic expenditure. This analysis is consistent with Pareto's theory of 'vital few and trivial many'. A larger percentage of the hospital's antibiotic expenditure was used for the purchase of few antibiotics while only a small percentage was used for the purchase of a large number of antibiotics. This study is in line with a study carried out in a the expendable medical store of a tertiary care hospital in Northern India, where group A items constitute 104 items accounting for 70.03% of the total expenditure, B category consist of 296 items accounting for 19.98% of expenditure, whereas the most items (1136) were categorized as C items (Kumar and Chakravarty, 2014).

The VED analysis differs from the ABC analysis in that whereas the former is based on the criticality and utility of the drugs to the patients, the latter is based on monetary value of the drugs (Migbaru *et al.*, 2016). The present study shows that VED analysis comprises of 7 (28%) antibiotics belonging to the group of vital (V) items accounting for 28.97% of total expenditure; group of essential (E) antibiotics consists of 10 (40%) of antibiotics accounting for 28.97% of expenditure on antibiotics, while group D (desirable) consists of 8 antibiotics which accounts for the highest antibiotic expenditure (50.91%). A similar study by Singh et al in 2015 reveals that the V, E and D categories consist of 46 (12.3%), 230 (61.5%) and 98 (26.2%) respectively. Another study on the ABC-VED matrix analysis of pharmaceutical inventory management in Tikur Anbessa specialized hospital in Ethiopia revealed that 168 (67.2%) items, 55 (22%) items and 1 item were considered as vital, essential and desirable respectively (Migbaru *et al.*, 2016).

The ABC-VED matrix analysis was conducted to combine the factor of monetary value and criticality. This study reveals that category I consist of 12 (48%) of antibiotics that were A, B, C or V, E antibiotics, accounting for 66.57% of expenditure (N3, 126, 162.46). The next category (II) of the ABC-VED matrix analysis consists of 9 (36%) antibiotics that were either B, C, or D, E antibiotics, accounting for 23.76% of expenditure (N1, 111, 903.76). Category III of the ABC-VED matrix analysis consists of 4 (16%) antibiotics of antibiotics that consumed 9.71% (N455, 986.74) of antibiotic expenditure. In a similar study conducted in the tertiary care, academic institute of Northern India, matrix analysis for the year 2009-2010 revealed that 75 (19.79%), 218 (57.52%) and 86 (22.69%) items were in class I, II & III respectively which account 74.86% ,22.13% and 3.00% respectively (Singh *et al.*, 2015). Similarly, the ABC-VED matrix analysis conducted from 2009 to 2013 in a specialized hospital in Ethiopia reveals that category I items contains items that are either vital or expensive drugs, category II

contains items that were mainly essential, while category III contains items were non – essential (desirable) and inexpensive (Migbaru *et al.*, 2016).

CHAPTER SIX

6.0 SUMMARY AND CONCLUSION

6.1 Summary

Antibiotics have increased life expectancy where they have been used rationally. If used irrationally, antibiotics can lead to the development of adverse effects, resistance, treatment failure and eroded patient confidence in the health care system. The use of antibiotics in children requires special knowledge and skill because they differ from adults both in terms of pharmacokinetics and pharmacodynamics.

In Nigeria and many other developing countries, drugs are prescribed and dispensed by personnel with low level of training, widely available in the markets, often taken as self-medication not necessarily in complete dosage regimen (Chedi, 2012).

The availability of certain parameters on prescriptions was impressive, except for prescriber identity which was very low. There were very few number of professional health care workers and large number of non-professional health care workers in Hasiya Bayero Paediatric Hospital.

The analysis of drug use indicators showed better values for professional health care workers than non-professional healthcare workers. However, intervention was able to impact positively on the values obtained from the non-professional healthcare workers, as most indicators improved.

DU 90% analysis shows that the professional healthcare workers prescribed more of penicillin antibiotics than cephalosporins, whereas the non-professional healthcare workers prescribed more of the cephalosporins than the penicillins. Whereas

amoxicillin/clavulanic acid was the most prescribed and utilized antibiotic by the professional healthcare workers, cefixime was the most prescribed and utilized antibiotic by the non-professional healthcare workers. Cefixime was not one of the antibiotics in the Kano state EML and was only recently (2017) listed in the WATCH group of antibiotics in the WHO EML.

ABC, VED and ABC-VED matrix analysis showed that some few antibiotics which are not critical consumed the largest part of antibiotic expenditure in Hasiya Bayero paediatric hospital, while some more critical, more useful antibiotics consumed the smaller part of antibiotic expenditure. Cephalosporin antibiotics particularly consumed the largest part of the hospital's antibiotic expenditure. There is therefore the need for more prudent spending on the purchase of antibiotics.

6.2 Conclusion

This study was designed to assess antibiotic utilization pattern in Hasiya Bayero Paediatric Hospital, Kano State, Nigeria. The prescription format in this facility was good but prescriber's identity was poor. Drug use indicators for professional health care workers were better than drug use indicators for non-professional healthcare workers. However, intervention offered to the non-professional health care workers resulted in an improvement in most of these values. DU 90% analysis showed that amoxicillin/clavulanic acid was the most utilized antibiotic among the professional health care workers, while cefixime was the most utilized antibiotic among the non-professional health care workers. The ABC, VED and ABC-VED matrix analysis of the pharmacy store showed that some few, less critical antibiotics consumed the largest part of the hospital's antibiotic expenditure, whereas larger, more useful antibiotics consumed least part of the hospitals' antibiotic expenditure.

6.3 Limitations of the study

- i. The main limitation to this study was that part of the data was collected between November, 2016 and January, 2017, a period characterized by prevalence of cough, cold and catarrh.
- ii. This is a single hospital study; hence findings may not be generalized for all hospitals.

6.4 Recommendations

- i. Government should employ more professionals such as Pharmacists and doctors. This will help in ameliorating antibiotic misuse arising from overwork of health personnel and lack of skilled personnel.
- ii. Continuing In-service medical education is advocated to improve quality of patient care by improving the skills and competence of health care personnel
- iii. Government should supervise the distribution and implementation of important documents such as the EML as well as its review.
- iv. Primary Health Care Personnel should adhere to their standing order.
- v. A multidisciplinary drug and therapeutic committee should be developed to address all aspects of care in the hospital, particularly antibiotic stewardship programmes.

6.5 Contributions of the Study to Knowledge

To the best of my knowledge, this is the first of such studies to be conducted in this facility and it has brought out the following:

- i. Lack of skilled and professional health care personnel hampers the proper use of antibiotics in Hasiya Bayero Paediatric Hospital, Kano.

- ii. The Essential Medicine List, an important document that is crucial to the rational use of drugs was not properly used. This can be seen for example, from the utilization of cefixime (most utilized antibiotic) which was not listed in the Kano State Essential medicine List, 2013.
- iii. The ABC/VED and ABC-VED matrix analysis shows that more priority can be given towards purchase of more useful drugs and medical consumables by efficient utilization of resources.
- iv. Periodic educational interventions on the personnel can assist in improving the use of drugs including antibiotics in the health facility.

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APPENDICES

APPENDIX I

PRESCRIBING INDICATOR FORM

Location: _____
 Investigator: _____ Date: _____

Seq. #	Type (R/P)	Date of Rx	Age (yrs)	# Drugs	# Gen-erics	Antib. (0/1)*	Injec. (0/1)*	# on EDL	Diagnosis (Optional)
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
Total									
Average									
Percentage					%	%	%	%	
				<i>of total</i>	<i>of total</i>	<i>of total</i>	<i>of total</i>	<i>of total</i>	
				<i>drugs</i>	<i>cases</i>	<i>cases</i>	<i>cases</i>	<i>drugs</i>	

* 0=No 1=Yes

APPENDIX II

PATIENT CARE FORM

Location: _____
 Investigator: _____ Date: _____

Seq. #	Patient Identifier (if needed)	Consulting Time (mins)	Dispensing Time (secs)	# Drugs Pre-scribed	# Drugs Dis-pensed	# Ade-quately Labelled	Knows Dosage (0/1) *
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
Count							
Total							
Average							
Percentage					%	%	%
				<i>of pre-</i>	<i>of dis-</i>	<i>of cases</i>	
				<i>scribed</i>	<i>pensed</i>	<i>asked</i>	

* 0=No 1=Yes

APPENDIX III



KANO STATE OF NIGERIA MINISTRY OF HEALTH

Ref
MCH/Off/797/T.I/164

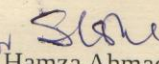
Date
16th September 2016

Pharm. Balarabe Zakariya'u Haruna
Department of Pharmaceutical Services,
Hasiya Bayero Paediatric Hospital,
Kano State.

RE: APPLICATION FOR ETHICAL APPROVAL

Reference to your letter dated 30th June 2016 on the above request addressed to Honourable Commissioner Ministry of Health requesting to conduct research titled "Evaluation of Antibiotic Prescription and utilization Pattern in Hasiya Bayero Paediatric Hospital, Kano State.

2. The research is for the award of Masters of Science in Pharmacy (Msc Pharmacy)
3. In view of the foregoing, I wish to convey the Ministry's approval for you to conduct the research in the above mentioned hospital in the state.
4. You are also requested to share your findings with the Ministry of Health, Kano.
5. Best Regards

for 
Hamza Ahmad
DPRS
Secretary (ORAC)
For: Honourable Commissioner

2nd & 3rd Floor, Post Office Road, P.M.B. 3066, Kano
Tel: 064634233, 634426, 635640, 633482, 632535, 647922, 634983, 635616
Cables of TELEGRAM: COMMHEALTH KANO