UNIVERSITY of RWANDA

EAC Regional Centre of Excellence for Vaccines, Immunization and Health Supply Chain Management (EAC RCE-VIHSCM)

AN EVALUATION OF ANTIMICROBIAL MEDICINES PRESCRIBING PRACTICES IN YUMBE DISTRICT, UGANDA.

THESIS SUBMITTED TO THE UNIVERSITY OF RWANDA, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTERS IN HEALTH SUPPLYCHAIN MANAGEMENT (MSc HSCM)

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SEPTEMBER 2019

STUDENT DECLARATION AND APPROVAL

I, MATUA Boniface hereby declare that this proposal is the result of my own work and has never been submitted for any other degree at the University of Rwanda or any other Institution.

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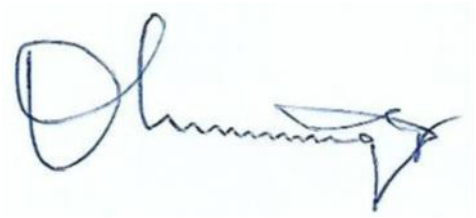

DEDICATION

This work is dedicated with great respect to my dear wife BAKO Rachael who encouraged me to believe in myself, whose great influence, encouragement and dedication have made me to have quality education, Almighty God may continue to bless us until completion of the course.

ACKNOWLEDGEMENTS

First and foremost, I would like to extend my sincere gratitude to the East African Community (EAC) Scholarship Programme for having allowed me pursue German Development Bank (KFW) funded Masters Scholarship that funded the course of health supply chain management (HSCM) at regional center of Excellence for Vaccines, Immunization and Health supply chain management (RCE VIHSCM) in University of Rwanda.

Secondly, special gratitude I give to my supervisors, Mr. Peter Takahikire University of Kisubi-Uganda and Dr. Kalidi Rajab Makerere University Uganda.

Further still, I am grateful to the management of Yumbe District Local Government for having permitted me attend the two years course especially to the (CAO) Chief Administrative Office and management as whole.

Finally, I would also like to acknowledge with much appreciation the crucial role of Professor Nelson Ijumba, the deputy vice chancellor academic affairs and research, who invested his full effort in guiding the team in achieving the goal.

ABBREVIATIONS AND ACRONYMS

ACT	Artemisinin combination therapy
AIDS	Acquired Immune Deficiency Syndrome
AMR	Antimicrobial resistance
ATC	Anatomical therapeutic chemical
DDD	Defined daily dose
DHO	District Health Office
DOTS	Directly observed treatment short course
EML	Essential Medicines List
GoU	Government of Uganda
HIV	Human Immune Virus
OPD	Out-Patient Department
IPD	In-Patient Department
MMS	Medicine Management Supervisor
MS	Medical Superintendent
MSH	Medicine Science for Health
NGO	Non – Governmental Organization
NMP	National Medicine Policy
PPS	Point Prevalence Survey
RDU	Rational Drug Use
SCM	Supply Chain Management
STGL	Standard Treatment Guidelines
TB	Tuberculosis
UCG	Uganda Clinical Guidelines
UNHCR	United Nation's High Commissioner for Refugees
UGX	Uganda shillings
WHA	World Health Assembly
WHO	World Health Organisation
YH	Yumbe Hospital
YLG	Yumbe Local Government

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ABSTRACT

Background: The irrational use of Antimicrobial medicines from health facilities decrease their usefulness due to the emergence of resistant strains of microorganisms and hence; an area of high concern for health personnel in improving patient outcomes and welfare. The irrational prescription of antimicrobials is the main modifiable driver of antimicrobial resistance. Ensuring access to effective antimicrobials and rational prescribing of antimicrobials is critical in reducing antimicrobial resistance and therefore prolonging their efficacy.

Objective: in this study we evaluated antimicrobials prescription practices in Yumbe District.

Method: To accomplish this, a cross sectional study design was employed to evaluate prescribing practices of antimicrobial medicines for a period of three months in five health facilities. World Health Organization (WHO) – core drug indicators were used. The study was conducted with a sample of 500 prescriptions, 100 from each facility were reviewed. Prescriptions were systematically sampled. The data was analyzed using Microsoft Excel 2010.

Results: Percentage of encounters with one or more antimicrobial medicines prescribed in the review period 23%. The majority of the prescriptions (66%) were not in compliance with the national treatment guideline, prescription encounters 23%, mean number of antimicrobial medicines per prescription from the five health centers was 1.338 with 55.2% prescribed generically and 100% from the EMHSL. An injection was found among 18.7% of the prescriptions. Antimicrobial medicine prescribed for diagnosis as per standard treatment guideline was 48%. The average cost per prescription was Uganda shillings 1,795 ($0.5).

Conclusion: Unnecessary antimicrobial medicines use is still common in real-world clinical practice and remains a public health challenge. This study shows that routine assessment of prescribing practices is useful to evaluate antimicrobial prescribing patterns, to identify possible irrational use of antimicrobial medicines, provide feedback and to improve the quality of antimicrobial medicines use. The government should continue to strengthen the administration of antimicrobials use in health facilities and hospitals through medical professional training and interventions to enforce the national standard treatment guidelines and thus reducing the irrational prescribing practices of antimicrobial medicines.

Keywords: Antibiotic, Rational drug use, outpatient study, Prescribing practices, availability.

OPERATIONAL DEFINITIONS

Evaluation: a process that critically examines an activity. It involves collecting and analyzing information about activities, characteristics, and outcomes. Its purpose is to make judgments about a program, to improve its effectiveness, and/or to inform programming decisions (Patton, 1987).

Antibiotic: a substance produced by a microorganism that acts to either inhibit the multiplication or kill another microorganism.

Antimicrobial substance (AMS): a chemical agent that acts against microorganisms, including bacteria (antibacterial), viruses (antiviral), fungi (antifungal), and protozoa (anti-protozoal). **Antimicrobial resistance:** is the ability of microbes to grow in the presence of a chemical (drug) that would normally kill them or limit their growth.

Availability of medicines: medicines are intended to be available within the context of functioning health systems at all times in adequate amounts, in the appropriate dosage forms, with assured quality and adequate information, and at a price the individual and the community can afford".

Rational use of medicines: Patients receive 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 use of medicines: occurs with polypharmacy, with use of wrong or ineffective medicines or with under use or incorrect use of effective medicines. These actions negatively affect the quality of medicine therapy, raise health care costs, and may cause adverse reactions or negative psychosocial effects.

Rational Prescribing: implies using the right drug for the right patient at the right time in the right dose and manner of administration, at affordable cost and with right information. The Uganda clinical guidelines, Ministry of Health Uganda and or WHO standards will be used to determine rational or irrational prescribing.

CHAPTER ONE

1.0 INTRODUCTION

From the time of introduction, antimicrobial medicines have played important role in decreasing morbidity and mortality due to infectious diseases although infectious diseases have remained the leading cause of death globally. More so, antimicrobial resistance (AMR) has recently been rising steadily worldwide and has reduced the ability of antimicrobial medicines to effectively control infectious diseases [1]. It's known that, the main driver of AMR is misuse of antimicrobial medicines and aggravated by other factors such as unrestricted access to antimicrobial medicines. Some instances of inappropriate medicine use comprise; treatment of viral infections, malaria with prescribing antimicrobial medicine, and inappropriate prescribing practices characterized by; polypharmacy, over prescribing injections [2]. The implication of inappropriate medicine use comprise: poor quality of care [3], inappropriate use associated with polypharmacy, increased cost of care/treatment, [4] and increased occurrence of adversarial effects like; prolonged morbidity, mortality, drug toxicity, prolonged period of admission in hospital, antimicrobial resistance, and the associated infections [5].

It was reported AMR leads to 700,000 deaths every year worldwide, this figure is projected to rise steeply to 10 million by 2050 if no interventions are established [9]; In Uganda for instance; the prevalence of Methicillin-Resistant Staphylococcus aureus (MRSA) varied from 2-50%, while Extended Spectrum Beta-lactamase (ESBL) prevalence ranged from 10-75% [6]. In addition, increasing resistance ranging from 4-30% has been reported among gram negative enterobacteria against carbapenems, a last-line treatment; a broad range of bacteria have still shown high rates of resistance over 50% in many cases to commonly used antibiotics such as penicillin, tetracyclines and co-trimoxazole. In addition, the inappropriate use of antimicrobial medicines, decrease their usefulness [7]. Additional aspects that complement towards antibiotic resistance remain: inappropriate diagnosis, unreasonable prescriptions and incorrect usage of medicine by patients [6] Excessive usage of antibiotics is associated with inappropriate prescription. This can be expensive with large impact on the limited budget for essential medicine and health supplies. The worldwide estimated sale of antibiotics was reported; 6 to 21% of the pharmaceutical market, to 25% of overall prescriptions [8], and 15 to 30% of medicine expenditure. In Europe for instance; Surveys have shown a wide range of antimicrobial use, as per 2018; the proportion of broad-

spectrum antibiotics used in hospitals 16%-62% of all antibiotics. Broad-spectrum antimicrobial rates in hospitals varied from 16% in Lithuania to 62% in Bulgaria. Overall observed antimicrobial prevalence ranged from a low of 15.9% in Hungary to a high of 55.6% in Greece [9]. Such high rates require the rational prescription of antimicrobial medicines based on diagnosis [3,10] Uganda national academy of sciences 2015, reported that; a broad range of bacteria show high rates of resistance over 50% in many cases to commonly used antibiotics such as penicillin, tetracyclines and co-trimoxazole. One in seven prescriptions were for surgical prophylaxis. It was found that 54% of antimicrobial courses for surgical prophylaxis lasted longer than 1 day [10] . However; irrational usage of medicines have a harmful impact on population well-being not only due to Antimicrobial Resistance (AMR) but also low availability, poor quality of care and adverse events [11] Currently antimicrobial resistance with increased hospital infections remained a major public health problem, predominantly regarding health facilities as a consequence of increased morbidity and mortality, in addition to the costs of health [8, 9]. Studies have shown that antimicrobial medicines therapy about 25%-40% Inpatients (IP) and, in about 50% of cases, were inappropriate in dosage, route of administration or indication [12]. More so, in hospital, infectious diseases were among the most prevalent, associated with longer ward occupation period with increased morbidity and mortality rates [5]. Admitted patients are exposed to increased risk of hospital-acquired infections associated with high mortality rates, longer bed occupation days, and increased costs of care compared with community-acquired infections (Pro. Denis K Eta al) [5]. According to World Health Assembly (WHA), tuberculosis (TB) has remained one of significant causes of death in adults despite application of extremely cost-effective intervention (DOTS) (Directly Observed Treatment, Short courses) to control the infection. And WHO 2014, reported poor and inadequate control of anti-tuberculosis medicine might lead to growth of drug-resistant strains making tuberculosis incurable. Antimicrobial medicines used as prophylaxis for long period increases toxicity, resistance and cost of treatment. [13]. This widespread prescription of antimicrobials encourages the emergence of antimicrobial resistance and later spreads resistance [5]. Misuse of broad-spectrum antibiotics of cephalosporin group, significantly hastens the development of methicillin resistance. Additional aspects contributing towards antibiotic resistance consist of; inappropriate prescribing and inappropriate usage of antimicrobial medicines [6]. A report on study done in the Netherlands that, increased prevalence of colonization with macrolides-resistant enterococci in healthy humans due to addition of antibiotics to animal feeds [7]. Complete

eradication of resistance is not possible but the strategic aim ought to be of containment by controlling situations promoting emergence and spread of resistant micro-organisms while maximizing efficacious use of antimicrobial medicines. It is believed that when pressures leading to excessive antimicrobial medicines use are removed and the chances for transmitting resistant organisms between human beings are reduced, the number of drug-resistant infections will drop. Therefore, the necessity of rationalizing the use of antimicrobial medicines to ensure the continued efficacy of the existing antimicrobial medicines will be of utmost importance [6].

1.1 PROBLEM STATEMENT

The irrational use of Antimicrobial medicines from health facilities decrease their usefulness as a result of development of resistant strains of microorganisms and therefore; an area of high concern for health personnel in improving patient outcomes and wellbeing. Different resistance mechanisms are developing and increasing, straining health workers skill to treat common infectious diseases; this has resulted to tougher, occasionally difficult due to reduced effectiveness of antimicrobial medicines.

Antimicrobial resistance seems to be worsened by human aspects in prescription of medicines for medical conditions. Incorrect use of medicines, wrong medicine administration route or too long duration of treatment and overuse of antimicrobial medicines for nonspecific conditions such as childhood diarrhea, mild non-bacterial infection, upper Respiratory tract Infection and simple malaria seem to contribute to antimicrobial resistance.

Anecdotal evidence shows that there is high consumption and frequent stock out of antimicrobial medicines in Yumbe District. More so, nosocomial infections are also becoming hard to treat. These may be partly due to irrational prescribing practices. The facilities in the District also receive a lot of donations of antimicrobial medicines some of which the health workers may not have sufficient knowledge about as they serve refugees from South Sudan. The study will investigate the prescribing practices and irrational use of antimicrobial medicines in Yumbe District.

1.2 PURPOSE OF THE STUDY

Evaluation of prescribing practices of antimicrobial medicine. The irrational prescription of antimicrobials was the main modifiable driver of antimicrobial resistance. Ensuring access to effective antimicrobials and appropriate use of antimicrobials was critical in reducing

antimicrobial resistance and therefore prolonging their efficacy. Achieving optimal antimicrobial use, required among others, ensuring availability of appropriate medicines and changing behaviour among prescribers, dispensers and consumers. This study would provide information that would be useful in designing interventions to improve rational use of medicine. This study was to achieve optimal clinical outcomes related to antimicrobial use.

1.3 GENERAL OBJECTIVE

To evaluate the prescription practices of antimicrobial medicines in selected health facilities of Yumbe District, Uganda

1.3.1 SPECIFIC OBJECTIVES

To evaluate the profiles of antimicrobial prescribing practices in Yumbe District.

To determine Health facility factors that affect antimicrobial prescribing practices in Yumbe District.

1.4 EVALUATION QUESTIONS

What are the antimicrobial medicines prescribing practices in Yumbe district?

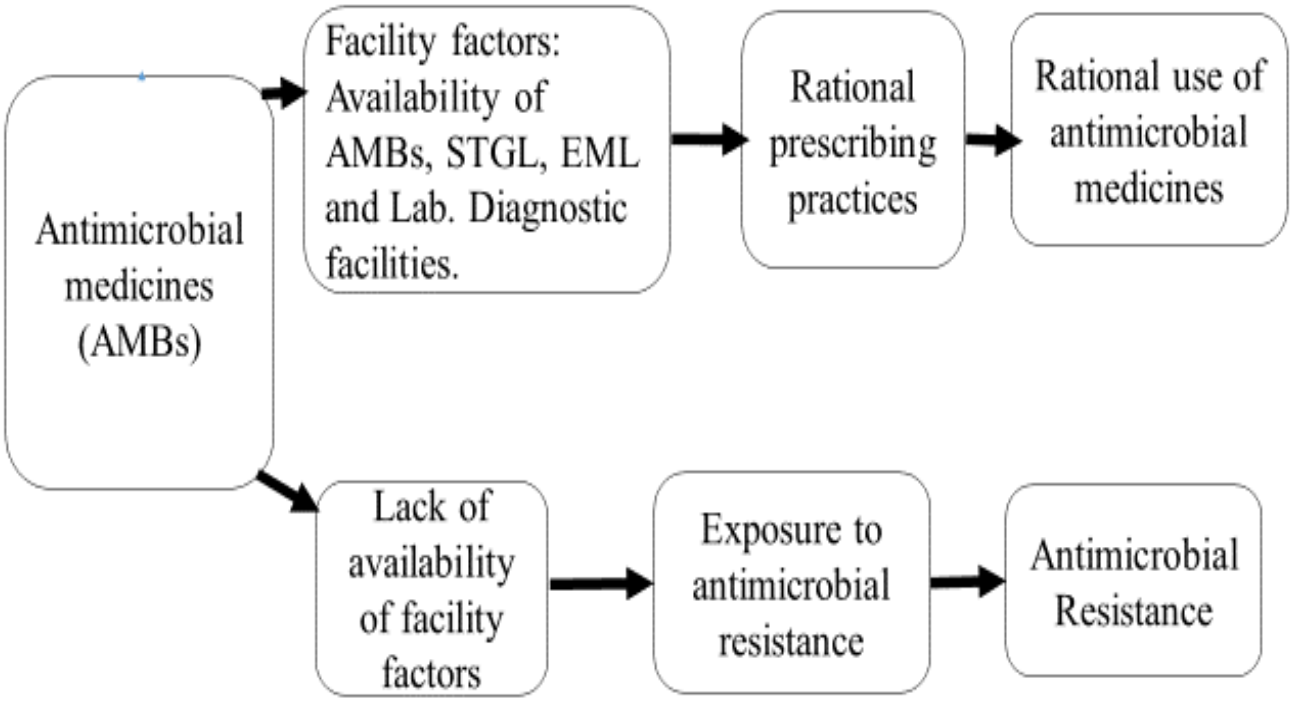
How does prescribing practices affect the availability of antimicrobial medicines stock in Yumbe district?

What is the stock level of antibacterial medicines in the last three months (March, April and May 2019 in Yumbe District?

1.5 CONCEPTUAL FRAMEWORK

Availability of antimicrobial medicines increases both rational and irrational prescribing practices and use of antimicrobial medicines. Irrational prescribing practices; over, under or wrong prescription without adherence to standard treatment guideline (STGL) lack of laboratory diagnostic facilities for antibiogram, lack of essential medicines list and non-availability of antimicrobial medicines. Factors that lead to poor prescribing practices may include; knowledge gap, failure to stick to STGL or Uganda Clinical Guidelines (UCG), Poor prescribing practice may lead to wastage and stock out of medicines. Also medicine shortages cause patients to suffer disruption to their treatment and interruption in patient treatment that can lead to antimicrobial resistance or death. Wrong prescribing practices increase consumption of antimicrobial medicines and more prescription errors occur. This exposes patient to adverse drug reaction and resistance. Increased consumption of antimicrobial medicines lead to increase in budget for medicines. Irrational antimicrobial medicines usage include; Prescribing practice of selecting antimicrobial medicines for conditions that do not require medicine therapy, wrong medicines for a specific conditions that require medicines, medicines of uncertain safety status. Use of antimicrobial medicines with doubtful or unproven efficacy, medicines of uncertain safety status and failure to prescribe available, safe, & effective medicines. Incorrect dose of medicines, wrong medicine administration route or too long duration of treatment and overuse of antibiotics for nonspecific conditions such as childhood diarrhea, mild non-bacterial infection, e.g., URI infection and simple malaria. Broad-spectrum antibiotics are frequently prescribed.

Conceptual framework



CHAPTER TWO

LITERATURE REVIEW

2.1 INAPPROPRIATE ANTIMICROBIAL MEDICINES USE, ANTIMICROBIAL RESISTANCE AND OTHER CONSEQUENCES

Inappropriate use of medicines comprise of over or under prescription, more usage of injections and antimicrobial medicines, polypharmacy, not adhering to standard treatment guidelines. Or prescribed medicines are not from Essential medicine List. And usage of trade names/brands instead of generic names are the major problems of present-day prescription practices causing increased cost of medicines [12]. Antibiotic resistance occurs once bacteria modification and become resistant to the antibiotics used to treat the infections they cause. More than half of all hospital patients receive antibiotics during their stay while admitted in the ward. Inappropriate prescriptions characterized by polypharmacy and overuse of antibiotics have been highlighted as common [13, 14]. In United States (U.S) there was very high rate of antibiotic prescription. The study evaluated out-patient data from 27 countries proved that U.S. fourth-highest prescriber of antibiotics [9]. Increased bacterial (Helicobacter pylori) resistance to amoxicillin and levofloxacin due to high community utilization of antimicrobial medicines has been reported in Uganda, 2017 [10]; and a high tendency towards forms of medicines prescription was observed, among general prescribing practices of antibiotics as well as an injectable [14]. There was a call of commitment to adhere to international standards and national antibacterial treatment guidelines regarding proper use of antibiotics in human and animal sectors. This was to ensure affordable, sustainable access to quality antimicrobials and to meet the needs of all people who need antimicrobials in Ghana, 2018 [12]. Helicobacter pylori resistance and antimicrobial utilization patterns in western Honduras, and rural Central America revealed high resistance patterns as for levofloxacin and amoxicillin in the management of Helicobacter pylori due to the over use of the medicines [15]. In the management of urinary tract infection (UTI) among elderly patients, there was complaint on over prescription and high use of antimicrobial medicines-quinolones causing non-compliance in the elderly population in Denmark [16]. In Central America setting, inappropriate use of empiric antibiotics increases hospital mortality in-patients with a severe infections [17]. A study on improvement intervention for paediatric pneumonia, increased first-line antibiotic use by 97% and

reduced inappropriate antibiotic prescription for cough or cold, malaria and diarrhea by 77%, 34%, and 38%, respectively [10].

2.2 FACTORS INFLUENCING ANTIMICROBIAL MEDICINES MISUSE

2.2.1 Trending factors that have been identified

Factors influencing prescribing behaviour include; characteristics of prescribers and patients, laxity in implementing regulation of prescription of antibacterial medicines, and delays in intervention strategies to decrease misuse of antimicrobial medicines and resistance to antimicrobial medicines [17,18]. Antimicrobial resistance danger is related to antibiotic misuse, elongated surgical prophylaxis, and inappropriate usage of antimicrobial medicines in hospital admitted patients [18]. Important factors identified for irrational prescribing practices of antimicrobial medicines by prescribers include: Diagnostic uncertainty, marketing influence from medicine marketers, attitudes and perceived demand from patients, monetary consideration, near-expiry stocks, over-stocked medicines, have been found to promote antibiotic over use [17]. In addition, the absence of continuing professional development also causes irrational prescriptions [17, 18] A study found that, connection, companionship or friendship with prescriber and financial status of individuals, relations and regions influence the patient and provider collaborations, affecting antimicrobial medicines usage and AMR. This consequently, together prescribers and patients affect the forms of antimicrobial medicines usage [18].

A research establish that proportion over 50% of all prescriptions, given out, or sold were incorrect. Whereas approximately 50% of patients flop to take medicines appropriately, and nearly a third of the universe population do not access essential medicines [20]. This has been discovered to be associated with multiple prescriptions; incorrect usage of antimicrobial medicines, and insufficient dosage [21].Supervision, Performance Assessment, and Recognition Strategy (SPARS) programs discovered poor prescribing practices of antimicrobial medicines in Hospitals and not adhering to treatment guidelines (UCG) for three mutual illnesses; Cough, Diarrhea and malaria which were treated with antibiotics [22]. At community level, there is non-adherence to prescription guidelines; many explanations for not observing guideline which comprise: insufficient drug information, poor labelling and traditional opinions on medicines. In addition still; adherence to standard treatment guidelines has been found poor for conditions such as, cough, cold, diarrhea, and malaria, which are often treated with antibiotics [23]. At the health center level, health workers

tend to knowledge gap on medicines, this proves inappropriate prescribing, which is a common problem [18].

From a study done in Northern Cameroon 2018, the overall antibiotic prescription rate was high, at 36.71% and antibiotics prescribed for malaria and where diagnosis was uncertain [12].

Another study done in Uganda showed that, there is an increased resistance of Streptococcus pneumoniae to penicillin based antibiotics. Recurrent contact to a specified antibiotic has been revealed to promote medicine resistance [22]. There was poor adherence to standard treatment guidelines for three common conditions, cough and cold, diarrhea and Malaria, which are often treated with antibiotics [24]. At the national level, there may be weakness of national drug policy implementation to improve drug use. Medicine Science for Health (MSH) has reinforced the Ugandan supply chain system through stronger policies, strategies, and implementation capacity [25]. A drug policy can only be effective if mechanisms for implementation are in place, like adequate monitoring of national drug regulation, regular supervision, and adequate storage facilities however; certain levels of health facilities and outlets may not comply with regulations of national drug authority [25].

2.2.2 Metrics for measuring rational antimicrobial use

Point Prevalence Surveys (PPS) is used to gather evidence on prescribing practices of antibiotics and other data appropriate towards treatment and managing infectious diseases in admitted patients, then complements investigation of antimicrobial consumption [26]

A DDD is only assigned for medicines with an Anatomical Technical Chemical (ATC) code.

The numbers of DDDs is calculated as follows;

Number of DDDs =Number of DDDs = $\frac{\boldsymbol{Totalgramsused}}{\boldsymbol{DDDvalueingrams}}$

2.3 DATA SOURCES FOR INFORMATION ON CONSUMPTION OF ANTIMICROBIALS

The recommended common but useful data sources for the rational and/or irrational antimicrobial usage include; outpatient prescription registers, stock cards, stock books, invoice, delivery notes, and individual patients [6, 7].

2.4 ANTIMICROBIALS INCLUDED IN THE STUDY

Gentamycin 80mg/2ml injection iv/im, Ceftriaxone sodium 1g powder for injection, Metronidazole 200mg, Erythromycin 250mg tab, Amoxicillin 250mg capsule, Amoxicillin dispersible tablets 250mg, Ampicillin/cloxacillin 250mg/250mg injection, Benzathine Penicillin 2.4 MU, Penicillin. Benzyl 1mu/600mg inj (pfr) im, Procaine penicillin fortified, Chloramphenicol sodium succinate 1g injection, Nitrofurantoin 100mg, Cotrimoxazole 960 mg tablet, Ciprofloxacin 500mg tablet and Doxycycline 100mg capsules.

2.5 ANTIMICROBIAL USE INDICATORS

Sixteen pointers associated to antimicrobial medicine use in hospitals are described in this section: 5 remain hospital related, 9 remain prescribing pointers, and 2 relate to patient attention. And a additional pointer linked to drug sensitivity.

2.5.1 HOSPITAL INDICATORS OF ANTIMICROBIAL USE

There are six hospital pointers. Existence of standard treatment guidelines (STGs) for infectious diseases

PRESCRIBING INDICATORS OF ANTIMICROBIAL USE

Nine prescribing pointers [27]

CHAPTER THREE

MATERIALS AND METHODS

3.1 STUDY SITE

The study site was Yumbe district. Yumbe district was created by an Act of parliament in (F/Y) 2000/2001 curved from Arua district as Aringa County. It occupies a total surface area of 2411 Km² located in North west part of Uganda and is approximately 531 Km from Kampala city . It is bordered to the North by Southern Sudan, South by Arua District, East by Moyo District and River Nile and West by Koboko and Maracha-Terego districts. Administratively Yumbe district is divided into 12 Sub-counties and 1 Town Council, with 101 parishes and 638 villages.

The district total population is 485,582, of which 48 % are males and 52 % are females with approximately 80% of the population being Muslims. The number of operational health facilities is 27. These include; 1 general hospital (Yumbe hospital), which is the district referral hospital; 2 Health Centre grade IVs (Midigo HC IV & Yumbe HCIV); 7 Health Centre grade III's; and 17 health Centre II's. These Health facilities provide both curative and preventive services including OPD, in patient, Maternal and child health services, plus other specialized services depending on the grade of the facility, and in the community inform of outreaches (36).

The district hosts refugees mainly from South Sudan and the Democratic republic of Congo, thus has benefited from infrastructural developments in form of construction and rehabilitation of health facilities, schools, and water points on top of recruitment of additional human resources for health.

This study was done at five health facilities that is; Yumbe Hospital; Yumbe and Midigo Health Centres IVs; and Ariwa, Barakala and Kulikulinga health centre IIIs. These health facilities were selected because they are the facilities with High Cadres, laboratories and admission facilities. Yumbe Hospital is currently under major renovation and therefore its patients are managed at Yumbe Health Centre IV.

3.2 STUDY DESIGN

A cross sectional study design was employed to evaluate the prescribing indicators and facility indicators for a period of three months from March –May 2019 to determine the stock availability

of antimicrobial drug in the health facilities, prescribing practices. In this study, the World Health Organization (WHO) core drug use indicators for assessing outpatient drug use of antimicrobials was used.

3.3 TARGET POPULATION

The study population included 500 outpatient prescriptions containing antimicrobial medicines from five health facilities. 100 prescriptions were obtained from each of the five facilities, these prescriptions were dispensed between the periods from March 1st to May 31st 2019.

3.4 SAMPLE SIZE DETERMINATION AND SAMPLING TECHNIQUE

According to World Health Organisation WHO/DAP/93 approval 100 prescriptions were taken from individual health facility [31]. A organized sample procedure was employed to handpick 100 outpatient prescriptions from each five health facility, a total of 500 prescription forms were investigated. The total number of prescriptions in the review period with an antimicrobial prescribed was determined and the sampling interval determined by dividing the total number by 100. However, for determining the proportion of encounters with an antimicrobial prescribed, all the prescriptions with an antimicrobial prescribed in the review period were determined and divided by the total number of prescriptions in the review period.

For evaluating availability of antimicrobials, 15 key medicines/tracer medicines were selected from each facility as per WHO recommendation which is a minimum of 15 essential medicines in each health facility. These were purposively selected by only including medicines that are expected to be available at the lowest level of care of the study facilities i.e. Health center III according to the national essential medicine list. The list of the tracer medicines used is in appendix II.

3.5 DATA COLLECTION

Data regarding prescribing indicators was taken from sampled prescription records retrospectively and was filled or recorded in structured check list accordingly. Besides, the availability of key/antimicrobial medicines which were assessed from store, the presence of Essential Drug List (EDL) and Standard Treatment Guideline (STGL) in Outpatient Department (OPD), were also assessed in the facility indicator form accordingly.

Data was collected from OPD registers, Dispensing logs, and stock cards or stock book. Forms were used to fill in the information. There was need to review available drug use data and complete data collection instruments in 1-2 weeks. After data have been transcribed from sources, additional information (e.g., prices, generic names) was to be entered to complete the forms. Data collection was supervised by the researcher.

3.6 INDICATORS/VARIABLES USED

3.6.1 Prescribing indicators

Percentage of encounters with one or more antimicrobials prescribed

Percentage of antimicrobials prescribed by generic name

Average No. of antimicrobials prescribed per patient

Percentage of patients prescribed antimicrobial medicines with diagnosis recorded

Percentage of patients receiving antimicrobial injections

Percentage of antimicrobials prescribed consistent with the EMHL

Average cost of antimicrobials prescribed per patient

Average duration of prescribed antimicrobial treatment

Percentage of prescriptions in accordance with Uganda Clinical Guideline (UCG)

3.6.2 Facility indicators/factors

Existence of standard treatment guidelines (STGs/UCG) for infectious diseases

Existence of an approved hospital formulary list or essential medicines list (EML)

Availability of a set of key antimicrobials in the facility stores on the day of the study

Average number of days that a set of key antimicrobials is out of stock

Expenditure on antimicrobials as a percentage of total facility medicine costs

Availability of diagnostic laboratory facility (Complete blood count)

3.7 INCLUSION CRITERIA

Only antibiotics listed in Annex II and administered were used to assess for availability. Prescriptions containing antibiotic/antibacterial (oral, rectal and injection) preparations with other medications were considered for inclusion.

3.8 EXCLUSION CRITERIA

Topical antibiotic preparations such as Lotion and ointments and eye preparations like eye drops, vaginal pessaries and ointments were excluded. Also prescriptions from outreach and special doctors' clinics were excluded.

3.9 STUDY TOOL TESTING

We used the World Health Organization (WHO) standard prescribing indicator. A pilot test was conducted in Yumbe hospital, where 10 outpatient prescriptions were reviewed to test the data collection tool. We ensured that, availability of the required data, the time estimated and modified the data collection form as appropriate. The results of the study tool testing published.

3.10 DATA PROCESSING AND ANALYSIS

Data was edited, coded, classified and tabulated.

Then Data processing and analysis was done using simple cross tabulation by use of mean and comparing the data. Presentation of data were done by bar graphs, pie charts, line graphs. With Microsoft excel 2010 version computer.

3.11 ETHICAL CONSIDERATIONS

Research clearance was obtained from School of Public Health-University of Rwanda, Makerere University School of Health Sciences Research Ethics committee (MU-SHS-REC). School of Health Sciences Institutional Research Board Makerere University gave approval for the study. The information obtained from the study participants were confidential with no identifiers. The data obtained was presented as aggregate data. Access to the information was restricted

3.12 CHALLEGES AND SOLUTIONS (Challenges faced and solutions devised)

Delay in getting ethical approval. This was mitigated by early application to IRB. The funding for the research could be limited. This was mitigated by the personal financing and application of financing from partners. The health facilities might lack electronic tools for data collection, solution was manual data collection. High number of clients in the facility could delay data collection as the registers was in use by health workers. This was mitigated by visiting the facilities in the morning and late in the evening.

CHAPTER FOUR: DATA PRESENTATION

4.1 RESULTS

A total of 500 prescriptions from five (5) Health Facilities (100 from each health Facility/hospital) were included in the study. The facilities included one (1) general district hospital, one (1) health center IV and three (3) health center IIIs.

Table 1 Summary of findings:

Core drug use indicators	Yumbe	National	WHO
Percentage of encounters with one or more antimicrobial medicine prescribed	23%	<20%	20-26%
Percentage of antimicrobial medicine prescribed by generic name	55.2%	100%	100%
Average No. of antimicrobial medicine prescribed per patient	1.338	< 1.6	1.6-1.8
Percentage of patients prescribed antimicrobial medicine with diagnosis recorded	48%	85%	100%
Percentage of patients receiving antimicrobial injections	25%	≤15%	13.4–24.1
Percentage of antimicrobial medicine prescribed consistent with the EML	100%	100%	100%
Average cost of antimicrobial medicine prescribed per patient US $	$0.28	$0.5-0.9	
Average duration of prescribed antimicrobial treatment days	5	5-10	5-10
Percentage of prescriptions in accordance with Uganda Clinical Guideline (UCG)	48%	100%	100%
Existence of standard treatment guidelines (STGs/UCG) for	100%	100%	100%
Existence of an approved hospital essential medicines list	0%	100%	100%
Availability of a set of key AMB in the facility stores on the day of the study	68%	100%	100%
Average number of days that a set of key AMB is out of stock	4 Days	0%	0%
Expenditure on AMBs as a percentage of total facility costs	38%		
Availability of diagnostic laboratory facility (Complete blood count)	40%	100%	100%

4.2: PRESCRIBING PRACTICES

4. 2.1: PERCENTAGE OF ENCOUNTERS WITH ONE OR MORE ANTIMICROBIAL MEDICINE PRESCRIBED

Percentage of encounters with one or more antimicrobials prescribed, calculated by dividing the number of patient encounters for the period of antimicrobial medicine were prescribed by the total number of encounters surveyed, multiplied by 100.

Of the 45,160 prescriptions in the review period, 10,402 (prescriptions had antimicrobial medicines giving percentage encounter of one or more antimicrobial medicines prescribed of 23% Details in table 1 below.

Table 2 showing percentage of encounters with one or more antimicrobial medicines prescribed

Hospital Number	Prescriptions in review period	Total prescriptions with antimicrobials	% of encounters with antimicrobials prescribed	WHO standard
1	7,494	1,950	26%	20-26%
2	7,710	1,873	24%	
3	7,232	1,696	23%	
4	10,794	2,797	26%	
5	11,930	2,086	17%	
Total/Average	45,160	10,402	23%	

4.2.2: PERCENTAGE OF ANTIMICROBIAL MEDICINE PRESCRIBED IN GENERIC NAME

From the total of 669 prescriptions, 369 (55.2%) of the antimicrobial medicines were prescribed in generic name (Table 2).

Table 3 Percentage of antimicrobial medicines prescribed in generic name

Hospital Number	No. of medicines prescribed	No. of medicines prescribed by generic name	% medicines prescribed by generic name	WHO standard
1	115	68	59%	
2	121	78	64%	100%
3	146	74	51%	
4	129	71	55%	
5	158	78	49%	
Total/Average	669	369	55.2%	

4.3: AVERAGE NUMBER OF ANTIMICROBIAL MEDICINE PRESCRIBED PER PATIENT

On average 1.338 antimicrobial medicines per patient were prescribed in the selected public health facilities of Yumbe District and an average of 28.8% of the prescriptions contains two or more antimicrobial medicines (Table 3).

Table 4 **Average number of antimicrobial medicine prescribed per patient**

Health facility	Patient number	Single prescriptions	Two or more Prescriptions	Total antimicrobial medicines prescribed	Prescription per patient	WHO standard
1	100	85	15	115	1.15	≤ 2 (1.6-1.8)
2	100	83	17	121	1.21	
3	100	62	38	146	1.46	
4	100	72	28	129	1.29	
5	100	54	46	158	1.58	
Average	100	71.2	28.8	133.8	1.338	

4.4: PRESCRIBING FREQUENCY OF ANTIMICROBIAL MEDICINES

The most commonly prescribed antimicrobials were penicillin/Amoxicillin 242 (36.2%), Nitroimidazoles/Metronidazole 159 (23.7%), Procaine penicillin fortified 106 (15.8%), Ciprofloxacin 85 (12.7%), ceftriaxone 82 (12.2%), gentamycin 69 (10.3%) and Ampicillin + cloxacillin 67 (10.1%) (Table 4)

Table 5**: Prescribing frequency of antimicrobial medicines**

Sr. No.	ANTIMICROBIAL AGENTS	No. (%)
	Amoxicillin 250mg cap	242(36.2%)
	Metronidazole 200mg tab	159(23.7%)
	Procaine Penicillin fortified (PPF) injection	106(15.8%)
	Ciprofloxacin 500mg tab	85(12.7%)
	Ceftriaxone 1Gm powder for injection	82(12.2%)
	Gentamycin 40mg/ml in 2ml vial	69(10.3%)
	Others	309(46.1%)

4.5: PERCENTAGE OF PATIENTS PRESCRIBED ANTIMICROBIAL MEDICINES IN LINE WITH DIAGNOSIS RECORDED

49% of the treatments were not in line Uganda Clinical Guidelines and 3% of treatments had no diagnosis and 48% prescriptions recorded were in line with UCG (Figure 1). The common diagnosis for which antimicrobials were prescribed included urinary tract infections (UTI) (16%), respiratory tract infections (RTI) (12%) and malaria (10%) (Table 5).

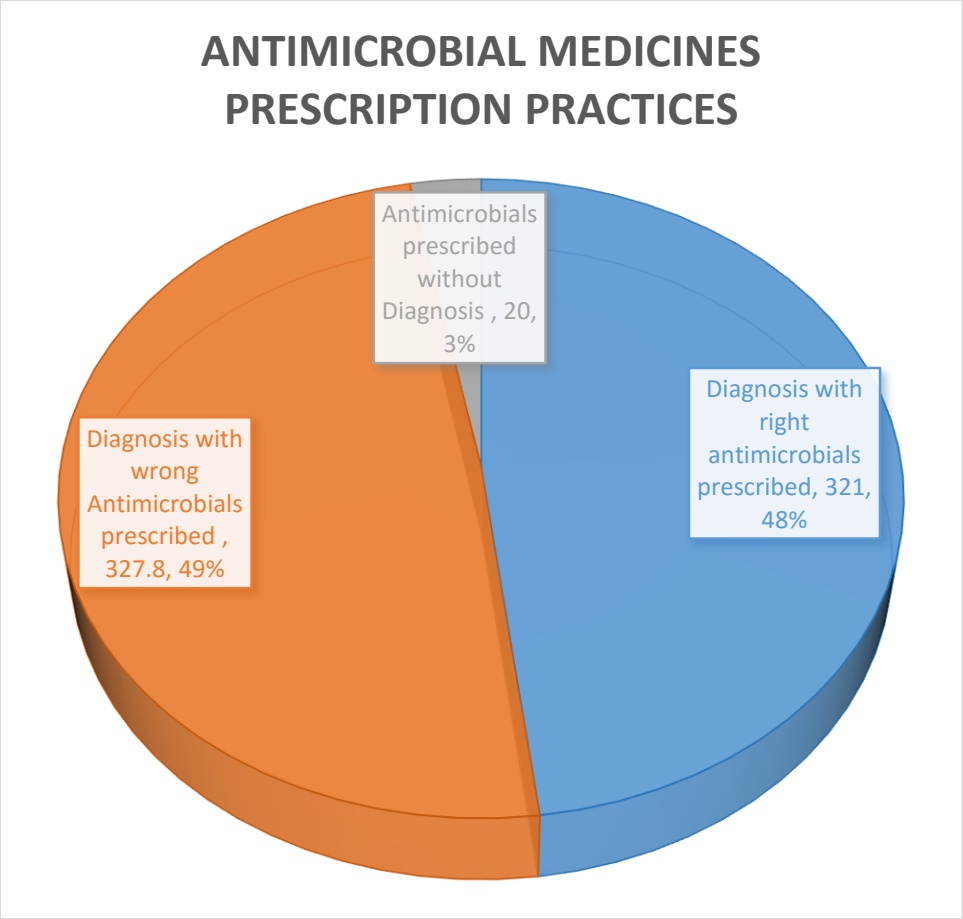


Figure 1 showing antimicrobial medicines prescription practices

20 (3%) prescriptions were without diagnosis

321 (48% prescription were in line with standard treatment guideline (UCG)

328 (49%) prescriptions were not in line with UCG

Table 6 showing common diagnosis for which antimicrobials were prescribed

Diagnosis	Facilities					Total	Percentage
	1	2	3	4	5		
UTI	7	10	21	21	20	79	16%
RTI	17	16	4	5	19	61	12%
Malaria	7	9	10	9	15	50	10%
URTI	18		15	5		38	8%
PID	4	6	5	9	5	29	6%
GE	15	3	8	2	2	30	6%
PUD	2	3	4	4	6	19	4%
Bacterial infection	0	0	5	8		13	3%
Helminthiasis	1	3	6		5	15	3%
Otitis media	0	5		2	1	8	2%
Pneumonia	0	2	1	6	1	10	2%
Gingivitis	0	2	4	2		8	2%
Allergy/insect bit	0	2		6		8	2%
Others	10	19	4	9	44	86	24%

URI: upper respiratory infections, UTI: Urinary tract infections, RTI: Respiratory tract infection, PID: Pelvic inflammatory disease, GE: Gastroenteritis, PUD: Peptic Ulcer disease

4.6A: PERCENTAGE OF PATIENTS RECEIVING ANTIMICROBIAL INJECTIONS

On average 25% of the patients received antimicrobial injections (Table 6).

Table 7 Percentage encounters with Antimicrobial injection prescribed

Health facility	Patient number	No of patients given an injectable	% of encounters with an injection prescribed
1	100	20	20%
2	100	19	19%
3	100	27	27%
4	100	22	22%
5	100	37	37%
Total	500	125	25%

4.6B: PERCENTAGE OF ANTIMICROBIALS PRESCRIBED CONSISTENT WITH THE ESSENTIAL MEDICINES AND HEALTH SUPPLIES LIST (EMHSL).

All the medicines prescribed were from the EMHSL of Uganda.

4.7. Average cost of antimicrobials prescribed per patient
Average cost of antimicrobial in Uganda currency 1,975 ($.5)

Table 8 Average cost of antimicrobials prescribed per patient

Item	HEALTH FACILITIES					
	1	2	3	4	5	Total
Total cost of essential Medicines as per current invoice (UGX)	3,678,543	3,712,775	3,695,673	11,276,295	9,310,369	31,673,655
Total cost of antimicrobial medicines as per current invoice (UGX)	2,061,480	1,877,980	1,618,580	3,096,310	3,250,520	11,904,870
Percentage cost contribution of antimicrobials	56%	51%	44%	27%	35%	38%
Average cost of antimicrobials per prescription (UGX)	1,592	1,581	1,560	2,132	3,011	1,975

4.6.2: AVERAGE DURATION OF PRESCRIBED ANTIMICROBIAL TREATMENT

Majority of the patients (88%) received antimicrobials for five (5) days (Table 8)

Table 9: Average duration of prescribed antimicrobial treatment

No days	Health facilities						Percentage
	1	2	3	4	5	Total	(%)
3	17	14	9	2	9	51	10
5	83	86	88	92	91	440	88
7	0	0	3	6	0	9	2

4.6.3: PERCENTAGE OF PRESCRIPTIONS IN ACCORDANCE WITH UGANDA CLINICAL GUIDELINE (UCG)

A substantial number of prescriptions (52%) were not in compliance with UCG (Figure 2).

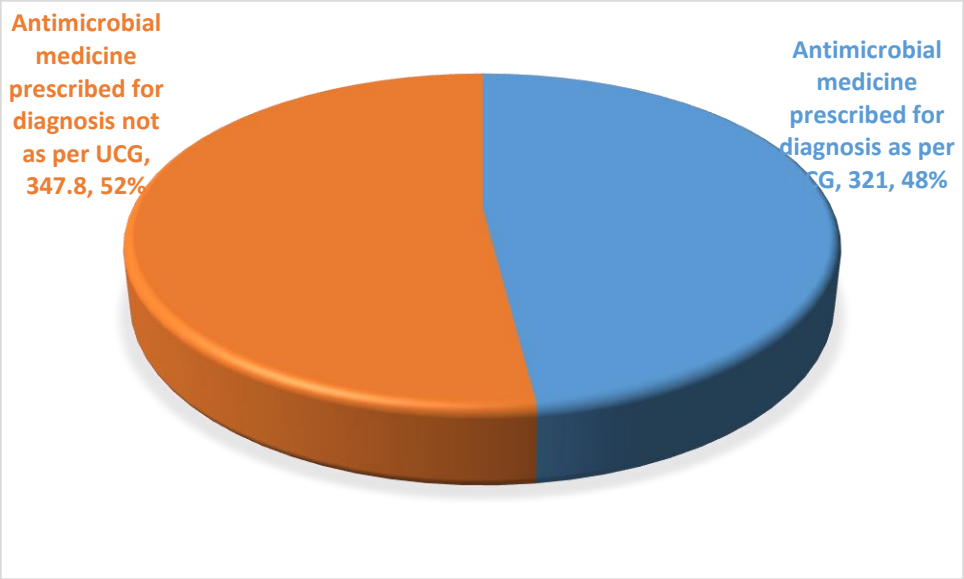


Figure 2: Percentage of prescriptions in accordance with Uganda Clinical Guideline (UCG)

321 (48%) antimicrobial medicines were prescribed in accordance with UCG

348 (52%) antimicrobial medicines were not prescribed in accordance with UCG

4.7: Health facility factors affecting prescribing practices

4.7.1: AVAILABILITY OF STANDARD TREATMENT GUIDELINES (UCG) FOR INFECTIOUS DISEASES, ESSENTIAL MEDICINES LIST (EML) AND DIAGNOSTIC FACILITIES

All the facilities had UCG and no essential medicines list. Only two facilities had diagnostic laboratory for complete blood count.

Table 10: Availability of standard treatment guidelines (UCG) for infectious diseases, essential medicines list (EML) and diagnostic facilities

Health facility Number	Existence of standard treatment guideline (STGL/UCG)	Existence of essential medicines list (EML)	Availability of diagnostic lab. facility (Complete blood count)
1	1	0	0
2	1	0	0
3	1	0	0
4	1	0	1
5	1	0	1
Average/Total	100%	0%	40%

4.7.2: AVAILABILITY OF A SET OF KEY ANTIMICROBIALS IN THE FACILITY STORES ON THE DAY OF THE STUDY

On average, 68% of the medicines were available on the day of the visit. No health facility had all the antimicrobials available.

Table 11: Availability of a set of key antimicrobials in the facility stores on the day of the study

ANTIMICROBIAL	HEALTH FACILITIES					
MEDICINE	1	2	3	4	5	Average/Total
Available medicines	12	11	6	11	11	51
%availability of antimicrobials	80%	73%	40%	73%	73%	68%

4.7.3: AVERAGE NUMBER OF DAYS THAT A SET OF KEY ANTIMICROBIALS IS OUT OF STOCK

On average each of antimicrobial medicine had 4 days of stock out, all facilities had stock outs.

Table 12 Names and days of antimicrobial medicines that ran out of stock

NAME OF MEDICINE	DAYS OF STOCK OUT IN FACILITY				
	1	**2**	**3**	**4**	**5**
Amoxicillin 250mg capsule	0	18 days	5 Days	18 Days	0
Amoxicillin 250mg dispersible tab	20 Days	0	16 Days	0	0
Ampicillin 250mg/cloxacillin 250mg inj	17 Says	21 Days	0	0	0
Ceftriaxone sodium 1g powder for inject	11 days	0	9 Days	14 Days	0
Chloramphenicol sod. Sc.1g injection	0	0	0	0	22 Days
Ciprofloxacin 500mg tablet	0	0	14 Days	0	0
Cloxacillin 500mg im (iv)	0	0	5 Days	15 Days	18 Days
Cotrimoxazole 960 mg tablet	0	0	0	0	13 Days
Doxycycline 100mg capsules	0	0	0	0	11 days
Erythromycin 250mg Tab	0	8 days	6 Days	3 Days	0
Gentamycin 80mg/2ml injection iv/im	0	11 Days	14 Days	0	0
Metronidazole 200mg Tab	0	0	14 Days	0	0
Nitrofurantoin 100mg Tablet	0	0	14 Days	0	0
Benzathine 2.4mu/1 injection	0	0	6 Days	0	0
Penicillin, procaine injection	0	0	0	0	0
Stock Availability	**12**	**11**	**6**	**11**	**11**
Stock out medicines	**3**	**4**	**9**	**4**	**4**
Total Days of stock out	**48**	**58**	**75**	**52**	**64**

Table 13: **Average number of days that a set of key antimicrobials is out of stock**

Days Of Stock Out	**HEALTH FACILITIES**					
Key Set Of Antimicrobials	**1**	**2**	**3**	**4**	**5**	**Average/Total**
Total stock out days	**48**	**58**	**75**	**52**	**64**	**297**
Total antimicrobials	**15**	**15**	**15**	**15**	**15**	**75**
Average stock out days per antimicrobial	**3**	**3.9**	**5**	**3.5**	**4.2**	**4**

4.7.4: EXPENDITURE ON ANTIMICROBIALS AS A PERCENTAGE OF TOTAL FACILITY MEDICINE COSTS

Percentage cost contribution of antimicrobials is 38% of total expenditure of essential medicines and health supplies (Table 7)

CHAPTER FIVE

DISCUSSION, CONCLUSION, LIMITATIONS AND RECOMMENDATIONS

5.1 PRESCRIBING PRACTICES

In our study, a total of 500 prescriptions containing 669 antimicrobial medicines were reviewed during the study period. Of the total 45,160 prescriptions in the review period, 10,402 prescriptions had antimicrobial medicines giving percentage encounter of one or more antimicrobial medicines prescribed of 23%. National recommended ideal range for an antibiotic prescription lies < 20% and WHO 20.0–26.8% (Table 1). However, our findings are consistent or are within WHO standard 20-26%. [27] And more than the national values < 20%. This might be associated with stock out of antimicrobial medicines.

The study discovered that the calculation of medicines prescribed in generic name stood 55.2%. The recommended ideal value of medicines prescription in generic name stands 100% (Table 1). Disagreement might be connected with numerous causes such as belief of prescribers on proprietary products, widespread persuasive activities of pharmaceutical companies manipulating prescribers' decisions and absence of legitimate obligation to prescribe medicine in generic names.

Our discoveries would similarly stand as a basis of baseline evidence for continuous watching of prescription analysis.

Prescribing indicators prescription is the reflection of prescribers' attitude towards the disease being treated and type of health care system. The results of this study revealed that the average number of drugs per encounter was 1.338. Our value is lower than the admissible range of 1.6–1.8 drugs per encounter. Numerous explanations might be for lower number of medicines in a treatment. For instance, incompetency on the part of prescribers, absence of constant medical education of the prescribers besides the unavailability of therapeutically right medicines. [5]. [29]. It is preferable to keep the mean number of drug per prescription as low as possible so as to prevent risk of drug – drug interaction, reduce cost of treatment and stock out of medicines.

In our study, it was found out that the most commonly prescribed antimicrobial medicines were: penicillin 401 (40.7%), Nitroimidazoles 159 (16.2%), Quinolones 85(8.6%) and Cephalosporins 82(8.3%). Amoxicillin 24.6% and Procaine penicillin fortified 10.8%, Ciprofloxacin 85 (8.6%), ceftriaxone 82 (8.3%) and gentamycin 69 (7%). Amoxicillin and procaine penicillin fortified were the more frequently prescribed from penicillin, metronidazole 16.2%, Ciprofloxacin 6.6% and ceftriaxone 8.3% were only medicines prescribed from their classes. Wider use of amoxicillin and PPF were observed in our study possibly due to their broad antibacterial spectrum, medicines of choice for the prescribers, for the most cases of the health conditions, low cost and their availability in stock.

In our study it was found that 48% of the right antimicrobial prescriptions for their diagnosis following UCG nomenclature, 49% had wrong antimicrobial prescriptions for their diagnosis and 3% had no diagnosis recorded. WHO standard 100% Diagnosis, 85% MOH. This anomalies could be knowledge gap as some enrolled nurses, nursing assistants also participate in prescribing medicines.

Urinary tract infections 79(16%) and respiratory tract infections 61(12%) were the main diagnosis for which antibacterial medicines were prescribed. We also found antimicrobial medicines prescribed for uncomplicated malaria 50(10%), helminthiasis 3%, dysmenorrhea 3%, candidiasis 4%, diarrhea 3% and skin rash 4% and in situations with unknown indication (No diagnosis) 14(3%). Following the Uganda clinical guideline 2016, MoH Uganda, no antimicrobial medicines should be administered as treatment for those conditions [29]. These demonstrate proof of antimicrobial misuse which can potentially lead to increased antimicrobial resistance [30] thus increasing the necessity to use more expensive antibiotics to treat life threatening infections caused by resistant bacteria in the future. These irrational prescribing patterns may be as a result of low cadres with inadequate knowledge and skills in prescribing antimicrobials. A study conducted in Uganda indicated that the majority of prescribing cadres [32] in which majority of prescribers were lower cadre professionals such as nursing assistant and enrolled nurses.

The study discovered that the percentage of encounters with an injection prescribed stood 25%. The recommended ideal value of antimicrobial medicine injection prescribed stands 13.4–24.1%

(Table 1). An extreme usage of injections, despite of appropriate oral dosage forms might lead to higher possibility of blood borne infections [3]. Additionally, injections, at all times more expensive than the oral forms [6]. Insufficient availability of other types of treatment for children, attitudes and opinions of prescribers and patients remain a few reasons associated with increased consumption of injectable.

The study discovered that Percentage of antimicrobials prescribed consistent with the essential medicines list (EML) was 100%. The recommended ideal value of medicine prescribed from the EMHSL/formulary stands 100% (Table 1). This finding confirmed practice of rational prescription [6].

Since the facilities within our study were public and they receive medicines from national medical stores, it is expected that all the medicines received were from EML.

Our study found average cost of antimicrobials prescribed per patient to be UGX 1,976 ($ 0.51) allocation per capita for medicines (for government allocates 1,039 Uganda shillings (UGX) for health care per patient.

Yumbe district population as at 1st July 2019; 629,400 people.

Conversion rate UGX 3,680: $1

Total financial allocation for essential medicines and health supplies is 654,066,749/-= $177,735.5

Per capita for health services is 1,039/- $0.28. This shows that Health facilities operate with small budget for health services.

The study found, Average treatment duration with antimicrobial medicines was for five (5) days (88%). This is the lower limit for prescribing antibiotics, in line with national and WHO standard (5-10 days)

In our study, a substantial number of prescriptions (52%) were not in compliance with UCG (Figure 2). The main reasons for non-compliance with UCG were prescribing antibacterials for non-bacterial infections and treatment of symptoms with no diagnosis.

5.2 HEALTH FACILITY FACTORS AFFECTING PRESCRIBING PRACTICES

In our study, it was found that all the facilities had UCG, no essential medicines list and only two facilities had diagnostic laboratory for complete blood count. Therefore most of the health facilities will not be able to appropriately diagnose infections.

Availability of standard treatment guidelines (UCG) for infectious diseases, essential medicines list (EML) and diagnostic facilities.

The study revealed that all health Centers did not have a copy of EML/formulary which is in line with the proposed norms (optimal value 100%).

However, the percentage of key drugs in the stock were 68% (optimal value 100%). Limited availability of key drugs might be associated with budgetary constraints, inadequate drug supply system or poor inventory management of the responsible staff. It was found that a copy of EMHSL was not available at all healthcare centers.

In our study Average number of days that a set of key antimicrobials is out of stock was 4 days. This implies that at least each medicine has an average of four (4) days out of stock during the review period. Therefore patients may not access prescriptions of medicines in these facilities when stocked out.

In our study it was found, that expenditure on antimicrobial medicines as a percentage of total facility medicine costs for five (5**)** selected health facilities 38% of total allocation for essential medicines and health supplies costs on antimicrobial medicines. And more expensive parenteral antimicrobial medicines were also commonly used. Considering that many health plans cover a large portion of the drug cost, the actual spending on antimicrobials would be much higher. Thus, reducing unnecessary antimicrobial use will result both in public health and financial benefits.

Overuse and misuse of antibiotics is alarming situation regarding population health, especially in developing countries.

In our study we found that, there was only 40% of laboratories with diagnostic facilities could not per-form antibiogram before prescription of the set of key antimicrobial medicines. This could

affect prescribers' behaviour, and consequently they may have increased tendency to prescribe broad spectrum antibiotics to cover suspected infections.

5.3 ASSOCIATION BETWEEN FACILITY FACTORS AND ANTIMICROBIAL MEDICINES PRESCRIBING PRACTICES

This study found that awareness of resistance amongst participating prescribers was low due to inadequacy of knowledge gap. Some prescribers prescribed without diagnosis.

20 (3%) prescriptions were without diagnosis and 328 (49%) prescriptions had wrong antimicrobial medicines indicated.

3 (60%) Health facilities lacked diagnostic laboratory facilities, hence culture and antibiotic sensitivity testing is never performed. Antibiotic prescription is thus empiric, hence the tendency of excessively prescribing only broad spectrum agents in our study area. Amoxicillin (36.2%) was the most frequently prescribed, followed by metronidazole (23.7%) and procaine penicillin fortified injection (15.8%)

Our study found that on average each antimicrobial medicine had a stock out day of 4 days, antibiotic shortages, which are linked to disease outbreaks and antimicrobial resistance, making treatment for preventable diseases extremely difficult. When demand spikes and shortages occur, prescribers often resort to using less optimal treatments. Not only are these less effective, but they also bring an increased risk of antimicrobial resistance (AMR).

50 (10%) Prescription were for simple malaria, 15 (3%) helminthiasis and 8 (2%) allergy. There prescriptions were not in line with STG. This often leads to the assumption that practitioners lack adequate education on antimicrobial medicines.

Our study found that, the lack of; laboratory results to guide prescription, prescriber's qualification, experience, updating knowledge and facility factors have significant relationship with antimicrobial medicines resistance.

5.4 CONCLUSION

It is concluded from the above study the irrationality was found in the prescription writing. The study highlights the problem of indiscriminate use of antimicrobial medicines, diagnosis, adherence to essential medicines and health supplies and laboratory supplies list, generic

prescribing and regard to proper way of prescribing practices. Though irrationality was there, some of the positive findings were observed; all antimicrobial medicines prescribed were from EMHSL, percentage of encounters with antimicrobials was in line with WHO standard, average number of antimicrobials prescribed to a patient was in range of WHO. Despite these, there were misuse of antimicrobial medicines in health facilities especially in the management of indications such as uncomplicated malaria, helminthiasis and allergy that do not require antibiotic interventions in their standard management guides and also in situations with unknown indication low percentage of generic prescribing, over use of parenteral route. However, the rate of antimicrobial medicines inadequacy or misuse detected in this study was high. The results of study call for interventional strategies to promote rational drug therapy. More emphasis needs to be laid on teaching the art of writing a prescription to prescribers.

5.5 LIMITATIONS OF STUDY

The study did not consider prescriptions of private health facilities and over the counter medications.

The data was only collected from outpatient registers leaving out inpatient records and clinics.

. We did not ascertain the reasons of inappropriate medicine use, which might be considered in upcoming studies.

5.6 RECOMMENDATIONS

Prescription should only be done by dully trained health care workers in health facilities studied. Improve prescribing practices by enforcing the use of standard treatment guidelines.

Medical professional training and interventions for prescribers should be conducted to reduce the irrational use of antimicrobial medicines.

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ANNEXTURES

ANNEX I: RESEARCH WORKPLAN

Items covered	JAN 2019	FEB 2019	MAR 2019	APR 2019	MAY 2019	JUN 2019	JUL 2019	AUG 2019	SEP 2019
Development of research topic& approval									
Proposal writing & approval									
Data collection									
Data editing, presentation									
Data analysis									
Writing the final report & approval									
Submission of the final research report									

ANNEX I1: ANTIMICROBIALS IN YUMBE HOSPITAL AND HC IVS

LIST OF ANTIMICROBIALS

Classification	Example
AMINOGLYCOCIDES	1. Gentamycin 80mg/2ml injection iv/im
CEPHALOSPORINS	2. Ceftriaxone sodium 1g powder for injection
METRONIDAZOLE	3. Metronidazole 200mg
MACROLIDES	4. Erythromycin 250mg tab
PENICILLINS	5. Amoxicillin 250mg capsule 6. Amoxicillin dispersible tablets 250mg 7. Ampicillin/cloxacillin 250mg/250mg injection 8. Benzathine Penicillin 2.4 MU 9. Penicillin. Benzyl 1mu/600mg inj (pfr) im 10. Procaine penicillin fortified
CHLORAMPHENICOL	11. Chloramphenicol sodium succinate 1g injection
NITROFURANTOIN	12. Nitrofurantoin 100mg
SALFONAMIDE	13. Cotrimoxazole 960 mg tablet
QUINOLONES	14. Ciprofloxacin 500mg tablet
TETRACYCLINES	15. Doxycycline 100mg capsules

ANNEX III: BUDGET FOR EVALUATION PROJECT ANNEX III: BUDGET FOR EVALUATION PROJECT

BUDGET FOR RESEARCH PROJECT				
ACTIVITY	UNIT	UNIT COST	REQUIRED	**TOTAL COST UGX**
PROPOSAL WRITING	1	5,000	22	110,000
Modem	1	100,000	1	100,000
Internet services (megabytes)	1	45,000	4	180,000
Ream of papers	1	30,000	1	30,000
Printing	1	150,000	1	150,000
Photocopying	1	150	300	45,000
Binding	2	5,000	4	20,000
Travels to meet supervisors	2	120.000	6	720,000
Sub Total	1	-		635,000
Data collection, Entry & Analysis				
Secretarial work	1	2	50,000	105,000
Sub Total	1			105,000
Transport Facilitation during data collection				
transport for Researcher	1	1,000	10	10,000
Transport for research assistant	1	4,000	10	40,000
Refreshment	2	5,000	10	50,000
Data analysis	1	50,000	1	50,000
Data entry in computer	1	50,000	3	150,000
Data Editing analysis	1	20,000	2	40,000
Sub Total				340,000
Final Report				
Typing	1	50,000	2	100,000
Ream of printing paper	1	30,000	1	30,000
Printing and binding	4	10,000	1	70,000
Sub Total				200,000

Grand Total				2,000,000

ANNEX IV: DATA COLLECTION FORM 1(TOOL)

PRESCRIBING INDICATORS

- Percentage of encounters with one or more antimicrobials prescribed
- Percentage of antimicrobials prescribed by generic name
- Average No. of antimicrobials prescribed per patient
- Percentage of patients prescribed antimicrobial medicines with diagnosis recorded
- Percentage of patients receiving antimicrobial injections
- Percentage of antimicrobials prescribed consistent with the EMHL
- Average cost of antimicrobials prescribed per patient
- Average duration of prescribed antimicrobial treatment
- Percentage of prescriptions in accordance with Uganda Clinical Guideline (UCG)

ANNEX V: PRESCRIBING INDICATORS CHECKLIST MEDICINES FOR ANTIBACTERIALTO BE USED FOR INPATIENTS

Facility I.D……. Level care……..

Total number of prescriptions in the review period……. Total number of prescriptions with antimicrobial prescribed……..

Total number of prescriptions with an injectable antimicrobial prescribed……

a) REVIEW OF 100 PATIENT PRESCRIPTIONS WITH AN ANTIMICROBIAL PRESCRIBED

Patient Number	No. of antimicrobials medicines prescribed	No. of antimicrobials medicines prescribed in generic	No. of injections prescribed	No. of medicines not in UCG/EMHSLU	Diagnosis recorded (Y=1/N=0)	Cost of antimicrobial medicine	Duration of treatment
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							

b) ADHERENCE TO STANDARD TREATMENT GUIDELINES (UCG)

Patient NO.	Diagnosis Recorded	Prescription in accordance with UCG Yes=1 or N=0	Explanation/reason if any
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			

ANNEX VI: DATA COLLECTION FORM 2 (TOOL)

Facility indicators/factors

- Existence of standard treatment guidelines (STGs/UCG) for infectious diseases
- Existence of an approved hospital formulary list or essential medicines list (EML)
- Availability of diagnostic laboratory facility (Complete blood count)
- Availability of a set of key antimicrobials in the facility stores on the day of the study
- Average number of days that a set of key antimicrobials is out of stock
- Expenditure on antimicrobials as a percentage of total facility medicine costs

PART 1: CHECKLIST FOR FACILITY FACTORS/INDICATORS AFFECTING PRESCRIBING OF ANTIMICROBIALS

No.	Item	Yes=1 or no=0
1	Existence of standard treatment guidelines (STGs/UCG) for infectious diseases	
2	Existence of an approved hospital formulary list or essential medicines list (EML)	
3	Availability of diagnostic laboratory facility (Complete blood count)	

PART 2: CHECKLIST FOR AVAILABILITY, DAYS OF STOCK AND COST OF ANTIMICROBIALS

1. TOTAL COST OF MEDICINES AS PER THE CURRENT INVOICE UGX……..
2. TOTAL COST OF ANTIMICROBIALS AS PER THE CURRENT INVOICE UGX ……..

No.	Name of medicine	Available on the day of visit Yes=1 or No=0	No. of days out of stock in the past 3 months (March-May)
1.	Gentamycin 80mg/2ml injection iv/im		
2.	Ceftriaxone sodium 1g powder for injection		
3.	Metronidazole 200mg		
4.	Metronidazole 500mg/100ml infusion		
5.	Amoxicillin 250mg capsule		
6.	Amoxicillin dispersible tablets 250mg		
7.	Ampicillin/cloxacillin 250mg/250mg capsules		
8.	Ampicillin/cloxacillin 250mg/250mg injection		
9.	Cloxacillin 500mg inj (pfr) iv/im		
10	Penicillin. Benzyl 1mu/600mg inj (pfr) im		
11	Chloramphenicol 250 mg capsule		
12	Chloramphenicol sodium succinate 1g injection		
13	Cotrimoxazole 960 mg tablet		
14	Ciprofloxacin 500mg tablet		
15	Doxycycline 100mg capsules		

ANNEX VII: ETHICAL CLEARANCE LETTER

MAKERERE UNIVERSITY
P.O. Box 7072 Kampala, Uganda
E-mail: healthsciences.irb@gmail.com
deanshs@chs.mak.ac.ug
Tel: 256 0200903786
Tel: 256 414 531533
Fax: 256 414 531533

COLLEGE OF HEALTH SCIENCES
SCHOOL OF HEALTH SCIENCES
OFFICE OF THE DEAN

Our Ref: Research protocol REC- Ref No: 2019-049

August 12th, 2019

Mr. Boniface Matua
University of Rwanda
Rwanda

Dear Mr. Matua,

Re: Approval of waiver of informed consent to access patient's records on files

In your request dated 04th July, 2019, you requested the committee to waive off informed consent in order to access patient's files for your research study titled "An Evaluation of Antimicrobial Medicines Prescribing Practices in Yumbe District Uganda". The study will only involve review of patients records in their files and no interviews will be conducted with patients.

On behalf of the committee, I am glad to inform you that the committee granted a waiver of informed consent to access patient's files basing on the reason mentioned above. You may proceed with your study after getting approval from the School of Health Sciences Research and Ethics Committee.

Yours sincerely,

MAKERERE UNIVERSITY
SCHOOL OF HEALTH SCIENCES
12 AUG 2019
INSTITUTIONAL REVIEW BOARD
P. O. BOX 7072, KAMPALA

Dr. Paul Kutyabami
Chairperson,
School of Health Sciences Research and Ethics Committee

MAKERERE UNIVERSITY
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COLLEGE OF HEALTH SCIENCES
SCHOOL OF HEALTH SCIENCES
OFFICE OF THE DEAN

August 12th, 2019

Mr. Boniface Matua
University of Rwanda
Rwanda

Category of review
[X] Initial review
[ ] Continuing review
[ ] Amendment
[ ] Termination of study
[ ] SAEs

Dear Mr. Matua,

Re: Approval of research protocol #SHSREC REF: 2019-049
"An Evaluation of Antimicrobial Medicines Prescribing Practices in Yumbe District Uganda"

Thank you for submitting an application for ethical review of the above referenced research protocol. The committee reviewed it and granted approval for **one (1) year**, effective **August 12th, 2019.** Approval is valid until **August 11th, 2020.**

Continuing Review
In order to continue working on this study (including data analysis) beyond the expiration date, the School of Health Sciences Research and Ethics Committee must reapprove the protocol after conducting a substantive, meaningful, continuing review.
This means that you must submit a continuing report form as a request for continuing review. To best avoid a lapse, you should submit the request six (6) to eight (8) weeks before the lapse date. Please use the forms supplied by our office.

Amendment Review
During the approval period, if you propose any change to the protocol such as its funding source, recruiting materials, or consent documents, you must seek School of Health Sciences Research and Ethics Committee approval before implementing it.
Please summarize the proposed change and the rationale for it in a letter to the School of Health Sciences Research and Ethics Committee. In addition, submit two (2) copies of an updated version of your original protocol application- one showing all proposed changes in bold or 'track changes,' and the other without bold or track changes.

Reporting
Other events which must be reported promptly in writing to the School of Health Sciences Research and Ethics Committee include:
Suspension or termination of the protocol by you or the grantor

Monitoring audit of research study activities
As per the Uganda National Guidelines for Research Involving Humans as Research Participants, Section 3.5, The Research and Ethics Committee has a duty to ensure that all research studies it approves are conducted in accordance with the research governance code of practice. In order to ensure compliance with scientific and ethical requirements, the School of Health Sciences Research and Ethics Committee undertakes random monitoring audits. If your research study is selected for monitoring audit, you will be given three (3) week's notice to prepare all documentation for inspection, Therefore, expect the monitoring team at your study site anytime.

It is your responsibility to inform us in the event of early termination of the research project or if you fail to complete the research project.

Do not hesitate to contact us if you have any questions. Thank you for your cooperation and commitment to the protection of human subjects in research.

Final approval is to be granted by Uganda National Council for Science and Technology.

Yours sincerely,

MAKERERE UNIVERSITY
SCHOOL OF HEALTH SCIENCES
APPROVED
VALID UNTIL
11 AUG 2020
RESEARCH & ETHICS COMMITTEE
P.O. BOX 7072, KAMPALA

Dr. Paul Kutyabami
Chairperson, School of Health Sciences Research and Ethics Committee
College of Health Sciences, Makerere University