Patterns of prescribing antibiotics and associated factors at the Jakaya Kikwete cardiac institute (JKCI), Muhimbili National Hospital (MNH) and Muhimbili Orthopedics Institute (Moi)

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PATTERNS OF PRESCRIBING ANTIBIOTICS AND ASSOCIATED FACTORS AT THE JAKAYA KIKWETE CARDIAC INSTITUTE (JKCI), MUHIMBILI NATIONAL HOSPITAL (MNH) AND MUHIMBILI ORTHOPEDICS INSTITUTE (MOI)

By

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A Dissertation Submitted in (Partial) Fulfillment of the Requirements for the Degree Master of Science (Applied Epidemiology)

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CERTIFICATION

The undersigned certify that, they have read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled: **"Patterns of prescribing antibiotics and associated factors at the Jakaya Kikwete Cardiac Institute (JKCI), Muhimbili National Hospital (MNH) and Muhimbili Orthopedics Institute (MOI)",** in (partial) fulfillment of the requirements for the degree of Master of Public Health of Muhimbili University of Health and Allied Sciences.

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DECLARATION AND COPYRIGHT

I, **Neema Joseph Nagu,** I declare that this **dissertation** is my own original work and that it has not been presented and it will not be presented to any other University for the similar or any other degree award.

Signature…….. **Date** ……...

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DEDICATION

This study is wholeheartedly dedicated to my beloved husband Godluck and our children Iman – Joel & Mary – Angela, who have been my source of inspiration and gave me strength when I thought of giving up, continually provide their moral, spiritual and emotional support.

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Lastly, I humbly dedicated this book to the Almighty God, thank you for the guidance, strength, power of mind, protection, skills and for giving me a healthy life.

ABSTRACT

Background: Worldwide, between 20 to 50% of antibiotics consumption is inappropriate, triggering substantial impact on the rational use of medicines and incidence of adverse drug reactions. Situation analysis on antibiotic use and resistance conducted in June 2015 in Tanzania, indicated that data on antibiotic resistance is scarce and there is evidence of resistance to commonly used antibiotics, such as; Ampicillin, Tetracycline and Trimethoprim-sulfamethoxazole. Therefore, the purpose of this study was to investigate the prescribing patterns as well as rationale of antibiotic prescription and the associated factors at the JKCI, MNH, and MOI.

Methods: A cross sectional review of patients records on prescriptions and laboratory results was conducted among patients admitted to JKCI, MNH and MOI between Jul – Sep 2018. Records from Hospital information's system (Clinical and Laboratory) were retrieved to identify prescriptions patterns as well as associated factors. Analysis was done using Epi Info 7 and Stata 13.0 as needed and logistic regression analysis was deployed to determine factors associated with prescribing pattern.

Results: Proportions of antibiotics prescription were found to be 60%, 64% and 72% at JKCI, MN Hand MOI respectively in 1,176 patient's prescription records studied. Only a total of 54.17%, 5.41% and 76.58% of antibiotics prescription records from JKCI, MNH and MOI were in accordance to the Tanzanian Standard Treatment Guidelines (STG). Laboratory data showed only 3.2% of all antibiotics prescription records had antimicrobial susceptibility tests done distributed as 0.79%, 2.38% and 0% at JKCI, MNH and MOI respectively. Gender, patient's category, prescriber's level of education and Hospital facility with AOR of 1.05(95%CI: 0.64 – 1.74), 1.83(95%CI: 1.09 – 3.08), 1.48(95%CI: 0.64 – 3.46) and 0.03(0.19 – 8.13) respectively were found to be significantly associated with antibiotics prescription practices.

Conclusion: The findings of this study provide evidence of irrational antibiotics use at JKCI, MNH and MOI. These baseline data on antibiotics prescribing patterns by healthcare providers are useful information on prescribing patterns to medical practitioners, hospital administrators as well as to inform policy makers. In addition, the findings will save as baseline data for further researches on factors contributing to irrational use of medicines.

TABLE OF CONTENTS

CERTIFICATION i
DECLARATION AND COPYRIGHT ii
ACKNOWLEDGEMENT iii
DEDICATION iv
ABSTRACT v
TABLE OF CONTENTS vii
LIST OF TABLES ix
LIST OF FIGURES ix
LIST OF ABBREVIATIONS x
DEFINITIONS OF KEY TERMS xi
CHAPTER ONE 1
1.0 INTRODUCTION 1
1.1 Background 1
1.2 Statement of the Problem 5
1.3 Conceptual Frame Work 7
1.4 Rationale 8
1.5 Research Questions 8
1.6.1 Broad Objective 9
1.6.2 Specific objectives 9
CHAPTER TWO 10
2.0 LITERATURE REVIEW 10
CHAPTER THREE 13
3.0 METHODOLOGY 13
3.1 Study area 13
2.2 Study design and duration 13
2.3 Study Population 13
2.4 Sample size calculation 13
2.5 Sampling 15

3.6 Data collection 16
2.7 Data Analysis Plan 16
2.9 Ethical approval 17
CHAPTER FOUR 18
4.0 RESULTS 18
4.1 Demographic characteristics of the study participants 18
4.2 Proportions of antibiotics prescribed 19
4.3 Proportions of antibiotics prescribed in accordance to STG 21
4.4 Proportion of antibiotics prescription based on Antimicrobial Susceptibility Test results 22
4.5 Bivariate Analysis 25
CHAPTER FIVE 30
5.0 DISCUSSION 30
CHAPTER SIX 33
6.1 Conclusion 33
6.2 Strength 33
6.3 Study limitations 33
6.4 Mitigation 34
6.5 Recommendations 34
REFERENCES 35
APPENDICES 42
Annex 1. 42
Annex 2 43
Annex 3: Approval of ethical clearance 47
Annex 4: Permission letters to collect data 48

LIST OF TABLES

Table 1: Independent variables 15
Table 2: Socio demographic characteristics 18
Table 3: Prescription records with antibiotics by Hospital 20
Table 4: Prescription records with antibiotics in accordance to STG 21
Table 5: Antibiotics prescription with INN or generic names 22
Table 6: Prescriptions with DST results 23
Table 7: a) Prescriber's level of education 23
Table 8: b) Prescriber's of year's into practice 24
Table 9: Bivariate and Logistic regression analysis results 28
Table 11: Summary of dependent and independent variables 42
Table 12: Description of measurements 43
Table 13: Data collection tool 46

LIST OF FIGURES

Figure 1: Schematic presentation conceptual framework 7

Figure 2: Hospitalized patient antibiotics prescription's distribution. 19

LIST OF ABBREVIATIONS

ABR	Antibiotic Resistance
ADR	Adverse drugs resistance
AMR	Antimicrobial Resistance
ARTI	Acute Respiratory Tract Infection
ASHP	American Society of Health - System Pharmacist
AST	Antimicrobial Susceptibility Test
CDC	Centre for Disease Control
DRC	Democratic Republic of Congo
DDD	Defined daily doses
DST	Drug Susceptibility Test
GP	General Practitioners
HFL	Hospital Formulary List
HMJS	Hospital Management Java System
IDSA	Infectious Disease Society of America
INN	International Nonproprietary Name
INRUD	International Network of Rational Use of Drugs
JKCI	Jakaya Kikwete Cardiac Institute
MNH	Muhimbili National Hospital
MOHCDGEC	Ministry of Health, Community Development, Gender, Elderly & Children
MOI	Muhimbili Orthopedics Institute
MRSA	Methicillin Resistant Staphylococcus aureus
MTC	Medicine Therapeutic Committees
SA	South Africa
SSI	Surgical Site Infections
STG	Standard Treatment Guidelines
WHO	World Health Organization

DEFINITIONS OF KEY TERMS

Antibiotics	Medicines, drugs or chemical substances that can either kill or inhibit the growth of bacteria organisms in the body of the host. The drugs include; penicillin or its derivatives, cephalosporin's or its derivatives and others
Prescription pattern	Prescribing, dispensing and distribution of medicines
Rational use of drugs	"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"
Irrational prescription	Irrational prescribing refers to prescribing that fails to conform to good standards of treatment. This may be evident in five different ways, namely: under-prescribing, over-prescribing, incorrect prescribing, extravagant prescribing, and multiple prescribing.
AMR	AMR is defined as the resistance of bacterial, viral, parasitic and fungal microorganisms to antimicrobial medicines that were previously effective for treatment of infections. It occurs naturally over time but is accelerated by the inappropriate use of antimicrobial medicines in the health, animal, food, agriculture and aquaculture sectors; lack of access to health services, including to diagnostics and laboratory capacity; and antimicrobial residues in soil, crops and water.

Polypharmacy	Polypharmacy can be defined as**,** use of more than a one medicines, is common in the older population with co - morbidity, as one or more medicines may be used to treat each condition.

CHAPTER ONE

1.0 INTRODUCTION

Antibiotic agents are a class of drugs used for infectious disease that contributes to reduced mortality and morbidity over the last century. Even so, the magnitude of infectious diseases has persistently increased in developing countries and regions with scarce economic resources access to diagnostic and therapeutic resources, including antibiotic supplies.

The historical background suggests that, the control of infectious diseases by use of antibiotics is one of the most important accomplishments in the history of medicine today.

Therefore, the prescribing of antibiotics by physicians shall be evidence based, unluckily these basic conditions are non-existing in large parts of the world. As a consequence of lack of resources such as finance for maintaining antibiotics supply chain system and/or lack of Antibiotic prescribing policy

1.1 Background

The greatest medical conquests of the 20th century was the discovery and introduction of antimicrobial agents that transformed the management of bacterial infections in the healthcare system worldwide(1,2). The discovery made tremendous benefits in the management of bacterial caused infections to both human and animal health and has reduced morbidity as well as mortality rates for infectious diseases that were once a major cause of death(3).

However, the continuing emergence and reemergence of infectious diseases due to populations of antimicrobial-resistant pathogenic bacteria resulting from overuse, misuse, and abuse of antibiotics is a major global health concern(4,5).

The World Health Organization estimates global death of 56. 9 Million due to both infectious and non-infectious diseases in 2016, from which 56% were from the African region due to both infectious and non-infectious diseases (WHO, 2018). Studies have shown at least 95% of infectious diseases burden globally are in developing countries and which depend on empirical antibiotics for treatment (WHO, 2018).

The burden of resistance falls heavily on low- and middle-income countries (LMICs), which usually have high burdens and hasty spread of infectious disease, inadequate water, sanitation and hygiene, pitiable nutrition, and growing rates of antibiotic consumption in both humans and animals, in addition to weaker health care systems and scarce standards and regulations that govern access, use, and quality of antibiotics(6).

According to the World's medicine report 2011 by WHO, at least 20% to 50% of antibiotic consumption is inappropriate globally, and the impact is greatest on low-income countries, which faces double burden of fewer antibiotic choices and higher rates of infectious diseases(7). Merely due to the emergence of antimicrobial resistance (AMR), a spectacle first observed in 1947, when microorganisms (Staphylococcus species) showed resistance against penicillin (8).

Tanzania's situation analysis and recommendations on antibiotic use and resistance conducted by GARP in June 2015 specified that, data on antibiotic resistance is scarce(9). In addition, there is evidence that shows that resistance levels of *S. pneumoniae* to commonly used antibiotics, such as; trimethoprim-sulfamethoxazole, tetracycline, erythromycin, chloramphenicol and ceftriaxone were 82.6, 10.4, 6.0, 3.5 and 0.0 %, respectively (10).

However, a study in a South Africa (SA) reported that 95.8% of prescribers believed antibiotic resistance (ABR) is a significant problem in SA and 66.5% of prescribers felt the pressure on prescribing resulted from patients (5).

Another study on point prevalence survey on antibiotic use and resistance in a referral hospital in Western Kenya observed that, among the patients surveyed, 67.7% were on antibiotics. The study recommended the need for urgently reviewing of the currently noticeable empiric antibiotic use and developing antibiotic guidelines and/or formularies especially for empiric use as well as implementing antimicrobial stewardship activities (11).

A study on antibiotic susceptibilities of indicator bacteria *Escherichia coli* and Enterococci spp. isolated from ducks in Morogoro Municipality, Tanzania observed a prevalence of multiple antibiotic resistances shown by *E. coli* which were: 28 (30.8%) isolates to four antibiotics, 35 (38.5%) to three antibiotics, 13 (14.3%) to two antibiotics, 11 (12.1%) isolates to one antibiotic respectively and suggested that the problem of antibiotic resistance is extensive even to bacteria isolates from animals which do not receive antibiotic therapy (12).

Although the problem associated with antibiotic use is a global encounter but developing countries are stricken the most due to double burden of high infectious diseases rates as well as limited resource (13–15).

Another study has revealed there is limited epidemiological data on bacterial resistance in human and animal pathogens in Zambia, DRC, Mozambique and Tanzania. Therefore, this prompt for large surveillance studies on AMR and coordinated efforts in improving diagnosis of infectious diseases together with surveillance of AMR in developing countries (16).

In addition, a study by on economic burden of resistance suggested improved data collections efforts are useful for burden of resistance(17).

Furthermore, with the emergence of antimicrobial resistance, several organizations such as Infectious Disease Society of America (IDSA) and the American society of Health System Pharmacist (ASHP) have identified a well-structured antimicrobial stewardship Program's the mainstay towards better antibiotics treatment outcome in optimizing the care of patients with infections (18).

Thus, management of antibiotics is necessary for clinical, economic and environmental implications. Furthermore, Tanzania has no policy on antibiotic rational prescribing and efforts to promote rational antibiotic use still experiences significant challenges.

Considering the situation, an investigation of antibiotic prescribing patterns and its predisposing factors at a tertiary hospital in Tanzania is warranted in order to provide data that was support health care policy makers.

1.2 Statement of the Problem

There has been tremendous increase of antibiotic use over the last decades with literatures indicating the increase in antibiotic resistance is proportional to the use of antibiotics (2-5),due to overuse, misuse and inappropriate prescription of antibiotics resulting into significant impact on the quality of care, cost of therapy and incidences of adverse drug reactions (13,19,20).

Some clinical consequences of AMR are increasing resistance towards treatment of patients in both community and hospital settings, the reduction and rise of resistant *Streptococcus pneumoniae*, the emergence and spread of community-acquired methicillin-resistant *Staphylococcus aureus*, the emergence and spread of cephalosporin-resistant and now fluoroquinolone-resistant *Escherichia coli*; the clonal spread of multiresistant *Enterococcus faecium*, the emergence and spread of carbapenem resistant *Klebsiella pneumoniae* in the hospital settings and the continued development of broadly drug-resistant *Pseudomonas aeruginosa* and *Acinetobacter baumanni*as enlightened by Louis B Rice (21).Number of factors are believed to be associated with rapidly developing AMR while several studies support the claim that inappropriate antimicrobial use (either prescribing antimicrobials when not required or prescribing a broad spectrum agent when a narrower spectrum agent would be adequate) (22) is the main element of AMR(6,23,24). A study by Erlandsson et al. conducted from the Scandinavia on infectious disease has reported that 74% of ICU patients were treated with antibiotics (84% in tertiary care units), only 30% of initial treatment decisions were based on positive microbiological data and most decisions on antibiotic prescription were empirical with cefuroxime being the most common among selected antibiotics(25).In addition to, a study conducted in China reported on average encounters with antibiotics and combined antibiotics prescription were 70.1% and 40.2% respectively, out of which only 37.9% were in accordance to standard treatment guideline(26).While a study in Kenya has claimed that almost 67% of hospitalized patients receive at least one antibiotic(27).This findings demonstrate the existence of multi-prescription of antibiotics in our settings. Although, the problems associated with antibiotics exist all over the world, developing countries are stricken the most because infection rates are much higher and resources are very limited(13,28).

However, antibiotic prescription is motivated by physician's empirical practices in tertiary government hospitals. Thus the study aim is to investigate on antibiotics prescribing patterns and associated factors at tertiary hospitals of JKCI, MNH and MOI, in order to identify problems associated with antibiotics usage. The findings that was be obtained from this study was inform and assist both tertiary hospitals (JKCI, MNH and MOI) and the Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC) in making better decisions.

Moreover, a study on antibiotic susceptibilities of indicator bacteria *Escherichia coli* and Enterococci spp. isolated from ducks in Morogoro MC – Tanzania had observed a prevalence of multiple antibiotic resistances shown by *E. coli* which were; 28 (30.8%) isolates to four antibiotics, 35 (38.5%) to three antibiotics, 13 (14.3%) to two antibiotics, 11 (12.1%) isolates to one antibiotic respectively. Thus, suggested that the problem of antibiotic resistance is extensive even to bacteria isolates from animals which do not receive antibiotic therapy(12).

1.3 Conceptual Frame Work

It is hypothesized that, patients receive medications (antibiotics) appropriate to their clinical needs in dosages sufficient to meet their own individual requirements, for intended period and at the lowest cost to them and their community (19).In accordance to the study objective, the outcome is related to 3 general areas of prescribing pattern, laboratory culture and sensitivity results and demographic records. The antibiotics use pattern in terms of frequency and percentage of single as well as multiple antibiotics was be determined. The Anatomical Therapeutic Chemical classification system was be used for coding of antibiotics prescribed, the defined daily doses (DDDs) of antibiotics as per (STG) was also be calculated and their comparison across wards and within departments in Institutions was also be determined.

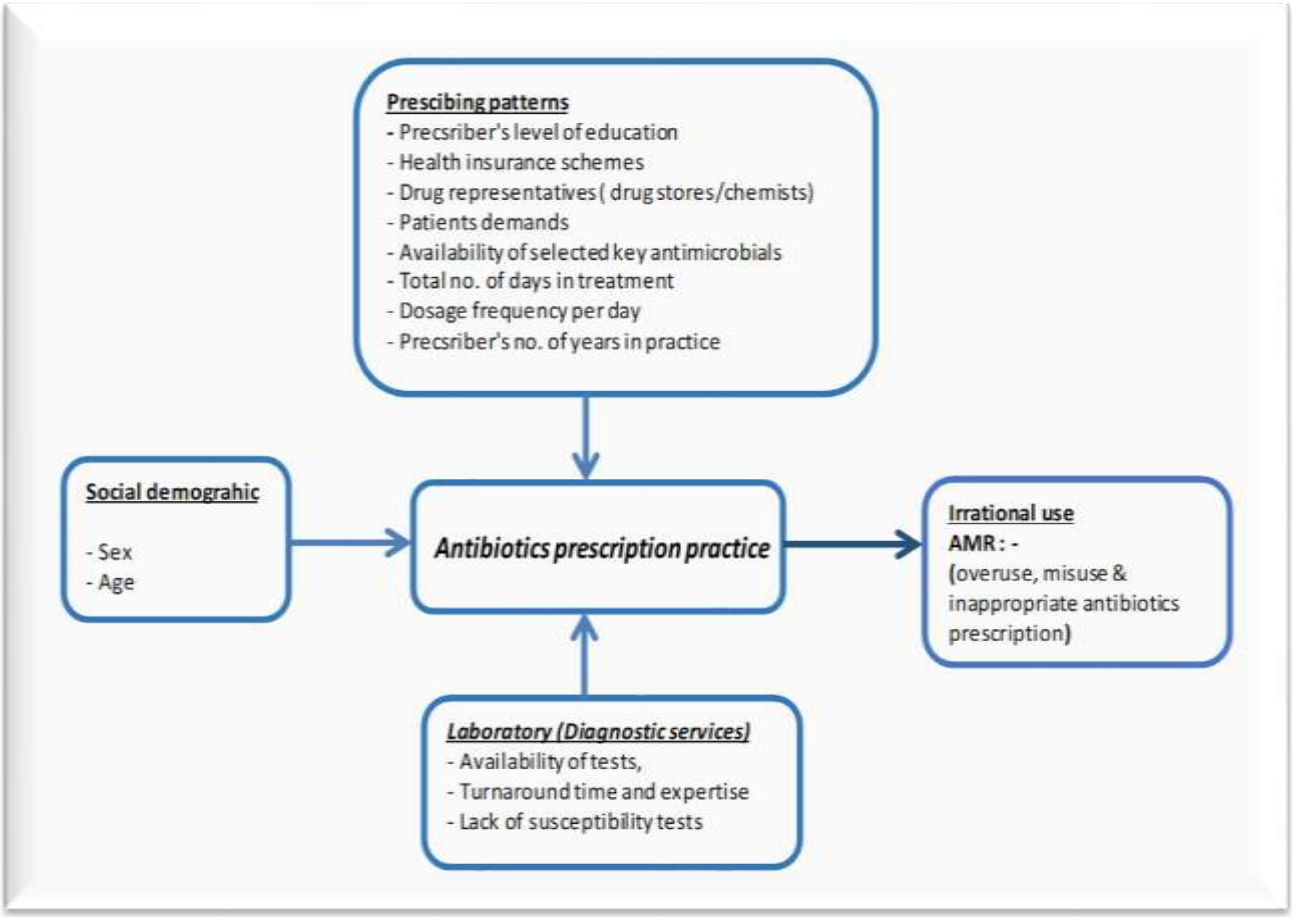


Figure 1: Schematic presentation conceptual framework

1.4 Rationale

This study revealed the patterns of prescribing and use of antibiotics as well as associated factors in tertiary hospitals of JKCI, MNH and MOI - Dar es Salaam Tanzania, and has identified gaps in practice with reference to standard treatment guidelines.

Therefore, the findings from the study will inform prescriber's s at JKCI, NMH, MOI, generally and policy makers in Tanzania on the identified gaps which in turn will support and/or used to benchmark policy and practice activities in the country with regard to quality of antibiotic use. Importantly, this insight will help policy-makers to implement appropriate interventions designed to improve the judicious use of antibiotics in tertiary hospitals.

1.5 Research Questions

1. What is the proportion of antibiotics prescriptions at JKCI, MNH and MOI?
2. What is the proportion of prescriptions with antibiotics that conform to the standard treatment guideline at JKCI, MNH and MOI?
3. What is the proportion of antibiotics prescriptions treatment that is based on obtained laboratory results at JKCI, MNH and MOI?
4. What are the factors associated with patterns of antibiotics prescription at JKCI, MNH and MOI?

1.6 Objectives

1.6.1 Broad Objective

To determine the proportion of antibiotics prescriptions patterns and associated factors at JKCI, MNH and MOI.

1.6.2 Specific objectives

1. To determine proportion of antibiotics prescription at JKCI, MNH and MOI.
2. To determine proportion of antibiotics prescription that conform to the standard treatment guideline at JKCI, MNH and MOI
3. To determine proportion of antibiotics prescription that was based/ adjusted by drug Susceptibility Test (DST) results at JKCI, MNH and MOI.
4. To determine factors associated with antibiotics prescription practices at JKCI, MNH and MOI.

CHAPTER TWO

2.0 LITERATURE REVIEW

Antibiotic use

Antibiotics are the most common prescribed medicines in a hospital setting, revealed by a study in the US on National trends inpatients antibiotic use, by Braggs J. et al. that estimated at least 55.1% of inpatient receive at least one course of antibiotics during their stay (29). Another study showed sales of beta-lactam antibiotics and macrolides for outpatients 15 European Union member countries antimicrobial use varied widely. They ranged from 3.8 to 23.6 DDD per 1,000 inhabitants per day for beta-lactam antibiotics and from 0.97 to 5.98 DDD for macrolides. The data suggested Europe's antimicrobial resistance is correlated with use of beta-lactam antibiotics and macrolides (30). In addition to, studies from Pakistan and Egypt using WHO/INRUD prescribing indicators to determine current prescribing practices and antibiotics use pattern in a tertiary hospital have reported irrational prescriptions of high antibiotics prescribing practices1.5% (17) and 52.2 % (31,32) respectively.

Point prevalence survey

A point prevalence survey of antibiotics uses and resistance at a referral hospital in Kenya has reported at least 67.7% of patients were on antibiotics and the most common antibiotics prescribes were third generation cephalosporin's 55%, imidazole's derivatives 41.8% and broad-spectrum antibiotics 41.8%. However, the most common indication for antibiotics use was medical prophylaxis 29%(11).

Irrational use of medicines

Medicines are important commodities in healthcare delivery, and when used rationally, can help cure diseases, relieve symptoms, and ease patient suffering. Nonetheless, irrational use of medicines is a major issue in health systems globally (13). According to the world's medicine report, it's estimated that more than half of all medicines are inappropriately prescribed, dispensed, or sold. Additionally, around 50% of patients fail to take their medicines correctly

(33).Furthermore, WHO defines five criteria that include appropriate indication, drug, patient, information and monitoring (34) that are considered to be essential for rational prescriptions. Impacts of irrational use of medicines can vary from increased adverse drug reactions (ADR's) to antimicrobial resistances (AMR).

Antibiotics use and resistance

According to L. Gayani Tillekeratne et al, on a study about antibiotic overuse for ART's in a public hospital in Sri Lanka have concluded that, among factors attributing to antibiotics prescriptions for ART's were physician's perceptions of patients burdens, diagnostics uncertainty, fear of bacterial super-infections and not limited to high volumes of patients and short visiting times and recommends organized modifications in the public outpatient care structure could encourage unnecessary antibiotic prescriptions for ARTI's (35).

Antibiotics susceptibility

A study by Shima et al on Antibiotic susceptibility of Helicobacter pylori strains isolated from Iranian children have shown a high prevalence of H. pylori resistance to metronidazole, ciprofloxacin, erythromycin, amoxicillin and furazolidone in Iran and hinted for determination of antibiotic susceptibility shows an important role in the selection of the appropriate anti H. pylori regimen (36).

Antimicrobial resistance

Several literatures on antibiotics resistance in developing countries have been conducted but few published on patterns and predisposing factors of prescribing antibiotics.

C a Hart, and S Kariuki in a study conducted on antimicrobial resistance in developing countries whose results showed antimicrobial drugs were unregulated and easily available at pharmacies, general stores and market stalls with 60% prevalence rate of antibiotics prescription which merely depends on symptoms only. In addition to, resistances antibiotics drugs is causing increased morbidity and mortality for infectious diseases such as pneumococcal meningitis and enteric fevers which is largely attributed to inadequate laboratory facilities(37).

According to Carl Llor and Lars Bjerrum study about Antimicrobial Resistance; risks associated with antibiotics overuse and initiatives to reduce the problem reported that, about 90% of all antibiotics prescriptions are issued by general practitioners for respiratory tract infections, and are the leading reasons for prescribing, however among risks associated with overuse of antibiotics are increased (Antimicrobial resistances, more severe infections, length of diseases, risks of complications, mortality rate, healthcare costs and adverse drugs reactions (20).

Antimicrobial resistance in human and animal

Mshana et al. conducted a systematic literature review microbiological study on Antimicrobial resistance in human and animal pathogens in Zambia, DRC, Mozambique and Tanzania and reported an increased trend of isolates from urine (such as E. Coli and K. Pneumoniae) to become resistant to commonly used antibiotics which is associated with empirical treatment largely attributed to inadequate microbiological facilities in health facilities (16).

Factors associated with irrational use of drugs

V. Lukali et al on factors associated with irrational drug use reported a 51.4% prevalence of irrational use of drugs with composite indicators reveling 65.4% and 52.2% prevalence rates for antibiotics and polypharmacy prescriptions suggesting factors contributing are irrational prescribing of antibiotics in a district hospital Zambia (38).

Irrational Use of Medicine - summary of key concepts

According to Ofori – Asenso R. and Agyeman A.A, although medicines are integral part of healthcare delivery, 'the concept of "rational use of medicine" can at times be confusing and not easily appreciated by patients, healthcare providers, policy makers, or the public'. Among the factors leading to irrational use of medicines as well as potential impacts of such practices are rational medicine use, good prescribing and dispensing (39).

The proposed study aims at reviewing prescriptions as well as laboratory records in order to address gaps identified above while investigating on prescribing patterns and factors with at JKCI, MNH and MOI and expected findings was provide a useful information about rational/irrational use of antibiotics to health professionals, patients, and policy makers**.**

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study area

The study was carried out in Dar es Salaam involving tertiary care hospitals namely JKCI, MNH and MOI all of which are public owned facilities. JKCI for cardiovascular medical intervention has an estimate of 200 bed capacity attending approximately 200 inpatients and 700 outpatients per week, with 34 prescriber's, and is further divided into 16 departments.MNH, the National Referral Hospital, with 1500-bed capacity and treats 1000–1200 outpatients weekly and the same number of admitted patients daily with 300 Prescriber's s in addition to, has 29 departments. While MOI, which is the National Trauma Referral Hospital in the field of Orthopedic, Neurosurgery and Traumatology has 250 bed capacity attending 1000 outpatients per week and the same number of admitted patients on daily basis with a total of 127Prescriber's.

2.2 Study design and duration

This was a cross sectional review of patients records on prescriptions and laboratory results. Principal source for completing data collection was through reviewing (HMIS) in - patient's prescription records and laboratory data on antibiotic sensitivity/susceptibility tests conducted at MNH, MOI and JKCI from July to Sep 2018.

2.3 Study Population

The study population included all in patients departments at mentioned institutions which were JKCI, MNH and MOI.

2.4 Sample size calculation

The sample size was estimated using Daniel's formula for single proportions.

Based on assumptions that, bed capacities at JKCI, MNH & MOI are 200, 1500and 250 respectively.

Thus, bed capacity ratio is 1: 7.5: 1.25 at JKCI, MNH & MOI respectively.

Then using Daniel (1999) formula for single proportion as quoted (40)

$$n = \frac{Z^2 P (1-P) D}{d^2}$$

Where:-

N= sample size

Z = Z statistic for a level of confidence, (CI at 95%),

P = expected prevalence or proportion of irrational prescription (50%, P = 0.5),

d = precision (in 5%, d = 0.05) and

D = Effect size (1.5)

Therefore,

$$= \frac{(1.96)^2 * 1 * (1 - 0.5) * 1.5}{(0.05)^2}$$

N= 1152.48 participating prescriptions

Adjusting for non-response rate

$$n = \frac{N}{1 - 0 \cdot 1}$$

Where,

n = adjusted sample size

N= Initial sample size= 1153/1-0.1

n =1281.111 participating prescription records.

The sample size of 1282 participating prescription records was be included in the study.

2.5 Sampling

JKCI, MNH& MOI were selected as tertiary hospitals respectively. In patients prescriptions on the specified period (i.e. July – Sep 2018) were collected. Participating prescription records (n = 1282) as calculated in the sample size above, from a proportion of 50% (13,16,40–42) of clinical encounters (Hospital Management JAVA system) on the duration stated and using sample randomly technique sample data the ratio of 1:7.5:1.25 based on Health facilities' bed capacities.

Random sampling selected participating no's of patient prescriptions gave 153, 961 & 168at JKCI, MNH and MOI respectively which then were systematically analyzed for common factors associated with antibiotics prescription practices. In addition to, Individual diagnosis were mapped with STG for assessing compliance.

Dependent variable

Antibiotic Prescription practice, (description of measurements annex 2)

Table 1: **Independent variables**

#	**Specific objective**	**Variable**	**Operational Indicators**
1	To determine proportion of antibiotics prescription	Prescription with antibiotics	Proportions of prescriptions with antibiotics
2	To determine proportion of antibiotics prescription in accordance to STG	i) Antibiotics used in accordance to STG ii) Number of antibiotics prescribed in a prescription iii) INN used iv) Dosage frequency per day	Proportions for each variable

3	To determine proportion of antibiotics prescription that were based on laboratory confirmed results	Prescription records with laboratory results	Proportions for each variable
4	Factors associated with antibiotics prescribing practices	i Sex ii Age iii Level of education iv Occupation v Place of residence	Proportions for each variable

The independent variables of this study included; prescribing patterns such as, prescriber's level of education, prescriber's years in practice, health insurance schemes. Social demographic characteristics such as age, sex, Diagnostics services such as availability of laboratory investigation tests, laboratory turnaround time as well as expertise in laboratory investigation unit. (Table @ Annex 1).

3.6 Data collection

Standard indicator e- forms were used to collect data from hospital bases information's system at JKCI, MNH and MOI. Data reliability is ensured by following the WHO guidelines and methods (13) The data was be collected during the months July – Sep 2018 (data sheets @ Annex 2).

All prescription records and Laboratory records from (July – Oct 2018) extracted from HMJS (Medical records, Pharmacy and Laboratory) databases at the (JKCI, MNH & MOI) respectively.

2.7 Data Analysis Plan

All prescriptions collected from July – Sep 2018 from MNH, MOI and JKCI (soft and hard copies) analyzed to respond to specific objective 1, and an estimated sample size (n = 1282) from a proportion of 50% was used to respond to specific objectives 2 – 4.

The statistical package (Epi Info 7/ Stata/Excel 2013) was used to design analytical template and to enter, clean, manage and analyze data. Categorical variables were summarized using frequencies and percentages whereas continuous variables summarized using mean and standard deviation (or median and interquartile range). The relationship between antibiotic prescription practice (dependent variable) and independent variable (demographic factors/prescribers patterns/diagnostic services) analyzed using chi-square tests and/or simple logistic regression analysis.

2.9 Ethical approval

Ethical clearance for conducting this research was obtained from the Ethical Review Board of Muhimbili University of Health and Allied Science. Permission to conduct this study sought from JKCI, MNH & MOI in charges respectively. Participant's names and Identifiers was not be included in the data collections tools. Confidentiality of the client's information, was maintained.

CHAPTER FOUR

4.0 RESULTS

4.1 Demographic characteristics of the study participants

From 1176 hospitalized patient's records reviewed, 44.7% patients were male and 55.3% were female. Out of 1176 patients' record reviewed in this study 76.3% where from MNH, 13.2% were from MOI and 10.2% were from JKCI. All the demographic characteristics of the patients included in the current study are summarized in table 2 and figure 2.

Table 2: Socio demographic characteristics

Patients variables	**Number**	**Results (%n)**
Age in group (years)		
1 ≤ 18	**322**	**27.38**
18 - 35	310	26.36
36 ≤ 55	**178**	**15.14**
55 >	366	31.12
Total	**1176**	**100**
Sex		
Female	626	53.33
Male	550	46.77
Total		
	1176	**100**
In patient's by facility		
JKCI	120	10.2
MNH	901	76.26
MOI	155	13.18
Total	**1176**	**100**

Hospitalized patient's records showing all prescription with and without antibiotics prescribed, figure 2 below,

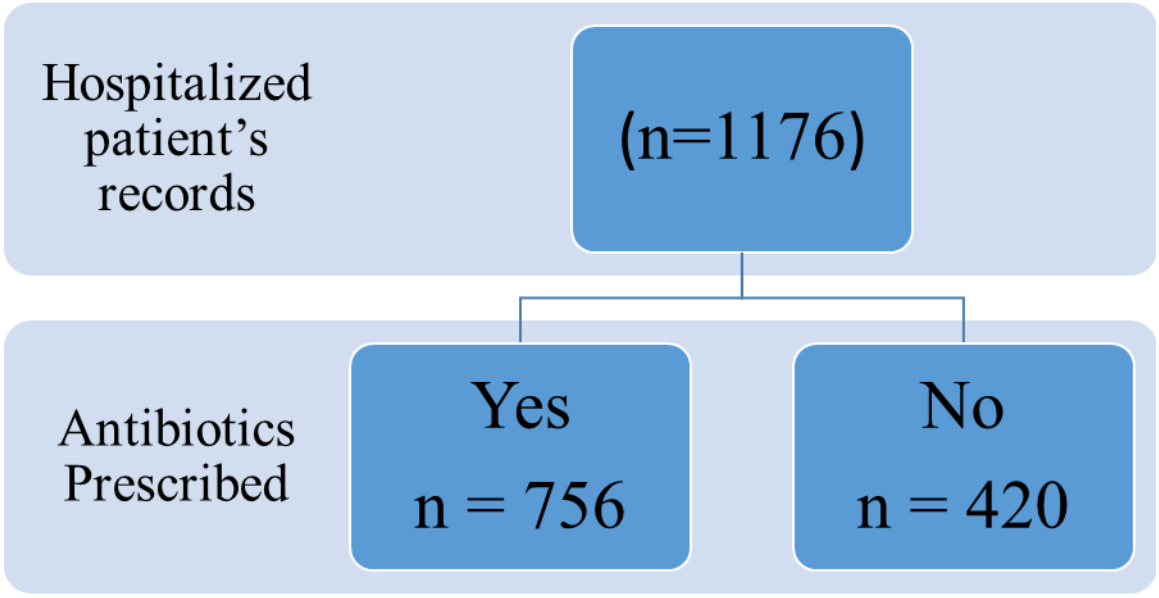


Figure 2: Hospitalized patient antibiotics prescription's distribution.

4.2 Proportions of antibiotics prescribed

Overall results on proportions of antibiotics prescription from JKCI, MHN and MOI indicated a total of 756 (64.29%) prescription records had antibiotics prescribed (i.e. 64.29% of in patients were prescribed with antibiotics) during the study period as described in (Table 3).

Table 3: Prescription records with antibiotics by Hospital

Hospital	Antibiotic prescription		Total			No	(%)
	Yes	(%)	Number	(%)			
JKCI	48	40	72	60	120	100	
MNH	328	36	573	64	901	100	
MOI	44	28	111	72	155	100	
Overall	**420**	**35.71**	**756**	**64.29**	**1176**	**100**	

Further stratification by hospital indicated, proportions of antibiotics prescriptions from Hospitals were at least 72 (60%), 573 (64%) and111 (72%) at JKCI, MNH and MOI respectively. MOI reported the highest proportions with -72% during the study period.

Out of all 756 (64%) prescriptions with antibiotics studied, more description of prescribing practice showed, at least 295 (25%) antibiotic(s) prescriptions had one antibiotic, 285 (24%) had two antibiotics, 106 (9%) had three antibiotics, 70 (5%) included more than four antibiotics during their hospitalization period as described in a stratified manner by facility which shows more of polypharmacy at MNH, as given in Figure 3.

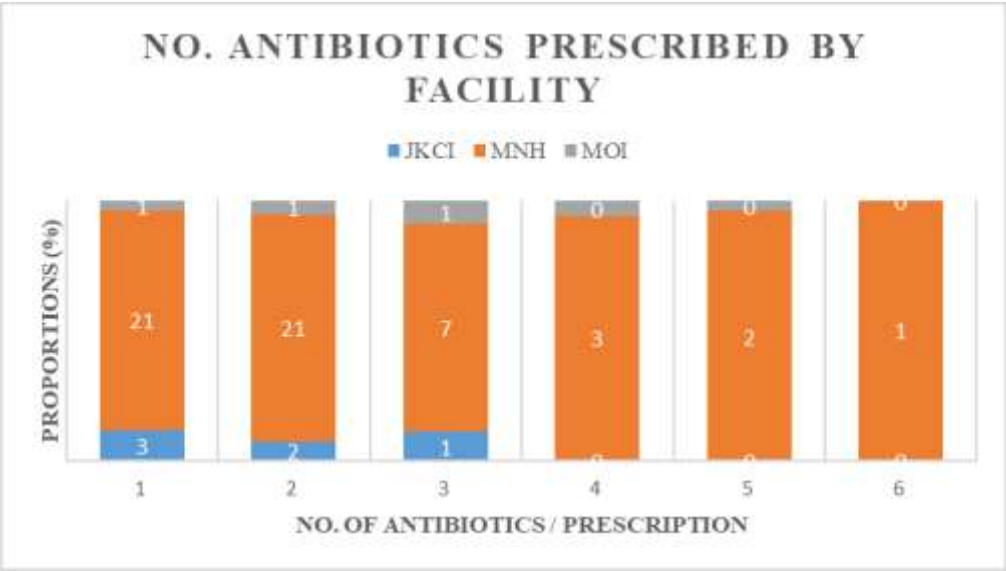


Figure3: Number of antibiotics prescription by facility

4.3 Proportions of antibiotics prescribed in accordance to STG

Pharmacy records were used to generate descriptive analysis of patient's antibiotics use, and results showed among all prescriptions with antibiotics only 155(20.50 %) were in accordance to STG as shown in table 4 below.

Table 4: Prescription records with antibiotics in accordance to STG

Hospital	Antibiotic prescription in accordance to STG				Total	
	No	(%)	Yes	(%)	Number	(%)
JKCI	33	45.83	39	54.17	72	100.00
MNH	542	94.59	31	5.41	573	100.00
MOI	26	23.42	85	76.58	111	100.00
Overall	**601**	**79.50**	**155**	**20.50**	**756**	**64.29**

Also results specified, proportions of antibiotics prescription in accordance to STG by Hospital were 39 (54.17%), 31 (5.41%) and 85 (76.58%) at JKCI, MNH and MOI respectively. MNH results revealed least adherence to STG with respect to JKCI and MOI.

Additionally, results showed, at least 82.8% of all pharmacy records followed International Non-proprietary Name(INN)/ generic names, hence decent prescribing patterns were demonstrated by prescribers at respective study sites as shown in table 5 below,

Table 5: Antibiotics prescription with INN or generic names

Hospital	INN Used				Total	
	No	(%)	Yes	(%)	Number	(%)
JKCI	4	6.35	59	93.65	63	100.00
MNH	76	13.5	487	86.50563	100.00	
MOI	49	37.69	81	62.31	130	100.00
Overall	**129**	**17.34**	**627**	**82.66**	**756**	**100**

Moreover, results above were further stratified according to study sites and revealed that, antibiotic prescriptions abided to INN or generic names as 59(93.65%), 487 (86.50%) and 81(62.31%) at JKCI, MNH and MOI respectively.

4.4 Proportion of antibiotics prescription based on Antimicrobial Susceptibility Test results

From all antibiotics prescribed that were checked against laboratory data, results computed only 22 (3.17%) of all patients prescriptions with antibiotics had Antimicrobial SusceptibilityTests (AST) done as illustrated in the table 6 below.

Table 6: Prescriptions with DST results

Hospital AST	Total					
No	**(%)**	**Yes**	**(%)**	**Number**	**(%)**	
JKCI	66	8.73	6	0.79	72	9.52
MNH	555	73.41	18	2.38	563	75.79
MOI	111	14.68	0	0	111	14.68
Overall	**734**	**96.83**	**22**	**3.17**	**756**	**100**

Further, stratification results indicated, of the 22 (3.17%) AST done, 2.38% were from MNH, 0.79% JKCI and none from MOI respectively. **Medical Practitioner's influence on prescribing patterns**

In addition, to prescriber's level of education in relation to prescribing patterns was also assessed. Analysis results described their distribution and evidently confirmed that 614 (86.2%) of prescriber's were medical specialists as illustrated in table 7.

Table 7: a) Prescriber's level of education

Education level	Number	Percentage (%)
GP	86	11.4
Specialist	614	86.2
Super specialist	56	7.4
Total	**756**	**100**

Results below describes prescriber's number of years into practice, however prescribing patterns showed at least 454 (60%) proportion of prescriber's are within 10 to 20 years of practice at JKCI, MNH and MOI, as summarized in Table 8 and proportions in figure 10.

Table 8: b) Prescriber's of year's into practice

Year's	Number	Percentage (%)
$0 \leq 10$	155	21
$10 \leq 20$	458	60
$20 \leq 30$	138	18
$30 \leq 35$	5	1
Total	**756**	**100**

4.5 Bivariate Analysis

1. Factors associated with antibiotics prescribing practices at JKCI, MNH and MOI

Analysis included all -antibiotics prescription and DST results for hospitalized patients during the study period to find factors associated with prescribing practices.

Results showed among antibiotic's prescriptions which conform to STG at Age below and above 18 year's old were only 35(11%) and 105(12%) respectively with OR= 0.94 (95% CI 0.62 – 1.41) p-value 0.775 which was not statistically significant in bivariate analysis.

However, odds of conforming to STG among investigated prescription records were 2.15 times more likely in female compared to male and was statistically significant in bivariate with (95%CI 1.4 - 3.1) p value < 0.001 this could be explained by the incursive nature of females.

Total number of antibiotics prescribed had odds of 1.47 in conforming to STG among those with one antibiotic compared to with those with more than one antibiotics encounter in a single prescription record and was statistically significant in bivariate analysis with (95%CI 1.02 -2.12) p value <0.041.

Subsequently, results indicated odds of being prescribed antibiotics conforming to STG for public insured and not insured patient categories were protective but were statistically significant with p value < 0.026 and p value < 0.027.

Further, the use of INN/generic names and prescriber's years of experience were found not to be significant in bivariate analysis. The AST was almost non-existent, with only 3.12% prescription records having drug susceptibility tests done.

In addition to, bivariate results shows level of education had influence in conforming to STG during antibiotics prescriptions. Thus, odds of conforming to STG in prescribing antibiotics were 1.22 times more in specialists compared to GP' but not statistically significant with (95%CI 0.64 -2.33)p value <0.549. While, odds of conforming to STG in prescribing antibiotics were 4.03 times more in Super-specialists compared to GP' with statistical significant (95%CI 1.76 -9.22p value <0.001.

Consequently, results showed odds of being prescribed antibiotics conforming to STG were protective at MNH compared to JKCI with statistical significance (95%CI 0.02 - 0.07) p value <0.001. Whereas, odds of being prescribed antibiotics conforming to STG were 1.23 times more at MOI compared to JKCI with no statistical significance (95%CI 0.65 - 2.33)p value <0.52.

The covariates with p value of ≤ 0.2 were further fitted in to multivariate logistic models to identify the independent factors to antibiotics prescribing practice. Factors used to assess antibiotics use were age, sex, number of antibiotics prescribed, INN/ generic use, patient's category, Prescriber's level of education, and Hospital facility.

The model results of cross sectional study revealed that, the following are independent risk factors associated with antibiotics prescription practices i.e. Gender, Patient category, Prescriber's level of education and Prescribers years of experience into the field.

It was exposed that, odds of being prescribed with antibiotics in conformity to STG were 1.05 times (OR = 1.052, 95%CI 0.64– 1.74) in male to female with no statistical significant.

Accordingly, odds of public insured patients prescribed antibiotics in conformity to STG were 1.24 (OR = 1.83, 95%CI 0.19 - 8.13) times compared to private insured patient with no statistical significance and p value < 0.83.Likewise, odds of not insured patients prescribed antibiotics were 1.83 times (OR = 1.83, 95%CI 1.09 – 3.08) to private insured patient was statistically significant with p value < 0.02

Further, prescriber's level of education was also associated with prescribing practice, odds of being prescribed antibiotics conforming to STG among specialists were 1.48 (OR = 1.48, 95%CI 0.64 – 3.46) times to GP but not statistical significant, p value <0.36.Furthermore odds of being prescribed antibiotics conforming to STG among super specialists were 1.26 (OR =1.26, 95%CI 0.45 – 3.55) times to GP with no statistical significance, p value <0.66.

Moreover, odds of being prescribed antibiotics conforming to STG in MNH were protective i.e. 0.03 (OR = 0.03, 95%CI 0.19 – 8.13) times to JKCI but statistically significant, p value < 0.001.Concequently odds of being prescribed antibiotics conforming to STG in MOI were also protective i.e. 0.97 (OR =0.97, 95%CI 1.09 – 3.08) times to JKCI but not statistically significant, p value < 0.93.

Independent variables subjected to bivariate analysis and with covariates with p value of ≤ 0.2 additional analysis in multivariate to determine factors associated with antibiotics prescribing practices at JKCI, MNH and MOI from July to Sep, 2018 in Dar es Salaam are summarized in Table 9.

Table 9: Bivariate and Logistic regression analysis results

Variables	Prescriptions with antibiotics not in accordance with STG (N=613)		Prescriptions with antibiotics in accordance with STG (N=143)							
	Number	**(%)**	**Number**	**(%)**	**COR**	**95%CI**	**P-value**	**AOR**	**95%CI**	**P-value**
Age group in years										
<18 years	287	89.01	35	10.99		Ref				
≥ 18 years	749	87.69	105	12.31	0.94	0.62 - 1.41	0.775			
Sex										
Female	347	86.53	54	13.47		Ref		Ref		
Male	266	74.93	89	25.07	2.15	1.42 - 3.13	**0.001**	**1.05**	**0.64 - 1.74**	**0.84**
Antibiotics prescribed										
NO	601	86.69	12	13.31		Ref				
YES	13	88.7	130	11.3	1.47	1.02 -2.12	**0.041**			
INN/generic use										
NO	102	78.62	27	21.37		Ref				
YES	513	81.73	114	18.27	0.84	0.52-1.35	0.483			
Sensitivity test										
NO	597	81.4	137	18.6		Ref				
YES	17	77.27	5	22.73	1.29	0.47 -3.55	0.62			

Patient category										
Private Insured	1	25	4	75		Ref		Ref		
Public Insure	375	81.55	85	18.45	0.077	0.008 - 0.75	**0.026**	**1.24**	**0.19 - 8.13**	**0.83**
Not Insured	462	65	249	35	0.075	0.008 - 0.74	**0.027**	**1.83**	**1.09 - 3.08**	**0.02**
Education level										
GP	86	85.19	15	14.81		Ref		Ref		
Specialist	614	82.27	119	17.73	1.22	0.64 - 2.33	0.549	**1.48**	**0.64 - 3.46**	**0.36**
Super specialist	56	58.82	32	41.18	4.03	1.76 - 9.22	**0.0001**	**1.26**	**0.45 - 3.55**	**0.66**
Years in practice										
1 - 5	33	80.65	8	19.35	0.86	0.33 - 2.20	0.75			
Jun-15	442	82.11	100	17.89	0.77	0.52 -1.15	0.21			
> 15	204	78.08	57	21.92		Ref				
Hospital facility										
JKCI	50	40.68	73	59.32		Ref		Ref		
MNH	536	95.17	27	4.83	0.04	0.02 - 0.07	**0.0001**	0.03	**0.19 - 8.13**	**0.001**
MOI	45	35.71	81	64.29	1.23	0.65 - 2.33	0.52	0.97	**1.09 - 3.08**	**0.93**

Chi-square test (x^2) were used for categorical variables and *t-test was done for continuous variables.

CHAPTER FIVE

5.0 DISCUSSION

In the study, we aimed to identify patterns of prescriptions and other independent variables that may explain differences in antibiotic use. This study is the first, to our knowledge, to provide proportions of temporal trends in prescription patterns and factors associated with among tertiary hospitals of (JKCI, MNH & MOI) from July 1 to September 30, 2018 in Dar es Salaam.

Prevalence surveys (see chapter 2, page 19 - 21) were used to explore factors related to antibiotic prescribing patterns. Although problems linked with the use of antibiotics exist all over the world, the seriousness of the problem is higher in the developing countries where infection rates are high but resources are very limited (13).

A total of 1176 patient's records reviewed, whereas male patients were 44.7% and 55.3% were female. Antibiotics prescription proportions were 76.3%, 13.2% and 10.2% with respect to JKCI, MNH and MOI.

Findings from the study identified overall antibiotic use of 64.29% in proportions of 60%, 64% and 72% at JKCI, MNH and MOI hospitals respectively.MNH presented antibiotics prevalence of 64% which is low compared to previous studies on antibiotics prescribing practice in Moshi, Tanzania with 71.5% and Uganda which reported 79% for inpatients receiving antibiotics during hospitalization days (43). This prevalence is higher when compared to other tertiary healthcare facilities. Ghana had reported 51.4% from a point prevalence survey (44) while major hospitals in Owerri Nigeria reported antimicrobial prevalence of 55.9% (45)and Inpatient Antibiotic Use Among US Hospitals From 2006 to 2012 reported 55.1% from Estimating National Trends(29).

Therefore, at least one out of two hospitalized patients at MNH receives antibiotics. Antibiotics prevalence in developing countries is considerable high compared to other developed countries(7,46), e.g. point prevalence survey in the UK reported a range of 36.4% and 43.0%among children prescribed with antibiotics between both district general and tertiary hospitals (47).

However, high proportions of antibiotics use in MNH can be explained by the presence of high proportion at about 63% of the isolates causing SSIs(48), resulting into inappropriate use of antimicrobial agents that isn't supported by Antimicrobial Susceptibility Test results.

Findings also revealed that out of 155 antibiotics prescription records reviewed at MOI, 111 prescription records had antibiotics prescribed. This translates to the prevalence of 71.29%, the study therefore suggested that majority of the patients who underwent surgical procedures received antibiotics prophylaxis before and/or after surgery. Similar observations also reported prevalence of 80% in Orthopedics and Traumatology Surgical Unit of a Tertiary Care Teaching Hospital in Addis Ababa (49).

Nevertheless, antimicrobial prophylaxis are recommended by America Society of Health-system Pharmacists (ASHP) for orthopedics procedures (50) and also reinforced by meta-analysis study thus presence of microorganisms such Methicillin Resistant Staphylococcus aureus (MRSA) continue to apply negative influence on survival (51). Therefore, in order to reduce morbidities resulting from and preventing mortality the use of antibiotics as prophylaxis in surgeries is recognized in the country as agreed in Tanzania Standard Treatment guidelines (52).

Misappropriation of antibiotics could result in destruction of its curative powers(53). This study identified antibiotic prescription that conformed to STG from in - patient's prescription records. Results showed only 54.17% and 5.41% at JKCI and MNH were conformed to STG respectively. The finding from MNH was fairly low compared to a study on antibiotic prescribing practice and adherence to guidelines in primary care in the Cape Town Metro

District, South Africa which reported 45.1% adherence (54). Several factors could be linked to STG non-conformity practices (empirical prescription patterns) ranging from patients, prescribers and/or availability of STG's. However, the main problem of not conforming to STG by prescriber's could be ascribed by diagnostic uncertainties, shortage of prescriber knowledge, in adequate opportunity for follow-up, easy availability and accessibility of antibiotics and not limited to adequate - of treatment guidelines (19).

Conversely, these results also indicated only 3.2% of antibiotics prescription records had antimicrobial susceptibility tests performed suggesting more than 96% of in patients from JKCI and MNH were empirically treated. Further, studies have reported inappropriate empirical treatment varied from 1.61% to 77.36% (55).Laboratory confirmed tests should be a prerequisite for rational antibiotics prescription in a hospital setting(56). In addition, antibiotics use should adhere to sequences of history, investigation and treatment for rational antibiotics therapy(57)

The results obtained from this study also showed a wide range of antibiotic prescribing patterns by general practitioners and specialists as compared to super specialists in JKCI, MNH & MOI respectively, as was reported Isfahan, Iran (58), that prescriptions with antibiotics were about one half 49% at MNH, Tanzania and prescriber's number of years in experiment is associated with antibiotics prescribing patterns In addition, other studies have suggested parents expectations towards antibiotics could be another driving factors to prescribers (59).

CHAPTER SIX

6.1 Conclusion

This study has revealed irrational antibiotics use which provides the stimulus to bring into line antibiotics prescribing practices in JKCI, MNH & MOI and to set higher level policy via their MTC's and implement training that ensures the optimal use of antibiotics.

Based on the study findings it is evident that, prevalence of irrational antibiotics use at JKCI, MNH and MOI was high suggesting the need for actions. Medical specialty and patient gender was among factors predictive of inappropriate antibiotics prescribing practice. Possible inequalities in care need further study.

6.2 Strength

A retrospective study over a period of 3 month inclusion of all in patients from JKCI, MNH & MOI, irrespective of age and sex which strengthens representativeness of results. Data-collecting tools were same at both study hospitals and the staff who collected the data were trained by the same person at both sites to minimize variances. Observations made from patients records might have minimized the effect on the prescribers of being observed and audited. All possible efforts were made to minimize the risk of missing data by continuous monitoring and cross-checking of the data.

6.3 Study limitations

Antibiotic use and prescribing patterns were investigated in only JKCI, MNH & MOI, hence findings cannot be generalized for the whole of Tanzania. Furthermore, different wards in tertiary care hospitals have varying degrees of antibiotics use. However, a large proportion of patients were categorized as belonging to the suspected bacterial infections diagnosis groups. Some of these diagnoses might have been categorized as non-bacterial infections if the etiology had been confirmed by microbiology reports. This could have contributed to even higher antibiotic prescribing rates in the non-bacterial infections diagnoses group due to the absence of confirmed etiology.

6.4 Mitigation

To address this bias, independent variables went through logistic regression in Stata to remove confounders for in the study sites.

6.5 Recommendations

Stewardship education in medical schools, frequent clinical meetings seminars and training are recommended to keep prescribers on good prescribing practices. Establishing an antibiotic surveillance systems and targeting interventions to the highest prescribers might be more effective approaches to antimicrobial stewardship. Disseminating standard treatment guidelines to healthcare providers and developing specialized treatment guidelines for facilities as JKCI and MOI. Periodic prescription surveys and drug utilization studies are recommended to support identifying any forms of irrational prescribing. Finding from these studies should be communicated and/or disseminated to healthcare providers in particularly prescribers and applicable interventions to remedy any problems identified. The baseline data reported by this study can assist hospital administrators, policy makers and researchers in improving prescribing practices in JKCI, MNH and MOI. This being an investigating study thus further researches are required in factors contributing to irrational use of medicines, Influence of patient's on antibiotics prescribing, Physician's knowledge, perception and behavior towards antibiotics prescribing and Physician's perception and practice towards Drugs and Susceptibility Test results.

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APPENDICES

Annex 1.

Table 10: **Summary of dependent and independent variables**

<table>
<tr><th colspan="2">Variable</th></tr>
<tr><td>Independent</td><td>Dependent</td></tr>
<tr><td>Prescribing Patterns

Prescriber’s level of Education

Health Insurance schemes

Drug Representatives

Patients demands

Availability of selected key antibiotics

Total days in treatment

Dosage frequency per day</td><td rowspan="4">Antibiotics prescription practice</td></tr>
<tr><td>Demographic
Age

Sex</td></tr>
<tr><td>Diagnostic services
Laboratory investigation tests
Laboratory turnaround time
Expertise in the lab unit</td></tr>
</table>

Annex 2

Table 11: **Description of measurements**

Variables, types of analysis and display						
Sn.	**Name**	**Description**	**Type**	**Level of Measure**	**Type of analysis**	**Display**
Demographic information						
1	Age	Age of a patient/prescriber	Continuous	Ratio	-Mean -Proportion	-Frequency distribution table
2	Sex	Sex of a patient/prescriber	Categorical	Nominal	-Mode -Proportion	-Frequency distribution table -Bar chart
3	Address (place) • District • Ward • Village/street	Address of a patient	Categorical	Nominal	-Mode -Proportion	-Frequency distribution table -Bar chart
Patients information's						
4	Antibiotics	Prescribed with antibiotics	Categorical	Nominal	-Mode -Proportion	-Frequency distribution table

						-Bar chart
Prescribers information						
5	Ward	Name of ward	Categorical	Nominal	-Mode - Proportion	-Frequency distribution table -Bar chart
6	Level	education level	Categorical - Intern - MD - Specialist	Nominal	-Mode - Proportion	-Frequency distribution table -Bar chart
7	Experience in Years	No of years into practice	Categorical < 5 5 - 10 > 10	Nominal	-Mode - Proportion	-Frequency distribution table -Bar chart
Antibiotics Information's						
8	Laboratory Investigation data	Sensitivity tests performed	Categorical	Nominal	-Mode - Proportion	-Frequency distribution table -Bar chart
9	Antibiotics	Number of antibiotics prescribed	Categorical 1 2 > 2	Nominal	-Mode - Proportion	-Frequency distribution table -Bar chart
10	INN	INN used	Categorical	Nominal	-Mode - Proportion	-Frequency distribution table -Bar chart

11	Antibiotics used	Antibiotics used in accordance to STG	Categorical	Nominal	-Mode - Proportion	-Frequency distribution table -Bar chart
12	Antibiotics used	No of antibiotics used of same generic	Categorical 1 2 > 2	Nominal	-Mode - Proportion	-Frequency distribution table -Bar chart
13	Dosage	Dosage frequency per day	Categorical 1 2 > 2	Nominal	-Mode - Proportion	-Frequency distribution table -Bar chart
14	Dosage	Doses prescribed	Categorical 1 2 > 2	Nominal	-Mode - Proportion	-Frequency distribution table -Bar chart
15	Out come	Outcome of prescribing practices	Categorical (-Rational -Irrational)	Nominal	-Mode - Proportion	-Frequency distribution table -Histogram

Table 12: Data collection tool

Investigation of Antibiotics prescription pattern in JKCI, MNH and MOI

Records of antibiotics treatment

Name of Unit: Data Collector : Date:

Prescribers Information's				Patient Information's						Antibiotic Information's									
1	2	3	4	1	2	3	4	5	6	1	2	3	4	5	6	7	8	9	10
Strata/Ward	**Qualification**	**Years in Practice**	**Sex**	**Clinical Hist. no**	**Age**	**Sex**	**Antibiotics Prescribed? Yes/No**	**Diagnosis**	**No. days Hospitalized**	**Was antibiotic sensitivity Test done? (Yes/No)**	**No. of Antibiotics Prescribed**	**Names of antibiotics prescribed**	**IVF used (Yes/No)**	**Antibiotics on STG/HFL**	**Dosage Form and strength**	**Total of days of treatment**	**No. of antibiotics of same generic prescribed**	**Dosage frequency per day**	**Doses prescribed**

Annex 3: Approval of ethical clearance

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
OFFICE OF THE DIRECTOR OF POSTGRADUATE STUDIES

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Ref. No. DA.287/298/01A/

26th March, 2019

Ms. Neema J. Nagu
MSc. Applied Epidemiology
MUHAS.

RE: APPROVAL OF ETHICAL CLEARANCE FOR A STUDY TITLED: "INVESTIGATING PATTERNS OF PRESCRIBING ANTIBIOTICS AND ASSOCIATED FACTORS AT THE JAKAYA KIKWETE CARDIAC INSTITUTE (JKCI), MUHIMBILI NATIONAL HOSPITAL (MNH) AND MUHIMBILI ORTHOPEDICS INSTITUTE (MOI)"

Reference is made to the above heading.

I am pleased to inform you that, the Chairman has, on behalf of the Senate, approved ethical clearance for the above-mentioned study. Hence you may proceed with the planned study.

The ethical clearance is valid for one year only, from 18th **March, 2019 to 17th March, 2020.** In case you do not complete data analysis and dissertation report writing by **17th March, 2020,** you will have to apply for renewal of ethical clearance prior to the expiry date.

Dr. Emmanuel Balandya
ACTING: DIRECTOR OF POSTGRADUATE STUDIES

cc: Director of Research and Publications
cc: Dean, School of Public Health and Social Sciences, MUHAS

Annex 4: Permission letters to collect data

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DAR ES SALAAM
Tanzania

In reply please quote: MNH/TRC/Permission/2019/046 **3rd April, 2019**

Head of Department,
Pharmacy
Muhimbili National Hospital

Head of Department,
Laboratory
Muhimbili National Hospital

RE: PERMISSION TO COLLECT DATA AT MNH.

Name of Student	**Neema Joseph Nagu**
Title	**" INVESTIGATING PATTE4RNS OF PRESCRIBING ANTIBIOTICS AND ASSOCIATED FACTORS AT THE JAKAYA KIKWETE CARDIAC INSTITUTE (JKCI), MUHIMB!LI NATIONAL HOSPITAL (MNH) AND MUHIMBILI ORTHOPEDICS INSTITUTE (MOI) ".**
Institution	Muhimbili University of health and Allied Sciences
Supervisors	**Dr. Doreen Kamori** **Dr. Mucho Mizinduko** **Dr. Mohamed A. Mohamed**
Period	3/4/2019 to 30/09/2019 (6 months)

The above named student has been permitted to collect data for the above study.
Please ensure that the researcher abide to the ethical principle and other conditions.

Sincerely,

Dr. Faraja Chiwanga
Head of Teaching, Research and
Consultancy Coordination Unit

c.c DCSS
c.c DMS
c.c. **Neema Joseph Nagu**

HEAD, TEACHING, RESEARCH & CONSULTANCY UNIT
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JAKAYA KIKWETE CARDIAC INSTITUTE

Postal Address:
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In reply please quote;

Ref: DISSERTATION/012/2019 **Date:** 04/04/2019

Ms. Neema J. Nagu
MUHAS

Dear Madam,

RE: PERMISSION TO COLLECT DATA AT JKCI

Reference is made to the above heading. With reference to your letter dated 28th March 2019, I am pleased to inform you that your request to conduct your study titled "**Investigating patterns of prescribing antibiotics and associated factors at JKCI**" has been granted permission.

We wish you the very best.

Best regards,

Pédrö Pallangyo M.D., M.P.H., M.Med
Chairman, Ethical Committee
Head, Research, Training & Consultancy

C.C
Director of Clinical Support Services

Mr. Rajabu (HMRD)

Kindly assist Mr. Neema with the data as per the letter addressed

Mackary

05-04-2019

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AB.145/292/O1B/116 **3rd March, 2019**

Director, Postgraduate studies
MUHAS
P.O.BOX 65001
DAR ES SALAAM

RE: REQUEST TO CONDUCT A RESEARCH

Reference is made to your letter dated 28th March, 2019 with reference No: HD/MUH/T.321/2017 regarding the above subject matter.

On behalf of the Management of the Institute I would like to official inform you that your request for Ms.Neema Nagu to conduct a research heading **'Investigating patterns of prescribing antibiotics' and associated factors'** at **MOI** has been approved. Therefore very kindly you're requested to inform the student that she can start to collect data as requested.

On the arrival you should come and see the undersigned person for more information.

It's my hope that you will extend enough cooperation regarding this matter.

With regards,

Abdallah Mbuguni
For: Executive Director

Cc: Medical Director -MOI