PREVALENCE AND DETERMINANTS OF ANTIBIOTIC PRESCRIPTION FOR UPPER RESPIRATORY TRACT INFECTIONS AMONG CHILDREN ATTENDING THE OUTPATIENT CLINICS IN THARAKA-NITHI COUNTY

MUSA SARUTI

A Thesis Submitted to the Institute of Postgraduate Studies of Kabarak University in Partial Fulfillment of the Requirements for the Award of Master of Medicine in Family Medicine

KABARAK UNIVERSITY

NOVEMBER 2020

DECLARATION

1. I do declare that;

   i) This thesis is my original work and to the best of my knowledge it has not been presented to any institution as a research paper for the award or conferment of any academic degree or diploma.

   ii) That the work has been subjected to the process of antiplagiarism and has met Kabarak University 15% similarity index threshold.

2. I do understand that issues of academic integrity are paramount and therefore I may be suspended or expelled from the university or my degree be recalled for academic honesty and other related malpractices.

Signature:…… **Date**: 21/11/2020

MUSA SARUTI

GMMF/M/1343/09/16

RECOMMENDATION

This thesis entitled **"Prevalence and Determinants of antibiotic prescription for Upper Respiratory Tract Infection among children attending the outpatient clinics in Tharaka-Nithi County"** and written by **Musa Saruti** is presented to the Institute of Postgraduate Studies of Kabarak University. We have reviewed this thesis and recommend it be accepted in partial fulfilment of the requirement for the award of the Master of Medicine, Family Medicine.

Signed: ……. Date: 22/11/2020

Dr. Chebiwot Kipsaina, MD, Ph.D.
School of Medicine and Health Sciences
Kabarak University

Signed: B Jason Brotherton…… Date: 21/11/2020

Dr Jason Brian Brotherton, MD,
Consultant Physician and Faculty at AIC Kijabe Hospital

ACKNOWLEDGMENT

I would like to thank my Lord Jesus-Christ, who made it possible for me to do this thesis. His grace and mercy have been sufficient to me in this process. Julia, your active presence and encouragement helped me to push against storms and to reach this point. It could have been harder without you. El-Barack, you have been a great baby boy, allowing me to work while holding you. My parents and siblings; thank you for being a great family.

Further, I would like to appreciate my supervisors, Dr Jason Brian Brotherton and Dr Chebiwot Kispaina. You were actively involved in this project, and your corrections and constructive feedback helped me to grow as a researcher. Lastly, I would like to thank my micro-research team with whom with started this journey.

DEDICATION

I dedicate this work to all clinicians and organizations who are fighting for appropriate use of antibiotics and who have the battle against antimicrobial resistance as their priority.

ABSTRACT

Upper respiratory tracts (URTI) are acute, self-limiting infection. In 80% of cases, the cause is viral. Consequently, routine antibiotics prescribing to treat URTIs is not justified as they have no clinical benefit and can contribute to antimicrobial resistance (AMR). However, clinicians are frequently prescribing antibioticswith no indication. AMR is one of the principal threats to public health throughout the world. This sequential explanatory study aimed to examine the prevalence of antibiotic prescriptions among under-fives with URTI and to determine the factors influencing prescriptions in Tharaka-Nithi County, Kenya. The first phase was a retrospective chart review withthe calculation of prevalence and Odds ratio. The researcher did asystematic sampling of charts of under-fives treated from December 2018 to November 2019 in outpatient for URTI. Children with a clinically suspected bacterial infection were excluded. This study found that antibiotic prescribing was 70.4%, and it was significantly associatedwith having tonsillitis, the level of education of the prescriber and living close to the hospital. In the second phase, medical officers and clinical officers working in the pediatric outpatient wereinterviewed. A thematic analysisrevealed the following influencing factors: easy access to antibiotics, lack of clinical confidence, limited clinical knowledge and communication skills, tonsillitis and reported fever,the workload in the outpatient clinic,parent's pressure. The recommendations include the reinforcement of regulations of antibiotic use inand out of hospitals with effective stewardship programs; focus on training clinicians regarding the indications of antibiotics,and training of clinicians to communicate effectively with patients. Hospitals should consider to reduce the workload of clinicians and to avail diagnostic testing tools. There is also a needto educate the community about appropriate antibiotic use.

Keywords: Upper Respiratory Tract Infection, Under-fives, Antibiotics prescription

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

AM	Antimicrobial
AMR	Antimicrobial Resistance
CO	Clinical Officer
ESR	Erythrocyte Sedimentation Rate
HIC	High-income Countries
LMIC	Low and Middle-Income Countries
MO	Medical Officer
POPC	Pediatric Outpatient Clinics
URTI	Upper Respiratory Tract Infection
WBC	White Blood Cell Count
WHO	World Health Organization

OPERATIONAL DEFINITION OF TERMS

Antibiotic: An agent used to treat a bacterial infection that kills or stops the growth of bacteria.

Antibiotic Resistance: The ability of bacteria to resist the effect of an antibiotic to which they were once sensitive.

Upper respiratory tract infection: Is an illness caused by viruses in most cases and bacteria is some cases. It involves the nose, sinuses, pharynx, tonsils or larynx.

Pharyngitis: Inflammation of the pharynx that causes a sore throat.

Tonsillitis: Inflammation of the tonsils, with or without exudate, caused mainly by a virus and sometimes bacteria.

CHAPTER ONE

INTRODUCTION

1.1 Introduction

This chapter comprises of background on the inappropriate antibiotic prescription as a significant contributing factor to antimicrobial resistance AMR. It discusses the statement of the problem of inappropriate prescriptionsfor URTI, the objectives of understanding the rationale behind antibiotic prescriptions, the justification, scope, and possible limitations of the study. Lastly, the chapter highlights the assumptions regarding this study.

1.2 Background of the Study

1.2.1. Overview of Upper Respiratory Tract Infections, URTI

A variety of virus and bacteria can cause URTI and the infection present with sneezing, nasal congestion or discharge (rhinorrhea), sore throat, cough, low-grade fever, headache, and malaise(Thomas et al., 2020). More than 100 serotypes of rhinoviruses are responsible for most cases (Heikkinen & Järvinen, 2003). Bacterial complications happen in 0.5-10%, usually from Group A Streptococci (Rezal et al., 2015). Therefore, there is no reason for routine prescription of antibiotics to treat URTIs because they have no clinical benefit in more than 80% of cases. However, clinicians frequently prescribe antibiotics without indication. (Alves et al., 2016).

The Centre for disease control (CDC) estimates that 100 million antibiotic prescriptions are issued in outpatient settings every year (McCaig et al., 2003). In addition to an antibiotic prescription for viral URTI without indication, broad-spectrum antibiotics are used when narrow-spectrum antibiotics would be indicated (Steinman 2003). In one study, 50% of the parents had expected an antibiotic prescription for their children with URTI, and more than 30% of clinicians thought that parents expected antibiotic prescription. For this reason and the

lack of enough time in the clinic, physicians found it easier to prescribe than to educate parents about appropriate antibiotic usage. However, there has never been shown an association between antibiotic prescription and patient satisfaction. It was instead associated with whether the patient felt that their physician spent time with them or not (Hamm et al., 1996). Not only was there no patient satisfaction in an inappropriate antibiotic prescription, but antibiotic use also is not without risk for patients and the community(Llor & Bjerrum, 2014).

1.2.2. Antibiotic Prescription and Antimicrobial Resistance

When microorganisms are repeatedly exposed to antimicrobials (AM), they change over time and become resistant. Unfortunately, Antimicrobial Resistance (AMR) leads to high morbidity and mortality in patients with infectious diseases. Although AMR occurs naturally over time, many practices contribute to increasing its appearance in the community (Bell et al., 2014). These practices include inappropriate prescribing by providers, improper use by patients, and farming practices to promote animal growth. Public Health England stated that by 2050, AMR would be responsible for ten million deaths every year, and this will lead to an estimated cost of around 66 trillion pounds (HealthMatters, 2014). The magnitude of AMR and its associated morbidity and mortality make it one of the significant threats to global public health (WHO, 2015).

Concerning the inappropriate prescription of antibiotics, according to a systematic review done by the World Health Organization (WHO), almost half of patient encounters in primary health care centres in Sub-Saharan Africa received Antibiotics. This high prescription rate is significantly higher than the WHO recommendation of 30% (Ofori-Asenso et al.,2016, p. 2). This review followed a systematic review conducted in 2015 that indicated a high prevalence of AMR in Sub-Saharan Africa (Leopold et al.,2014). These two WHO studies analyzed

together suggest an association between inappropriate prescription and antibiotic resistance in Africa.

In 2011, the Kenyan working group of the Global Antibiotic Resistance Partnership (GARP) reported that antibiotic resistance is a growing challenge in Kenya. In many cases, the first line of antibiotics has lost its effectiveness. The loss of efficacy of some second and third-line antibiotics has also been demonstrated. For example, some severe infections caused by the Enterobacteriaceae could only be treated by Carbapenems, and expensive and broad-spectrum antibiotic, ultimately driving up cost and prolonging hospitalization (GARP, 2011). Even though AMR is a global problem, resistance patterns are unique to their respective local context. For example, evidence from Sub-Saharan Africa shows a higher prevalence of multi-drug resistant gram-negative organisms as opposed togram-positive in the west. The reasons for this difference have not been well studied (Maina et al., 2016).

1.2.3 Prevalence of Antibiotic Prescription for URTI Globally and in Africa

The top two diagnoses for which clinicians overprescribe antibiotics are URTI and bronchitis (McAvoy, 1994; Lee et al., 2014). In one study conducted in Greece, Vietnam, Uganda, and Kyrgyzstan, 50 % of children were prescribed antibiotics for URTI (Kjærgaard et al., 2019). Seventy-eight percent of patients, in another study, received antibiotics for URTI. About thirty percent of those antibiotics were broad-spectrum antibiotics like amoxicillin/clavulanate and cefuroxime (Ochoa et al, 2000; Gonzales et al., 2001). However, virological studies have shown that viruses are the commonest cause of URTI worldwide, including Kenya. The superimposedbacteria were found foraround 24% of all URTI in a study performed in Nakuru, Kenya (Matu, 2014). Moreover, a recent systematic review confirmed that antibiotics do not treat viral URTI nor prevent complications such as pneumonia (Kenealy,2013). Despite all this evidence, literature shows that 50 to 70% of patients receive antibiotics for URTI

(Gonzales et al., 2001; Larrabee, 2002). More so for childhood URTI, 20–90 % are treated with antibiotics, with the large percentage being reported in LMICs(WHO, 2011).

Some high-income countries (HICs) are trying to reduce the number of antibiotic prescriptions given in the ambulatory clinics, but LMICs countries are not doing as well. In Sweden, one study found that URTI in under five was still the leading cause of antibiotics prescribed, and overall the prescription rate was 26.5%. In that same study, there were a lot of socio-demographic influences in the prescribing of antibiotics. Being under five years of age, living in urban areas, and of thefemale gender was associated with antibiotic prescription (Ternhag et al., 2014). Another study in Malta found a prescription rate of 45% considering all age groups and these prescriptions were influenced by clinical factors like signs and symptoms such as cervical lymphadenopathy, and non-clinical factors such as a patient request or female patient, femaleprescriber (Saliba-Gustafsson et al., 2019).

Compared to HICs, the antibiotic prescription rates in LMICs are higher for URTI, and any other suspected infectious disease. In one study done in rural china, 68% of children who came with URTI symptoms received antibiotics in public facilities. Findings from this study showed that age and the township location were associated with higher risks of receiving an antibiotic prescription (Zhang et al., 2017). Not far from China, in Malaysia, a similar study found a prescription rate of around 64.8%. The reason for receiving a prescription varied but included the level of education of prescribers, the age of the patient, and the specific diagnosis like pharyngitis, tonsillitis(Bp et al., 2013). These findings are close to the one found in Laos, where one study revealed even higher prescription rate of antibiotic prescription in under-fives with URTI, 96.4% (Keohavong et al., 2019).

Similarly, in Africa, respiratory symptoms are still the leading reason for antibiotic prescription like elsewhere in the world. One study conducted in the rural region of Kumbo in

Cameroun found that 44% of children underten years of age were prescribed antibiotics. These prescriptions were written in their primary health care facilities, and the leading indication of all antibiotic prescriptions in that study was still URTI (Chem et al., 2018). In another study done in Namibia, 78% of patients treated for URTI were prescribed antibiotics. This prescription was associated with age under-five and the differential diagnosis of pharyngitis, unspecified URTI, and tonsillitis(Kunda & Haoses-Gorases, 2015). In Kenya, one recent study done in private healthcare clinics in Nairobi found that 94 % of all patients were prescribed antibiotics and specifically for URTI it was 97.3% (Kleczka et al., 2019).

These high rates of antibiotic prescription in LMICs are happening despite being discouraged by the World Health Organization, the CDC, and governmental guidelines (Department of Maternal & World Health Organization, 2014; Brink et al., 2015). The reasons behind these inappropriate prescriptions are complex and with multiple facets (McKay et al., 2016a). However, examining antibiotic prescriptions for URTI is an acceptable strategy to evaluate the rationale for an antibiotic prescription (Alves Galvão et al., 2016). The concern of AMR due to inappropriate prescribing practices raises the question about factors behind antibiotic prescriptions in outpatient clinics since most children with URTI are seen and treated in this setting. Most studies on inappropriate antibiotic prescriptions have been conducted in western countries and Asia. The target for those studies was mainly general practitioners since they are actively involved in the outpatient management of children with URTI (Rezal et al., 2015). In Kenya, it is mostly clinical officers (CO) and medical officers (MO) who work in the outpatient clinic, and there is a paucity of data about inappropriate antibiotic prescriptions in the outpatient. Two recents studies in Nairobi were conducted in private facilities located in slum areas and did not have patients chart review but used online tools with limited information to validate the diagnosis of URTI (Kleczka et al., 2019; Mekuria et al., 2019).

We aimed to conduct this study in rural Tharaka-Nithi County. Rural health facilities face realities that are different from those in urban settings in terms of the socio-economic status of their patients, laboratory capacities, resources for investigations, etc. Therefore, this study aimed to help understand the factors involved in the decision of prescribing antibiotics to under-fives with Upper respiratory infection. The understanding of these factors will help in the battle against AMR by targeting one of the significant contributors which are inappropriate prescription.

1.3 Statement of the Problem

The inappropriate prescription of antibiotics is a significant contributor to AMR, and this situation is real worldwide (World Health Organization, 2015). Because of the cost, the mortality and the morbidity associated to AMR, WHO has declared AMR a global public health threat. If the progression of AMR is not prevented, by 2050, the mortally associated to it is estimated tobe 10 million death per year and this will cost 66 trillion Pounds globally(*Health Matters*, n.d.). Preventing the progression of AMR includes assessing and stopping inappropriate antibiotic prescriptions.

Examining prescriptions for childhood URTI is anacceptable strategy to assessthe rationality of antibiotic prescription, as most URTIs have a viralaetiology and antibiotics haveno role in their management(Alves Galvão et al., 2016). The inappropriateness of antibiotic prescription has been seen worldwide and sub-Saharan Africa has not been spared. According to WHO, almost 50% of patients in primary care settings receive antibiotics in Africa. The 50 per cent is beyond the 30 %, which is the maximum acceptable by WHO (Leopold et al., 2014). In Kenya, AMR has been reported but we have limited data regarding the extent of the problem and its contributing factors including antibiotic prescriptions in outpatient settings.

An extensive search of the literature published online and in the local universities repositoryrevealed no data on antibiotic prescriptions for Tharaka-Nithi County. However, a chart review of 80 cases of under-fives with URTI treated in a faith-basedhospital, one of the largest in Tharaka-Nithi County, found that half of those patients were prescribed antibiotics in the outpatient clinic. This practice is continuing while literature has confirmed that viruses are responsible for most cases of URTI. This reality makes routine antibiotic prescriptions unnecessary.Additionally, the WHO and CDC discourage routine prescription of antibiotics for the treatment of URTIs (WHO, 2017).

If different parts of the world are already in the battle against AMR, many African countries are left behind according to the World Health Organization (2015). Africa, Kenya, and Tharaka-Nithi are facing the AMR reality without enough local evidence regarding contributing factors such as determinants of inappropriate prescription of antibiotics. Ascertaining the prevalence and understanding the reasons why clinicians working in outpatient clinics prescribe antibiotics for URTI in children will help to examine the determinants of antibiotic prescriptions in Tharaka-Nithi County. The findings will inform possible interventions to reduce inappropriate antibiotic prescriptions.

1.4 Purpose of the Study

To examine the prevalence and the determinants of antibiotic prescriptions for URTI in under-fives in outpatients' clinic in Tharaka-Nithi County.

1.5 Objectives of the Study

The following are the objectives of this study:

i) To determine the prevalence of antibiotic prescription for URTI among under-fives in Tharaka-Nithi County.

ii) To examine the factors contributing to antibiotic prescriptions in URTI in under-fives in Tharaka- Nithi County.

1.6 Research Questions

The following are the research questions for this study:

i) What is the prevalence of antibiotic prescriptions for URTI in under-fives in Chogoria and Chuka Hospital?

ii) What are the determinants of antibiotic prescriptions in URTI in children less than five years?

1.7 Justification for the Study

Inappropriate antibiotic prescription is a major contributor to AMR and assessing antibiotic prescription practices in URTI is an accepted way to understand if the prescriptions are appropriate or not. AMR is one of the most threatening public health concerns, according to the WHO. Failing in this battle against AMR will make the 3rd sustainable development goal hard to achieve. For example, maternal and infant mortality cannot be reduced if we cannot treat infections. Moreover, in Africa, where access to a broad spectrum and even new antibiotics is difficult, it is crucial to be good stewards of the antibiotics that are available.That said, the beneficiaries of this study are the general population in Tharaka-Nithi County and the surrounding areas. Unnecessary antibiotic prescriptions will not only lead to AMR but will expose patients to unnecessary side effects such as diarrhoea, allergic reactions, yeast infections, etc. The result can lead to increased health care costs and increased morbidity and mortality (World Health Organization, 2015).

Healthcare providers also will benefit from this study by becoming familiar with the idea of AMR and by understanding how everyday practices can contribute. This study will hopefully improve their prescribing practices. Hospitals and teaching institutions will benefit from this

study by understanding the areas where they may need to emphasize in their Continuous Medical Education (CME) to strengthen the knowledge of antibiotics stewardship. Antimicrobial stewardship has been defined as "the optimal selection, dosage, and duration of antimicrobial treatment that results in the best clinical outcome for the treatment or prevention of infection, with minimal toxicity to the patient and minimal impact on subsequent resistance (Gerding, 2001).

1.8 Scope of the Study

This study took place in Tharaka-Nithi County, at one faith-based hospital (Mission Hospital) and one public hospital. The faith-based hospital is a 300-bed hospital that offers services in Internal Medicine, General Surgery, Obstetrics and Gynecology, and Pediatrics. The outpatient department comprises the Medical Outpatient Clinic (MOPC), Outpatient Department (OPD), and private clinic. Children are seen in the Maternal Child Health (MCH) and Pediatrics Outpatient Clinics (POPC) that operates five days per week (Monday to Friday, 8:00 AM to 5:00 PM). This mission hospital is the largest in the County; it shares the catchment population of 390 000 people with the county referralPublic Hospital as the two main referral facilities in the County.The Public hospital has a total bed capacity of 127 beds. It offers inpatient and outpatient services in Pediatrics, Medicine, Obstetrics and Gynecology and General Surgery.

This study focused on antibiotic prescribed to children who attended the outpatient clinic with URTI from December 2018 to November and the experience of clinicians who work in outpatient. From the chart, close to five thousands children were seen during that period with URTI.

1.9 Limitations of the Study

The limitations of this study are that it is a cross-sectional study. That said, causation could not be proven even if we found an association between some demographic data, clinical signs, and antibiotic prescriptions. The other limitation of this retrospective cross-sectional chart review is the limited generalizability of the findings to different settings.On the other hand, the clinicians prescribing in the two hospitals do not represent all the clinicians in the County. For the semi-structured interview, there is a risk of recall bias since the clinicians will be asked to use their previous experiences to answer questions.

1.10 Assumptions for the Study

The researcher assumed that there is inappropriate prescribing of antibiotics for URTI among under-fives in Tharaka-Nithi County. Additionally, the researcher assumed that all eligible study subjects would be able to participate in the study and would be able to recall all the experiences in prescribing antibiotics for URTI in under-fives. Further, it was assumed that clinicians would be prompted to prescribe antibiotics in this age group to prevent the lower respiratory tract infection and its associated mortality in this age group.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This section shall review existing literature in terms of the definition of antimicrobial resistance (AMR), the antibiotic prescription for URTI in children, the prevalence of antibiotic prescription and antimicrobial resistance, and factors influencing antibiotic prescription. Further, the theoretical and conceptual framework for this study shall be explored.

2.1 Definition of Antimicrobial Resistance

Antimicrobial resistance occurs when microorganisms like bacteria, fungi, viruses, parasites change when they are exposed to antimicrobial drugs. Some of the antimicrobial drugs include antibiotics, antifungals, antivirals, antimalarials, and anthelmintics. Microorganisms that develop antimicrobial resistance are sometimes referred to as "superbugs". As a result, antibiotics become ineffective, making treatment difficult, while increasing the likelihood of community spread (World Health Organization, 2016).

2.2 Antibiotic Prescription for URTI in Children

Antibiotic prescribing for URTI is still a reality in clinical practice.The percentages rangefrom 20–90%, and most of these prescriptions are happening in LMICs (WHO, 2019). Some developed countries are trying hard in the regulation of antibiotics prescriptions in outpatients. In Sweden, one study found that URTI in under-fives was still the leading cause of antibiotics prescription, and overall the prescription rate of antibiotics was 26.5%. In that Swedish study, some socio-demographic factors like female gender, urban residence, and the age under five years old had a negative influence on the prescription of antibiotics. (Ternhag et al., 2014). In Malta, another study found a prescription rate of 45% considering all age groups and there

were significant correlations between antibiotic prescriptions and the number of signs and symptoms, cervical lymph nodes and non-clinical factors such as a patient request or gender of the prescriber (Saliba-Gustafsson et al., 2019).

In LMICs, the antibiotic prescription rate is higher for URTI. In one study conducted in rural china, 68% of children who came with URTI symptoms received antibiotics in public facilities, and the age and the township location were associated with a higher risk of antibiotic prescription (Zhang et al., 2017). In another Asian country, Malaysia, a similar study found a prescription rate of around 64.8%. These prescriptions were significantly associated with the level of education of prescribers, the age of the patient, and the specific diagnosis under URTI (Bp et al., 2013). These findings are similar to the one found in Laos, where one study found 96.4% of antibiotic prescription in under-fives with URTI, 96.4% (Keohavong et al., 2019).

Similarly, in Africa, respiratory symptoms are still leading the reason for an antibiotic prescription. One study conducted in the rural parts of Cameroun found that 44% of under-ten were prescribed antibiotics. This study was conducted in their primary health care facilities, where the leading indication of antibiotic prescription was still URTI (Chem et al., 2018). On the same continent, in Namibia, one study reported that 78% of patients treated for URTI were prescribed antibiotics. In that study, there was an association between antibiotic prescription with the age group under-five, and the differential diagnosis (Kunda & Haoses-Gorases, 2015). This reality of over-prescription is real in Kenya even though URTIs are caused mainly by viruses, and still, most patients are treated with antibiotics (Matu, 2014). One study conducted in some private healthcare clinics in Nairobi found that 94 % of patients were prescribed antibiotics and specifically for URTI, it was 97.3% (Kleczka et al., 2019).

2.3 Prevalence of Antibiotic Prescribing and Antimicrobial Resistance Review

Hundred million antibiotic prescriptions are issued in outpatient settings each year (McCaig et al., 2003). In various parts of the world, the prevalence varies. In Italy for example, 58% of under-fives with URTI were prescribed antibiotics and the lack of experience of the clinician was a significant determinant of more antibiotic prescription(Di Martino et al., 2017).In America, one study reported that around 50% of antibiotics prescribed in outpatient are inappropriate with no indication or inappropriate class and dose(Pichichero, 2002). This inappropriate or inadequate exposure of antimicrobials to antibiotics has been reported to be the single most important factor in the emergence of antimicrobial resistance(Baquero et al., 1998).

The occurrence and the global spread of new resistance mechanisms have a direct negative impact on the morbidity and mortality related to common infectious diseases.AMR will compromise the future of medicine if there will not be an effective antibiotic for patients undergoing chemotherapy, orthopaedic surgery, caesarian section, organ transplant. All these interventions will become high-risk procedures because of postoperative infections that will be difficult to treat. Therefore, AMR is fragilizing the success of the Millennium Development Goals (MGD) and making difficult the achievement of the Sustainable Development Goals (SDG). Itmeans that untreatable infectious diseases make good health and well-being nearly impossible (WHO, 2016).

Although AMR might developpe naturally through genetic adaptation of the bacteria, inappropriate usage of antibiotics in humans and animals is a significant contributor to the resistance.Resistants bacteria can spread from person to person and between humans and animals if there are no effective infection control measures (World Health Organization, 2016). Also, it is essential to note that apart from misuse and inadequate infection control

measures, the lack of strict regulations in the pharmaceutical sector is a real booster for AMR in most countries (World Health Organization, 2015).

AMR is a growing global issue and one of the greatest threats topublic health today. According to WHO, all countries are affected, and the cost of care for patients infected by resistant bacteria is higher in terms of resource allocation, morbidity, and mortality (World Health Organization, 2016). The appropriate use of antimicrobials can minimize the progress of AMR. However, a mixture of factors like fear, limited knowledge of clinicians, and the community has fueled inappropriate handling of antibiotics. Even in countries where antibiotics are issued by prescription only, patients' influence on doctors has been reported because some patients believe that antibiotics will treat viral infections.This reality was confirmed in a European survey that found that more than 50% of French respondents with viral-like URTI expected an antibiotic (Carlet et al., 2012).

2.4 Factors Influencing Antibiotic Prescription

Clinical distinction between viral and bacterial infection can be difficult in resource-limited settings where many facilities do not have the equipment or knowledgeable personnel to perform cultures to isolate specific bacteria and determine sensitivities to available AM (McKay et al., 2016a). In western countries, the fear of malpractice and negligence promotes inappropriate prescription of medications when the clinicians want to use every antimicrobial available to treat infectious diseases in critical settings. This lack of precision worsens the AMR in the community. (Howell et al. 2013).

Some medical systems encourage inappropriate prescription by rewarding clinicians depending on their prescription rate. This financial incentive was a reality in China until 2010. One study in Beijing children hospital, 98% of patients who had common cold were given an antibiotic prescription. (Howell et al., 2013). The principal of "prescription-only" is not real in

most health care systems where patients can access antibiotics in the local marketplaces without prescription. This self-medication is promoting the spread of AMR, even here in Kenya (Jacobs & Richtel, 2019). In India, for example, from 2005 to 2010, the sales of broad-spectrum antibiotics increased six-fold (Westley, 2012).

Moreover, there arealmost no practical restrictions to limit the prescription by clinicians. Beyond the written low, the enforcement does not exist on the ground. In some cases, health workers increase their benefit by selling antibiotics to their patients or by prescribing expensive antibiotics to insured patients. Antibiotic prescribing practices are influenced by medical training and other socio-cultural factors associated with antimicrobial awareness. (Laxminarayan & Heymann, 2012). Examining prescriptions of antibiotics for URTI is an acceptable strategy to assess the appropriateness of antibiotic prescribing, knowing that the vast majority of URTI are viral and antibiotics have no role in the management of URTI (Alves Galvão et al., 2016; Gonzales et al., 2001).

Despite treatment guidelines and other sources of information available to clinicians, there is evidence that clinicians'knowledge about indications of antibioticsis still limited.In one study reported by GARP Kenya, 73% of health care professionals thought that antibiotics might have antiviral properties to treat viral diarrhoea (World Health Organization, 2015; GARP Kenya 2011). In another study done in Asembo and Kibera in Kenya reported 52.5% and 20 % respectively, inappropriate antibiotic prescription in the management of diarrhoea (Rhee et al., 2019). The above study was in line with another one that was done in the rift valley, though inpatient setting but reported high inappropriate antibiotic use. Only 33.9% of the antibiotics prescription was considered indicated (Momanyi, 2017).

After a comprehensive search, there was no published study done in a rural outpatient setting that assessed the antibiotics prescription for URTI in paediatrics in Kenya and more so in Tharaka-Nithi County. All these facts make the researcher consider that it is crucial to know the prevalence and the determinants of the antibiotic prescriptions in URTI among under-fives, in outpatient settings in Tharaka-Nithi County.

2.5 Theoretical Framework for the Study

The Theory of Planned Behavior (TPB) will be used for this study**.** In TPB, a person's intention is influenced by three constructs that all interact with each other. These three constructs are the independent variables: attitude, subjective norm, and perceived behavioural control. The dependent variable is the intention to perform the behaviour.

Attitude is defined as the degree to which a person perceives the behaviour based on a favourable or unfavourable assessment of the behaviour (Ajzen, 1991). In our study, attitude was about the clinician's attitude towards antibiotic prescriptions, focusing primarily on those given for URTI.

A subjective norm is defined as any social influence that may determine if the individual performs or does not perform the behaviour (Ajzen, 1991). The subjective norm was about the clinician's perception of social pressure coming from patient family members, hospital administration, and other colleagues about the antibiotic prescriptions in general and specifically URTI. Perceived Behavioral control relates to how difficult or easy it is to prescribe antibiotics in URTI in a child less than five years old. Perceived Behavioral control has internal and external factors. Internal factors were the skills, knowledge of clinicians, and their previous training. External factors included protocols in the hospitals, national and international guidelines on antibiotic prescriptions in URTI. The intention, the dependent variable, is defined as "indications of how hard people are willing to try, of how much of an

effort they are planning to exert, to perform the behaviour"(Ajzen, 1991). In this study, it was about the reaction and the effort in the clinician's daily experience to fight against the direct or indirect pressure motivational factors.

Based on this theory of planned behaviour, for a clinician to develop the routine of prescribing antibiotics for URTI, there is an interconnection between what they know about the benefits of antibiotics in URTI management,the colleagues'attitude towardsantibiotic prescription for URTI management and the accessibility to antibiotics in the working environment. If all these factors are favourable to antibiotic prescription, the clinician might easily prescribe antibiotics for URTI.

This theoretical framework will guide best my study because, it considers the factors depending on the clinicians' view toward antibiotics prescription, factors (internal and external) influencing their antibiotics' prescription. These factors include the work environment, administration, patient family members, the place of hospital protocols, and guidelines.

2.6 Conceptual Framework

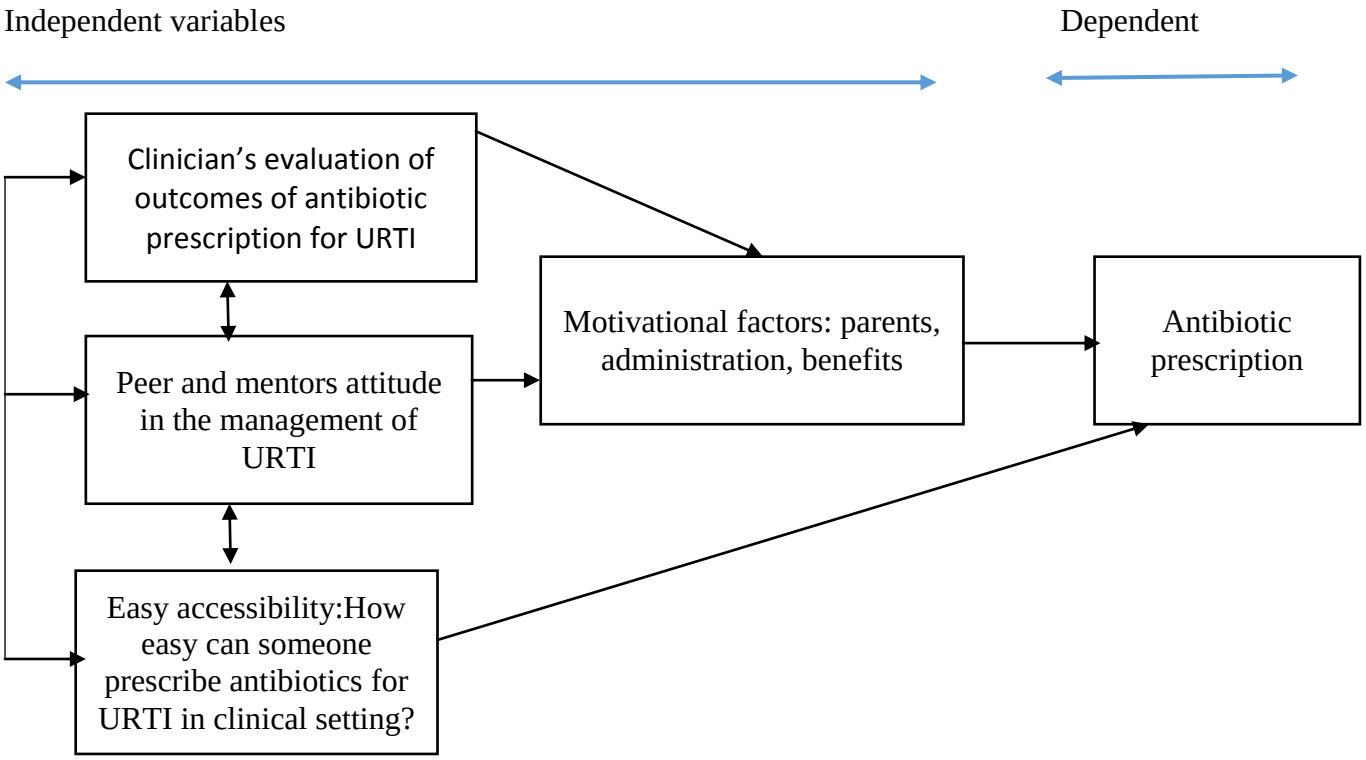

Figure 1: Conceptual framework of determinants of antibiotic prescription for URTI

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter presents the research design, the location of the study, the study population, the selection criteria, the sampling methods, and the sample size, the data collection procedure. It also contains the data analysis procedures and ethical considerations.

3.2 Research Design

This thesis lent itself an explanatory sequential mixed-method design. The first phase of the research was a retrospective cross-sectional studythat was followed by a qualitative exploratory study. The retrospective cross-sectional chart review was undertaken to determine the prevalence of antibiotic prescription for URTI in onefaith-based hospital and one public hospital from December 2018 to November 2019. The chart review included the demographic characteristics of the patients, their body temperature, the duration of clinical URTI symptoms, the treatment prescribed, and the level of education of the prescriber.

The second phase of the study includedthe qualitative exploratory study that entailedin-depth individual semi-structured interviews of Medical and Clinical Officers working in the pediatric outpatient clinic. This design was selectedbecause the researcher set to explore the lived experience of the clinicians when they are prescribing antibiotics for URTI in outpatient. Therefore, the mixed-method design in this study means that the findings from the quantitative phase informed the way the semi-structured interviews were conducted during the qualitative phase. The timeline for this study is described in Appendix VI.

3.3 Location of the Study

This study was conducted, in one faith-based facility, ChogoriaMission hospital and one publichospital, Chuka general. Both facilities are the main referral hospitals in Tharaka-Nithi County. The faith-basedhospital is a non-profit, mission hospital locatedabout 4 hours' drive from Nairobi on Meru-Nairobi Highway and the public hospital located 20 Km away from the faith-based facility.The estimated target population by the County health record for the two facilities isrespectively 33965 and 44486 for the public and the faith-based. The proportion of under-fives is 13.7% of the total target population. However, these two facilities are referral centres for a significant part of the County. They, therefore, could receive more than the estimated target population through referrals (Tharaka-Nithy County Health records,2018).

3.4 The Population of the Study

For the chart review, the target population was made of under-fives who were managed in the outpatient clinic of Chuka and Chogoria hospital for URTI from December 2018 to November 2019. Their medical records were reviewed retrospectively. The under-fives are a special group for WHO planning regarding the reduction of mortality and morbidity among children. They could be a group for which clinicians could be tempted to prescribe unnecessary antibiotics for fear of complications. Lower acute respiratory infections are the second cause of mortality in this specific age group after prematurity. For this reason, clinicians are more likely to prescribe antibiotics for URTI to prevent lower respiratory tract infections (WHO, 2017).

The target population for the qualitative phase of the study included COs and MOs working in the pediatric outpatient clinics in Chuka and Chogoria hospitals. In the two study sites,the MOs and COs are the primary care providers for evaluation and prescribing of antibiotics.

3.5 Sampling Procedure and Sample Size

3.5.1 Sampling Procedure

A systematic sampling method was used to select cases that fulfilled the inclusion criteria for the chart review. This method was selected because it is random and gives a chance for each chart to be selected.Since both hospitals were using the electronic medical record in their outpatient clinic, the researcher retrieved cases by diagnosis and filtered the outpatient clinics and the age group under-fives. This procedure displayed the cases per month for the entire study period. The random selection of cases following the pattern that is described in the section of the data collection procedure.

For the qualitative part of the study, a purposive sampling of experienced and fluent MOs and Cos working in the pediatric outpatient during the study period was used. The clinicians had to provide written consent.

3.5.2 Sample Size

The number of Medical officers and clinical officers who were interviewed was determined by saturation. Seventeen interviews were conducted, butthere was a total of 20 clinicians in both hospitals who were eligible for the interviews.Saturation was reached after the thirteenth interview, but the researcher continued up to 17 interviews to confirm themes. From previous studies with a purposive sampling method, the saturation was reached the first 12 interviews and the authors suggested that six interviews may be sufficient to developpe meaningful themes and significant interpretations (Guest, Bunce & Johnson, 2006).

For the chart review, the systematic sampling technique considered all the under-fives that were treated from December 2018 to November 2019in the pediatric outpatient clinics of both hospitals. Considering the average of 384 cases reported as URTI per month, 4600 was used

as the average population size for one year. This calculation is considering the law of unbiasedness of the average.

Using the formula and the table of Robert Krejcie and Daryle Morgan(Krejcie & Morgan, 1970), the calculated sample size was around 357 cases. However, 385 files were reviewed because of convenience.

$$s = X^2 NP(1-P) \div d^2(N-1) + X^2 P(1-P)$$

s = required sample size.

X^2 = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841).

N = the population size (4600 in our case)

P = the population proportion (assumed to be .50 since this would provide the maximum sample size).

d = the degree of accuracy expressed as a proportion (0.05)

3.5.3 Inclusion Criteria

For the quantitative phase of the study, aretrospectivechart review was conducted. It included a review of medical charts for all under-fives who were treated for URTI in outpatient, with or without antibiotics prescribed from December 2018 to November 2019. The operational definition of URTI is provided on page xiii. However, because of the coding bias that could mask inappropriate prescriptions, the diagnosis like tonsillitis and pharyngitis were specially filtered and included with the unspecified URTI (Martinez, Rood, & Rothberg, 2019).

For the qualitative phase, Medical Officers and Clinical officers working in the pediatric outpatient clinics in the Chogoria and Chuka hospitals during the study period were included

if they gave written consent. The clinicians included ought to have at least 1month experience in reviewing children in the outpatient clinic.

3.5.4 Exclusion Criteria

For the chart review, children with the following were excluded ;

i. Differential diagnosis of pneumonia or any other bacterial infection, bronchial asthma, malnutrition, children with swollen tender cervical lymph nodes, or HIV positive patients. Children with malnutrition and asthma were excluded because of possible confounders in the indication of antibiotic prescription. Cases of tonsillitis with a McIsaac score of more than 3 were excluded because of the increased possibility of bacterial aetiology.
ii. Children who got admitted from the outpatient clinic the date of the diagnosis of URTI were excluded as well because their prescriptions are mainly counted as an inpatient.

For the qualitative phase, all health care providers working in the casualty were excluded and those with less than one month experience. The clinicians who were on leave were also excluded.

3.6 Data Collection Instruments

For the chart review, the researcher extracted data from electronic medical records (EMRs) using the data collection tool(appendix II). Sanitas was the EMR in the faith-based facility and hms:85 in the public hospital. The two EMRs allowed to retrieve cases by age, diagnosis, and date of the clinic.

For the qualitative phase, the initial interview guide (appendix I) was developed based on a literature review of previews studies on antibiotic prescription in URTI(McKay et al., 2016a; O'Connor et al., 2018). Additionally, the guide was developed in consideration of the theory

of planned behaviour explained in chapter II(Ajzen, 1991). After the quantitative data analysis, the statistically significant findings informed some additions in the interview guide. Among the additions, thefollowing questions were included:"how does the physical address of patients affect your decision about prescribing an antibiotic?"."what is your experience withpatients who haveURTI and tonsillitis like symptoms?" "How confident do you feel about not prescribing an antibiotic for URTI?", "can you tell me what could be the difference in the way you prescribe antibiotics if you were not in a Public hospital (for clinicians working in public)"? The interview guide was then piloted.

3.6.1 Pilot Study

The findings from the quantitative phase led to the addition of some specific questions about antibiotic prescriptions in relationship to tonsillitis, patients' age, the physical address of the patient. After those changes to the initial interview guide, it was piloted for validation in Tigania and Meru with three MOs were interviewed. The pilot study led to an adjustment in the duration of the interviews, which was changed from 45minutes to 30 minutes. The reduction was because, by that 30 minutes, the interviews were effectively complete. Thepilot study was conducted in a similar setting similar to the one of the actual study. The other measures for validation are described in the data analysis section.

3.7 Data Collection Procedure

The cases corresponding to our inclusion criteria were filtered by diagnosis, age groups under-fives, and outpatient clinics. Then the systematic sampling method was used to select patients' files randomly. Before the selection of the files, they were grouped per month for better randomization. The principal investigator started by picking one chart number randomly. From there, every 12^{th} file was included up to when the sample size was reached. This interval was calculated using the total number of URTI cases retrieved divided by the

sample size (4600:384).In cases were the selected patients' file was incomplete, the researcher pickedthe next file from the same month. The collected data were filled in the data collection tool (Appendix II).

The demographic data regarding patients' physical address (close to the hospital versus far from the hospital), age (< 3years versus ≥3 years for tonsillitis cases and in five groups for other cases), and clinical findings like axillary temperature (< 38 versus ≥38) and duration of the disease (≤7 days versus >7 days) were grouped in categorical data. The definition of these ranges for the variables was mainly adopted from the information gotten from the 2006 American Academy of Family physician guidelines for the management of URTI in children (Wong, Blumberg, & Lowe, 2006) and the McIssac score for tonsillitis in children. The level of education of the prescriber was grouped into two categories which were clinical officer, medical officer. For the physical address, "near or far" from the hospital was defined by three clinicians working in outpatient with a public health officer in the sub-county. Living "near" corresponded to live within 10 km from the hospital where the patient was treated. Patients who came from towns/villages located beyond 10 km were considered to come from far(Jones et al., 1999; Nicholl et al., 2007).

For the qualitative phase of the study, the written consent (Appendix III) was sought from the respondents after getting permission from their respective hospital administrations. Once the permission was granted, the interviewees were approached by a face-to-face method and prepared two to three days before the interview. The interviews were conducted in English in a comfortable, secure office for the interviewees. The interviews were audio-recorded with the participants' consent. On top of the audio recording, the field notes were used as needed.The interviews were initially intended to last 45 minutes, but after the piloting of the tool, the duration was revised to 30 minutes maximum. During the interview, the validated

interview guide (Appendix I) that was used was open-ended. An expert transcribed the interviews in transcription, and the researcher reviewed the initial transcripts.

3.8 Data Analysis

All the quantitative data was cleaned and coded using Excel before being transferred and analyzed in the Statistical Package for SocialSciences (SPSS for Windows, version 24). Frequencies were run toidentify coding and data entry errors. Plausibility checks were carried out,and inconsistent data were compared with the original rawdata,and data were cleaned appropriately. The researcher coded all the data; hence inter-observer variation was avoided.

A preliminary investigation of the data was undertaken using the contingency frequencytables. Several Chi-square tests were undertaken to identify the association betweenpotential explanatory factors. These Chi-square tests were used to identify the associationbetween the antibiotic prescription and the demographic and the clinical factors.Also, Chi-square tests were used to find any significant difference between percentages of prescriptions in public and the faith-based hospitals, and the level of education of prescribers. The T-test was used to find out if the difference between the percentages of antibiotic prescriptions versus no antibiotic for URTI was statistically significant. Subsequently,binary logistic regression was run for significant variables to calculate their effect on antibiotic prescription—the confidence interval of 95%.

For the qualitative phase, the interviews were transcribed and analyzed using Nvivo12 following the steps of the thematic analysis of Braun and Clarke in 6 steps (Braun & Clarke, 2006).The researcher used the inductive thematic analysis, which gave him the possibility to code the data without trying to find the preexisting codes or the researcher's analytic preconceptions. The transcripts were analyzed to extract themes and sub-themes by the

principal investigator, and these themes were counter checked by one consultant from the faith-based hospital, CC.

3.9 Enhancing Rigour

The credibility of the findings from the interviews was enhanced by the use of the reflexivity of the researcher. A pre-understanding note was written before data collection, and a reflective journal was also written after each interview to help the researcher's reflection on the process. For each interview, each clinician was given enough time to add any supplementary information that they could have forgotten. The researcher reviewed the transcriptions for accuracy. Moreover, four clinicians reviewed their transcripts and the research findings to enhance credibility as suggested by COREQ guideline for reporting qualitative research (Tong et al., 2007).

The description of the data collection procedure and the decision trail used by the researcher point to the dependability of the data.To enhance validity, the themes were data-driven and not identified in advance. CC, one of the consultants in the faith-based hospital reviewed some transcripts, the themes, and the coding report from Nvivo12. He agreed with the themes and the sub-themes. Moreover, the findings were cross-checked by the two thesis supervisors who assessed the thematic analysis and the findings. This process was helpful for the trustworthiness and the quality of the findings.After data analysis, the audio recorder was locked in a secured cabinet that will be accessible to the principal researcher only. The transcribed answers are stored in a locked file for the next five years.

3.10 Ethical Considerations

All participants who voluntarily gave informed consent to the qualitative phase of the study signed the consent form (Appendix III) after reading the detailed participant information sheet (Appendix IV). Throughout the study, confidentiality and anonymity were maintained. No

identifiers of the participants or their respective hospitals were recorded, but identification numbers or initials of their names were assigned for data analysis purposes. Participants had the right to withdraw their consent at any point without their decision being considered negatively. Participants were not paid for their participation in the study. However, they were an option for snacks for refreshment after the interviews (appendix IV). For any readdress, participants were free to call the Kabarak IREC secretariat or the researcher at the contacts that were given in the appendixes (III and IV).

Since this study was not intending to interview guardians of the children and the children themselves, no consent or assent was sought from them. The ethical approval was sought from the Institutional Ethical Review Committee of Kabarak University, and a research permit was obtained from the National Commission for Science Technology and Innovation (NACOSTI). For data handling and dissemination, the data will be accessible to the principal researcher only. They will be locked in a secured cabinet for five years after the study before destruction.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1 Introduction

This chapter presents the findings, interpretations, and discussions according to the research objectives. The objectives of this study were two-fold: to determine the prevalence of antibiotic prescription for URTI among under-fives in Tharaka-Nithi County and to examine the factors influencing these antibiotic prescriptions.

4.2 Demographic Information

Table 1: Demographic Characteristics of the Under- Fives(N=385)

		N	%
Age (months)	0-11	66	17.1
	12-23	127	32.9
	24-35	92	23.8
	36-47	47	12.2
	48-58	53	13.7
Gender	Male	237	61.6
	Female	148	38.4
Proximity to hospital*	Close to the hospital	252	65.5
	Far from the hospital	133	34.5
Hospital type	Faith-based(Mission)	232	60.2
	Public	153	39.8

*Living in thewithin10 km from the hospital

Most patients were under 36 months of age (<3 years of age), and three-fifths of them were male. Two third of all URTI cases were living within 10 km from the respective hospital.

For Qualitative Data

Seventeen clinicians were interviewed: five Medical Officers (MOs,) and twelve Clinical Officers (COs) (Table 2). Of the seventeen, the majority (11) were female clinicians. The

duration of their experience in the management of under-fives ranged from 2 months to 34 years. The median time of experience was 3years and an interquartile range of 4.43 years. The first quartile 0.66 years, and the third quartile 5years of experience.

Table 2: Demographic Data of Clinicians

Number	Code	Gender	Clinician cadre	Duration of practice (year)	Mission/Public facility
1.	KT	M	MO	4	Mission
2.	MMM	F	CO	0.7	Mission
3.	VK	M	MO	0.3	Mission
4.	KM	M	CO	1.5	Mission
5.	MNM	F	MO	0.2	Mission
6.	SV	F	MO	0.3	Mission
7.	MMN	F	CO	0.7	Mission
8.	DGB	F	CO	2	Mission
9.	MKM	F	CO	3	Public
10.	EK	M	MO	6	Mission
11.	JM	F	CO	2	Mission
12.	FGCAL	F	CO	3	Mission
13.	BKM	F	CO	3	Public
14.	PM	F	CO	5	Public
15.	CMM	M	CO	15	Public
16.	NG	M	CO	34	Public
17.	GK	F	CO	5	Public

4.3 Prevalence of Antibiotic Prescription for Upper Respiratory Tract Infection

Table 3: Proportion of Antibiotic Prescription for URTI among Under-Fives

Variable		**With antibiotics n (%)**	**No antibiotics n (%)**	**p-value**
Treatment for URTI		271 (70.4)	114(29.6)	0.00
Diagnosis	Tonsillitis in URTI	59 (96.7)	2 (3.2)	0.00
	URTI without tonsillitis	212(65.4)	112 (34.6)	
Duration of symptoms	<7 days	219 (70.1)	93 (29.9)	0.68
	>7 days	8 (61.5)	5 (38.5)	
	Not reported	44 (73.3)	16 (26.7)	
Body temperature	No fever (<38C)	125(65.8)	65 (34.2)	0.33
	Fever(≥38)	21(75)	7 (25)	

The prevalence of antibiotic prescription for URTI was 70.4%. Considering only patients who had URTI with signs of tonsillitis, the prevalence was even higher, 96.7%. This percentage was significantly elevated compared to 65.4% of antibiotics prescribed for patients who had URTI without signs and symptoms of tonsillitis (p-value 0 .00). Most patients had symptoms for less than seven days. However, the duration of symptoms was not associated with antibiotic prescriptions. For the cases where the temperature was reported, 87% had no fever, and there was no significant difference in antibiotic prescribing for patients with fever and those with no fever (75% versus 65.7%, p: 0.33).

Tonsillitis and the Modified Centor score (McIsaac score) Elements

Table 4: Tonsillitis and McIsaac Score

		Age		Total cases
		<3 years	≥3 years	
Temperature	<38	30	16	46
	≥38	10	5	15
Total tonsillitis cases		40 (65%)	21 (35%)	61

Forty patients out of the 61 (65.5%) with tonsillitis were under-three (low risk of bacterial tonsillitis and therefore note eligible for the McIsaac score). Of the remaining 35% that qualified for the McIsaac score, 5 (8% of the 61 cases) had a score of 3 (age=1, fever=1, and inflamed tonsils=1) that could warrant a throat swab and a consideration of antibiotic, not a routine antibiotic prescription.

Determinants of antibiotic prescription

Table 5: Binary Logistic Regression Analysis for Potential Determinants of Antibiotic Prescription

Variables	**(Antibiotic Rx%)**	**Exp(B)**	**lower**	**Upper**	**Sig**
Facility	Public (77.1%)	1.74	1.09	2.77	.019
	Faith-based (65.9%)				
Patients' Age (year)	<3 (68.7%)	1.36	.81	2.28	.24
	≥3 (75%)				
Patients'Gender	Male (70.5%)	.98	.62	1.54	.96
	Female (70.3%)				
Proximity to the Hospital	Near the hospital (74.6%)	1.77	1.12	2.77	0.01
	Far from the hosp (62.4%)				
Diagnosis	URTI with tonsillitis (96.7%)	21.2	4.52	99.33	0.00
	URTI without tonsillitis (65.4%)				
Clinician cadre	CO (77.5%)	15.9	6.98	36.2	0.00
	MO(23.5%)				

The odds of being prescribed an antibiotic for URTI were1.74(95%CI 1.09-2.77) times higher in the public facility compared to the faith-based facility. The age of the patients and their gender did not influence the odds of antibiotic prescription. However, the proximity to the hospital increased the odds of being prescribed an antibiotic. OR 1.77(95%CI 1.22-2.77). Also, for patients with tonsillitis, the odds of antibiotic prescription were high, OR 21(95%CI 4.52-99.3), and lastly,clinical officers were more likely to prescribe an antibiotic compared to medical officers, OR 15.9(95%CI 6.98-36.2).

4.4 Qualitative Findings

Factors influencing antibiotic prescription for URTI

Table 6: Themes and Sub-themes from the Interviews

	Themes	**Sub-themes**
1	Access to antibiotics	- Premedication - The presence of another prescriber - Working environment
2	Clinicians training and competence	- Limited clinical knowledge - Ineffective Communication - Guidelines and Undergraduate training
3	Clinical confidence	- Clinical uncertainty and Fear of a negative outcome - Unwarranted laboratory Investigations
4	Clinical findings	- Presence of Fever - Inflamed tonsils
5	Socio-demographic factors	- Age - Proximity to the hospital - Free health care services for under-fives
6	Parents' pressure for an antibiotic prescription	
7.	Workload in the outpatient clinic	

4.4.1. Access to Antibiotics

Premedication

All clinicians reported having managed children who come in after having already been treated with antibiotics for 1 to 3 days. Qualified clinicians did not prescribe most of these antibiotics; instead, antibiotics were acquired over the counter by the administering parents. The children were brought to the hospital because there was no clinical improvement after the course of the antibiotics. All clinicians reported feeling powerless or not confident enough to discontinue the antibiotic that the child had been on, even if it was for one day only. The clinicians reported said that premedication is a challenging situation to be in, and it felt safer for them to let the patient continue with the r antibiotic they were already taking. One clinician reported:

> *"some of them (parents) will tell you that the child has taken Amoxil for two days, and the challenge is to stop it or continue. Most of the times we say: if you are on it just continue with it" KT*

The fear of interrupting the dose of antibiotic was linked to the fear of contributing to antimicrobial resistance even when it was clear that the antibiotic was not indicated in the first place. Some clinicians made it clear to patients that they had to complete the course of antibiotics. One clinician reported:

> *"They (patients) have to continue and finish the course of antibiotics, but we don't change the antibiotic. Maybe I will just add something on top to relieve the symptoms. Maybe an antihistamine, antipyretic to ease the symptoms. But usually, we advocate for them to finish the course if they have already started." CMM*

On the other hand, some clinicians thought that they could not discontinue the antibiotic because whoever prescribed the antibiotic could have had a clinical indication for the

antibiotic prescription in regards to the initial presentation of the patient. They had to "trust" and encourage the continuation of the antibiotic. This"trust" was linked to uncertainty in the diagnosis and fear of a negative outcome. One reported:

> *"They (patients) have to finish the course of the antibiotic because we hadn't met them before the antibiotic was started. We don't know how the initial clinical presentation was and why the firstclinician decided to put them on antibiotics." MKM*

Some of the clinicians went even further to prescribe what they considered to be a "stronger" antibiotic if the patient did not improve after taking Amoxicillin for a few days. This practice was happening for patients who had a diagnosis of URTI. It was linked to uncertainty and some concerns about the natural history of URTI in some patients. Clinicians reported:

> *"But if they(patients) have taken the antibiotics for four days,you can consider changing the drug they are taking, or you take the history again and examine." EN*
>
> *"sometimes I feel like…since they've been on Amoxicillin, I will just give theman antibiotic and this time around it might be Augmentin because they have been on amoxicillin" KT*

Clinicians reported that in some cases when a patient is already on an antibiotic, the tendency is to do some laboratory investigations for them to argue to discontinue the antibiotic. However, most clinicians considered these investigations to be unnecessary because the result rarely changes their decision. In most cases, the patient will be asked to continue with the antibiotic despite the normal result of the laboratory test. One experienced clinical officer in a public hospital reported:

> *"Other patients come with the temperature of 38oC, so you end up sending them for investigations because they've been treated in peripheral facilities with no*

improvement. They arrive in our facility with septrin, Amoxicillin, etc. Despite them not having pneumonia you may extend their antibiotics" .PM

The presence of another prescriber

It was evident interviewing the clinicians that they prescribed antibiotics because, from their conversation and assessment of the guardians' understanding regarding the role of antibiotics in URTI, the clinicians felt that if they did not prescribe the antibiotics, the guardian would acquire the antibiotics from other sources. One clinical officer in the mission hospital indicated:

"You just give to the parent Augmentin because you know if you don't do that he will go and get the Augmentin from outside or he will come tomorrow and request for it." KM

The clinicians feared that the other sources of antibiotics might not have the right indication, the right medication, or the right dose for the weight of the child.

The idea of looking for another prescriber by the parents did not happen only when the clinician declined to prescribe antibiotics; it could happen even when the clinician has prescribed an antibiotic that does not meet the parent's expectation. For example, one clinician in a public hospital prescribed unnecessary Amoxicillin, but the "knowledgeable" parent wanted a "stronger" antibiotic. After explaining the rationale behind the choice of the antibiotic, the clinician felt like the parent would still look for what he wanted elsewhere. Here is what he reported:

"You might prescribe the Amoxicillin that won't be used. So instead of coming back to you, the mother of the sick child will go over the counter to buy the drug she wants and gives it to the child. So when the child worsens, they will bring them back to the

hospital but the good thing they will explain that the drug that you prescribed was not given to the child since they bought another one" .PM

The comments of one clinician further supported the notion of guardians seeking other sources of antibiotics out of the hospital:

"You tell parents that it's a URTI, it's viral, and they don't need antibiotics. They would leave feeling unsatisfied and even if they seem to agree with you that the child just needs nasal drops and Ibuprofen,some of them probably go and self-diagnose and go buy an over the counter Amoxicillin or go to another facility for the antibiotics". SV

One clinician in the mission hospital thought that ordering a full hemogram would help to convince the mother not to give the antibiotic to the child. Unfortunately, that did not seem to be convincing. Here is what he reported:

"You may do a full hemogram and you find it is normal then you reassure the mother. But the mother goes home unsatisfied because you haven't given them the antibiotics. So they go and buy" EK

Knowing that the patient could access antibiotics out of the hospital contributed to unnecessary prescriptions of antibiotics in both mission and public hospitals.

Working environment

The core role of clinicians in the hospital setting is to manage patients, including appropriately prescribing antibiotics. According to the participating clinicians, the hospital environment did not have enough restrictions to prevent unnecessary antibiotic prescriptions if they were pushed to prescribe for any other inappropriate indication. One clinical officer in the mission hospital suggested :

"In the current setting, it is so easy to prescribe because there is no one who is after you. If you don't care much about the harm you are causing it would be so easy since

no one follows up prescriptions, no one asks questions about how do you do this or that, but I think it would be better if there were some regulations". MKM

One clinician was of the notion that in some URTI cases, the hospitals' administration did not discourage some inappropriate antibiotic prescriptions. For that clinician, the administration's attitudeconsiders the customersto be right if they complain. Here is what the clinician reported:

"For the patients around, it's hard to convince them if a child comes with the hotness of the body. They tell you it is not malaria they have to get an antibiotic. Unfortunately for us if you don't do that they just go to the administration and complain… When you are called to explain, you just give your side of the story, but at the end of the day the patient is right". JM

The lack of standards operating procedures (SOPs) and antibiotic stewardship programs in health facilities seemed like an ingredient for inappropriate antibiotic prescribing. The clinicians did not feel empowered to refuse parents' requests. This lack of SOPs has given some patients the boldness to request for antibiotics, to expect antibiotics, and to complain if they don't receive antibiotics. One clinician in the public hospital reported:

"When they (parents) go to the hospitals' pharmacy, they know the drugs they want to see. If there is no amoxicillin that they are used to, they will start complaining to the pharmacist. The pharmacist will tell them to go back to the doctor and ask them to prescribe the ones you want, and they come back. Someone will ask you if you have denied them the drugs because they are not paying for them. The client will tell you that if you want to charge them, they have money and they can pay. Now you wonder what to tell this client". EN

The "freedom" to prescribe antibiotics in the outpatient clinics seemed to be linked to the lack of regulation. This freedom was expressed by one medical officer who recognized that despite

not having an effective antibiotic stewardship program, the presence of a consultant who was rigorous in matters of antibiotic prescription, made her do the right thing while in the clinic:

> *"So I will say this: I also feel like at a different time in a different place I would probably have prescribed antibiotics. But now with Dr X, who was very strict on antibiotic prescriptions, I cannot. But like as I said, the only reason we are not giving a lot of antibiotics is because of the strict rules I found in place from Dr X". MNM*

Generally, clinicians reported that there were no external or systemic barriers to inappropriate antibiotic prescription in both the mission and the public hospitals. Most clinicians knew that it was inappropriate to prescribe antibiotics for URTIs, but they needed restrictions on top of the knowledge to do the right thing.

4.4.2. Clinicians Training and Competence

Limited clinical knowledge

The interview revealed that there was a lack of basic medical knowledge about URTI among the clinicians. Some issues identified regarding URTI among the clinicians included the lack of awareness of the aetiology of most of the URTI, endorsement of antibiotics as part of URTI. Also, conducting some laboratory investigations to rule out a disease like malaria in a patient with purely URTI symptoms in a region with rare to no cases of malaria. One clinical officer reported this about the aetiology of URTI and the possible role of antibiotics:

> *"According to me, you know they (URTI) are nosocomial infection. There are other bacteria that we do acquire from the environment. Hence, when I give an antibiotic, I give that antibiotic hoping that it will target a certain microorganism so that the child can do well and they do". KM*

The inaccurate knowledge of URTI management requiring, for example, unnecessary laboratory investigations were attributed to training received, or personal clinical experience.

Indications for antibiotics prescription for URTI varied among the clinicians. One clinician suggested that antibiotics are effective for febrile URTI when evidence indicates that even a febrile URTI can be self-limiting without antibiotics. This finding was exemplified by one clinician, indicating :

> *"I had a two years old patient, and his mother brought him with the hotness of body, cough, and nasal blockage. He had not taken any medicines.We did some investigations like full haemogram and blood smear (BS) for malaria. The full haemogram was normal, and BS for malaria was negative. We gave some azithromycin suspension 5mg OD, paracetamol 5ml TDS for three days, and some saline nasal drops. So now after the 4th days, the mother told me that the nasal blockage had subsided, but the fever was still on and off, so I thought of giving high dose amoxicillin, and the following day the kid was okay". KM*

The clinician attributed the clinical improvement of the child to the high dose of amoxicillin and not to the possible natural resolution of a viral infection.

In other circumstances, one clinician reported the risk of contracting a bacterial URTI through unclean breastfeeding procedures. Therefore there was an indication for an antibiotic prescription. The clinician indicated that breastfeeding children required antibiotics to "cover" them in the event of any infections. The response exemplified this:

> *"What I consider sometimes is breastfeeding.Sometimesmaybe the baby introduces bacteria through breast milk; so it's better to cover them up with antibiotics instead of passive observation". DGB*

Other indications for antibiotics for URTI reported by the clinicians included physical symptoms such as whitish or yellowish nasal discharge as a sign of bacterial infection in

febrile patients. They, according to the clinicians, maybe at a high risk of having bacteria infection.

Ineffective communication

Most clinicians expressed challenges in their communication with guardians about the contraindication of antibiotics in URTI. These challenges were manifested by the use of medical jargon, language barriers, lack of time for feedback from parents, or poor listening skills by clinicians. Some clinicians felt like they lack what it takes to convince parents. In these cases, clinicians were aware of the inappropriateness of the antibiotic prescription, but despite the clinical knowledge they prescribed. One clinician in the public hospital reported:

> *"In despite the effort of counselling them (parents) you find yourself in a fix and you are giving them an antibiotic of which it was not your wish as per the guideline".PM*

On the other hand, some clinicians had language barriers in their communication with the patient. These barriers were expressed by the use of medical jargon without equivalent in the patients' language. Here is what one clinician expressed from his experience in communicating with patients:

> *"Most of them (patients) don't understand the English that we use. They understandthe vernacular language that does not have some medical word equivalent. Still, we usually tell them that the common cold will resolve on its own, so they don't need antibiotics… Okay, we try to explain to them but even if they go you feel like they have left unsatisfied". CMM*

According to clinicians, the unsatisfied patients were the ones who were more likely to go out and look for antibiotics elsewhere. Because of this unsatisfaction, it was clear that challenges ineffective communication could lead to inappropriate antibiotic prescriptions. Another clinician learned from her experience that emphasizing the adverse effects of the medication

has been a successful communication strategy to discourage parents from expecting antibiotics. The clinician expressed it like this:

> *"You can tell the mother that drugs will kill the child's cells, though you know it won't.But you just counsel and tell her more of the negative things about the antibiotics, the disadvantage of it more than the advantage of it". GK*

The emphasis on the adverse effect of antibiotics might not have a longterm benefit as the clinicians recognized. However, for lack of better communication tools, exaggerations have been used. Another clinician in the faith-based hospital used a similar strategy to explain the antimicrobial resistance concept and put it this way:

> *"Yeah. I think they are scared (when talking about side effects and AMR) because if you tell them (parents)that if their childcomes in the future when they are truly sick, they won't get cured by antibiotics because they have used themseveral times inappropriately". MNM*

For some clinicians who felt like they were able to convince parents, they did not feel like every day, the time would allow for effective communication. Therefore, some days, antibiotic prescriptions was a shortcut. It meant that effective communication skills in a limited duration of time were lacking. One MO in the mission hospital expressed it this way:

> *"From my experience some days you will be so busy. You might explain, but youwon't have time to make the mother understands and be comfortable with the information you are giving her". SV*

On the other hand, some clinicians have decided to give up when it comes to educatingparents about antibiotic use for URTI. Most of them stated this:

> *"I just give (an antibiotic prescription) becauseshe (the mother) has insisted although I have tried to explain to her, she is not keen on what am explaining" DGB*

"I tell them: since it's your baby, what you want shall be done. If that's what will give you peace". JM

"At the end of the day, I keep on saying that if you feellike my opinion is not good enough, you are entitled to a second opinion". MNM

Guidelines and medical training

All clinicians reported that their decision to prescribe antibiotics or otherwise was based on medical knowledge or experience. In terms of URTI management guidelines and protocols, the interview established that a number of the clinicians expressed the lack of clear instructions for the management of URTI. According to the clinicians, the existing Basic Paediatric Protocol in Kenya did not have clear guidance for the management of URTI despite having a clear guide for the management of pneumonia and other respiratory diseases such as asthma and tuberculosis.

Some clinicians reported that despite their awareness of the recommended WHO guidelines, Integrated management of childhood illness (IMCI) on URTI management, their practice on the ground went against the guidelines. One clinician in the public hospital reported:

"We were trained with IMCI, but it seems as if this thing is being forgotten in practice. I'm seeing we are going out of it. We've forgotten about it." NG

On the other hand, one clinician felt like national or international guidelines might not be followed if there are no "in-house" regulations or endorsement of the guideline in their hospital. The clinician reported:

"Despite having the guidelines, we need to have in-house regulations because most of the time if you doubt about the diagnosis or the treatment, there is nowhere (document) to consult. So I feel like if we had some internal guidelines, it would be of much help". MKM

The vast majority of clinicians knew from different guidelines that they should not routinely prescribe antibiotics for URTI management. However, they ignored the guidelines on the ground for clinical and non-clinical argument. One clinicianreported:

> *"For the management of URTI, we normally use the Kenyan guidelines or the WHO, which suggests thatpatients who come with URTI don't need to be given antibiotics. But sometimes, based on the clinical assessment, you still disregard the guidelines and give antibiotics". EK*

Another clinician argued that patients' satisfaction might conflict with the guideline and reported:

> *"The guidelines are clear, but at times, you find that the patient will not be satisfied." EN*

4.4.3. Clinical Confidence

Clinical uncertainty and fear of a negative outcome

Three-quarter of the clinicians expressed some level of clinical uncertainty that led them to prescribe antibiotics for URTI. The uncertainty was expressed in areas such as physical exam findings, history of the disease, or laboratory findings. This clinical uncertainty led to unnecessary laboratory investigations and inappropriate antibiotic prescriptions. One MO in mission hospital suggested :

> *"For cases where we have a prolonged cough of more than one week, but when you still auscultate the chest is clear, I might still do an ESR and a chest x-ray. Most of the time, you decide to over-treat instead of undertreating despite the normal findings". VK*

In some cases where the clinician did not have a definite diagnosis, the clinicians considered that a five days course of antibiotics would not hurt. These prescriptions provided

psychological relief to clinicians when they were not sure about what they should do. One clinician justified the action :

"Sometimes the mum says that the fever has been so serious. Those are moments that I feel like giving antibiotics to this kid won't hurt! I have found myself giving antibiotics because I considered that amoxicillin wouldn't hurt, yeah!" KT

The fear of negative outcome fueled the decision for the clinician to prescribe antibiotics in some of the URTI cases. These decisions were are not evidence-based, but they seemed to dictate the practice. For example, one clinician explained the practice that:

"There is what we call the presumed outcomes. Because of that, you don't want to send them home, and then they come two days later with severe pneumonia. So sometimes you start them on antibiotics. Yes, you know they should not be given this because it's self-limiting, but you give them antibiotics and assume that it might worsen when they go home". EK.

Clinicians expressed their fear and concerns about the risk of disease progression to severe pneumonia. In contrast, the clinicians were well aware that, like most viral infections, URTIs can worsen during the first week of the disease progress. However, this fear seemed to obscure their clinical judgment and led them to prescribe antibiotics inappropriately.The clinicians rationalized the fear of adverse outcomes and the decision to prescribe antibiotics as a method to helpthe patients and the clinicians' peace of mind. Some clinicians used the term "to cover" to express the indication of the antibiotic prescription, which is for prophylaxis purposes.

Unwarranted laboratory investigation

Some clinicians knew the benefit of C- reactive protein and a throat swab to establish the difference between viral and bacterial aetiology. However, those tests were not available in

the facilities. Because of that, some clinicians thought that a normal full hemogram could help rule-in the viral aetiology. Therefore, they ordered a full hemogram, and for those who had a "slight" elevation of WBC, the clinicians felt confused by the non-specific results. This confusion led to more doubt and consequently, to antibiotic prescription.

One of the clinicians reported:

"Every time I have done a full hemogram for these patients, the white cell count (WBC) is within the normal range or slightly elevated, but the lymphocytes are like 70-80%. That makes me feel like it's most likely viral, which is confirming what I already thought. But for some cases, it can be confusing". MNM

The fact that slight elevation of WBC in some cases with lymphocytosis can happen in URTI, some clinicians thought of prescribing antibiotics after having some confusing laboratory investigations. One clinician suggested:

"Since the child was febrile, I just needed to do a full hemogram.With non-specific findings, I treated symptomatically whereby I just gave azithromycin syrup 5 ml, for the dry cough, I gave cetrizine, and in case of any congestion I just gave saline drops. Yeah". DGB

4.4.4. Clinical Findings and Antibiotic Threshold

Tonsillitis and pharyngitis

Clinicians who were asked about their approach in the management of patients who presented with sore throat with inflamed tonsils as part of URTI symptoms said that antibiotics should not miss in the treatment. Most of them considered a bacterial aetiology and concluded that an antibiotic might be useful. One senior clinical officer in the public hospital commented:

"Sore throat responds well to antibiotics. Formerly we used to give an injection of Penicillin. These days we do orals. So oral antibiotics work especially azithromycin.

It (sore throat) responds very well because that bacteria which causes sore throat is a streptococcus". NG

Another clinician advocated for a stat dose ofintravenous ceftriaxone if possible, in line with the guideline on the treatment of bacterial tonsillitis. However, in practice, this was generalized to almost all acute tonsillitis cases with any reported hotness of the body.

The suspicion of acute tonsillitis and pharyngitis was considered a single clinical finding that could change the treatment plan to include antibiotics. One experienced clinician argued :

"For pharyngitis, I change the antibiotic, and I give a stronger antibiotic. Maybe amoxicillin-clavulanic acid combination or if we have azithromycin we do that". CMM

Presence of fever

Like tonsillitis, fever was another clinical finding that determined the decision on an antibiotic prescription for URTI both in public and the mission hospital. In cases where the fever was associated with tonsillitis, antibiotics were prescribed. The antibiotic was prescribeddespite the knowledge that patients with viral URTI and acute viral tonsillitis or pharyngitis could also be febrile.For almost all the clinicians,there was a notion that the presence of viral-like symptoms with fever was a clear indication to prescribe antibiotics as well as to conduct unwarranted laboratory investigations. Two clinicians argued :

"If it's cough, you can soothe the throat with something else, but if there's fever you have to give antibiotics". GK

"A child with a temperature from 38.0 (degree Celsius) and above, I do a full hemogram first I check the white blood cells. Despite them being high or normal, I will just give an antibiotic." DG

4.4.5 Socio-demographic Factors

Patients' age and antibiotic prescription

More than a third of clinicians considered that younger patients' immunity was e immature, hence such a group of patients would benefit from the antibiotic "coverage" for URTI. One clinician indicated:

> *"Age is something that determines because a newborn baby from the hospital comes with the cough and let's say hotness of body, you know this child's immunity isn't as strong as the one who is five years. you will tend to cover him with antibiotics because his immunity is low" KM*

Furthermore, some clinicians considered antibiotic prescription for URTI in younger children for prophylaxis purposes; to prevent disease progression and revisit to the hospital:

"Yeah because six months even if it is just nasal blockage and the temperature is high personally, I have to give an antibiotic also, not just to treat the nasal blockage but to ensure that they (patients) don't come back. Because what happens,I have seen through my experience this young one below six months start with nasal blockage after two days the child is coughing." NG

Proximity to the hospital

Half of the clinicians considered the physical address of the patient influences the clinical decision of whether they would prescribe an antibiotic for URTI or not. Patients who lived far were more likely to get an antibiotic prescription than those who lived close. The clinicians believed that patients who lived far from the hospital were less likely to come back to the hospital if they needed an urgent review. One experienced clinician in the public hospital claimed :

"Yes, we will tend to give those living far antibiotics than the one living near because, by the time they access the hospital, that distance might be too long for them, so you tend to give them". PM

The argument of living far was stronger when it was combined with the clinicians' uncertainty and feelings. One clinician reported:

"Because for a mother who is coming from far, you feel that there will be challenges for a review, yeah we also tend to give an antibiotic. Just in case they are unable to come back in time and maybe the condition worsens they'll be on the safe side."NG

Free health care services

The leeway for patients to come back to the hospital more than one time in the course of one URTI episode provided a push for clinicians to prescribe antibiotics. The return visits were associated with the free outpatient services for under-five in the governmental hospital. One senior clinician commented that before the outpatient service was waived, revisits by patients were minimal and were 'genuine':

"Initially, before the consultation became free, the trend was different. The number of revisits was minimal and genuine revisits if I may call them that way. Nowadays things have changed. You know, if a patient presents with similar symptoms three days after the initial treatment, you are forced, or you feel you should give an antibiotic." CMM

Such revisits sometimes would happen on the same day in a public hospital because the team in the evening is different from the day time team. The patient would prefer to come back for the free antibiotic if the clinician during the day did not find an indication for an antibiotic prescription. For example, one clinician suggested that:

"Let's say I'm on night duty and I have reported at around 6 pm. I'll find the number of kids I see around 40% were seen during the day time the same day. Maybe an

antibiotic wasn't given. They are back hours later because they know already that there's a different clinician. They tend to abuse the system if I may put it that way" CMM.

On the other hand, in the mission hospital, the health care service is not free. Still, the National Health insurance fund (NHIF) gave the possibility of an admission for parents who insisted on being prescribed antibiotics while the clinician was not convinced. The admission of short duration was considered safer than inappropriate prescription by one clinician:

"For those who have the NHIF cover, I think it's cheaper to admit than to send them (patients) home on antibiotics that they didn't require. I think it's easier for admission and it is more protective for the kid." MKM

This reality of admission instead of prescription was not found to be feasible in the public hospital because of the lack of NHIF for most patients.

"It is easier to prescribe and observe than to admit. Because for our county, most of the people that we are dealing with are the ones experiencing extreme poverty. So if you tell them about admission, the guardian or the parent doesn't have NHIF, so you'll find that they won't afford to pay the hospital bill, so they prefer to go home and come back."EN

4.4.6 Parents' Pressure for an Antibiotic Prescription

Almost all clinicians considered that the role of the parents/guardian in the prescription of antibiotics was critical. Every day, clinicians treat children of parents who are not aware of the appropriate prescription of antibiotics and who expect an antibiotic in case of URTI. However, sometimes, clinicians assumed that parents wanted antibiotics for their children, or else they will not be satisfied. The pressure from parents for antibiotic prescription was

evident when the clinicians did not show confidence and effective communication skills while managing the child, with one clinician reporting :

> *"They (parents) tell you: 'doctor I'm not going home until you prescribe some medicine. there are even some patients who are treated down there (in MCH), and they come here claiming that the other doctor has not treated them well since he/she has not prescribed the antibiotic" PM*

Most clinicians thought that parents/guardians were more satisfied with antibiotic prescription than with understandable explanation as indicated :

> *"When I give them antibiotics, they are more satisfied. The first thing they think their child is sick so giving them an antibiotic will make them realize that you are doing something" DGB*

Interestingly, clinicians acknowledged the contraindication of antibiotic prescription for URTI for children; instead, they rationalized their approach to prescribing an antibiotic as a positive way of dealing with parents of a sick child. For example, one clinician commented:

> *"Yes, you find yourself prescribing because there is that aspect of the mother, you must treat the psychology of the mother." BKM*

On the other hand, some clinicians considered that a few percentages of parents get satisfied with explanations without prescription. But for this small group, the clinicians had to explain and to give follow up plans to the parents.

Some clinicians considered that the informed parents often labelled as "Google parents" were more aggressive to ask for antibiotics based on their limited knowledge, compared to the less informed parents.

4.4.7 Workload in the Outpatient Clinic

The number of patients that the clinicians have to see per day seems to be another determinant of antibiotic prescription. However, this depends on many other factors, such as parents' understanding and attitude in the clinic.

One clinician believed that for some patients, it is a matter of time to give them the right information for them to understand. However, the workload does not offer that time for every patient when the queue of patients waiting is long. The clinician reported:

> *"Already you know that they want an antibiotic so if you were to change their minds you would take a lot of time while you have many patients who are waiting to be seen" JM*

After a long busy day, it seemed like clinicians could lose interest in patients' education because of intellectual and physical fatigue. One medical officer gave this example:

> *" After you have spent like the whole day in the clinic telling people how it's a viral ` infection and that they don't need antibiotics; after several hours of being given "bad eyes", you decide to prescribe for that one patient who is very unsatisfied" SV*

4.5 Discussion

In this section, the prevalence and determinants will be discussed by highlighting the main findings of this study.The purpose of this study was to examine the prevalence and the determinants of antibiotic prescriptions for URTI in under-fives in outpatient clinics in Tharaka-Nithi County.

4.5.1 Prevalence of Antibiotic Prescription for URTI

Overall, this study found that the prevalence of antibiotic prescription for URTI in the outpatient clinic was high at 70.4%, compared to reported WHO figures of 30%(Ofori-

Asenso et al., 2016), and 20% of the European surveillance network(Williams et al., 2018). The high prevalence was associated with the level of education of the prescriber, proximity to the hospital, public facility, and the diagnosis of tonsillitis. Furthermore, clinicians revealed other potential determinants like easy access to antibiotics, ineffective communication with guardians, workload, and parents' pressure.

The high percentage of antibiotic prescriptions in this study was slightly lower than previous studies conducted in the slamsettings of Nairobi, Kenya, and Namibia. In 2019, a study conducted in nine private primary healthcare clinics in Nairobi reported a prevalence of antibiotic prescription for URTI of 97.3% (Kleczka et al., 2019) with another second study conducted in four not-for-profit outreach clinics reporting a high antibiotic prescription prevalence of 79.7% (Mekuria et al., 2019). Similarly, another study in Namibia found similar results with up to 78% of URTI patients being managed with an antibiotic in a public health centre. However, for that study, the author included adults in the analysis (Kunda et al., 2015).

The findings of high prevalence in the group of private clinics could be explained by the financial incentive in the private sector, as Mekuria et al. reported. The current study was conducted at a mission and a public hospital, where prescription incentives might be non-monetary and which might explain the slightly lower prevalence compared to the previous studies.

In regards to tonsillitis treatment, the study established that there were significant differences between the percentages of antibiotic prescription for tonsillitis versus other URTI.The difference in treatment might be explained by the misconception that most cases of tonsillitis are of bacterial aetiology hence requiring antibiotic treatment. Furthermore, the misconstrued aetiology of tonsillitis is recognized as one explanation for variation in treatment, which was

supported by the fact that only 8% of the total of 61 patients with tonsillitis had a modified Centor score (McIsaac) of 3. The rest of the patients had less than 3 points or were less than three years old. Studies have shown that being less than three years old makes the bacterial aetiology less likely and therefore, cannot be calculated by this scoring system (Shulman et al., 2012).

Several studies have established similar findings of higher antibiotic prescriptions for tonsillitis compared to other URTI symptoms (M et al., 2018;McKay et al., 2016b). In some studies, the use of antibiotics for tonsillitis was ongoing even in the under-three years old, where the streptococcal aetiology is less likely. (Aabenhus et al., 2017). Similarly, in the united kingdom, Williamhad the same findings, where 71.6% of children were given an antibiotic despite having a threshold of less than 20% (Williams et al., 2018).

The high prevalence of antibiotic prescription for URTI is not surprising; instead, it indicates the practice is taking place in developed and undeveloped economies. However, the difference established is that fewer antibiotics are described in developed countries. The postulated explanation in the prevalence difference of antibiotics prescription could be due to the restrictions in antibiotic prescription in developed countries and the level of education of prescribers in theoutpatient clinics (Ternhag et al., 2014)

These poor prescription habits in Low and middle-income countries would be associated with poor policies in the restriction of antibiotic use and the knowledge of primary care providers (Zhang et al., 2017).

4.5.2 Determinants of Antibiotic Prescription

The number of explanations was determined for the high prevalence of antibiotic prescription for URTI.

Private versus public hospital

This study found that patients in the public hospital were more likely to be prescribed antibiotics than in the mission hospital. The difference in prescription practice in the two hospitals could be explained by the fact that clinicians team in the public outpatient clinics was constituted mainly of COs compared to those in the mission hospital where it was constituted of some MOs. Similar differences have been reported in Malaysia(Bp et al., 2013).

Another potential reason could be the fact that under-fives receive free treatment in public hospitals in Kenya. Free access to health care services may increase the possibility of a return visit to the hospital, which may push clinicians to prescribe antibiotics in the second visit. Additionally, the workload in public hospitals is higher compared to the mission or private hospitals (Calbo et al., 2013; Manyisa & van Aswegen, 2017)., and this has been associated with a high risk of antibiotic prescription for URTI in outpatient settings(Calbo et al., 2013; Manyisa & van Aswegen, 2017). This finding contrasts with the data from Malta that showed no difference in public versus private settings for antibiotic prescription by the general practitioners (Saliba-Gustafsson et al., 2019).

Patients' age

Contrary to other studies, age was not used to influence the decision of antibiotic prescription for URTI in this study. However, most clinicians thought that they could easily prescribe antibiotics to younger patients. The reason was because of the presumed fragility of their immune system. This study was different from another study in England where older children had more antibiotic prescriptions than the younger ones (Williams et al., 2018). In contrast, one study in Italy found that the proportion of antibiotic prescriptions was decreasing with age with older children having fewer antibiotic prescriptions (Resi, 2003).

Patients' gender

Patients' gender has been a debated potential factor to antibiotic prescription for URTI. This study found no difference in the percentage of antibiotic prescription between males and females. This finding is consistent with a study from the United Kingdom (UK), where gender was not a potential factor influencing antibiotic prescription in under-fives (Williams et al., 2018). In contrast, previous studies found that female gender was a predictor of higher antibiotic prescription (Saliba-Gustafsson et al., 2019). Moreover, another study showed that female patients had less risk of being prescribed antibiotics, especially when treated by female doctors compared to the male counterpart (Eggermont et al., 2018).

Proximity to the hospital

Living close to the hospital was significantly associated with an antibiotic prescription. It is assumed that patients who live close to the facility are more likely to be reassured and advised to return to the facility if symptoms persist instead of prescribing antibiotics. However, in this study, the majority of clinicians reported that they were likely to prescribe an antibiotic if a parent returns during the same URTI episode. Therefore, children living close to the hospitals are more likely to come back and being prescribed an antibiotic. The prescriptions were quickly issued despite clinicians knowing that the course of the disease can take up to 2 weeks. The hospital proximity was also found to be a determinant of antibiotic prescription by Ternhag in Sweden because of easy follow-up visits (Ternhag et al., 2014).

Fever and antibiotic prescription

Despite the recommendation against antibiotic prescription, several studies reported in the McKay et al. review demonstrated that fever was a determinant of antibiotic prescription for URTI (McKay et al., 2016b). However, this study did not find an association between fever and antibiotic prescription. Most patients had no fever, but they were given antibiotic

prescriptions. In cases of tonsillitis, a fever could increase the Centor score and therefore, the likelihood of antibiotic prescription. However, in this study, only 8% of patients had a score of 3 because they had a fever with inflamed tonsils, and they were more than three years old. This finding contrasts with a study conducted in Malta and other places where the fever was a predictor of antibiotic prescription for URTI (Saliba-Gustafsson et al., 2019;M et al., 2018). Therefore, in this study, other factors apart from fever could be the main contributors to the prescription of antibiotics. Most clinicians considered that fever should be a sign of a bacterial infection and therefore indicate an antibiotic prescription. However, the fact that the antibiotic prescribing did not depend on the temperature means that it depended on other factors. These factors, reported by clinicians, could be clinical uncertainty, parent's pressure or simply the lack of knowledge about the uselessness of antibiotic in the management of most URTI.

Clinicians' level of education

The odds of a CO to prescribe an antibiotic for URTI was 15.9 times higher than the MO. This high prescription could be linked to the difference in the levels of education and the associated clinical confidence. Similarly, in Malaysia, COs were found to prescribe more than MOs (Bp et al., 2013). McKay et al. in their systematic review found that 'front-line' general practitioners such as family physicians and emergency physicians, in developed countries were more likely to prescribe antibiotics than paediatricians or internal medicine practitioners. The review attributed this form of prescription to the workload of the 'front-line practitioners and the type of training (McKay et al., 2016b). These two reasons could be considered in this study, whereby clinical officers attend to more patients compared to medical officers in the outpatient clinics. Most clinicians explained that the workload was associated with the lack of time to explain to most guardians the treatment plan and therefore easily prescribed antibiotics.

Easy access to antibiotics

Some patients in this study attended the outpatient clinic with antibiotics from home or from the external pharmacy, which, compelled some clinicians to extend the prescription to a full course. The unwarranted antibiotic prescriptions by clinicians were fueled by the lack of standard operating procedures on antibiotic prescriptions in the hospitals. Moreover, thinking that the patient would get the antibiotic outside of the hospital was pushing clinicians to prescribe the antibiotics. The easy access to antibiotic is a multifaceted issue that has been associated with the lack of resources to enforce policies regarding the distribution of antibiotics in and out of hospitals (Ayukekbong et al., 2017). In the hospital setting, the lack of antibiotics stewardship program has been demonstrated to contribute to inappropriate use of antibiotics (Shah et al., 2017). Similar reasons for lack of such policies in this study made the clinicians feel that there was nothing to restrain them from prescribing apart from their clinical knowledge.

Guidelines

The clinicians referred to the Kenyan Basic Pediatric Protocol for the treatment of URTI (*Guidelines, Standards & Policies Portal*, n.d.). However, that protocol does not provide guidelines for URTI management. As a result of this, some clinicians do not use the guideline for URTI management. In contrast, others use Integrated management for children's illness from the World Health Organization (WHO, 2012). Moreover, the lack of stewardship programs to make sure that local, national, and approved international guidelines are followed could contribute to inappropriate prescriptions of antibiotics. One South African study, like many others, has shown that clinicians do not follow clinical guidelines by themself (Gasson et al., 2018). On the other hand, one study from Kenya found that all clinicians declared to follow the Kenyan protocols for URTI, but they prescribed antibiotics to 79.7% of patients

with URTI (Mekuria et al., 2019). This gap calls for further questions about the understanding of the content of guidelines or the guidelines themselves.

Ineffective communication and antibiotic prescription

Most clinicians did not feel competent enough to convince parents of children not to use antibiotics of URTI. This issue was associatedwith the workload and the limited skills in effective communication among the clinicians. However, for the few clinicians who reported having a good relationship with some patients, they explained how that could build trust and that the patients could accept easily to go without antibiotics and still be satisfied.

Medical training does not have enough modules of communication, and clinicians have been reported to have poor communication skills (Cabral et al., 2016). Little and colleagues (2019) showed that communication training reduced antibiotic prescribing for patients with respiratory tract infections (Little et al., 2019). Moreover, one other European study found that internet-based training in communication skills was the most cost-effective intervention in the reduction of inappropriate antibiotic prescriptions (Oppong et al., 2018).

Therefore, there was an area of improvement in terms of clinician's communication skills to build a better patient-doctor relationship. One study conducted in Australia showed that parents were expecting a clear communication from the doctors and not an antibiotic prescription while doctors believed the parents needed antibiotic prescription (Biezen et al., 2019).

Lack of clinical confidence

The lack of clinical confidence was manifested by clinical uncertainty, fear of negative outcomes, and unnecessary lab tests. These factors could be associated with the medical or clinical training as some studies have revealed that final year medical students in Australia

exhibited limited knowledge and confidence in infectious diseases compared to cardiovascular diseases (Weier et al., 2017). The limited knowledge could lead to unnecessary fear of negative outcomes or fear of disappointing the parents (Horwood et al., 2016). For the same reason of fear, clinicians wanted to rule out underlying bacterial disease. For this, they were ordering the full hemogram, and most of them thought that elevated lymphocyte count in URTI could help differentiate viral from bacterial infection. The full hemogram was available, but for uncomplicated URTI, it has not been proven to be useful (Korppi et al., 1993). Therefore, this finding could be a reflection of the limited knowledge that most clinicians have.

Moreover, most clinicians did not express the need for C-reactive protein (CRP) testing and a throat swab to help them with the diagnosis. This omission could be because it was not available, but it could still be a reflection of limited knowledge about the evidence for these tests. Some clinicians said that the diagnosis of URTI is clinical, but some others said that a better lab could help them to make better decisions for 'borderline' cases.

Parents' pressure and clinicians' workload in the outpatient clinics

Most clinicians associated their inappropriate prescription of antibiotics to parents/guardian pressure and the lack of time to convince them. They considered that if parents were well informed about antibiotic use in URTI before they come to the clinic, it could be easier to convince them and to clear the queue faster. This perceived pressure from the guardian is not a valid reason from the parents' perspective. Several studies have shown that parents were looking for reassurance more than antibiotics (Biezen et al., 2019). A systematic review by Mckay showed that patient desire of an antibiotic was not associated or was modestly associated with a prescription compared to physicians' perception of patients' desire of antibiotic that was stringing associated with antibiotic prescribing (McKay et al., 2016b). This

challenge could be connected to poor communication skills, as said earlier, or to the workload of clinicians working in outpatient. One Norwegian study found that clinicians with a higher consultation rate prescribed antibiotics easily for URTI because of lack of time to explain and in trying to clear the queue (Gjelstad et al., 2011).

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The final chapter shall include a summary of the findings, and the conclusions based on the key findings. Based on the significant findings, several recommendations are made to address the issue ofantimicrobial resistance by curbing the inappropriate antibiotic treatment in Upper Respiratory Tract infections. Additionally, areas for future research are discussed in this Chapter.

5.2 Summary

This sequential explanatory (QUANT-QUAL) study sought to explore the prevalence and the determinants of antibiotic prescription for URTI in under-fives in the outpatient clinic in Tharaka-Nithi County, Kenya.

The prevalence of antibiotic prescription was 70.4%. Practitioners in the public hospital prescribed antibiotics for URTI more than those in the Faith-based hospital. Several factors that determine the prescription of antibiotics for URTI were identified. These included: the level of education of the prescriber,the suspicion of tonsillitis, the patients' easy access to the hospital, the accessibility to antibiotics by patients, ineffective communication between clinicians and parents,inconsistent use of guidelines, clinicians'limited knowledge and lack ofclinical confidence, pressure from the parents and the workload in the outpatient clinic.

5.3 Conclusion

Clinicians prescribed antibiotics to 70.4% of children with URTI. This prevalence is higher than the 30% recommended by WHO and 20% by the Europian guidelines for URTI. The high percentage of antibiotic prescriptions could be explained byclinical and non-clinical determinants. The clinical determinants included the diagnosis of tonsillitis, the level of the

education of the prescribers, their lack of clinical confidence, thelimited knowledge of some clinicians andthe ignorance ofclinical guidelines. The non-clinical determinantss included the ineffective communication skills, parent's pressure requesting for an antibiotic, the proximity to the hospital, the easy access to antibiotics,the workload of clinicians working in the outpatient clinic, and the free health care services for under-fives in public facilities. These factors are interconnected, and together they lead tothe inappropriate prescription of antibiotics for URTI in the outpatient clinics. Interventions to reduce inappropriate antibiotic prescription should target clinicians' education, regulation of access to antibiotics and patient education.

5.4 Recommendations

5.4.1 Policy Recommendations

i. There is an urgent need to reinforce the regulation for antibiotic prescribing and dispensing in the community and hospitals.

ii. Clinicians' training needs to clarify the management of common viral infections and the contraindication of antibiotic prescription in the context of antimicrobial resistance. This training needs to continue with ongoing medical educations in their facilities for updates.

iii. Clinicians need to be trained on how to communicate effectively with guardians/parents. This training needs to start from school and be sharpened in the hospitals by experts on effective communication.

iv. There is a need to train clinicians in essential investigations for URTI and to reinforce the lab diagnostic capacities with the rapid tests of throat swab for tonsillitis and C-reactive protein for other URTI.

v. There is a need to balance the number of patients that each clinician should see per day for them to have enough time for patient's education in the clinic.

vi. Hospitals need to initiate and sustain antimicrobial stewardship programs and clarify the guidelines on antibiotic use.

vii. There is a need for community education about contraindication of antibiotics for URTI and the reality of antimicrobial resistance to reduce parents' pressure and anxiety when they come to the clinic. This education can be done through church leaders, women groups, community leaders, radio, flyers, etc.

5.4.2 Recommendations for Further Research

i. A study on the prevalence of antibiotic prescription for URTI in children with moderately elevated C-reactive protein.

ii. A study on the antibiotic prescription for tonsillitis with negative throat swab for group A streptococcal infection in children.

iii. A study on parents' knowledge and attitude regarding antibiotic use for URTI

iv. A study on the effectiveness of continuous medical education on prescribing practices.

v. A study on the training in communication skills and antibiotic prescribing practices.

vi. A study on the impact of an antimicrobial stewardship program in a rural hospital on antibiotic prescription.

REFERENCES

Aabenhus, R., Hansen, M. P., Saust, L. T., & Bjerrum, L. (2017). Characterisation of antibiotic prescriptions for acute respiratory tract infections in Danish general practice: A retrospective registry-based cohort study. *Npj Primary Care Respiratory Medicine*, *27*(1), 1–6. https://doi.org/10.1038/s41533-017-0037-7

Ajzen, I. (1991). The theory of planned behaviour. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Alves Galvão, M. G., Rocha Crispino Santos, M. A., & Alves da Cunha, A. J. (2016). Antibiotics for Preventing Suppurative Complications from Undifferentiated Acute Respiratory Infections in Children Under Five Years of Age. *Cochrane Database of Systematic Reviews*. Retrieved from: https://doi.org/10.1002/ 14651858. CD00 7880.pub3

Ayukekbong, J. A., Ntemgwa, M., & Atabe, A. N. (2017). The threat of antimicrobial resistance in developing countries: Causes and control strategies. *Antimicrobial Resistance & Infection Control*, *6*(1), 47. https://doi.org/10.1186/s13756-017-0208-x

Baquero, F., Negri, M., Morosini, M., & Blázquez, J. (1998). Antibiotic Selective Environments. *Clinical Infectious Diseases*, *27*(s1), S5–S11. https://doi.org/10.1086/ 514916

Bell, B. G., Schellevis, F., Stobberingh, E., Goossens, H., & Pringle, M. (2014). A systematic review and meta-analysis of the effects of antibiotic consumption on antibiotic resistance. *BMC Infectious Diseases*, *14*, 13. https://doi.org/10.1186/1471-2334-14-13

Biezen, R., Grando, D., Mazza, D., & Brijnath, B. (2019). Dissonant views—GPs' and parents' perspectives on antibiotic prescribing for young children with respiratory tract infections. *BMC Family Practice*, *20*(1), 46. https://doi.org/10.1186/s12875-019-0936-5

Bp, K., Cm, O., Ft, T., & Cy, W. (2013). Antibiotic prescribing for upper respiratory tract infections in Sarawak district hospitals. *The Medical Journal of Malaysia*, *68*(2), 136–140.

Braun, V., & Clarke, V. (2006). Using Thematic Analysis in Psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Brink, A. J., Cotton, M. F., Feldman, C., Finlayson, H., Friedman, R. L., Green, R., Hendson, W., Hockman, M. H., Maartens, G., Madhi, S. A., Reubenson, G., Silverbauer, E. J., & Zietsman, I. L. (2015). Updated recommendations for the management of upper respiratory tract infections in South Africa. *South African Medical Journal*, *105*(5), 345-352–352. https://doi.org/10.7196/SAMJ.8716

Butler, C. C., Hood, K., Verheij, T., Little, P., Melbye, H., Nuttall, J., Kelly, M. J., Mölstad, S., Godycki-Cwirko, M., Almirall, J., Torres, A., Gillespie, D., Rautakorpi, U., Coenen, S., & Goossens, H. (2009). Variation in antibiotic prescribing and its impact on recovery in patients with acute cough in primary care: Prospective study in 13 countries. *BMJ*, *338*. https://doi.org/10.1136/bmj.b2242

Cabral, C., Ingram, J., Lucas, P. J., Redmond, N. M., Kai, J., Hay, A. D., & Horwood, J. (2016). Influence of Clinical Communication on Parents' Antibiotic Expectations for Children With Respiratory Tract Infections. *Annals of Family Medicine*, *14*(2), 141–147. https://doi.org/10.1370/afm.1892

Calbo, E., Álvarez-Rocha, L., Gudiol, F., & Pasquau, J. (2013). A review of the factors influencing antimicrobial prescribing. *Enfermedades Infecciosas y Microbiología Clínica*, *31*, 12–15. https://doi.org/10.1016/S0213-005X(13)70127-7

Changing Use of Antibiotics in Community-Based Outpatient Practice, 19911999. (2003). *Annals of Internal Medicine*, *138*(7), I–24. Retrieved from: https://doi.org/10.7326/0003-4819-138-7-200304010-00001

Chem, E. D., Anong, D. N., & Akoachere, J.-F. K. T. (2018). Prescribing patterns and associated factors of antibiotic prescription in primary health care facilities of Kumbo East and Kumbo West Health Districts, North West Cameroon. *PLoS ONE*, *13*(3). https://doi.org/10.1371/journal.pone.0193353

Di Martino, M., Lallo, A., Kirchmayer, U., Davoli, M., & Fusco, D. (2017). Prevalence of antibiotic prescription in pediatric outpatients in Italy: The role of local health districts and primary care physicians in determining variation. A multilevel design for healthcare decision support. *BMC Public Health*, *17*(1), 886. https://doi.org/10.1186/s12889-017-4905-4

Drroopesh. (2016, September 16). WHO updates fact sheet on Antimicrobial Resistance (15 September 2016). *Communitymedicine4asses*. https://communitymedicine4asses.com /2016/09/16/who-updates-fact-sheet-on-antimicrobial-resistance-15-september-2016/

Eggermont, D., Smit, M. A. M., Kwestroo, G. A., Verheij, R. A., Hek, K., & Kunst, A. E. (2018). The influence of gender concordance between general practitioners and patients on antibiotic prescribing for sore throat symptoms: A retrospective study. *BMC Family Practice*, *19*(1), 175. https://doi.org/10.1186/s12875-018-0859-6

Gasson, J., Blockman, M., & Willems, B. (2018). Antibiotic prescribing practice and adherence to guidelines in primary care in the Cape Town Metro District, South Africa. *South African Medical Journal*, *108*(4), 304-310–310. https://doi.org/10.7196/SAMJ.2018.v108i4.12564

Gerding, D. N. (2001). The Search for Good Antimicrobial Stewardship. *The Joint Commission Journal on Quality Improvement*, *27*(8), 403–404. https://doi.org/10.1016/S1070-3241(01)27034-5

Gjelstad, S., Straand, J., Dalen, I., Fetveit, A., Strøm, H., & Lindbæk, M. (2011). Do general practitioners' consultation rates influence their prescribing patterns of antibiotics for acute respiratory tract infections? *Journal of Antimicrobial Chemotherapy*, *66*(10), 2425–2433. https://doi.org/10.1093/jac/dkr295

Gonzales, R., Bartlett, J. G., Besser, R. E., Hickner, J. M., Hoffman, J. R., & Sande, M. A. (2001). Principles of Appropriate Antibiotic Use for the Treatment of Nonspecific Upper Respiratory Tract Infections in Adults: *Background. Annals of Emergency Medicine, 37(6), 698–702. Retrieved from: https://doi.org/10.1067/S0196-0644(01)70088-1*

Greg, G., Arwen, B., Johnson, L. (2006). How Many Interviews Are Enough?: An Experiment with Data Saturation and Variability. Retrieved from: https://journals.sagepub.com/doi/abs/10.1177/1525822x05279903

Guidelines, Standards & Policies Portal. (n.d.). Retrieved July 9, 2020, from http://guidelines.health.go.ke/#/category/27/266/meta

Hamm, R. M., Hicks, R. J., & Bemben, D. (1996). Antibiotics and Respiratory Infections: Are Patients More Satisfied When Expectations Are Met? *Journal of Family Practice*, *43*(1), 56–62.

Heikkinen, T., & Järvinen, A. (2003). The Common Cold. *Lancet (London, England)*, *361*(9351), 51–59. Retrieved from: https://doi.org/10.1016/S0140-6736(03)12162-9

Health matters. (2020). *Antimicrobial resistance*. GOV.UK. Retrieved February 25, 2020, from https://www.gov.uk/government/publications/health-matters-antimicrobial-resistance / ealth-matters-antimicrobial-resistance

Horwood, J., Cabral, C., Hay, A. D., & Ingram, J. (2016). Primary care clinician antibiotic prescribing decisions in consultations for children with RTIs: A qualitative interview study. *British Journal of General Practice*, *66*(644), e207–e213. https://doi.org/10.3399/bjgp16X683821

Jacobs, A., & Richtel, M. (2019). In a Poor Kenyan Community, Cheap Antibiotics Fuel Deadly Drug-Resistant Infections. *The New York Times*. Retrieved from https://www.nytimes.com/2019/04/07/health/antibiotic-resistance-kenya-drugs.html

Jones, A. P., Bentham, G., & Horwell, C. (1999). Health service accessibility and deaths from asthma. *International Journal of Epidemiology*, *28*(1), 101–105. https://doi.org/10.1093/ije/28.1.101

Kariuki, S. (2019). *Antibiotic Use and Resistance in Kenya.*CDEPP

Kenealy T, Arroll B. Antibiotics for the Common Cold and Acute Purulent Rhinitis. Cochrane Database of Systematic Reviews 2013, Issue 6. Art. No.: CD000247. DOI: 10.1002/14651858.

Keohavong, B., Vonglokham, M., Phoummalaysith, B., Louangpradith, V., Inthaphatha, S., Kariya, T., Saw, Y. M., Yamamoto, E., & Hamajima, N. (2019). Antibiotic prescription for under-fives with common cold or upper respiratory tract infection in Savannakhet Province, Lao PDR. *Tropical Medicine and Health*, *47*(1), 16. https://doi.org/10.1186/s41182-019-0143-z

Kjærgaard, J., Anastasaki, M., Stubbe Østergaard, M., Isaeva, E., Akylbekov, A., Nguyen, N. Q., Reventlow, S., Lionis, C., Sooronbaev, T., Pham, L. A., Nantanda, R., Stout, J. W., & Poulsen, A. (2019). Diagnosis and treatment of acute respiratory illness in children under five in primary care in low-, middle-, and high-income countries: A descriptive FRESH AIR study. *PLoS ONE*, *14*(11). https://doi.org/10.1371/journal.pone.0221389

Kleczka, B., Kumar, P., Njeru, M. K., Musiega, A., Wekesa, P., Rabut, G., & Marx, M. (2019). Using rubber stamps and mobile phones to help understand and change antibiotic prescribing behaviour in private sector primary healthcare clinics in Kenya. *BMJ Global Health*, *4*(5). https://doi.org/10.1136/bmjgh-2019-001422

Korppi, M., Kröger, L., & Laitinen, M. (1993). White blood cell and differential counts in acute respiratory viral and bacterial infections in children. *Scandinavian Journal of Infectious Diseases*, *25*(4), 435–440. https://doi.org/10.3109/00365549309008524

Krejcie, R. V., & Morgan, D. W. (1970). Determining Sample Size for Research Activities. *Educational and Psychological Measurement*, *30*(3), 607–610. https://doi.org/10.1177/001316447003000308

Kunda, M., & Haoses-Gorases, L. (2015). An Investigation of Antibiotic Prescribing in Patients with Upper Respiratory Tract Infections (URTIs) at Katutura Health Centre, Windhoek, Namibia. *Single Cell Biology*, *04*(04). https://doi.org/10.4172/2168-9431.1000122

Larrabee, T. (2002). Prescribing Practices that Promote Antibiotic Resistance: Strategies for Change. *Journal of Pediatric Nursing: Nursing Care of Children and Families*, *17*(2), 126–132. Retrieved from: https://doi.org/10.1053/jpdn.2002.124130

Lee, G. C., Reveles, K. R., Attridge, R. T., Lawson, K. A., Mansi, I. A., Lewis, J. S., & Frei, C. R. (2014). Outpatient antibiotic prescribing in the United States: 2000 to 2010. *BMC Medicine*, *12*(1), 96. Retrieved from: https://doi.org/10.1186/1741-7015-12-96

Leopold, S. J., van Leth, F., Tarekegn, H., & Schultsz, C. (2014). Antimicrobial drug resistance among clinically relevant bacterial isolates in sub-Saharan Africa: A systematic review. *Journal of Antimicrobial Chemotherapy*, *69*(9), 2337–2353. https://doi.org/10.1093/jac/dku176

Little, P., Stuart, B., Francis, N., Douglas, E., Tonkin-Crine, S., Anthierens, S., Cals, J. W. L., Melbye, H., Santer, M., Moore, M., Coenen, S., Butler, C. C., Hood, K., Kelson, M., Godycki-Cwirko, M., Mierzecki, A., Torres, A., Llor, C., Davies, M., … Yardley, L. (2019). Antibiotic Prescribing for Acute Respiratory Tract Infections 12 Months After Communication and CRP Training: A Randomized Trial. *Annals of Family Medicine*, *17*(2), 125–132. https://doi.org/10.1370/afm.2356

Llor, C., & Bjerrum, L. (2014). Antimicrobial resistance: Risk associated with antibiotic overuse and initiatives to reduce the problem. *Therapeutic Advances in Drug Safety*, *5*(6), 229–241. https://doi.org/10.1177/2042098614554919

Maina, D., Omuse, G., Revathi, G., & Adam, R. D. (2016). The spectrum of Microbial Diseases and Resistance Patterns at a Private Teaching Hospital in Kenya: Implications for Clinical Practice. *PLOS ONE*, *11*(1), e0147659. https://doi.org/10.1371/journal.pone.0147659

Manyisa, Z. M., & van Aswegen, E. J. (2017). Factors affecting working conditions in public hospitals: A literature review. *International Journal of Africa Nursing Sciences*, *6*, 28–38. https://doi.org/10.1016/j.ijans.2017.02.002

Martinez, K. A., Rood, M., & Rothberg, M. B. (2019). Coding Bias in Respiratory Tract Infections May Obscure Inappropriate Antibiotic Use. *Journal of General Internal Medicine*, *34*(6), 806–808. https://doi.org/10.1007/s11606-018-4823-x

Matu, M. (2014). Aetiology of Acute Respiratory Infections in Children under Five Years in Nakuru, Kenya. *Journal of Microbiology & Experimentation*, *1*(4). Retrieved from: https://doi.org/10.15406/jmen.2014.01.00021

M, M., A, D., B, H., A, P., Gb, T., Ad, M.-H., Se, J., A, B., Rw, B., & Mb, R. (2018). Provider Variation in Antibiotic Prescribing and Outcomes of Respiratory Tract Infections. *Southern Medical Journal*, *111*(4), 235–242. https://doi.org/10.14423/smj.0000000000000795.

McKay, R., Mah, A., Law, M. R., McGrail, K., & Patrick, D. M. (2016b). Systematic Review of Factors Associated with Antibiotic Prescribing for Respiratory Tract Infections. *Antimicrobial Agents and Chemotherapy*, *60*(7), 4106–4118. https://doi.org/10.1128/AAC.00209-16.

Mekuria, L. A., de Wit, T. F., Spieker, N., Koech, R., Nyarango, R., Ndwiga, S., Fenenga, C. J., Ogink, A., Schultsz, C., & van't Hoog, A. (2019). Analyzing data from the digital healthcare exchange platform for surveillance of antibiotic prescriptions in primary care in urban Kenya: A mixed-methods study. *PLOS ONE*, *14*(9), e0222651. https://doi.org/10.1371/journal.pone.0222651

McCaig, L. F., Besser, R. E., & Hughes, J. M. (2003). Antimicrobial-Drug Prescription in Ambulatory Care Settings, United States, 1992–2000. *Emerging Infectious Diseases*, *9*(4), 432–437. Retrieved from: https://doi.org/10.3201/eid0904.020268

Momanyi, L, B. (2017). *Antibiotic Prescribing Patterns at Rift Valley Provincial General Hospital: a Point Prevalence Survey*. The University of Nairobi

Nicholl, J., West, J., Goodacre, S., & Turner, J. (2007). The relationship between distance to hospital and patient mortality in emergencies: An observational study. *Emergency Medicine Journal : EMJ*, *24*(9), 665–668. https://doi.org/10.1136/emj.2007.047654

O'Connor, R., O'Doherty, J., O'Regan, A., & Dunne, C. (2018). Antibiotic use for acute respiratory tract infections (ARTI) in primary care; what factors affect prescribing and why is it important? A narrative review. *Irish Journal of Medical Science (1971 -)*, *187*(4), 969–986. https://doi.org/10.1007/s11845-018-1774-5

Ochoa, C., Eiros, J. M., Inglada, L., & Vallano, A. (2000). Assessment of Antibiotic Prescription in Acute Respiratory Infections in Adults. *Journal of Infection*, *41*(1), 73–83. https://doi.org/10.1053/jinf.2000.0689

Ofori-Asenso, R., Brhlikova, P., & Pollock, A. M. (2016). Prescribing indicators at primary health care centers within the WHO African region: A systematic analysis (1995-2015). *BMC Public Health*, *16*(1). https://go.gale.com/ps/i.do?p=HRCA&sw=w&issn=14712458&v=2.1&it=r&id=GALE%7CA461628841&sid=googleScholar&linkaccess=abs

Oppong, R., Smith, R. D., Little, P., Verheij, T., Butler, C. C., Goossens, H., Coenen, S., Jowett, S., Roberts, T. E., Achana, F., Stuart, B., & Coast, J. (2018). Cost-effectiveness of internet-based training for primary care clinicians on antibiotic prescribing for acute respiratory tract infections in Europe. *Journal of Antimicrobial Chemotherapy*, *73*(11), 3189–3198. https://doi.org/10.1093/jac/dky309

Pichichero, M. E. (2002). Dynamics of Antibiotic Prescribing for Children. *JAMA*, *287*(23), 3133–3135. https://doi.org/10.1001/jama.287.23.3133

Post Graduate, Department of ENT, RMMCH, Chidambaram-608002, Tamilnadu, & Usha, S. (2017). Clinical Correlation between McISSAC Score and Throat Swab Culture In Predicting Streptococcal Pharyngitis In Patients Presenting With Sore Throat. *Journal of Medical Science And Clinical Research*, *5*(11). https://doi.org/10.18535/jmscr/v5i11.12

Resi, D. (2003). Antibiotic prescriptions in children. *Journal of Antimicrobial Chemotherapy*, *52*(2), 282–286. https://doi.org/10.1093/jac/dkg302

Rezal, R. S., Hassali, M. A., Alrasheedy, A. A., Saleem, F., Aryani Md Yusof, F., Kamal, M., … Godman, B. (2015). Prescribing patterns for upper respiratory tract infections: A prescription-review of primary care practice in Kedah, Malaysia, and the implications. *Expert Review of Anti-Infective Therapy*, *13*(12), 1547–1556. https://doi.org/10.1586/14787210.2015.1085303

Rhee, C., Aol, G., Ouma, A., Audi, A., Muema, S., Auko, J., … Verani, J. R. (2019). Inappropriate use of antibiotics for childhood diarrhoea case management — Kenya, 2009–2016. *BMC Public Health*, *19*(3), 468. https://doi.org/10.1186/s12889-019-6771-8

Saliba-Gustafsson, E. A., Hampton, A. D., Zarb, P., Orsini, N., Borg, M. A., & Lundborg, C. S. (2019). Factors associated with antibiotic prescribing in patients with acute respiratory tract complaints in Malta: A 1-year repeated cross-sectional surveillance study. *BMJ Open*, *9*(12). https://doi.org/10.1136/bmjopen-2019-032704

Shah, N., Joshi, A., & Ganguly, B. (2017). Impact of Antibiotic Stewardship Program on Prescribing Pattern of Antimicrobials in Patients of Medical Intensive Care Unit. *Journal of Clinical and Diagnostic Research : JCDR*, *11*(7), FC11–FC15. https://doi.org/10.7860/JCDR/2017/27171.10237

Shulman, S. T., Bisno, A. L., Clegg, H. W., Gerber, M. A., Kaplan, E. L., Lee, G., Martin, J. M., & Van Beneden, C. (2012). Clinical Practice Guideline for the Diagnosis and Management of Group A Streptococcal Pharyngitis: 2012 Update by the Infectious Diseases Society of America. *Clinical Infectious Diseases*, *55*(10), e86–e102. https://doi.org/10.1093/cid/cis629

Ternhag, A., Grünewald, M., Nauclér, P., & Tegmark Wisell, K. (2014). Antibiotic consumption in relation to socio-demographic factors, co-morbidity, and accessibility of primary health care. *Scandinavian Journal of Infectious Diseases*, *46*(12), 888–896. https://doi.org/10.3109/00365548.2014.954264

Tharaka-Nithi health records department (2018). Health facility target population.nd

Thomas, M., Koutsothanasis, G. A., & Bomar, P. A. (2020). Upper Respiratory Tract Infection. In *StatPearls*. StatPearls Publishing. http://www.ncbi.nlm.nih.gov/books/NBK532961/

Tong, A., Sainsbury, P., & Craig, J. (2007). Consolidated criteria for reporting qualitative research (COREQ): A 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*, *19*(6), 349–357. https://doi.org/10.1093/intqhc/mzm042

Weier, N., Thursky, K., & Zaidi, S. T. R. (2017). Antimicrobial knowledge and confidence amongst final year medical students in Australia. *PLoS ONE*, *12*(8). https://doi.org/10.1371/journal.pone.0182460

WHO | Recommendations for management of common childhood conditions. (n.d.). WHO; World Health Organization. Retrieved July 9, 2020, from https://www.who.int/maternal_child_adolescent/documents/management_childhood_conditions/en/

World Health Organization. (2019). *International statistical classification of diseases and related health problems* (11th ed.). https://icd.who.int/

Williams, M. R., Greene, G., Naik, G., Hughes, K., Butler, C. C., & Hay, A. D. (2018). Antibiotic prescribing quality for children in primary care: An observational study. *The British Journal of General Practice*, *68*(667), e90–e96. https://doi.org/10.3399/bjgp18X694409

WHO. (2017). *Causes of Child Mortality*. Retrieved May 23, 2019, from WHO website: http://www.who.int/gho/child_health/mortality/causes/en/

Wong, D. M., Blumberg, D. A., & Lowe, L. G. (2006). Guidelines for the Use of Antibiotics in Acute Upper Respiratory Tract Infections. *Clinical Practice*, *74*(6), 11.

World Health Organization. (2015). *Worldwide Country Situation Analysis: Response to antimicrobial resistance.* Retrieved from http://apps.who.int/iris/bitstream/

World Health Organization, Department of Maternal, N., Child and Adolescent Health, & World Health Organization. (2014). *Revised WHO classification and treatment of pneumonia in children at health facilities: Evidence summaries.* Retrieved from http://apps.who.int/iris/bitstream/

World Health Organization (2016). Antimicrobial resistance fact sheet. *Updated September*

Zhang, Z., Hu, Y., Zou, G., Lin, M., Zeng, J., Deng, S., Zachariah, R., Walley, J., Tucker, J. D., & Wei, X. (2017). Antibiotic prescribing for upper respiratory infections among children in rural China: A cross-sectional study of outpatient prescriptions. *Global Health Action*, *10*(1), 1287334. https://doi.org/10.1080/16549716.2017.1287334

Zoorob, R., Sidani, M. A., Fremont, R. D., & Kihlberg, C. (2012). Antibiotic Use in Acute Upper Respiratory Tract Infections. *American Family Physician*, *86*(9), 817–822.

APPENDICES

Appendix I: Interview Guide

Initials of the clinician's Name:_____

Gender:_____

Type of training: MO or CO:_____

Years of practice: _____

INTRODUCTION:

This interview aims to understand the management of upper respiratory tract infections (URTIs) in under-fives in Tharaka-Nithi County and your understanding of the determinants of antibiotic prescription or treatment in the management.

1. On a typical usual clinic day when you have a 3-year-old with cough, rhinorrhea, throat pain, and the temperature at 37.8, How do you approach this patient in terms of differential diagnosis and management?

Prompts: Pneumonia? Bronchitis? Asthma? Allergies? URTI?

Prompts: Amoxil? Paracetamol? Brufen?

2. What do you have available to guide your diagnosis and management in such a case?

Prompts: Xray? Labs if yes which one? History and Physical exam? Clinical guidelines. If Yes, how helpful do you find those resources?

3. What has been your experience in prescribing antibiotics in patients with URTI?
4. When is it easy for you to prescribe antibiotics in paediatrics with URTI?
5. How does the physical address of the patient (either close or far from the hospital) affect your decision of prescribing an antibiotic?
6. What has been your experience with patients with URTI and tonsillitis like symptoms or pharyngitis in terms of antibiotic prescription?
7. How confident do you feel about not prescribing an antibiotic for URTI?
8. What can make it difficult for you to prescribe antibiotics in your settings?
9. How different could be your prescription if you were not in a Public hospital (for clinicians working in public)
10. Do you have an idea about the aetiology of most of the URTI in your patients' population?
11. What would you doif you had access to a better laboratory?

Prompts: PCR, cultures? Procalcitonin?

12. What about the knowledge that you got from medical school and your colleague's opinion?

Prompt: Do you refer to what you learned in Medical school? If yes, how do you trust it?

13. What do you think about antimicrobial-resistant and its contributing factors?

14. In your opinion, what other factors determine how you manage URTI?

Conclusion: Is there any question regarding antibiotics prescription and AMR that you would like us to discuss before we finish?

Appendix II: Antibiotic Prescription Data Form

Case number	Age (years, months)	Gender (M/F)	Residence (Village, town)	Diagnosis as written in the chart	Duration of symptoms(days) before a hospital visit	The temperature in Degree Celcius	Antibiotic Rx	Level of education of the Prescriber

Appendix III: Consent Form

Consent to take part in research

I…… voluntarily agree to participate in this research study. ·I have the freedom to withdraw my consent at any time or to choose not to answer some questions ant that will have no consequences.

Within two weeks after the interview, I can withdraw permission to use the data from my interview for analysis. In that case, my interview will be deleted.

- I received an explanation about the nature and the objectives of this study, and I asked questions about the study.
- I understand that participation involves sharing my experience in the management of under-fives with upper respiratory tract infection.
- I am not benefiting directly from this study in terms of money.
- It is fine with me to audio-record my interview.
- The information provided in this interview will be treated with confidentialityand anonymity by using codes instead of other identifiers.
- The codes that will be attributed can be used in the dissertations, conference presentations, and published papers.
- If the information that I will provide put my life or someone's life at risk, the researcher may report this to the relevant authorities - He will discuss this with me first but may be required to report with or without my permission.
- I understand that signed informed consent forms and original audio recordings will be retained in a secured cabinet.
- The transcript of my interview without identifiers will be kept for five years before destruction.
- I understand that under freedom of information legalization I am entitled to access the information I have provided at any time while it is in storage as specified above.
- I am free to contact the Kabarak IREC secretariat or the researcher in case I need more information or clarification.

Signature of participant:_____ Date :_____

I believe the participant is giving informed consent to participate in this study:_____

Signature of researcher:_____ Date: _____

Researcher: Musa Saruti, MBChB, Fam Med Resident, Kabarak University

Tel: +254795016268,

Email: msaruti@kabarak.ac.ke, grevillesaruti@gmail.com

Kabarak University IREC: +254724887431, PO Box: Private Bag 20157 Kabarak.

Appendix IV: Participant Information Sheet

(to be retained by the participant)

Prevalence and Determinants of antibiotic prescriptions for Upper Respiratory Tract Infection among under-fives in outpatient clinics in Tharaka Nithi County.

Invitation

You are invited to participate in a research study that is planning to analyze the determinants of antibiotic prescriptions for upper respiratory tract infection in under-fives in outpatient clinics.

The study is being conducted by Dr Musa Saruti, a Family Medicine resident at Kabarak University. The study is done in partial fulfilment of the requirements for the award of the Master's Degree in Medicine/ Family Medicine

This form aims to give you detailed information before you decide to participate in this study. Take time to go through it.

What is the purpose of this study?

The purpose is to investigate the factors that influence antibiotic prescriptions in the treatment of URTI in under-fives.

1. Why have I been invited to participate in this study?

Because you manage under-fives with URTI and your daily experience in handling children with URTI is valuable for this study

2. What if I don't want to take part in this study, or if I want to withdraw later?

If you decide not to participate, it will not affect your relationship with the researcher or the hospital or any other organization.

You are free to withdraw from the study any time with no explanation needed.

However, it may not be possible to withdraw your data from the study results if these have already had your identifying details removed.

3. What does this study involve?

If you accept to be interviewed, you will sign the Participant informed Consent Form. After that, you will be interviewed and asked to share your experience in the management of URTI.

4. How is this study being paid for?

The study is not sponsored, and no money is paid to the researcher.

5. Are there risks to me in taking part in this study?

Given that the study will take place on weekdays, it may take 45 minutes of your time for the interview. To minimize the discomfort, the interview will be conducted in an office that will be convenient for you, and in the timing that will be convenient for you.

6. Will I benefit from the study?

This study aims to further medical knowledge and may improve the management of URTI.

7. Will taking part in this study cost me anything, and will I be paid?

Participation in this study will cost you 45 min of your time that will be allocated for the interview. There is no payment for participating in the study. However, you can share some snacks after the interview.

8. How will my confidentiality be protected?

The information that you will give will not have your name and will not be shared. All the identifiers will be coded in a way that only the principal investigator would be able to trace for data analysis. After analysis, the data will be looked into in a secured cabinet for at least five years.

9. What happens with the results?

The results might be published in a peer-reviewed journal and be presented in conferences. In all presentations, anonymity and confidentiality will be maintained. The results of the study will be provided to you if you wish.

10. What should I do if I want to discuss this study further?

Feel free to call the researcher Musa for any queries you may have on 0795016268

11. Who should I contact if I have concerns about the conduct of this study?

Feel free to contact the researcher or the Kabarak IREC secretariat.

Thank you for taking the time to consider this study.

If you wish to take part in it, please sign the attached consent form.

This information sheet is for you to keep.

Appendix V: Budget

Category	**Cost (KES)**	**Detail**	**Source**
Personnel	Ksh 30,000 (estimation)	Data collection, transcription fees and coding of data	In-kind/ to be funded
Services	Kes 4,000 est	ERB fees, the printing of transcriptions,	In-kind/ to be funded
Reusable Items	Kes 2,500 est	Audio recorder	In-kind/ to be funded
Non-reusable Items	Kes 4,000 est	Snacks for interviewees	To be funded
Other			
Total	Kes 39,500 est		

Appendix VI: Timelines

Activities	October 2019	November 2019	December 2019	January 2020	February2020	March2020	April2020	May2020	June2020	July2020
Submission of the proposal to KABU-IREC and forward of the proposal to the Institute of Postgraduate studies										
KABU-IREC approval and application for the NACOSTI research permit										
NACOSTI research permit issued and presented to the study sites										
Retrospective Charts review and data analysis										
Interviews for the qualitative Phase										
Thematic analysis of the interviews and write up										
Discussion, conclusion and recommendations										
Submission of the thesis to IPGS and Preparation for the defense										

Appendix VII: Kabarak University IREC Clearance Letter

KABARAK UNIVERSITY

INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

P.O. Private Bag – 20157 Kabarak M: +254 724 887 431 F: +254 51 343529

www.kabarak.ac.ke/irecsecretariat.html E: irecsecretariat@kabarak.ac.ke

Reference: KABU01/IREC/013/VoL1/2020

22nd Jan 2020

Formal Approval Number: KABU/IREC/013

Dr **Musa Greville Saruti** GMMF/M/1343/09/16, Department of Medicine (Family Medicine)
School of Medicine and Health Sciences, Kabarak University

KABARAK UNIVERSITY
INSTITUTIONAL RESEARCH ETHICS COMMITTEE
22 JAN 2020
APPROVED
P. O. PRIVATE BAG - 20157, KABARAK

Dear **Dr Musa,**

FORMAL APPROVAL OF RESEARCH PROPOSAL

The Institutional Research and Ethics Committee reviewed your research proposal on 7th October 2019 titled:

"Prevalence and Determinants of Antibiotic Prescription for Upper Respiratory Tract Infections among under-Fives in Outpatient clinics in Tharaka-Nithi County, Kenya."

You have addressed all concerns raised and now I am pleased to inform you that your proposal has been granted a Formal Approval Number: **KABU/IREC/013** on 17th January 2020. You are therefore permitted to start your study.

Note that this approval is for 1 year; it will thus expire on 21st January 2021. If it is necessary to continue with this research beyond the expiry date, a formal request for continuation should be made in writing to KABU IREC secretariat two months prior to the expiry date.

You are required to submit progress report(s) regularly as dictated by your proposal. Furthermore, you MUST notify the committee of any proposal change(s) or amendment(s), serious or unexpected outcomes related to the conduct of the study, or study termination for any reason. The committee expects to receive a final report at the end of the study.

Yours faithfully,

Prof. Wesley Too, PhD, MPH
Chairman, Institutional Research and Ethics Committee.

Cc Registrar- Academic Affairs and Research
Dean School of Medicine and Health Sciences
Director, Institute of Post Graduate Studies

Kabarak University Moral Code

As members of Kabarak University family, we purpose at all times and in all places, to set apart in one's heart, Jesus as Lord. (1 Peter 3:15)

Kabarak University is ISO 9001:2015 Certified

Appendix VIII: Nacosti Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **977193**

Date of Issue: **07/February/2020**

RESEARCH LICENSE

This is to Certify that Dr.. MUSA GREVILLE SARUTI of Kabarak University, has been licensed to conduct research in Tharaka-Nithi on the topic: Prevalence and Determinants of Antibiotic Prescription for Upper Respiratory Tract Infection among Under-Fives in Outpatient Clinics in Tharaka-Nithi County for the period ending : 07/February/2021.

License No: **NACOSTI/P/20/3287**

977193

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

Appendix IX: Research Permission From Chogoria Hospital

P.C.E.A CHOGORIA HOSPITAL

P .O. Box 35-60401 Chogoria, Kenya. *Tel: 254 064 22620,*
Fax: 254 064 22123 Hotline: 0713 656186, 0734 192208
Email: info@pceachogoriahospital.org *Website:* www.pceachogoriahospital.org

Musa Saruti

Family Medicine Resident

Kabarak University.

February 10th 2020

RE: LETTER OF PERMISSION TO CONDUCT RESEARCH

Dear Dr. Musa,

You can proceed with your research project on prevalence and determinants of antibiotic prescription for upper respiratory tract infection among under-fives in our outpatient clinic.

Note is taken of the Ethical approval from the Kabarak University Institutional Research and Ethics Committee KABU/IREC/013 issued on the 22nd January 2020 as well as the Research License from the National Commission for Science, Technology & Innovation number NACOSTI/P/20/3287 issued on the 7th February 2020. we encourage you to share the findings with our clinical team because we hope that it will help us to strengthen our antimicrobial stewardship system.

Sincerely yours,

10 FEB 2020

Dr Ikunda,

Chief Medical officer,

PCEA CHOGORIA HOSPITAL

THE HOSPITAL SERVES AS GENERAL, REFERAL AND TRAINING HEALTH INSTITUION

Appendix X: Research Permission From Chuka District Hospital

THARAKA NITHI COUNTY GOVERNMENT
DEPARTMENT OF HEALTH SERVICES AND SANITATION

CELL: 0728 226 333
Email: medsuptchuka@gmail.com

When replying please quote:
Ref: CKA/ MED/T/1/VOL.VII

OFFICE OF THE MEDICAL SUPERINTENDENT
CHUKA DISTRICT HOSPITAL
P.O. Box 8 - 60400
CHUKA

Date: 10TH FEBRUARY, 2020

DR. MUSA SARUTI
FAMILY MEDICINE RESIDENT
KABARAK UNIVERSITY

Dear Dr. Saruti,

RE: LETTER OF PERMISSION TO CONDUCT PROPOSED RESEARCH

This letter is issued to let you know that you can proceed with the prospective chart review for your research project on **Prevalence and Determinants of Antibiotic Prescription of Upper Respiratory Tract Infections among under fives** in the Outpatient Clinic.

Note is taken of the Ethical approval from the Kabarak University Institutional Research and Ethics Committee KABU/IREC/013 dated 22nd January 2020 as well as the Research License from the National Commission for Science, Technology and Innovation number NACOSTI/P/20/3287 dated 7th February 2020. You are hereby authorized to proceed with the research and urged to share the findings with Chuka Hospital for purposes of quality improvement.

MEDICAL SUPERINTENDENT CHUKA DISTRICT HOSPITAL
10 FEB 2020
P.O. BOX 8 - 60400 CHUKA

DR. MAUREEN OGETO
MEDICAL SUPERINTENDENT
CHUKA DISTRICT HOSPITAL