

**DETERMINANTS OF ANTIBIOTIC PRESCRIPTION PRACTICES FOR
PNEUMONIA AMONG CLINICIANS AT MBAGATHI LEVEL 5 HOSPITAL,
NAIROBI COUNTY- KENYA**

BRENDAH KASANDI

PHT-3-2337-2/2022

**RESEARCH DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENT FOR THE CONFERMENT OF THE DEGREE OF MASTER'S OF
PUBLIC HEALTH, SCHOOL MEDICINE AND HEALTH SCIENCES, KENYA
METHODIST UNIVERSITY.**

2024

DECLARATION AND RECOMMENDATIONS

I declare that this dissertation is my original work and has not been presented in any other university.

Brenda Kasandi Atoko

PHT-3-2337-2/2022

Signed:

Date:

This dissertation has been submitted for examination with our approval as university supervisors

Lily J.A Masinde

Department of Public Health, Human Nutrition & Dietetics, Kenya Methodist University.

Signed:

Date:

Ms. Phoebe Kerubo Masita

Department of Public Health, Human Nutrition & Dietetics Kenya Methodist University.

Signed:

Date:

DEDICATION

I dedicate this thesis to my loving parents, Mrs Florence Atoko and The Late Mr Gabriel Atoko. The values they instilled in me that have significantly guided me in my academic journey. I am grateful to my mother, a retired health worker, who inspired me to pursue a career in health. I wish to honour my late father who was the epitome of excellence with this study.

ACKNOWLEDGEMENT

A special thanks to my supervisors, Dr. Lily Masinde and Ms. Phoebe Kerubo Masita, who have been a great resource. I cannot thank them enough for their immense support, patience and much-needed guidance during this entire process.

I would like to acknowledge and thank Kenya Methodist University Department of Public Health for impacting me with knowledge and skills required in writing this thesis. I also wish to appreciate useful feedback from faculty and my fellow students.

Finally, I wish to express my gratitude to The County Government Nairobi and the leadership of Mbagathi Level Five Hospital for allowing me to conduct this research at their health facility. A special thanks to the clinicians at Mbagathi level five hospital, for their willingness to provide feedback which made the completion of this research an enjoyable experience.

ABSTRACT

Antibiotic prescribing practices play a critical role in addressing the rising concern of antibiotic resistance and optimizing patient outcomes. While a majority demonstrated a good understanding of the importance of antibiotic stewardship, there were instances of inappropriate prescribing which have become highly persistent in low resource settings. Factors such as patient demand, lack of diagnostic resources, time constraints, and perceived pressure from peers influenced prescribing decisions. In local context, there is paucity of data regarding clinician-prescribing practices. Purpose of the study was to investigate determinants of antibiotic prescription practices for pneumonia among clinicians at Mbagathi level 5 hospital, Kenya. Through a cross-sectional study design, the study explored the level of compliance with pneumonia antibiotic prescription guidelines, socio-economic factors influencing prescription practices, health system-related determinants, and the knowledge and awareness of clinicians regarding pneumonia antibiotic prescription. A census approach was utilized where a total of 151 clinicians participated in the study. Data was collected using a structured questionnaire. Descriptive and inferential approaches were used for analyzing data. Categorical data was summarized using frequencies and percentages. Chi square test was used to investigate determinants of compliance. Level of significance was considered at 0.05. Stata version 17 was used for data analysis. Majority, 92(60.5%) of the respondents were male, 64(42.1%) were aged between 31 to 40 years and 59(38.8%) were aged between 41 to 50 years. The findings also showed that 66 (43.4%) were medical officers, 55(36.2%) were clinical officers while 31(20.4%) were consultants. The findings established that 68.4% of the clinicians had high compliance to antibiotic prescription practices for pneumonia while 31.6% had low compliance. Gender of clinician, designation, presence of medical insurance, perception on diagnostic tests availability, availability of drugs presence of staff and knowledge were significant determinants of compliance to antibiotic prescription practices for anemia. There is still gap in compliance to prescription practices which must be effectively addressed through enhancing education, improving resource availability, addressing socioeconomic barriers, promoting gender sensitivity, ensuring adequate staffing, and regular audits.

Keywords: *Prescription practice, Pneumonia, Clinicians, Determinants, Antibiotic Stewardship and antibiotic resistance*

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LIST OF ACCRONYMS

AMR - Antimicrobial Resistance

ANOVA - Analysis of variance

AR - Antibiotic Resistance

ARIs - Acute Respiratory Infections

ASPs - Antibiotic Stewardship Programs

CCC - Comprehensive care services

CDC - Centers for Disease Control and Prevention

CDSS - Clinical Decision Support Systems

CVR - Content Validity Ratio

FDCs - Fixed-Dose Combinations

KEMU – Kenya Methodist University

LMIC - Low- and Middle-Income Countries

MDR-GNB - Multi-Drug Resistant Gram-Negative Bacteria

NACOSTI - National Commission for Science, Technology & Innovation

NHIF National Health Insurance Fund

OMS - World Health Organization (in Spanish, Organization Mundial de la Salud)

SMEs - Subject Matter Expert Raters

WHO - World Health Organization

CHAPTER ONE: INTRODUCTION

1.0 Introduction

This chapter provides a preview of the study while identifying the underlying problem that influenced this study. This section will include background, statement of the problem, purpose of the study, objectives, justification, limitations, delimitations, significance of the study, assumptions and operational definitions.

1.1. Background

According to World Health Organization (WHO) (2020), antibiotics are defined as medicines that are used in prevention and treatment of bacterial infections. Antibiotic resistance (AR) is a phenomenon that occurs when bacteria undergo changes as a result of the utilization of antibiotics. The development of antibiotic resistance is currently one of the most significant challenges facing the world's health, food security, and development (Ding et al., 2023). The trends have showed increasing resistance mechanisms globally thus, threatening the ability to treat and manage infectious diseases including pneumonia (Llor & Bjerrum, 2014). Antibiotics are getting less effective, which means that it is becoming increasingly difficult, and in some cases perhaps impossible, to cure a rising number of infections. These infections include gonorrhoea, blood poisoning, pneumonia, and tuberculosis. Moreover, resistance to almost all known antibiotics has been observed consequently increasing disease burden in an already resource-constrained economy.

Pneumonia is an acute respiratory infection that mostly affects the lungs causing inflammation of the tissues (Kunhikannan et al., 2021). *Streptococcus pneumoniae*, commonly referred to as pneumococcus, is indeed a major bacterial pathogen responsible for causing pneumonia. Over time, some strains of *Streptococcus pneumoniae* have developed resistance to various classes of antibiotics, including penicillin and macrolides. Antibiotic

resistance in *Streptococcus pneumoniae* is a concern and can impact the treatment of pneumococcal infections (Jullien et al., 2020). The presenting symptoms for pneumonia such as cough, fever, difficulty breathing, and chest pain. Pneumonia has been one of the leading public health concerns globally with approximately 2.5 million people dying annually (WHO, 2020). Almost 30% of all cases being children younger than five years (CDC, 2022). Studies have established that most of these mortalities are associated with antibiotic resistance (Bolge et al., 2021; Hu et al., 2022).

According to Centre for disease control and prevention (CDC), pneumococcal bacteria is the most resistant type of bacteria with more than 30% of cases (CDC, 2023). Further, the most commonly reported MDR-GNB causes of pneumonia were *A. baumannii*, *K. pneumoniae*, and *P. aeruginosa*, with *A. baumannii* (Assefa, 2022). Misuse of antibiotics and poor prescribing patterns have been noted to contribute to increased risk of antibiotic resistance among pneumonia patients. A report published by CDC found that 28 percent of the antibiotics prescribed at the outpatient department were unnecessary which illustrate the poor prescribing pattern among clinicians (CDC, 2022).

The World Health Organization present a broader focus on the management of pneumonia among children with a clear diagnosis plan. Increased global burden of under-five's mortality secondary to pneumonia in the early 1980s prompted World Health Organization to establish a pneumonia control approach that was appropriate for countries with limited resources or no diagnostic equipment for pneumonia. Simple signs were used to define varied degrees of pneumonia severity in context where diagnostic technology was limited or unavailable; the classifications indicated the necessary case management response (Atamna et al., 2019). However, over the years, these guidelines have been effectively revised to conform to the changing symptoms and severity of pneumonia. The adjustments include redefining the

classification of pneumonia severity and switching the antibiotic that is considered to be the first line of treatment.

The findings from a study in India established that 92% of patients in non-teaching hospitals and 89% in teaching hospitals were prescribed antibiotics with 61% in non-teaching and 40% in teaching hospitals utilized access category. Prescribing of *watch* antibiotics and FDCs increased significantly in both hospitals between 2008 and 2017 among patients with pneumonia, cellulitis and peritonitis (Damlin et al., 2020). Another study in Vietnam established that out of 193,010 outpatient visits, 97% resulted in antibiotic prescription. Among these 92.5% were access antibiotics while 5.6% were watch antibiotics and 1.8% of antibiotics given were not recommended (Nguyen et al., 2023). Concerns regarding antibiotic overuse are heightened by the disturbingly high proportion of antibiotic prescriptions for acute respiratory infections (ARIs) that are written in primary care settings, as well as the frequent use of watch-antibiotics for children.

The WHO guidelines have utilized across the world including African context (*WHO Supports Introduction to Antibiotic Stewardship in Three Hospitals*, 2022). Antibiotic stewardship programs (ASPs) have emerged as essential initiatives in healthcare settings worldwide to address the growing threat of antibiotic resistance and ensure the prudent use of these vital medications (Atif et al., 2021). The burden of antibiotics overuse has remained a major problem in African context. (Gasson et al., 2018) in South Africa found that 45.1% of clinicians had good prescribing patterns. A recent report in Ghana established that 32% of patients had inappropriate antibiotic prescription (Owusu et al., 2022). Another study in Uganda established a high burden of poor antibiotic practices among pneumonia patients with 24.9% having rational antibiotic prescription (Abeja et al., 2022).

Previous studies have established that among factors influencing antibiotic prescription, socio-economic and health system related factors have been found to influence clinician prescribing practices (Barbieri et al., 2022; O’Kelly et al., 2021). Affordability of antibiotics, presence of insurance cover, patient pressure and religion are fundamental determinants of prescribing antibiotics among clinicians (Asante et al., 2017; Gaygısız et al., 2017; Sulis et al., 2020). The WHO has also outlined six key pillars which define improved efficiency and delivery of quality of care. These pillars include service delivery, health workforce, health information systems, access to essential medicines, financing and leadership. Critical focus on these pillars provide a conducive environment to increase antibiotic prescribing efficiency considering the high of the health system (Oleribe et al., 2019). However, there are gaps within the system which limit overall commitment to these measure in improving patient outcomes.

In Kenya, the ministry of health has provided key guidelines that have focused on building a more strong and elaborate engagement to control pneumonia. The results from a trial conducted in Kenya in 2015 showed that equivalence of injectable penicillin and oral amoxicillin led to a change in the integration of Kenyan Pneumonia guidelines which was aimed at ensuring that they align with the recently developed World Health Organization 2016 guidelines(Agweyu et al., 2015). There is little research on the antibiotic prescribing patterns and determinants which provide a research gap. A recent investigation conducted by Momanyi et al. (2019) found that the proportion of patients who were prescribed antibiotics was 54.7%. The majority of antibiotics were utilized therapeutically (75.4%), rather than preventatively (29.0%). Only 9.6% of patients receiving surgical prophylaxis received only a single dosage in accordance with the most recent guidelines. The vast majority of patients receiving surgical prophylaxis were on prolonged duration (more than one day). Cephalosporins (44.7%) and penicillin (46.9%) were the two types of antibiotics that were

prescribed the most frequently. Only 37.3% of all patients had documentation showing an indication for the administration of antibiotics (Momanyi et al., 2019). Antibiotic prescribing patterns among clinicians play a fundamental role in contributing to the existing burden of AR.

Mbagathi Level Five Hospital is one of the leading infectious disease hospitals and thus the underlying expectation focus on high and effective antibiotic prescribing pattern among clinicians.

1.2.Statement of the Problem

It is necessary that healthcare professionals, particularly physicians, to maintain a high level of compliance by constantly adhering to the criteria for prescribing antibiotics for pneumonia. In order to provide the best possible patient care, their prescription practices should also be guided by a thorough understanding of the socioeconomic and health system-related factors as well as a thorough comprehension of the prescription practices for antibiotics used to treat pneumonia. It is estimated that resistant infections are responsible for at least 700,000 fatalities annually across the world, with multidrug-resistant communicable diseases accounting for 230,000 of those deaths (Edwards et al., 2021). A study conducted in 2019 estimated 4.95 million deaths associated with bacterial AMR, highest mortality being in western Sub-Saharan Africa (Aslan Kayiran et al., 2020).

The 2015 annual surveillance data from inpatients at Kenyatta National Hospital in Nairobi Kenya revealed that multidrug resistance and extensive drug resistance levels among all pathogens analysed were 88% and 26%, respectively. Kenya like other Low- and Middle-Income Countries (LMIC) is experiencing a double burden of disease due to a rise in non-communicable diseases while the country is still grappling with infectious diseases such as pneumonia. Momanyi et al. (2019) illustrated that despite 54.7% of patients having antibiotic

prescription, only 37.3% had reason for antibiotic use documented. However, there is little known information about the prescribing patterns of clinicians in management of pneumonia patients and determinants contributing to the prescription pattern.

A study by (Bii et al., 2002) at Mbagathi level five hospital identified that pneumonia was the common infectious disease among patients presenting at the facility. However, prescribing patterns were not investigated in their study presenting a gap to investigate the commitment among clinicians in following the underlying ministry of health pneumonia treatment guidelines. Patients with pneumonia are more likely to experience negative outcomes when physicians and other healthcare professionals prescribe incorrectly. These mistakes could result in less effective treatment outcomes, higher medical expenses, a higher risk of antibiotic resistance, and decreased patient safety. Furthermore, these improper behaviors may make it more difficult to manage pneumonia patients overall and may call for corrective and improved prescribing procedures to improve patient outcomes.

1.3.Purpose of the Study

This study investigated factors influencing compliance to antibiotic prescription guidelines for pneumonia among clinicians at Mbagathi Level-Five Hospital, Kenya.

1.4.Objectives of the Study

1.4.1. Broad Objective

To investigate determinants of antibiotic prescription practices for pneumonia among clinicians at Mbagathi Level-Five Hospital, Kenya.

1.4.2. Specific Objectives

- 1) To establish the level of compliance with pneumonia antibiotic prescription guidelines among clinicians at Mbagathi Level- Five Hospital.

- 2) To determine socio-economic related determinants of pneumonia antibiotic prescription practice among clinicians at Mbagathi Level-Five Hospital, Kenya.
- 3) To investigate health system related determinants of pneumonia antibiotic prescription practice among clinicians at Mbagathi Level-Five Hospital, Kenya.
- 4) To establish knowledge and awareness of pneumonia antibiotic prescription practice among clinicians at Mbagathi Level-Five Hospital, Kenya.

1.5. Research Questions

- 1) What is the level of compliance with pneumonia antibiotic prescription guidelines among clinicians at Mbagathi Level Five Hospital, Kenya?
- 2) What are the socio-economic related determinants of pneumonia antibiotic prescription practice among clinicians at Mbagathi Level-Five Hospital, Kenya?
- 3) What are the health system related determinants of pneumonia antibiotic prescription practice among clinicians at Mbagathi Level Five Hospital, Kenya?
- 4) What is the level of knowledge and awareness of pneumonia antibiotic prescription practice among clinicians at Mbagathi Level Five Hospital, Kenya?

1.6. Justification of the Study

Antibiotic resistance has become a global public health threat in recent years, and it is estimated that by 2050, it could cause up to 10 million deaths annually (Chokshi et al., 2019). The emergence and spread of antibiotic resistance (AR) are linked to the overuse and misuse of antibiotics, particularly in low resource settings where access to effective and appropriate antibiotics is often limited (Chem et al., 2018). Primarily, overuse of antibiotics resulting from inappropriate prescribing is the principal cause of resistance (Frieri et al., 2017). Following the increasing trend of antibiotic resistance in both human and animal health, the Global Action Plan on AR was adopted in 2015 and members including Kenya agreed to jointly combat antibiotic resistance. Member states committed to develop national actions

plans on AMR consistent with the Global Action Plan (Organization Mundial de la Salud [OMS], 2016).

Mbagathi level-five Hospital Nairobi, Kenya, is renowned for management of infectious disease in Kenya and served as an isolation centre during the Covid-19 pandemic. The commitment of clinicians towards compliance with the pneumonia treatment guidelines has not been investigated in this setting despite playing a major role in control of such diseases. This study provides a basis within which the compliance with treatment guidelines and underlying determinants will be investigated to improve quality of care and inform policy implementation in improving level of compliance.

1.7.Limitations and Delimitations of the Study

1.7.1. Limitations

The assessment of compliance was done from clinician perspective and did not involve cross checking patient files to determine actual prescriptions made hence could have led to a higher rate of compliance than normal.

1.7.2. Delimitations

Collection of data was done anonymously which encouraged clinicians to be honest with their responses.

1.8. Significance of the Study

The findings from this study will help document the patterns of prescribing practices to help understand the burden poor prescribing practices among clinicians which is vital in improving the health and wellbeing of children diagnosed with pneumonia.

Further, the findings from the study will also help identify areas of over-prescribing, unnecessary antibiotic use, or incorrect choice of antibiotics, which can fuel the emergence

and dissemination of resistant bacteria. By understanding these practices, interventions can be developed to promote responsible antibiotic use and mitigate the risk of antibiotic resistance.

By studying prescribing practices, it is possible to investigate clinical guidelines and evidence-based practices, ensuring that patients receive appropriate and effective treatment. These findings will also create an improved knowledge in an area that has not been exhaustively investigated by researchers and policy makers.

1.9. Operational Definition of Terms

Prescription practice: Is the process by which healthcare providers prescribe medications to their patients based on set guidelines.

Determinants: Factors that influence a prescribing practice.

Guideline adherence refers to the extent to which clinicians follow established clinical guidelines or recommendations when making decisions about the diagnosis, treatment, and management of pneumonia.

Clinicians encompass healthcare professionals involved in the diagnosis, treatment, and management of patients.

Polypharmacy occurs when a patient is prescribed multiple medications concurrently.

Guideline adherence refers to the extent to which clinicians follow established clinical guidelines or recommendations when making decisions about the diagnosis, treatment, and management of pneumonia.

Multi-drug resistance refers to the ability of microorganisms, such as bacteria, fungi, and parasites, to resist the effects of multiple drugs that are typically effective against them.

Resistance the ability of organisms (like bacteria, viruses, or parasites) to withstand the effects of drugs or treatments that would normally inhibit or kill them.

CHAPTER TWO:

LITERATURE REVIEW

2.0.Introduction

This section provides an evaluation of the past literature on antibiotic prescribing practices and underlying determinants. The sections included will include socio-economic determinants, health system related determinants and conceptual framework which provide a review of the relationship between independent and dependent factors.

2.1. Burden and Diagnosis of Pneumonia

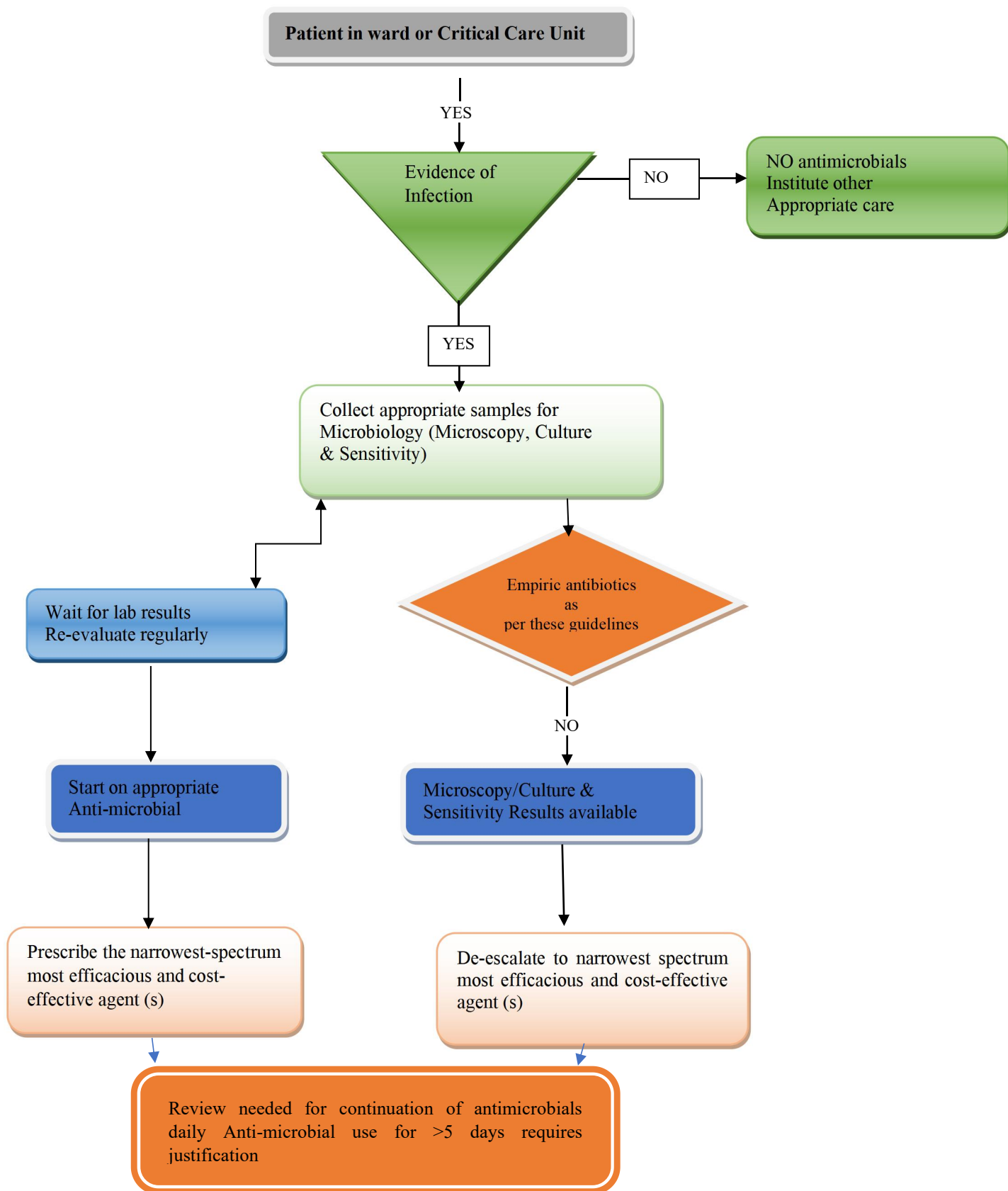
Pneumonia is described as a bacterial infection of the lung tissue. Blood cultures, lung biopsy, nasopharyngeal aspirates, and immunological urine and blood tests are some of the methods that can be used to classify the basic etiological agent (Wussler et al., 2019). Because of the invasiveness of the operation and the resulting morbidity, lung biopsies are rarely performed. Since blood cultures have such low yields (5-15%), they cannot be relied upon to make an informed decision. In the majority of children with pneumonia, rapid and highly sensitive laboratory tests on samples from the upper respiratory tract or induced sputum will detect nucleic material from pathogens (Graham et al., 2020).

Best practice on antibiotic use as illustrated in antibiotic prescribing algorithm below recommends appropriate investigations for all infections, collection of samples before initiating antibiotic therapy, de-escalation to the narrowest spectrum most efficacious and most cost-effective option. The need for antibiotic therapy should also be reviewed regularly and treatment exceeding five days requires justification.

2.2. Ministry of health guidelines

Figure 2.1

Antibiotic Prescribing Algorithm



2.3. Socio-economic Related Determinants of Prescription Practice Among Clinicians

Antibiotics are essential tools in the treatment of bacterial infections, but their misuse and overuse contribute to the growing threat of antibiotic resistance. The prescribing patterns of physicians play a significant role in determining the appropriate use of antibiotics. However, in low resource settings, where socio-economic disparities are prevalent, various factors related to socio-economic status can influence antibiotic prescribing practices among clinicians (Servia-Dopazo & Figueiras, 2018). Kenya just like other developing countries is faced with a growing burden of disease and resource strain which has caused competing needs. Affordability of antibiotics, having insurance cover, patient and relative pressure, religion and financial incentives to clinicians for prescribing antibiotics have been identified as key determinants for prescribing patterns.

2.3.1. Affordability and Presence of Insurance Cover

The affordability of antibiotics can significantly influence clinician prescribing practices, especially in healthcare systems where cost considerations play a substantial role in treatment decisions. Clinicians are often aware of the financial burden that healthcare costs can place on patients. When choosing antibiotics, they may consider the affordability of different options to ensure that patients can access and afford the prescribed medication. In turn clinicians also in some instances consider presence of insurance cover to prescribe antibiotics which could lead to prescription that are unnecessary for patients. A cross sectional study conducted in China investigating association between insurance cover and antibiotic prescription revealed that there was significant association between antibiotic use and patient insurance cover (Dong et al., 1999). Another case control study in France established that

presence of health insurance was significant determinant of antibiotic prescription (Opatowski et al., 2021).

2.3.2. Patient and Relative Pressure

Patient centred care is fundamental in attaining high level of quality. Medical ethics require patient autonomous and thus play a major role in access to quality healthcare. However, sometimes patients and relatives come up with undue pressure which negatively influence prescribing patterns among clinicians. Patients may have a strong desire for antibiotics, even when they are not necessary or appropriate. Patients may believe that antibiotics are a cure-all for their illnesses and may pressure physicians to prescribe them. Prescribing to patients who are also clinicians can be challenging. Whereas it is expected that clinicians should be having a better understanding on antibiotic prescription guidelines, some come already armed with their preferred antibiotic that they would like prescribed. This demand can be challenging for physicians, who may feel pressured to prescribe antibiotics to satisfy their patients' expectations, even when they know it is not necessary or appropriate. Several studies have demonstrated the impact of patient demand on antibiotic prescribing practices among physicians. A study conducted by Butler et al. (2016) found that patients who demanded antibiotics were more likely to receive them, even when their symptoms did not warrant antibiotic treatment. Similarly, a study by Tinker et al. (2021) found that physicians were more likely to prescribe antibiotics when patients expected them, regardless of the clinical indications for antibiotic treatment.

2.3.3. Financial Incentive

Financial incentives, such as bonuses or reimbursements, tied to prescribing practices have the potential to influence clinician behaviour. The premise behind these incentives is to

promote desired clinical outcomes, cost-effective care, or patient satisfaction. However, when financial rewards are directly linked to prescription volumes or specific medications, the potential for misuse or overuse of antibiotics arises. This may occur due to a desire to maximize financial gains or meet performance targets (Dixon et al., 2021).

A study conducted in China established that external factors played an instrumental role and physician's antibiotic use was associated with patient pressure, time pressure, financial incentives, institution environment (rural area) and high socio-economic setting. Further analysis revealed that majority of antibiotic subscribers were male and had lower educational qualification (Liu et al., 2019).

2.3.4. Religion and Culture

The religious beliefs of patients and their potential impact on the prescription of antibiotics by clinicians is an interesting and complex topic. While religion itself might not be a direct determinant of prescription decisions, certain religious practices, beliefs, and cultural factors could indirectly influence clinical decisions, including antibiotic prescriptions. Religious and cultural beliefs can shape how individuals perceive health, illness, and treatment. Some religious groups may have specific views on health and healing, which could influence their willingness to accept certain medical interventions, including antibiotics. A cross sectional survey in Saudi Arabia investigating the influence of religion on antibiotic prescription established those patients had a variety of perspectives regarding the prescription of antibiotics. Twenty-five percent of patients believed that it was necessary to take antibiotics for every infection, while forty-four percent believed that antibiotics should be prescribed for respiratory tract infections. After further investigation, it was discovered that the patient's expectations regarding the prescribing of antibiotics were substantially connected with the inappropriate use of antibiotics. On the other hand, there was a negative correlation between

inappropriate antibiotic use and patient satisfaction with antibiotic prescribing (Fallatah et al., 2023). A qualitative study in Congo revealed that personal beliefs negatively influenced antibiotic prescribing patterns (Eibs et al., 2020).

2.4. Health System Related Determinants of Prescription Practice Among Clinicians

The health system factors incorporate the WHO six pillars which include health service delivery, health workforce, health information system, access to essential medicines, leadership and governance. Prescription practices among clinicians play a crucial role in patient outcomes, medication safety, and the overall effectiveness of healthcare systems. Several health system-related determinants influence physicians' prescription practices. These include, human resource factors, financial challenges, physical resources and access to health information systems. In Kenya, majority of patients access care through the National Health Insurance Fund (NHIF). Other forms of payment include out of pocket and insurance covers. The preference of patients with insurance covers, high prescription of close to expiry antibiotics and inability to implement antibiotic guidelines have negatively influenced prescribing practices among clinicians. Such measures are contrary to the antimicrobial's stewardship guidelines and in countries such as Kenya where there has been limited enforcement of these guidelines, the welfare of patients has been greatly impacted. However, there is limited published information about health system related factors that influence prescribing practices among clinicians (Alowfi et al., 2023).

2.4.1. Availability of Antibiotics

The availability of medical supplies can have a significant impact on antibiotic prescription patterns among clinicians. Adequate availability antibiotics of good quality, safe, cost-effectiveness, and scientifically sound is essential. There is a tendency to overprescribe drugs

that have a shorter shelf life or drugs nearing expiry. Physicians' prescribing decisions are influenced by the availability of essential medications in healthcare settings. Inadequate medication supply, stockouts, or limited formularies can constrain physicians' choices, leading to suboptimal prescribing practices. Accessibility to medications, including affordability and insurance coverage, also influences prescribing decisions, as patients' ability to access prescribed medications impacts treatment and outcomes (Atif et al., 2021).

2.4.2. Availability of Diagnostic Services

Early diagnosis and treatment of diseases is not only cost effective but also leads to better health outcomes, hence the need for diagnostic services. Availability of comprehensive services is a vital component of the service delivery pillar of a health system. This including diagnostic tools and laboratory resources that plays a crucial role in supporting evidence-based decision-making and facilitating appropriate antibiotic prescribing practices. Radiological diagnostic procedures such as chest x-ray, chest computed tomography and bronchoscopy confirm findings obtained from patient's physical examination and medical history

Access to laboratory resources for culturing pathogens and testing their sensitivity to antibiotics enables clinicians to tailor antibiotic prescriptions to specific pathogens and their susceptibilities (Ecker et al., 2013; Pallavi et al., 2012). Blood cultures sputum tests polymerase chain reaction, pleural fluid culture, blood gas test is some of the laboratory tests required in pneumonia diagnosis and management

2.4.3. Monitoring of Prescription Practices

Monitoring prescription practices and antibiotic prescription patterns is a crucial component of antibiotic stewardship programs and efforts to combat antibiotic resistance. Such monitoring helps ensure that antibiotics are prescribed appropriately and in line with

evidence-based guidelines. Establishing surveillance systems to track antibiotic prescription rates, types of antibiotics prescribed, and the conditions they are prescribed for. This helps identify trends and potential areas of overuse or inappropriate use. However, in healthcare settings where there are no clear monitoring systems, prescribing patterns might be difficult to monitor which increase the likelihood of antibiotic prescription inappropriacy (Christensen et al., 2022). Another major issue has been moral hazard in care delivery (Razon et al., 2005). Healthcare professional is guided by high levels of ethical consideration and integrity where healthcare providers are expected to behave and perform their duties in certain manner. However, healthcare has become a major business especially in low-income countries where there is high number of health facilities mushrooming. These facilities are developed to achieve a financial gain where the performance of care providers is geared towards profit making rather than the wellbeing of patients (Alghounaim et al., 2021).

2.4.4. Policy Guidelines in the Facility

Antibiotics have been hailed as one of the most significant medical advancements in history, saving countless lives from once-fatal infections. However, their overuse and misuse have led to a global crisis of antibiotic resistance, rendering these life-saving drugs less effective against bacterial infections. Leadership and governance pillar of a health system involve ensuring that strategic policy frameworks exist. In response to this looming threat, hospitals have recognized the importance of policy guidelines in predicting antibiotic prescribing patterns of clinicians. By establishing evidence-based policies, hospitals can steer clinicians towards more prudent antibiotic use, ultimately safeguarding both current and future generations from the devastating consequences of antibiotic resistance (Gasson et al., 2018).

Policy guidelines in predicting antibiotic prescribing patterns of clinicians are vital in the battle against antibiotic resistance. By implementing evidence-based practices, hospitals can

optimize antibiotic use, promoting patient safety, reducing healthcare costs, and safeguarding the efficacy of these life-saving drugs for future generations. Collaboration between healthcare professionals, continuous monitoring, and an unwavering commitment to antibiotic stewardship are crucial in maintaining the delicate balance between providing effective treatments and preserving the effectiveness of antibiotics. Through such concerted efforts, hospitals can play a pivotal role in addressing the global challenge of antibiotic resistance and ensuring a healthier and safer future for all (Alghounaim et al., 2021).

A cross-sectional retrospective study in Cameroon found that the most prevalent indications for prescribing were respiratory tract infections (21.27%) (Chem et al., 2018). A systematic review by Teixeira Rodrigues et al. (2013) also identified time pressure and guidelines implemented were the most common factors associated with antibiotic prescribing among physicians.

A New Delhi qualitative study found three themes: doctor and patient behaviour, laxity in antibiotic prescribing and dispensing, and intervention techniques to reduce antibiotic abuse and resistance. Doctors' antibiotic prescriptions were influenced by diagnostic ambiguity, patient demand and expectation, practice sustainability and finances, medical representatives, and poor knowledge. Overstocked and near-expired medications and lack of time drove antibiotic overuse in public institutions. Doctors also blamed patient behaviour and inadequate prescription prescribing and distribution regulations for antibiotic overuse (Kotwani et al., 2010).

Clinical guidelines and protocols provide evidence-based recommendations for specific medical conditions and play a vital role in guiding physicians' prescribing practices (Odoi et al., 2021). The quality, relevance, and availability of guidelines significantly impact prescription practices. Well-developed, up-to-date guidelines facilitate standardized and

appropriate prescribing, improving patient outcomes. However, challenges arise when guidelines are unavailable, outdated, or not tailored to the local context, potentially leading to variations in prescribing practices (Evripidou et al., 2015).

2.4.5. Staffing and Workload

One of the key components of a well-functioning health system is a sufficient and skilled healthcare workforce, which is closely related to staffing and workload. Staffing and workload are essential pillars of a robust health system, contributing to the overall effectiveness, efficiency, and quality of healthcare services. Staffing and workload are critical factors that can significantly influence antibiotic prescribing patterns among clinicians. The demands placed on healthcare providers can impact their decision-making processes and contribute to variations in antibiotic prescription practices. Research has showed that high workload can limit the time clinicians have for each patient encounter. In such cases, clinicians might opt for quick solutions, including prescribing antibiotics, to address patients' concerns promptly (Borek et al., 2020; Christensen et al., 2022). According to the Kenya National Bureau of Statistics (KNBS) Kenya's doctor-to-patient ratio is 19 practitioners per 100,000 people, which translates to 1 doctor per 5,263 Kenyans, five times the WHO-recommended ratio of 1 doctor for every 1,000 people. Efforts to reduce workload, support evidence-based practices, and prioritize patient-centred care can help mitigate the influence of these factors on antibiotic prescribing decisions.

2.5. Knowledge and Awareness of Pneumonia Antibiotic Prescription

A cross sectional study conducted in Malawi established that 84% antibiotic prescriptions were adherent to the guidelines, 12% were non-adherent and 3.5% had the indication for antibiotic not clearly outlined. The findings further revealed that the most common indication

for antibiotic use was pneumonia and ceftriaxone was the commonly prescribed antibiotic. Among patients, 38% of them had culture taken to adjust treatment (Sibande et al., 2022). The less utilization of culture in the present study illustrated the need to implement regular audits to reduce the impact of antibiotic resistance and improve patient care.

A systematic review conducted in low- and middle-income countries by Foxlee et al. (2021) revealed that the elements that promote commitment to antibiotics were grouped into 18 different strategies, which were then recategorized into five major strategies. These five major strategies were organizational, capacity building, monitoring and review, clinical decision support systems (CDSS), and persuasive tactics. Audit and feedback, in conjunction with either instructional seminars or focus group discussions, were the intervention components that were utilized the majority of the time (Foxlee et al., 2021). Further, a study in Norway revealed that commitment to antibiotic prescription increased from 61.7% to 83.8% with increased audit and feedback review (Høgli et al., 2016).

According to the findings of a cross-sectional audit that was carried out in Ghana for the purpose of determining whether or not guidelines for the prescribing of empirical antibiotics to individuals who had urinary tract infections were adhered to, 83% of all patients were given prescriptions for empirical antibiotics, and of those, 88% were given oral ciprofloxacin or cefuroxime. Sixty-eight percent of the patients had the appropriate antibiotic prescription (Owusu, et al., 2022).

A mixed method study conducted in Namibia investigating the compliance to prescribing guidelines among public health care facilities, the findings showed that 73% complied with standard treatment guidelines and 69% had antibiotic. The vast majority of prescribers in Namibia were familiar with the Namibian standard treatment recommendations and had access to them (94.6%). Furthermore, the vast majority of prescribers said that the guidelines

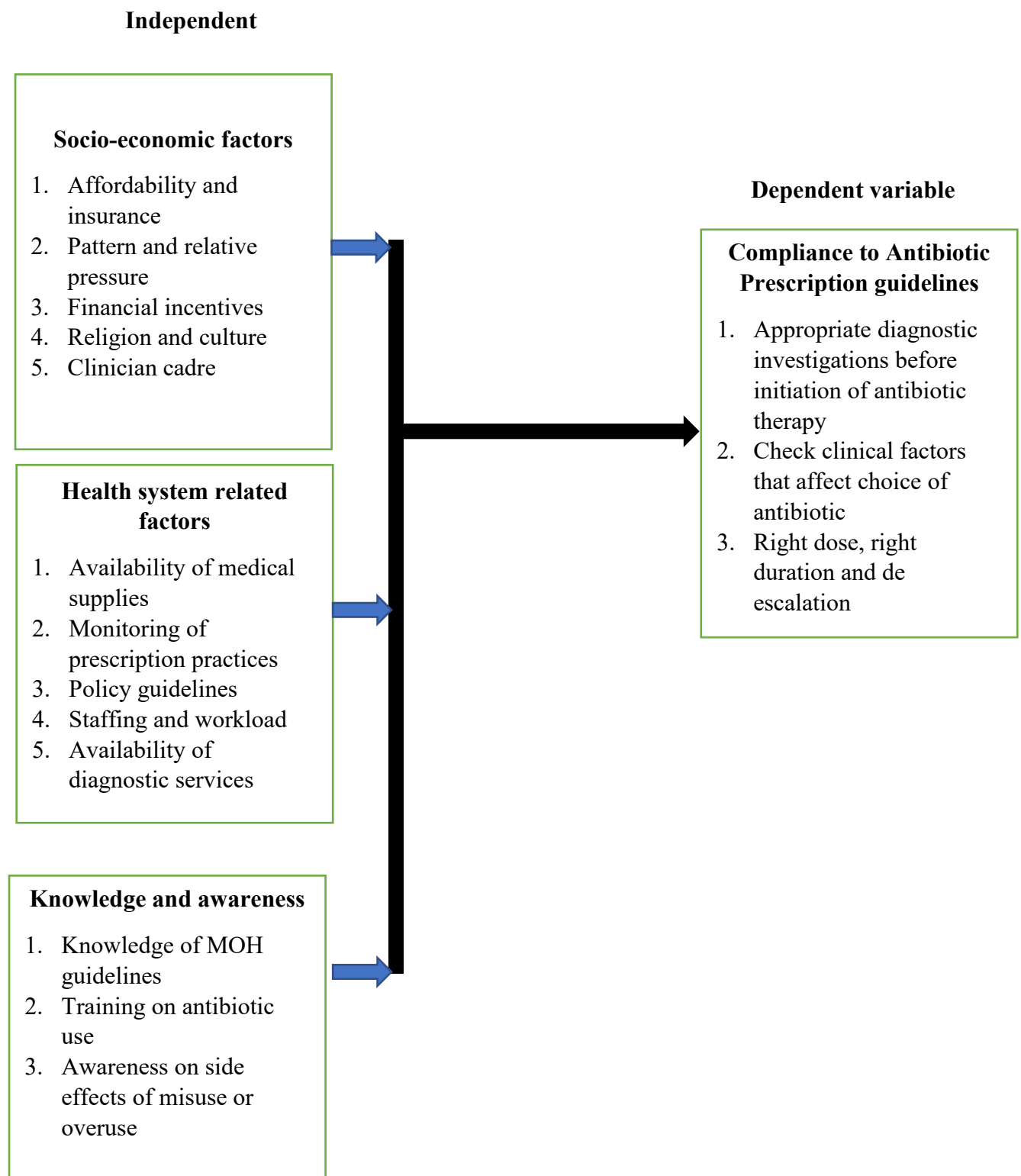
were simple to follow and that they frequently referred to them. The primary factors that contributed to compliance with guidelines were programmatic in nature. These factors included availability to current and objective guidelines, support mechanisms for continuing education on how to utilize them, and simplicity of referencing. Their use was hindered by the absence of regulatory structures to deal with noncompliance (Niaz, et al., 2020). A retrospective medical review in South Africa established that less than half of clinicians had good antibiotic prescribing patterns (45.1%) (Gasson, et al., 2018).

A prospective observational study was carried out in Ethiopia with the purpose of investigating the adherence to guidelines for assessment and empiric antibiotic recommendations for community acquired pneumonia. The findings of the study showed that only 50 of the 141 patients who were initially given an admitting diagnosis of severe community-acquired pneumonia ended up satisfying the guideline criteria. This resulted in an over-diagnosis rate of 41.9%. The research also uncovered the fact that empiric antibiotic guidelines for community-acquired pneumonia were not adhered to. Ceftriaxone was the antibiotic that was prescribed the most frequently by itself at a rate of 21.7%, while the combination of ceftriaxone and azithromycin was the antibiotic treatment that was prescribed the most frequently at a rate of 50.7% (Mekonnen Eticha & Gemechu, 2021).

2.6. Conceptual Framework

Figure 2.2

Conceptual Framework



Source (Author, 2023)

2.1. Theoretical Review

2.1.1. Theory of planned Behaviour

According to Azjen (2011) he claimed that attitudes, subjective norms, and perceived behavioural control all have an impact on an individual's behavioural intentions, which in turn affect that conduct. This framework may include components that represent the attitudes of clinicians toward recommendations, the perceived norms that are common in the medical community, and the perceived ease or difficulty of following guidelines. The main goal is to assess the variables that affect physicians' adherence to the recommendations for antibiotic prescription for pneumonia. which unmistakably show how a clinician's actions affect prescribing practices.

2.1.2. Health Belief Model

The Health Belief Model by Rosenstock (1974) the framework for antibiotic prescription practices in pneumonia among physicians takes into account the severity, susceptibility, advantages, and barriers as perceived by the physicians. This model highlights how decision-making by doctors is influenced by their perceptions of the advantages and disadvantages of antibiotic treatment, as well as its urgency and necessity. Furthermore, the model acknowledges the interaction between socioeconomic characteristics and health attitudes, offering insights into the external factors influencing the prescription behavior of clinicians.

CHAPTER THREE

METHODOLOGY

3.0.Introduction

This section presents a review and outline of processes and methods that were used in the study. This chapter focusses on the research design used, the study's target population, sampling design and sample size, data collection instruments and techniques, and data analysis techniques.

3.1. Study Design

A study design refers to the plan or strategy developed to conduct research or a study. This study adopted a cross sectional research design with a census approach. The design below outlines the procedures to be followed to collect and analyse data and the type of research question being addressed.

3.2. Study Setting

This study was done at Mbagathi level-five Hospital, initially known as South Hill Hospital for Infectious Diseases. The hospital is located in Kenyatta Golf Course Location, overlooking the Kibra informal settlement. The hospital was an isolation extension of the current Kenyatta National Hospital up to 1995, when it was a fully-fledged hospital. It is also worth noting that the facility served as a treatment and isolation centre during the covid 19 pandemic. With an out-patient turn-over of 1,200 patients daily and a bed capacity of 320, the facility offers preventative, curative, palliative as well as rehabilitative services, in line with level-five categorization criteria. Inhabitants of the adjacent informal settlement of Kibra account for the majority of clients where overcrowding, poor sanitation, unsafe drinking water and social disorder predispose them to infectious diseases, consequently requiring antibiotic use

3.3. Target Population

The study included medical officers, consultants and clinical officers working at Mbagathi level five hospital. The medical officers and clinical officers were targeted because they are mandated to prescribe medication to patients.

3.3.1. Inclusion Criteria

Consultants, medical officers and Clinical officers working in general clinics and Doctors and clinical officers who consent

3.3.2. Exclusion Criteria

Clinicians who declined to consent

3.4. Sampling Procedure and Sample Size

3.4.1. Sampling Procedure

A complete enumeration of all clinicians was done. All clinicians who were on duty during the study period were targeted and those who agreed to participate in the study were recruited.

3.4.2. Sample Size Determination

The study adopted a census approach where all 171 clinicians working at the facility were targeted. A total of 152 clinicians participated in this study.

3.5. Data Collection Instruments

A structured questionnaire was used to collect data. The questionnaire was uploaded to Kobo collect for online data collection. The questionnaire was structured based on the study objectives. A rating system known as a five-point likert scale provided five possible responses ranging from extreme attitude to its opposite. The questionnaire included sections where section A included demographic and socio-economic factors. Section B included information on health system related factors while section C included information on awareness and knowledge on pneumonia antibiotic prescribing practices and finally the last

section part D covered antibiotic prescription practices, this was based on self-assessment on the existing national guidelines in order to evaluate whether clinicians followed guidelines prior to prescribing antibiotics for their respective patients presenting at the facility. Clinicians who correctly identify all the needed procedures were considered as compliant while those who are unable to fully identify all the processes and procedures in question will be considered to be non-compliant.

3.5.1. Instrumentations

Table 3.1.

Instrumentations

Sections	Objective	Instruments
Section A	Determine social-economic related determinants of pneumonia antibiotics prescription practice among clinicians	Likert scale item questionnaire
Section B	Investigate health systems related determinants of pneumonia antibiotics prescription practice among clinicians.	Likert item scale questionnaire
Section C	Establish knowledge and awareness of pneumonia antibiotics practices among clinicians	Likert item questionnaires and structured questionnaires
Section D	Establish the level of compliance with pneumonia antibiotics prescription guidelines among clinicians	Likert item scale questionnaire

3.5.2. Data Validity of the Study

This study tool was checked in principle, content, and criteria validity in order to guarantee the validity of its measurements. The degree to which the measurement is consistent with the

accepted philosophy and understanding of whatever is being measured was used to evaluate construct validity. On the other hand, content validity was assessed the measurement's comprehensiveness, taking into account how well it covers each element of the topic being studied. Criterion validity looked at how well the measurement's findings match up with other accepted measurements of the idea, evaluating how close and how wide this correspondence was.

3.5.3. Data Reliability

According to Scholtes et al. (2011), reliability was evaluated in this study to ascertain how trustworthy the data gathering tool assesses the intended idea. Reliability, accuracy, consistency, and comparability are qualities that a trustworthy research instrument should possess in order to improve the study's capacity to identify links and differences within the population being examined. In order to increase the measure's dependability, the researcher will include multiple related items and evaluate a wide range of people utilizing uniform testing procedures., following the recommendations of Mugenda and Mugenda (2003).

According to George and Mallery's (2003) criterion, reliability is represented as a coefficient with a range of 0.0 to 1.0. Values above 0.9 are regarded as excellent, above 0.8 as good, above 0.7 as acceptable, above 0.6 as dubious, above 0.5 as poor, and below 0.5 as undesirable. The internal consistency reliability of the research instrument was evaluated by means of the Cronbach's alpha technique in this study which was found to be 0.8.

Reliability is the repeatability of the findings which integrates the need to effectively integrate better processes. A pilot study including 10% of the study sample was done in Mama Lucy hospital to account for both the private and public setting.

3.6. Methods of Data Collection

3.6.1. Data Collection

Data collection began after approval from Kenya Methodist University administration, permission from NACOSTI and from Mbagathi level five hospital administration. With permission from the medical superintendent, an email containing an informed consent as well as the data collection tool was sent to all the clinicians. Only those who consented accessed the questionnaire. Email reminders were sent weekly to encourage participation. The respondents were required to answer the questions based to their knowledge including those that were off duty or on leave.

3.6.2. Pilot Test

A 10% of the study sample population was used to pilot the study and ensure that the study tool effectively answers the study objectives. Pilot test was conducted at Mama Lucy Kibaki hospital. This is because the hospital has same profile as the study sites. This helped improve efficiency and efficacy of the study tool.

3.6.3. Data Cleaning and Entry

The researcher crosschecked the data entry tools for completeness. Data was entered using Epi data 3.1 and then exported to STATA 15.1 for analysis.

3.7. Data Analysis and Presentation

Data analysis was done using STATA version 17. A chi square test or Fischer's exact test for association was used to investigate the determinants of antibiotic prescription practices among clinicians. The level of significance was assessed at 95% significance level ($p < 0.05$).

3.7.1. Data analysis

Table 3.2

Data analysis

	Objectives	Method of analysis
1	Establishing the Level of Compliance with Pneumonia Antibiotic Prescription Guidelines	We computed descriptive statistics to put an overall compliance rate figure on paper, like means and percentages. Furthermore, inferential statistics was utilized to determine the elements linked to non-compliance, such as logistic regression or chi-square tests. The accuracy of compliance rate was estimated using confidence intervals.
2	Determining Socio-economic Related Determinants of Pneumonia Antibiotic Prescription Practice	The study employed binary regression analysis to ascertain the socio-economic factors that impact the prescription of antibiotics. The model incorporated variables like years of experience, education, and income.
3	Investigating Health System Related Determinants of Pneumonia Antibiotic Prescription Practice	Fischer's exact test and Pearson chi square tests were performed. Multivariable analysis was done using binary logistic regression.
4	Establishing Knowledge and Awareness of Pneumonia Antibiotic Prescription Practice	The knowledge scores and awareness levels were summarized using descriptive statistics. Fischer's exact test and Pearson chi square tests were performed. Multivariable analysis was done using binary logistic regression.

3.8. Ethical Consideration

The study was approved by KEMU school of post-graduate studies. Similarly, ethical approval was sought from KEMU ethical review board. Permission to carry out the study from a county facility was obtained from the county government of Nairobi. Permission to carry out the study and interact with participants was sought from hospital administration in each facility.

An informed consent form was sought from all the study participants. Only those who consent will be recruited into the study. Confidentiality was maintained by using identifiers in referring to the study participants. No personal identifiers were captured. An informed consent was administered and only those who consented were recruited. Participation into the study is voluntary and no one was coerced to participate in the study.

CHAPTER FOUR:

RESULTS

4.1.Introduction

This study sought to investigate determinants of antibiotic prescription practices for pneumonia among clinicians at Mbagathi level 5 Hospital Nairobi, Kenya. A total of 152 clinicians were recruited into the study. The specific objectives included level of compliance, socio-economic related factors, health system related factors, knowledge and awareness of pneumonia antibiotic prescription practice among clinicians at Mbagathi level-five Hospital.

4.1.1. Demographic Characteristics of Clinicians at Mbagathi level-five Hospital

Majority, 92(60.5%) of the respondents were male, 64(42.1%) were aged between 31 to 40 years and 59(38.8%) were aged between 41 to 50 years. The findings also showed that 66(43.4%) were medical officers, 55(36.2%) were clinical officers while 31(20.4%) were consultants. Almost half, 73(48%) of the respondents had more than 10 years of working experience as shown in Table 4.1

Table 4.1

Demographic Characteristics of Clinicians at Mbagathi level-five Hospital

	Frequency	Percent
Gender		
Male	92	60.5
Female	60	39.5
Age(years)		
21 – 30	11	7.2
31 – 40	64	42.1
41 – 50	59	38.8
>50	18	11.8
Designation		
Consultant	31	20.4
Medical officer	66	43.4
Clinical officer	55	36.2
Years of experience		
<5	17	11.2
5 – 10	62	40.8

4.1.2. Socio- economic Related Factors Influencing Clinician's Prescription Patterns

The clinicians were also asked about the socio-economic factors influence on their prescription patterns as shown in Table 2. The results showed that 71(46.7%) of the respondents agreed that they evaluate the ability of patient to afford determines the type of antibiotics prescribed, 56(36.8%) agreed while 47(30.9%) strongly agreed with the statement that presence of medical insurance influences the choice of antibiotic prescribed. Further, 73(48%) agreed that patient and relative pressure play a role in choice of antibiotic prescribed, 47(30.9%) of the clinicians were neutral on the statement that incentives from drug companies have an effect on the choice of antibiotic prescribed and 56(36.8%) were also neutral on the statement that patients religious and cultural beliefs influence the choice of antibiotic prescribed.

Table 4.2

Socio -economic Related Factors Influencing Clinician's Prescription Patterns

	Strongly disagree n(%)	Disagree n(%)	Neutral n(%)	Agree n(%)	Strongly agree n(%)
Ability of patient to afford determines the type of antibiotics prescribed		27(17.8)	17(11.2)	71(46.7)	37(24.3)
Presence of medical insurance influences the choice of antibiotic prescribed		29(19.1)	20(13.2)	56(36.8)	47(30.9)
Patient and relative pressure play a role in choice of antibiotic prescribed		14(9.2)	46(30.3)	73(48.0)	19(12.5)
Incentives from drug companies have an effect on the choice of antibiotic prescribed	5(3.3)	17(11.2)	47(30.9)	66(43.4)	17(11.2)
Patients religious and cultural beliefs influence the choice of antibiotic prescribed	1(0.7)	9(5.9)	56(36.8)	65(42.8)	21(13.8)

4.2.The Level of Compliance with Pneumonia Antibiotic Prescription Guidelines

The respondents were asked questions regarding their compliance with pneumonia antibiotic prescription guidelines as shown in Table 2. The findings showed that 90(59.2%) of the respondents agreed that they follow guidelines for prescribing antibiotics in pneumonia cases on choice of antibiotics and treatment duration, 92(60.5%) also agreed with statement that they update my knowledge of pneumonia treatment guidelines. In addition, 98(64.5%) of the respondents agreed that they are aware that the clinical factors in patients that influence the choice of antibiotic, 101(66.4%) agreed that they always consult reference sources (such as guidelines, drug information databases) when prescribing medication while 105(69.1%) of the respondents agreed that they frequently communicate potential risks or side effects of prescribed medications to my patients.

Table 4.3

Level of Compliance with Pneumonia Antibiotic Prescription Guidelines

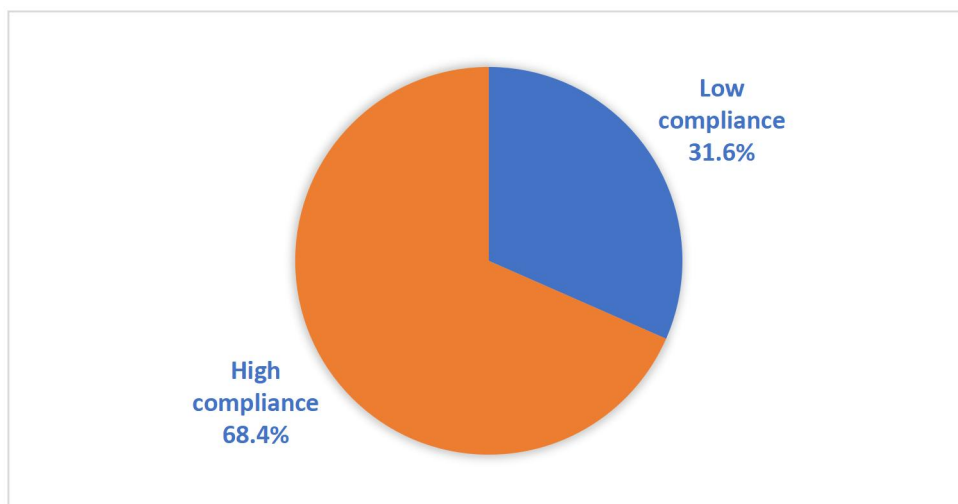
	Strongly disagree n(%)	Disagree n(%)	Neutral n(%)	Agree n(%)	Strongly agree n(%)
I follow guidelines for prescribing antibiotics in pneumonia cases on choice of antibiotics and treatment duration	2(1.3)	0	31(20.4)	90(59.2)	29(19.1)
I update my knowledge of pneumonia treatment guidelines	1(0.7)	0	25(16.4)	92(60.5)	34(22.4)
I am aware of the clinical factors in patients that influence the choice of antibiotic	0	0	19(12.5)	98(64.5)	35(23.0)
I always consult reference sources (e.g, guidelines, drug information databases) when prescribing medication	0	0	16(10.5)	101(66.4)	35(23.0)
I frequently communicate potential risks or side effects of prescribed medications to my patients	0	0	20(13.2)	105(69.1)	27(17.8)

4.2.1. Level of Compliance

The five items assessing compliance were summed up with agree and strongly agree being considered as compliance. Thus, the summed-up scores ranged from 5 to 25 with scores of ≥ 20 being considered as highly compliant while < 20 scores were considered as having low compliance. The findings established that 104(68.4%) of the clinicians had high compliance while 48(31.6%) had low compliance as shown in Figure 4.1

Figure 4.1

Level of compliance



4.3. Socio-economic Related Determinants of Pneumonia Antibiotic Prescription Practice.

The findings from Pearson chi square and Fischer's exact test established that there was significant association between gender and compliance with pneumonia antibiotic prescription practice, $\chi^2(1) = 8.05$, $p = 0.005$. There was also significant association between designation and compliance with pneumonia antibiotic prescription practice ($p = 0.005$). There was also significant association between the assertion on the presence of medical insurance influencing decision to prescribe ($p = 0.005$) as shown in Table 3.

Table 4.4*Socio-economic Related Determinants of Pneumonia Antibiotic Prescription Practice*

	Compliance		χ^2	Df	P value
	High	Low			
Gender					
Male	55(59.8)	37(40.2)	8.05	1	0.005
Female	49(81.7)	11(18.3)			
Age					
21 – 30	7(63.6)	4(36.4)		3	0.439
31 – 40	46(71.9)	18(28.1)			
41 – 50	34(57.6)	25(42.4)			
>50	17(94.4)	1(5.6)			
Designation					
Consultant	28(90.3)	3(9.7)		2	<0.001
Medical officer	51(77.3)	15(22.7)			
Clinical officer	25(45.5)	30(54.5)			
Years of experience					
<5	13(76.5)	4(23.5)		2	0.719
5 – 10	41(66.1)	21(33.9)			
>10	50(68.5)	23(31.5)			
Ability of patient to afford influence my decision to prescribe					
Agree	69(63.9)	39(36.1)		2	0.405
Disagree	25(92.6)	2(7.4)			
Neutral	10(58.8)	7(41.2)			
Presence of medical insurance influence my decision to prescribe					
Agree	63(61.2)	40(38.8)		2	0.005
Disagree	27(93.1)	2(6.9)			
Neutral	14(70.0)	6(30.0)			
Patient and relative pressure influence my decision to prescribe					
Agree	66(71.7)	26(28.3)		2	0.207
Disagree	11(78.6)	3(21.4)			
Neutral	27(58.7)	19(41.3)			
Presence of financial incentive in prescribing antibiotics influence my decision to prescribe					
Agree	57(68.7)	26(31.3)		2	0.997
Disagree	15(68.2)	7(31.8)			
Neutral	32(68.1)	15(31.9)			

4.4. Health System Related Determinants of Pneumonia Antibiotic Prescription Practice

In investigating health system factors, the findings showed that 88(57.9%) of the respondents disagreed with the statement that diagnostic tests readily available, 87(57.2%) of the clinicians stated that antibiotic prescription guidelines or protocols available. Availability of antibiotics was also investigated with 92(60.5%) of the respondents disagreeing with the statement that required Antibiotics are available. Further, 98(64.5%) disagreed with the statement that medical personnel are available while 64(42.1%) disagreed with the statement that prescription monitoring is readily available as shown in Table 4.

Table 4.5

Health System related factors of pneumonia antibiotic prescription practice

	Strongly disagree n(%)	Disagree n(%)	Neutral n(%)	Agree n(%)	Strongly agree n(%)
Diagnostic tests readily available.	4(2.6)	88(57.9)	21(13.8)	31(20.4)	8(5.3)
Antibiotic prescription guidelines or protocols available.		7(4.6)	12(7.9)	87(57.2)	46(30.3)
Required Antibiotics are available.	6(3.9)	92(60.5)	23(15.1)	24(15.8)	7(4.6)
Medical personnel are available.	5(3.3)	98(64.5)	18(11.8)	21(13.8)	10(6.6)
Prescription monitoring is readily available.	30(19.7)	64(42.1)	26(17.1)	25(16.4)	7(4.6)

4.4.1. Health System Related Determinants of Pneumonia Antibiotic Prescription Practice

The findings from Pearson chi square or Fischer's exact established that there was significant association between respondent perception of diagnostic tests availability and compliance with pneumonia antibiotic prescription practice, $\chi^2(2) = 9.13$, $p = 0.010$. Availability of drugs readily was also significantly associated with compliance with pneumonia antibiotic

prescription practice, $\chi^2 (2) = 8.96$, $p = 0.011$. Presence of staff was also associated with compliance with pneumonia antibiotic prescription practice, $\chi^2 (2) = 9.514$, $p = 0.009$ as shown in Table 5.

Table 4.6

Health System Related Determinants of Pneumonia Antibiotic Prescription Practice

Health system	Level		χ^2	Df	P value
	High n(%)	Low n(%)			
Diagnostic tests are readily available.					
Agree	33(84.6)	6(15.4)	9.13	2	0.010
Disagree	61(66.3)	31(33.7)			
Neutral	10(47.6)	11(52.4)			
Guidelines or protocols on antibiotic prescribing are readily available.					
Agree	94(70.7)	39(29.3)		2	0.115
Disagree	5(71.4)	2(28.6)			
Neutral	5(41.7)	7(58.3)			
Drugs are readily available.					
Agree	25(80.6)	6(19.4)	8.946	2	0.011
Disagree	69(70.4)	29(29.6)			
Neutral	10(43.5)	13(56.5)			
Staff are readily available.					
Agree	25(80.6)	6(19.4)	9.514	2	0.009
Disagree	72(69.9)	31(30.1)			
Neutral	7(38.9)	11(61.1)			
Prescription monitoring is readily available.					
Agree	25(78.1)	7(21.9)	2.573	2	0.276
Disagree	60(63.8)	34(36.2)			
Neutral	19(73.1)	7(26.9)			

4.5. Knowledge and Awareness of Pneumonia Antibiotic Prescription Practice

Majority of the respondents, 107(70.4%) agreed that they are familiar with the national prescription guidelines and protocols in Kenya, 79(52%) agreed that they are very confident in my knowledge of the appropriate prescribing practices according to the guidelines. In addition, 101(66.4%) of the respondents agreed that they know many factors that influence my decision to prescribe medication differently from the recommended guidelines, such patient preferences, resource limitations while 104(68.4%) also agreed that they usually attend training on antibiotic diagnostic as shown in Table 6.

Table 4.7
Knowledge and Awareness

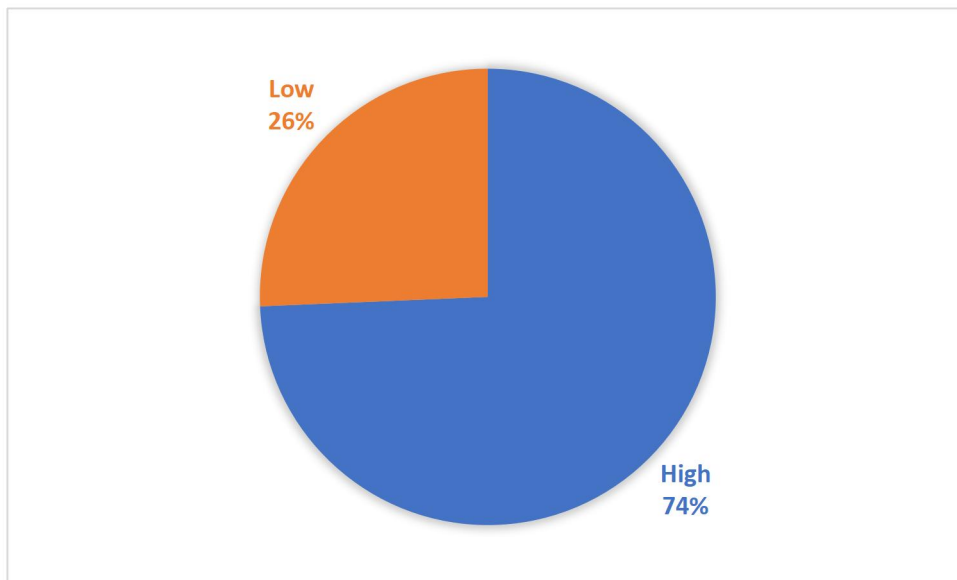
<i>Statements</i>	Strongly disagree n(%)	Disagree n(%)	Neutral n(%)	Agree n(%)	Strongly agree n(%)
I am familiar with the national prescription guidelines and protocols in Kenya	2(1.3)	5(3.3)	11(7.2)	107(70.4)	27(17.8)
I am very confident in my knowledge of the appropriate prescribing practices according to the guidelines		4(2.6)	46(30.3)	79(52.0)	23(15.1)
I know many factors that influence my decision to prescribe medication differently from the recommended guidelines, such patient preferences, resource limitations		7(4.6)	17(11.2)	101(66.4)	27(17.8)
I always involve patients in a shared decision-making when prescribing medications		4(2.6)	46(30.3)	79(52.0)	23(15.1)
I understand and I have received adequate training and updates on prescription guidelines		18(11.8)	20(13.2)	95(62.5)	19(12.5)
I usually attend training on antibiotic diagnostic	1(0.7)	8(5.3)	17(11.2)	104(68.4)	22(14.5)
I think there should be stricter monitoring or enforcement of prescription guidelines in Kenya		16(10.5)	20(13.2)	92(60.5)	24(15.8)

4.5.1. Overall Knowledge and Awareness

The seven items were summed up and converted into percent. Those who had a score of $\geq 80\%$ were considered to have high level of knowledge while $<80\%$ were considered to have low level of knowledge and awareness. The findings showed that 113(74.3) of the respondents had high level of knowledge as shown in Figure 2.

Figure 4.2

Overall Knowledge and Awareness



4.5.2. Knowledge and Awareness of Pneumonia Antibiotic Prescription Practice

The findings from Pearson chi square revealed that there was significant association between knowledge and antibiotic prescription practice, $\chi^2(1) = 34.42, p < 0.001$ as shown in Table 7.

Table 4.9*Knowledge and Awareness of Pneumonia Antibiotic Prescription Practice*

	Compliance		χ^2	Df	P value
	High n(%)	Low n(%)			
Knowledge					
High	92(81.4)	21(18.6)	34.42	1	<0.001
Low	12(30.8)	27(69.2)			

CHAPTER FIVE:

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1.Introduction

Pneumonia, a leading cause of morbidity and mortality worldwide, is a respiratory infection that primarily affects the alveoli in the lungs. Antibiotic therapy is the cornerstone of treatment for bacterial pneumonia, and appropriate prescription practices are crucial for effective management and patient outcomes. However, the compliance and determinants of antibiotic prescribing practices among clinicians has not been effectively explored. The present study sought to establish the determinants of antibiotic prescription practices for pneumonia among clinicians in a county hospital in Nairobi.

5.2.Compliance with antibiotic prescription guidelines

The present study indicates that 68.4% of clinicians comply with antibiotic prescription practices for pneumonia, with 31.6% demonstrating noncompliance. These findings align closely with previous research in various regions, underscoring both the consistency and variability in adherence to pneumonia treatment guidelines globally. In Ethiopia, a study by Eticha and Gemechu (2021) reported a non-adherence rate of 36.4% to national guidelines for antibiotic use. This figure is comparable to the 31.6% noncompliance found in the current study, suggesting similar challenges in guideline adherence despite geographical differences. The factors influencing these rates likely include similarities in healthcare infrastructure, clinician training, and access to up-to-date guidelines. The findings from a study in Ghana revealed that established that 68% of the patients who were prescribed antibiotics for pneumonia followed the set guidelines (Owusu et al., 2022). A study in Ghana by Sefah et al., (2021) revealed even lower adherence, with only 33% compliance among clinicians. This finding indicates a higher rate of noncompliance compared to the present study, pointing to

significant barriers to guideline adherence in the Ghanaian healthcare setting. Factors such as resource limitations, differing healthcare policies, and patient expectations may contribute to these lower adherence rates.

In contrast, a prospective study conducted in China by Lui et al. (2020) found a non-adherence rate of 25%, which is slightly lower than the current study's 31.6% noncompliance. This suggests better adherence to guidelines in China, possibly due to more robust implementation of clinical guidelines, continuous medical education, and stronger healthcare policies that support guideline compliance. Interestingly, a retrospective study in Saudi Arabia by Alessa et al., (2023) reported a higher noncompliance rate of 50%. However, it is crucial to note that this study focused on patient outcomes rather than clinician behaviour directly. The divergence in findings might be attributed to differences in study design, highlighting the importance of direct assessment of clinician practices to accurately gauge compliance levels. Overall, the present study's findings are consistent with global trends, showing significant variability in adherence to pneumonia treatment guidelines. This variability highlights the need for targeted interventions to improve compliance, such as enhancing clinician education, improving access to guidelines, and addressing systemic barriers within healthcare systems.

5.3.Socio-economic Related Determinants of Pneumonia Antibiotic Prescription Practice

The present study also sought to investigate the determinants of compliance to pneumonia antibiotic prescription practice found that among the socio demographic factors investigated, gender of the clinician was a significant factor associated with compliance to antibiotic prescription practice. This could be explained by the assertion that female clinicians may be

more meticulous in following guidelines due to a higher propensity for risk aversion or a greater emphasis on adherence to protocols as part of professional conduct.

The present findings also established that cadre of clinician was significantly associated with compliance with prescription practice. Higher cadre such as consultants had a higher level of compliance compared to lower cadre such as clinical officers. The findings highlight that the professional role or cadre of the clinician, such as whether they are specialists, general practitioners, or junior doctors, plays a crucial role in adherence to guidelines. These findings align with those from a study in Ghana which established that there was a higher-ranking clinician, such as consultants and specialists, were more likely to adhere to pneumonia prescribing guidelines compared to junior doctors and general practitioners (Sefah et al., 2021). The study attributed this to the extensive training and experience of higher-ranking clinicians. Lui et al. (2020) in a study done in China also revealed that compliance rates were higher among senior physicians compared to junior staff. It suggested that seniority and specialization in respiratory medicine contributed to better adherence, emphasizing the role of advanced clinical knowledge and experience.

The study found that clinicians are significantly influenced by the socioeconomic status of patients, especially their medical insurance status, when deciding on antibiotic prescriptions. This highlights the pragmatic considerations clinicians must balance between optimal clinical practice and the realities of patient access to medications. These findings align with those from a study in Ethiopia which highlighted that lower socioeconomic status often led to deviations from standard antibiotic guidelines due to financial constraints. Clinicians sometimes prescribe less expensive, but not necessarily first-line, antibiotics to accommodate patients' economic limitations (Eticha & Gemechu, 2021). The findings from a study in Ghana also revealed that patients without insurance were less likely to receive the

recommended antibiotics, as clinicians opted for more affordable alternatives that might not align with best practice guidelines (Sefah et al., 2021).

Financial constraints are a significant barrier to adherence to clinical guidelines. Patients without insurance or with lower socioeconomic status may not afford the recommended treatments, prompting clinicians to deviate from guidelines. The impact of socioeconomic status on compliance varies significantly across different healthcare systems. In countries with universal healthcare or comprehensive insurance coverage, adherence to guidelines is higher compared to regions where patients bear more of the healthcare costs directly.

5.4. Health System Related Determinants of Pneumonia Antibiotic Prescription Practice

The present findings found that presence of diagnostic tests availability, availability of drugs and presence of staff were significantly associated with pneumonia antibiotic prescription compliance among clinicians. These findings align with those from Sefah et al. (2021) in Ghana who found that the lack of diagnostic facilities was a major barrier to guideline adherence. Clinicians often had to rely on clinical judgment alone, which increased the likelihood of non-compliant antibiotic prescribing. Liu et al. (2020) in China also revealed that the availability of advanced diagnostic tests, such as PCR and rapid antigen tests, significantly improved compliance with antibiotic guidelines. This was due to the precise identification of bacterial versus viral pneumonia, reducing unnecessary antibiotic use.

Further, the availability of essential antibiotics is another critical determinant of compliance. When recommended antibiotics are not available, clinicians may be forced to prescribe alternatives that may not align with guidelines. Eticha and Gemechu (2021) established that drug shortages were a common issue that led to non-compliance. Ensuring a consistent supply of recommended antibiotics was identified as a key factor in improving adherence. Alessa et al. (2023) in a study done in Saudi Arabia affirmed that drug availability was also a

significant factor in Saudi Arabia. Hospitals with well-stocked pharmacies and efficient supply chains demonstrated better adherence to pneumonia treatment guidelines.

The present study highlights the significant impact of laboratory resource availability on compliance with pneumonia antibiotic prescription guidelines. Access to comprehensive laboratory resources, including pathogen culturing and sensitivity testing, allows clinicians to tailor antibiotic treatments to specific pathogens and their susceptibilities. This precision in treatment not only improves patient outcomes but also enhances adherence to clinical guidelines. Ecker et al. (2013) affirmed that the availability of such laboratory resources enables clinicians to prescribe antibiotics that are specifically effective against the identified pathogens, thereby improving treatment efficacy and compliance with guidelines. Pallavi et al. (2012) also highlighted the importance of pathogen-specific antibiotic therapy, noting that laboratory resources are essential for accurate diagnosis and tailored treatment plans.

5.5.Knowledge and Awareness

The present findings established that 74% of the clinicians had good knowledge on the antibiotic prescription practices for pneumonia. The findings also established that there was a significant association between knowledge and antibiotic prescription compliance among clinicians. These findings are comparable to those from Opatowski et al. (2021) in France emphasized that clinician knowledge, supported by access to continuing education and resources, was a significant determinant of guideline adherence. Knowledgeable clinicians were more likely to prescribe antibiotics appropriately. Sefah et al. (2021) affirmed these findings highlighting that the regular training and updates on pneumonia treatment guidelines were crucial for improving adherence. Clinicians who participated in such training sessions were more likely to comply with prescription practices. Knowledgeable clinicians are better equipped to make informed decisions regarding antibiotic prescriptions, understanding the

nuances of different cases and the importance of adhering to guidelines (Eticha & Gemechu, 2021).

Sriram et al. (2011) highlighted that the lack of continuous medical education was a barrier to compliance. Clinicians with regular access to updated guidelines and training exhibited higher adherence rates. Tinker et al. (2021) found that educational interventions targeting antibiotic stewardship improved compliance with guidelines. Clinicians who attended training sessions showed significantly higher adherence to recommended practices. The ability to refer to the latest information ensures that clinicians are well-informed about the best practices for treating pneumonia. This is supported by studies such as Lui et al. (2020) in China, which found that clinicians with access to updated guidelines through professional development programs exhibited better adherence.

5.6.Conclusion

The study investigated the factors influencing compliance with pneumonia antibiotic prescription practices among clinicians, revealing that 68.4% exhibited high compliance with established guidelines, while 31.6% showed low compliance.

Gender was found to be a significant factor, with differences in compliance rates between male and female clinicians. Additionally, the designation of clinicians also played a crucial role, with higher-ranking clinicians such as specialists demonstrating better adherence to guidelines compared to their junior counterparts. These findings suggest that both personal and professional characteristics influence guideline compliance.

The presence of medical insurance was another significant determinant, influencing clinicians' decisions to prescribe antibiotics. This highlights the impact of socioeconomic factors on clinical decision-making, suggesting that financial considerations of patients play a role in treatment planning and adherence to guidelines.

Access to diagnostic tests was significantly associated with compliance, emphasizing the importance of accurate diagnosis in guiding appropriate antibiotic use. Similarly, the availability of drugs was crucial, with ready access to recommended antibiotics being linked to higher compliance rates. Adequate staffing also played a role, as sufficient personnel support allows clinicians to adhere more closely to best practices. Clinicians with higher levels of knowledge were more likely to adhere to established guidelines, underscoring the importance of continuous medical education and access to updated clinical information.

5.7.Recommendations

Implement regular training and professional development programs focused on antibiotic stewardship and pneumonia treatment guidelines.

Develop policies that ensure equitable access to healthcare resources regardless of patients' socioeconomic status. This includes expanding insurance coverage and providing financial assistance to underinsured or uninsured patients to reduce the impact of financial barriers on treatment decisions.

Establish quality assurance and audit-feedback mechanisms to monitor and improve adherence to antibiotic prescription guidelines.

5.8 Area for Further Research

To conduct large comparative studies comparing compliance from clinician perspective and observed compliance through review of patient files.

Conduct comparative studies across different healthcare systems and regions to identify best practices and common challenges in antibiotic prescription compliance.

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APPENDICES

Appendix I: Informed Consent

Title of Study: DETERMINANTS OF ANTIBIOTIC PRESCRIBING PRACTICE GUIDELINES AMONG CLINICIANS IN PUBLIC AND PRIVATE HOSPITALS IN NAIROBI COUNTY, KENYA

Principal Investigator: BRENDA KASANDI

Co-investigators: Dr. Lily Masinde and Ms. Phoebe Kerubo Masita

Introduction:

Purpose of the Study

This study will seek to determine the level of adherence and determinants of antibiotic prescribing practice guidelines among clinicians in public and private hospitals In Nairobi County, Kenya.

Introduction

I am Brenda Kasandi, a Masters student at Kenya Methodist University. I am carrying out a study on the adherence and determinants of antibiotic prescribing practice guidelines among clinicians in public and private hospitals in Nairobi County, Kenya.

Study Procedure

If you agree to participate in this study, you will be required to sign this form and thereafter, you will be given a structured questionnaire which you will answer based on your knowledge. Participating in this study will take approximately 10 -15 minutes of your time.

Risks, Stress and Discomfort

There are no major risks, stress or discomfort of participating in the study apart from your time. This study is observational based.

Benefits of the Study

Inappropriate or excessive use of antibiotics can lead to adverse patient outcomes, including treatment failure, increased morbidity, and even mortality. By studying prescribing practices, we can identify patterns of misuse or overuse of antibiotics, which can help develop interventions to improve patient safety and optimize treatment outcomes.

Compensation

No financial benefits are associated with take part in the study.

Confidentiality

Any information about you will have a unique identifier instead of your personal information such as age or phone number. The results of this research study may be presented at meetings or in publications; however, your identity will not be disclosed.

Right to Refuse or Withdraw

You do not have to take part in this research if you do not wish to do so. You may stop participating in the research at any time that you wish without losing any of your rights.

Whom to Contact

If you have any questions, you may ask them now or later, even after the study has started. If you wish to ask questions later, you may contact the myself Brenda Kasandi on +254 722 314619.

Participants Consent

I confirm that the researcher has explained fully the nature of the study and the extent of activities which I will be asked to undertake. I confirm that I have had adequate opportunity to evaluate and ask questions about this study. I understand that my participation is voluntary and that I may withdraw at any time during the study, without having to give a reason. I, therefore, consent to participate in the study after reading and understanding the purpose of the study.

Sign Date

Researcher's statement

I, the undersigned, have fully explained the relevant details of this research study to the participant named above and believe that the participant has understood and has willingly and freely given his/her consent.

Researcher's Name: **Brenda Kasandi** Date: _____

Signature _____

Appendix II: Study Questionnaire

Questionnaire Number:

Date:

Section A: Demographic characteristics

1. **Gender:** Male [] Female []
2. **Age:** 21- 30 Years [] 31-40 Years [] 41-50 Years [] 51- Years and above
3. **Designation:** Consultant [] Registrars [] Medical officer [] Medical officer intern [] Clinical officers [] Clinical Intern officers []
4. **Years of experience:** 0-10 Years [] 11-20 Years [] 21-30 Years [] 31-40 Years [] 41 Years and above []

Section A: Socio- economic Factors

5. On the scale of 1-5 Strongly disagree to strongly agree, rate how the following influence your decision to prescribe antibiotics to patients (where 1= Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree and 5= Strongly Agree)

Socio-economic factors	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
a) Ability of patient to afford determines the type of antibiotics prescribed					
b) Presence of medical insurance influences the choice of antibiotic prescribed					
c) Patient and relative pressure play a role in choice of antibiotic prescribed					
d) Incentives from drug companies have an effect on the choice of antibiotic prescribed					
e) Patients religious and cultural beliefs influence the choice of antibiotic prescribed					

Section B: Health System Related Factors

6. On the scale of 1-5 Strongly disagree to strongly agree, rate the availability of the following resources in your practice where 1= Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree and 5= Strongly Agree)

Health system factors	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
a) Diagnostic tests readily available.					
b) Antibiotic prescription guidelines or protocols available.					
c) Required Antibiotics are available					
d) Medical personnel available					
e) Prescription systems monitoring is readily available.					

Section C: Knowledge and Awareness

7. On the scale of 1-5 Strongly disagree to strongly agree rate Knowledge and awareness in your practice (where 1= Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree and 5= Strongly Agree

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
a) I am familiar with the antibiotic prescription guidelines and protocols in Kenya					
b) My prescribing practices are in accordance to the guidelines					
c) I always involve patients in a shared decision-making when prescribing medications					
d) I understand and I have received adequate training and updates on prescription guidelines					
e) I usually attend training on antibiotic steward ship					

Section D: Prescribing patterns (Likert scale questions)

8. On the scale of 1-5 Strongly disagree to strongly agree rate the following patterns where 1= Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree and 5= Strongly Agree

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
a) I follow guidelines for prescribing antibiotics in pneumonia cases on choice of antibiotics and treatment duration					
b) I update my knowledge of pneumonia treatment guidelines					
c) I am aware of the clinical factors in patients that influence the choice of antibiotic					
d) I always consult reference sources (e.g., formularies, guidelines, drug information databases) when prescribing medication					
e) I frequently communicate potential risks or side effects of prescribed medications to my patients					

Appendix V: Institutional Approval



KENYA METHODIST UNIVERSITY

P. O. Box 267 Meru - 60200, Kenya

Fax: 254-64-30162

Tei: 254-064-30301/31229/30367/31171

Email: deanrd@kemu.ac.ke

DIRECTORATE OF POSTGRADUATE STUDIES

March 14, 2024

Commission Secretary,
National Commission for Science, Technology and Innovations,
P.O. Box 30623-00100
NAIROBI.

Dear Sir/Madam,

RE: BRENDA KASANDI – (REG. NO. PHT-3-2337-2/2022)

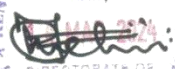
This is to confirm that the above named person is a bona fide student of Kenya Methodist University, in the School of Medicine and Health Sciences, Department of Public Health, Human Nutrition and Dietetics undertaking a Master's Degree in Public Health. She is conducting research on: "Determinants of Antibiotic Prescription Practices for Pneumonia among Clinicians at Mbagathi Level 5 Hospital, Kenya".

We confirm that her research proposal has been presented and approved by the University.

In this regard, we are requesting your office to issue a research license to enable her collect data.

Any assistance accorded to her will be highly appreciated.

Yours sincerely,


Dr. John M. Muchiri (PhD)
Dean, Postgraduate Studies

Cc: Dean SMHS
CoD, PHT
Program Coordinator - PHT
Student Supervisors

Appendix VII: ISERC Approval



KENYA METHODIST UNIVERSITY

P. O. BOX 267 MERU - 60200, KENYA
TEL: 254-064-30301/31229/30367/31171

FAX: 254-64-30162
EMAIL: INFO@KEMU.AC.KE

March 14, 2024

Our Ref: KeMU/ISERC/PHT/03/2024

BRENDA KASANDI
PHT-3-2337-2/2022

Dear Brenda,

SUBJECT: DETERMINANTS OF ANTIBIOTIC PRESCRIPTION PRACTICES FOR PNEUMONIA AMONG CLINICIANS AT MBAGATHI LEVEL 5 HOSPITAL, KENYA

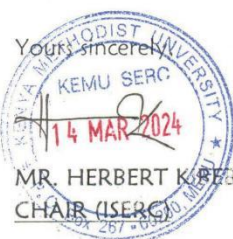
This is to inform you that Kenya Methodist University Institutional Scientific Ethics and Review Committee has reviewed and approved your research proposal. Your application approval number is KeMU/ISERC/PHT/03/2024. The approval period is 14th March, 2024-14th March, 2025.

This approval is subject to compliance with the following requirements:-

- I. Only approved documents including (informed consents, study instruments, MTA) will be used.
- II. All changes including (amendments, deviations, and violations) are submitted for review and approval by Kenya Methodist University Institutional Scientific Ethics and Review Committee.
- III. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to KeMU ISERC within 72 hours of notification.
- IV. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to KeMU ISERC within 72 hours.

- V. Clearance for export of biological specimens must be obtained from relevant institutions.
- VI. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
- VII. Submission of an executive summary report within 90 days upon completion of the study to KeMU ISERC.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) <https://oris.nacosti.go.ke> and also obtain other clearances needed.

Yours sincerely,

MR. HERBERT KIBEGE
CHAIR, ISERC

Appendix VIII: Approval from Nairobi County



NAIROBI CITY COUNTY
www.nairobi.go.ke

HEALTH, WELLNESS AND NUTRITION

Office of the County Chief Officer – Medical Services

REF: NCCG/HWN/REC/542 DATE: 16th APRIL 2024

BRENDAH KASANDI
KENYA METHODIST UNIVERSITY (KEMU)

Dear Ms. Brendah,

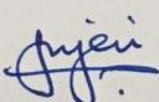
RE: RESEARCH AUTHORIZATION

This is to inform you that the Nairobi City County – County Health Research Ethics Committee (REC) reviewed the documents on the study titled "Determinants of Antibiotic Prescribing Practices for Pneumonia Among Clinicians at Mbagathi Level five hospital."

I am pleased to inform you that you have been authorized to carry out the study in Nairobi County. The researcher will be required to adhere to the ethical code of conduct for health research in accordance with the Science Technology and Innovation Act, 2013 and the approval procedure and protocol for research for Nairobi.

On completion of the study, you will submit one hard copy and one copy in PDF of the research findings to the REC. In addition, you required to disseminate the research findings to health sector in liaison with the county REC. By copy of this letter, the Chief Executive Officer – Mbagathi Hospital is to accord you the necessary assistance to carry out this research study.

Yours sincerely,



DR. IRENE MUCHOKI
CHIEF OFFICER MEDICAL SERVICES &
Ag. CHIEF OFFICER NUTRITION, WELLNESS & SCHOOL FEEDING PROGRAM

Cc: Chief Officers – Public Health and Health Facilities
Chief Executive Officer – Mbagathi Hospital

LET'S MAKE NAIROBI WORK

TELEPHONE: +254 725 624 489; +254 738 041 292 | EMAIL: INFO@NAIROBI.GO.KE | CITY HALL, CITY HALL WAY, P.O. BOX 30075 00100, NAIROBI, KENYA

Appendix IX: Permission from Mbagathi Hospital

S

NAIROBI CITY COUNTY

Tel: 2724712, 2725791, 0721 311 808
Email: mbagathihosp@gmail.com



Mbagathi Hospital
P.O. Box 20725- 00202
Nairobi

HEALTH, WELLNESS AND NUTRITION SERVICES

REF: MDH/RS/VOL.3/03/298

24th April, 2024

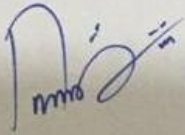
Ms. Brenda Kasandi Kasandi,
NAIROBI

Dear Kasandi,

RE: RESEARCH AUTHORIZATION.

This is in reference to your application for authority to carry out research, on ***'Determinants of antibiotic prescription practices for Pneumonia among clinicians at Mbagathi Level 5 Hospital.'*** I am pleased to inform you that your request to undertake research in the hospital has been granted.

On completion of the research, you are expected to submit one hard copy and one soft copy of the research report/thesis to this office.





Dr. Alexander Irungu, PhD
Chief Executive Officer
Mbagathi County Hospital

Appendix X: NACOSTI Permit

 REPUBLIC OF KENYA	 NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION
Ref No: 948507	Date of Issue: 12/April/2024
RESEARCH LICENSE	
	
This is to Certify that Miss.. BRENDAH KASANDI KASANDI of Kenya Methodist University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nairobi on the topic: DETERMINANTS OF ANTIBIOTIC PRESCRIPTION PRACTICES FOR PNEUMONIA AMONG CLINICIANS AT MBAGATHI LEVEL FIVE HOSPITAL, KENYA for the period ending : 12/April/2025.	
License No: NACOSTI/P/24/34147	
948507 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.	
See overleaf for conditions	

THE SCIENCE, TECHNOLOGY AND INNOVATION ACT, 2013 (Rev. 2014)
Legal Notice No. 108: The Science, Technology and Innovation (Research Licensing) Regulations, 2014

The National Commission for Science, Technology and Innovation, hereafter referred to as the Commission, was established under the Science, Technology and Innovation Act 2013 (Revised 2014) herein after referred to as the Act. The objective of the Commission shall be to regulate and assure quality in the science, technology and innovation sector and advise the Government in matters related thereto.

CONDITIONS OF THE RESEARCH LICENSE

1. The License is granted subject to provisions of the Constitution of Kenya, the Science, Technology and Innovation Act, and other relevant laws, policies and regulations. Accordingly, the licensee shall adhere to such procedures, standards, code of ethics and guidelines as may be prescribed by regulations made under the Act, or prescribed by provisions of International treaties of which Kenya is a signatory to
2. The research and its related activities as well as outcomes shall be beneficial to the country and shall not in any way:
 - i. Endanger national security
 - ii. Adversely affect the lives of Kenyans
 - iii. Be in contravention of Kenya's international obligations including Biological Weapons Convention (BWC), Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), Chemical, Biological, Radiological and Nuclear (CBRN).
 - iv. Result in exploitation of intellectual property rights of communities in Kenya
 - v. Adversely affect the environment
 - vi. Adversely affect the rights of communities
 - vii. Endanger public safety and national cohesion
 - viii. Plagiarize someone else's work
3. The License is valid for the proposed research, location and specified period.
4. The license any rights thereunder are non-transferable
5. The Commission reserves the right to cancel the research at any time during the research period if in the opinion of the Commission the research is not implemented in conformity with the provisions of the Act or any other written law.
6. The Licensee shall inform the relevant County Director of Education, County Commissioner and County Governor before commencement of the research.
7. Excavation, filming, movement, and collection of specimens are subject to further necessary clearance from relevant Government Agencies.
8. The License does not give authority to transfer research materials.
9. The Commission may monitor and evaluate the licensed research project for the purpose of assessing and evaluating compliance with the conditions of the License.
10. The Licensee shall submit one hard copy, and upload a soft copy of their final report (thesis) onto a platform designated by the Commission within one year of completion of the research.
11. The Commission reserves the right to modify the conditions of the License including cancellation without prior notice.
12. Research, findings and information regarding research systems shall be stored or disseminated, utilized or applied in such a manner as may be prescribed by the Commission from time to time.
13. The Licensee shall disclose to the Commission, the relevant Institutional Scientific and Ethical Review Committee, and the relevant national agencies any inventions and discoveries that are of National strategic importance.
14. The Commission shall have powers to acquire from any person the right in, or to, any scientific innovation, invention or patent of strategic importance to the country.
15. Relevant Institutional Scientific and Ethical Review Committee shall monitor and evaluate the research periodically, and make a report of its findings to the Commission for necessary action.

National Commission for Science, Technology and
Innovation(NACOSTI),
Off Waiyaki Way, Upper Kabete,
P. O. Box 30623 - 00100 Nairobi, KENYA
Telephone: 020 4007000, 0713788787, 0735404245
E-mail: dg@nacosti.go.ke
Website: www.nacosti.go.ke