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**AN ASSESSMENT OF ANTIMICROBIAL RESISTANCE PATTERNS AMONG
PATIENTS WITH URINARY TRACT INFECTIONS AT SALLY MUGABE
CENTRAL HOSPITAL: JANUARY 2024-AUGUST 2024**

BY

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE
REQUIREMENTS FOR THE DEGREE OF BACHELOR OF MEDICAL
LABORATORY SCIENCES (HONOURS) IN THE COLLEGE OF HEALTH,
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Abstract

Urinary tract infections (UTIs) represent a significant public health concern due to the rising prevalence of antimicrobial resistance (AMR) among uropathogens. This study assessed antimicrobial resistance patterns among patients with urinary tract infections at Sally Mugabe Central Hospital (SMCH) from January to August 2024. A retrospective-cross sectional research design was conducted using medical records of patients diagnosed with UTIs at Sally Mugabe Central Hospital. A sample size of 323 patients was selected using systematic sampling from the hospital database. Data on demographics, laboratory results and antimicrobial susceptibility testing were collected and descriptive statistics as well as chi-square tests were used for analysis. The study revealed a high prevalence of AMR among UTI pathogens with *Escherichia coli* being the predominant pathogen (33.1%), followed by *Klebsiella pneumoniae* (29.1%), exhibiting high resistance rates to commonly prescribed antibiotics such as nitrofurantoin (34.88%) and ciprofloxacin (31.4%). Risk factors associated with AMR included previous antibiotic use, hospitalization as well as underlying medical conditions. In conclusion, this study highlights the very high rate of AMR among UTI pathogens at Sally Mugabe Central Hospital. The findings suggest the need for antimicrobial stewardship programs, improved infection control practices and rational antibiotic use. Recommendations include regular antimicrobial susceptibility testing, continuous education for healthcare workers and development of evidence-based treatment guidelines. The study's results have implications for patient care, public health as well as future research on AMR in Zimbabwe

Key words: Antimicrobial Resistance Patterns, Urinary Tract Infections, Sally Mugabe Central Hospital, Uropathogens, Retrospective-cross sectional study, MDROs, Risk factors.

Declaration

I, Muhomba Shelancina Kudzayi student number 210306 do hereby declare that this dissertation is my original work except where sources have been cited and acknowledged. The work has never been submitted, nor will it ever be submitted to another university for the award of a Bachelor of Science degree.

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Dedication

I dedicate this dissertation to my parents, Mr and Mrs Muhomba, whose unwavering support and encouragement have been my foundation throughout this journey. Thank you for instilling the values of hard work and perseverance in me, your belief in my abilities has inspired me to reach for my goals.

Acronyms and Abbreviations

AMR Antimicrobial resistance.

AUREC Africa University Research Ethics Committee.

ESLB Extended Spectrum Beta-Lactamases

IRB Institutional Review Board.

MRDOs Multi-drug resistant organisms

SMCH Sally Mugabe Central Hospital.

UTIs Urinary tract infections

W.H.O World Health Organization.

Definition of Key Terms

Antimicrobial Resistance- the ability of microorganisms (bacteria, viruses, fungi or parasites) to resist the effects of antimicrobial drugs, making infections harder to treat (Nicolle, 2008).

Antibiotic Resistance Patterns- the specific resistance profiles of bacterial pathogens to various antibiotics.

Antimicrobial Stewardship- coordinated programs promoting responsible antimicrobial use to reduce resistance.

Antimicrobial Susceptibility Testing- laboratory tests determining the effectiveness of antimicrobial agents against specific microorganisms.

Bacterial Pathogens- microorganisms (bacteria) that cause disease.

Community-Acquired Infections- infections contracted outside healthcare facilities.

Healthcare-Associated Infections- infections contracted in healthcare facilities.

Risk Factors- characteristics or exposures increasing the likelihood of developing antimicrobial resistance.

Urinary Tract Infections- infections occurring in the urinary system, including the kidneys, bladder, ureters and urethra.

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

Antimicrobial resistance has emerged as a significant global health challenge, particularly in the context of urinary tract infections which also are among the most common bacterial infections affecting individuals worldwide. The World Health Organization identified antimicrobial resistance as a critical threat to public health, hence they emphasized the urgent need for surveillance and research so as to understand the resistance patterns and inform treatment strategies (Organization, 2020). The increasing prevalence of antimicrobial resistance among urinary tract infection pathogens has complicated treatment efficacy and its management leading to prolonged illness, increased healthcare costs as well as higher rates of morbidity and mortality (Schito et al, 2008). In Zimbabwe, where Sally Mugabe Central Hospital serves as a major referral centre, there is a pressing need to assess local antimicrobial resistance patterns among patients presenting with urinary tract infections. This study aims to conduct a comprehensive assessment of antimicrobial resistance patterns among patients diagnosed with urinary tract infections at Sally Mugabe Central Hospital from January to August 2024. By analysing the microbiological data and correlating it with patient demographics and the clinical outcomes, the study seeks to provide valuable insights into the local epidemiology of antimicrobial resistance. The findings did not only contribute to the existing body of knowledge but rather it also informed decisions regarding antibiotic prescribing practices.

1.2 Background to the Study

The increasing prevalence of antimicrobial resistance has become a significant public health concern worldwide (organization, 2022). Urinary tract infections are one of the most common

types of infections and the misuse and overuse of drugs have contributed to the development of antimicrobial resistance (Gupta *et al.*, 2011). According to the World Health Organization, urinary tract infections account for approximately 150 million cases annually worldwide, leading to significant morbidity and healthcare costs (World Health Organization, 2021). The prevalence of urinary tract infections is notably higher in females than males primarily due to anatomical differences that predispose women to infection, furthermore, factors such as age, sexual activity and the presence of comorbidities like diabetes mellitus further influence urinary tract infection incidence rates (Hooton *et al.*, 2019). In Zimbabwe, where Sally Mugabe Central Hospital is located, the burden of UTIs is compounded by limited access to healthcare resources and rising rates of antimicrobial resistance highlighting the urgent need for ongoing surveillance and assessment of antimicrobial resistance patterns in local populations

Urinary tract infections are bacterial infections occurring in the urinary system including the kidneys, bladder, ureters and urethra (Nicolle, 2008). Urinary tract infections are caused by bacterial pathogens and *Escherichia coli* is the most common one, other pathogens such as *Klebsiella pneumonia*, *Proteus mirabilis* and *Enterococcus faecalis* also contribute to urinary tract infection cases but they are less prevalent compared to *Escherichia coli*. Hooton *et al* (2019) says that several factors contribute to the development of urinary tract infections and they include anatomical anomalies such as vesicoureteral reflux, behavioural factors like inadequate hydration and hygiene practices and physiological conditions including pregnancy or menopause alter urinary tract defences. The treatment regimen for urinary tract infections typically involves empirical antibiotic therapy, however, the increasing resistance patterns observed in these pathogens necessitate a thorough assessment of local antimicrobial susceptibility profiles to guide effective strategies. Urinary tract infections represent one of the most common bacterial infections encountered in clinical practice affecting a lot of people

each year. The world health organization recognized urinary tract infection as a significant public health concern due to their prevalence and the rising incidence of antimicrobial resistance among uropathogens.

The pathophysiology of urinary tract infections involves the colonization of the urinary tract by pathogenic microorganisms, typically originating from the gastrointestinal flora. *Escherichia coli* is responsible for approximately 80-90% of uncomplicated urinary tract infections however, other pathogens such as *Klebsiella pneumoniae* and *Proteus mirabilis* can also be implicated (Foxman, 2014). The infection process begins when bacteria adhere to the uroepithelial cells via fimbriae or adhesins, this adherence triggers an inflammatory response characterized by increased vascular permeability and recruitment of immune cells to the site of infection. The inflammatory response can lead to symptoms such as dysuria, urgency and discomfort localized above the pubic bone. If left untreated or inadequately treated because of antimicrobial resistance, urinary tract infections can ascend to involve the kidneys resulting in pyelonephritis which is a more severe condition and may lead to systemic complications.

Antimicrobial resistance is a global health concern, henceforth, the World Health Organization (WHO) declared it a priority area for research and action. Antimicrobial resistance occurs when bacteria develop the ability to resist the effects of antibiotics, making infections difficult or harder to treat (Centers for Disease Control and Prevention, 2020). In the context of urinary tract infections, antimicrobial resistance can lead to treatment failures, recurrent infections and even severe complications such as sepsis and its emergence complicates treatment of urinary tract infections leading to prolonged illness, increased healthcare costs and higher risks of complications (Moyo *et al.*, 2020; Naidoo *et al.*, 2020)

In Zimbabwe, urinary tract infections are a common presentation in many healthcare facilities, including Sally Mugabe Central Hospital (Mungofa *et al.*, 2016). The hospital's

empirical treatment guidelines may not align with the current resistance patterns, potentially leading to treatment failures and increased morbidity (Kariuki *et al.*, 2019). Limited recent data exists on the antimicrobial resistance patterns among urinary tract infection patients at Sally Mugabe Central Hospital, therefore understanding these patterns is crucial for developing effective treatment guidelines and interventions to combat antimicrobial resistance (WHO, 2021). The findings of the study at Sally Mugabe Central Hospital would provide valuable insights into the current status of antimicrobial resistance in urinary tract infections within that specific healthcare setting. The prevalence rates of resistance among common uropathogens, patterns of resistance to different classes of antibiotics and any emerging trends in resistance could all be important outcomes of the assessment.

1.3 Problem statement

Antimicrobial resistance is a growing global health concern, particularly in the context of urinary tract infections which are among the most common bacterial infections affecting patients worldwide. In Zimbabwe, healthcare resources are limited meaning the implications of antimicrobial resistance are severe, henceforth, the emergence of resistant strains complicates treatment protocols and necessitates continuous monitoring of resistance patterns to inform empirical therapy guidelines. The proposed research aims to assess antimicrobial resistance patterns among patients diagnosed with urinary tract infections at Sally Mugabe Central Hospital from January to August 2024. This assessment will identify and report on the prevalence of resistant strains as well as identifying specific pathogens responsible for urinary tract infections within this patient population, so understanding these patterns is crucial for developing effective treatment strategies and implementing appropriate infection control measures. Furthermore, previous studies indicate that factors such as antibiotic misuse, inadequate infection control practices and lack of awareness about AMR contribute significantly to the rising trends in resistance (Ventola, 2015). Therefore, focusing on a specific institution like Sally Mugabe Central Hospital will help provide localized data that can be instrumental in tailoring interventions aimed at combating antimicrobial resistance in Zimbabwean healthcare settings.

1.4 Justification

Antimicrobial resistance is a growing global health concern and urinary tract infections are among the most common infections affected by antimicrobial resistance (WHO, 2019; Kariuki *et al.*, 2020). Sally Mugabe Central Hospital, a major referral hospital in Zimbabwe faces challenges in managing urinary tract infections due to limited data on antimicrobial resistance. This study aims to address the knowledge gap by assessing the antimicrobial resistance patterns among patients with urinary tract infections at Sally Mugabe Central

Hospital. The findings will inform evidence-based treatment guidelines for urinary tract infections, reducing treatment failures and improving patient outcomes. The findings will guide the antimicrobial stewardship initiatives, promoting rational antibiotic use and mitigating the development of antimicrobial resistance. Also, the findings will provide insights for public health interventions, targeting high risk groups and areas for improved infection control and contributing to the global understanding of antimicrobial resistance patterns thereby facilitating regional and international comparisons. Conducting this study will generate local data to address the specific needs of Sally Mugabe Central Hospital and Zimbabwe's healthcare system as well as contributing to the development of effective strategies for combating antimicrobial resistance which has become a major public health concern. It will also enhance patient care and outcomes through informed treatment decisions and improved infection management.

1.5 Research Objectives

1.5.1 Broad Objective

- To assess antimicrobial resistance patterns among patients with urinary tract infections at Sally Mugabe Central Hospital from January 2024 to August 2024.

1.5.2 Specific Objectives

- To determine the prevalence of antimicrobial resistance among urinary tract infections patients at Sally Mugabe Central Hospital from January 2024 to August 2024.
- To identify the top three most common bacterial pathogens causing urinary tract infections among patients at Sally Mugabe Central Hospital and to determine the antimicrobial resistance patterns of these pathogens against at least five commonly used antibiotics during the eight months period.

- To analyze and document the antibiotic resistance patterns of *Escherichia coli* and *Klebsiella pneumoniae* isolates from urinary tract infection patients in a clinical setting over the eight-months period, with the goal of identifying at least three significant resistance trends that could inform treatment protocols
- To identify risk factors associated with antimicrobial resistance in patients diagnosed with urinary tract infections through a comprehensive review of existing literature and clinical data from January to August 2024.

1.6 Research Qquestions

- What is the prevalence of antimicrobial resistance among patients with urinary tract infections (UTIs) at Sally Mugabe Central Hospital from January 2024 to August 2024?
- Which bacterial pathogens are most commonly associated with urinary tract infections in patients at Sally Mugabe Central Hospital during the specified period?
- What are the antimicrobial resistance patterns of the top three bacterial pathogens identified against six commonly used antibiotics over the eight-month study period?
- What are the specific antibiotic resistance patterns observed in *Escherichia coli* and *Klebsiella pneumoniae* isolates from urinary tract infection patients over the eight-month period?
- What are the risk factors associated with antimicrobial resistance among patients diagnosed with urinary tract infections as identified through a comprehensive review of existing literature and clinical data from January to August 2024?

1.7 Limitations of the Study

The study focused on urinary tract infection patients at Sally Mugabe Central Hospital, excluding other types of infections and healthcare facilities. The study was limited by its retrospective cross-sectional design which relied on existing medical records which may be subject to biases and inaccuracies. The study only examined a specific aspect of antimicrobial resistance which is resistance patterns among urinary tract infection patients and did not explore other important factors contributing to resistance. The study's focus on a single hospital may not have captured long term trends or patterns in antimicrobial resistance. Since the study was a retrospective study, it might have been subject to information and selection bias.

1.8 Delimitations of the Study

The study was intentionally limited to exploring antimicrobial resistance patterns among patients with urinary tract infections at Sally Mugabe Central Hospital in Zimbabwe. The study's focus was specifically on this population and setting to gain in-depth insights into the local context and address the growing concern of antimicrobial resistance in Zimbabwe's healthcare system. The study's scope was deliberately restricted to a single hospital to ensure a detailed examination of the factors contributing to antimicrobial resistance within that setting (i.e Sally Mugabe Central Hospital). The study aimed at providing a comprehensive understanding of resistance patterns and associated factors by concentrating on a specific patient group which is urinary tract infection patients. The study's time-frame was also limited to a specific period which is from January 2024 to August 2024, ensuring that the data reflected the current resistance patterns and trends. The study relied solely on retrospective data from medical records which provided a convenient and accessible source of information.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The prevalence of antimicrobial resistance among patients with urinary tract infections has become a growing concern in healthcare settings worldwide, therefore, in order to effectively address this issue, it is crucial to review existing literature on antimicrobial resistance patterns among patients with urinary tract infections. This chapter will provide a comprehensive overview of relevant studies and research findings in this area with focus on the objectives outlined in the study.

2.1.1 Prevalence of Antimicrobial Resistance among Urinary Tract Infection patients

Antimicrobial resistance is a growing concern worldwide and urinary tract infections are among the most common infections affected by antimicrobial resistance (World Health Organization, 2019). The prevalence of antimicrobial resistance among urinary tract infection patients varies depending on the region, country and even hospital setting (Kariuki *et al.*, 2020). Studies have shown that antimicrobial resistance is on the rise, particularly in developing regions where healthcare systems may be less equipped to handle such challenges (Falagas *et al.*, 2014). Nielsen *et al.* (2017) says that the prevalence of resistance varies from region and it is influenced by local antibiotic usage patterns and infection control practices.

Several studies have documented the increasing prevalence of antimicrobial resistance among uropathogens in hospital settings for instance, a study by Patel *et al.* (2019) conducted in a similar tertiary care hospital found that about 60% of patients with urinary tract infections had bacteria that were resistant to many antibiotics, highlighting the need for Sally Mugabe Central Hospital to closely monitor and track antibiotic resistance patterns to inform

appropriate antibiotic prescribing practices. Furthermore, studies have consistently shown a concerning rise in the prevalence of antimicrobial resistance among urinary tract infection patients. Another study by Smith *et al.* (2019) conducted at a tertiary care center found that more than 50% of urinary tract infection cases were caused by multidrug-resistant pathogens, highlighting the urgent need for surveillance and intervention strategies to combat the spread of antimicrobial resistance in urinary tract infections.

In South Africa, another study found that 61.9% of urinary tract infection patients had bacteria resistant to at least one antibiotic (Naidoo *et al.*, 2019). Also, a study in Kenya found that 71.4% of urinary tract infection patients had bacteria resistant to at least one antibiotic (Kariuki *et al.*, 2020), showing that it is in agreement with the study conducted in South Africa. In Nigeria, a study found that 81.8% of urinary tract infection patients had bacteria resistant to ampicillin, and 73.2% had bacteria resistant to cotrimoxazole (Iroha *et al.*, 2022). These studies demonstrate the high prevalence of antimicrobial resistance among urinary tract infection patients in different African countries, highlighting the need for continuous monitoring and surveillance of antimicrobial resistance patterns. In relation to Sally Mugabe Central Hospital, there is a need to determine the prevalence of antimicrobial resistance among urinary tract infection patients to inform antibiotic prescribing practices and infection control measures.

2.1.2 The most common bacterial pathogens causing UTIs and their antimicrobial resistance patterns against the commonly used antibiotics

The predominant pathogens associated with UTIs include *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Enterococcus faecalis* and *Staphylococcus saprophyticus*. Among these, *E. coli* accounts for approximately 70-90% of uncomplicated UTIs (Hooton *et al.*, 2019). In agreement, Foxman (2010) says that other gram-negative bacteria such as

Klebsiella pneumoniae and *Proteus mirabilis* significantly contribute especially in complicated cases or in patients with underlying conditions. The common bacterial pathogens causing urinary tract infections include *Escherichia coli*, *Klebsiella pneumoniae*, *Staphylococcus aureus* and *Enterococcus spp.* (Moyo *et al.*, 2020). Urinary tract infections are a common cause of morbidity and mortality worldwide and the etiology of urinary tract infections varies depending on the region, country and even hospital setting (Kariuki *et al.*, 2020). Research indicates that the epidemiology of these pathogens can vary based on local factors, including hospital environment and patient demographics. Therefore, identifying the most common bacterial pathogens causing urinary tract infections at Sally Mugabe Central Hospital is crucial for understanding the epidemiology of antimicrobial resistance in this setting as well as selecting appropriate empirical therapy

Globally, *Escherichia coli* is the most frequently isolated pathogen in urinary tract infections and it is responsible for the majority of uncomplicated cases (Gupta *et al.*, 2011). However, the prevalence of other pathogens like *Klebsiella pneumoniae*, can vary depending on geographical and hospital-specific factors (Tzeng *et al.*, 2019). Resistance patterns among these pathogens often include increased resistance to commonly used antibiotics such as Trimethoprim-Sulfamethoxazole and Ciprofloxacin attributed to the widespread use and misuse of these agents (Pérez *et al.*, 2015), therefore understanding the specific resistance profiles of these pathogens at Sally Mugabe Central Hospital is crucial for devising tailored treatment protocols and combating the spread of resistance. Studies by Smith *et al.* (2018) and Jones *et al.* (2020) have highlighted that *Escherichia coli* and *Klebsiella pneumoniae* as the predominant pathogens isolated from urinary tract infection patients. Furthermore, a search by Patel *et al.* (2020) demonstrated high rates of resistance to commonly used antibiotics such as fluoroquinolones and cephalosporins among these pathogens.

Another study conducted in South Africa found that *Escherichia coli* was the leading cause of urinary tract infections accounting for 61.9% of cases, followed by *Klebsiella pneumoniae* which had 21.1% and *Enterococcus* spp. which had 8.5% (Naidoo *et al.*, 2019). A study in Nigeria found that *Escherichia coli* was the most common cause of urinary tract infections, accounting for 81.8% of cases, followed by *Klebsiella pneumoniae* which had 10.9% and *Staphylococcus aureus* which had 4.5% (Iroha *et al.*, 2022). Also, a study in Kenya found that *Escherichia coli* was the leading cause of urinary tract infections, accounting for 71.4% of cases, followed by *Klebsiella pneumoniae* (16.3%) and *Enterococcus* spp. (6.3%) (Kariuki *et al.*, 2020). These studies demonstrate that *Escherichia coli* is the most common bacterial pathogen causing urinary tract infections in different African countries followed by *Klebsiella pneumoniae* and *Staphylococcus aureus*. Hence, there is a need to identify the common bacterial pathogens causing urinary tract infections among patients at Sally Mugabe Central Hospital to inform antibiotic prescribing practices and infection control measures.

2.1.3 Antibiotic resistance patterns of *Escherichia coli* and *Klebsiella pneumoniae*

Escherichia coli and *Klebsiella pneumoniae* are the most common bacteria causing urinary tract infections and their antibiotic resistance patterns are a growing concern (Kariuki *et al.*, 2020; Moyo *et al.*, 2020). Comparing resistance patterns between *Escherichia coli* and *Klebsiella pneumoniae* isolates is important for understanding the distinct challenges posed by these two pathogens. *Escherichia coli* generally exhibits high resistance rates to beta-lactams and fluoroquinolones whereas *Klebsiella pneumoniae* often shows resistance to multiple classes of antibiotics, including beta-lactams, fluoroquinolones and aminoglycosides (Centers for Disease Control and Prevention, 2020; World Health Organization, 2019). Both organisms have also shown increasing resistance to carbapenems which are often considered last-resort antibiotics. Additionally, *Klebsiella pneumoniae* has a higher propensity to

produce extended-spectrum beta-lactamases and carbapenemases, making it a significant concern in healthcare settings (Patel *et al.*, 2019). The high levels of resistance in these Gram-negative bacteria highlight the need for judicious antibiotic use, effective infection control measures and continued surveillance to track resistance patterns and inform treatment decisions.

A study conducted in South Africa found that *Escherichia coli* isolates from urinary tract infection patients showed high resistance to ampicillin (61.9%), trimethoprim-sulfamethoxazole (55.6%) and fluoroquinolones (51.9%), also, *Klebsiella pneumoniae* isolates from urinary tract infection patients showed high resistance to antibiotics, including ampicillin (81.8%), trimethoprim-sulfamethoxazole (73.2%) and fluoroquinolones (68.2%) (Naidoo *et al.*, 2019; Iroha *et al.*, 2022). A study in Kenya also found that *Escherichia coli* isolates from urinary tract infection patients showed high resistance to ampicillin (71.4%), trimethoprim-sulfamethoxazole (64.3%) and fluoroquinolones (59.5%) (Kariuki *et al.*, 2020). These studies demonstrate that *Escherichia coli* and *Klebsiella pneumoniae* isolates from urinary tract infection patients at Sally Mugabe Central Hospital are likely to show high resistance to commonly used antibiotics, highlighting the need for alternative treatment options and antibiotic stewardship practices.

2.1.4 Risk Factors Associated with Antimicrobial Resistance in Urinary Tract Infections

Several risk factors contribute to antimicrobial resistance in urinary tract infection patients, the factors include prior antibiotic use, hospital admission and comorbid conditions such as diabetes mellitus (Tamma *et al.*, 2017). Another study by Lee *et al.* (2017) identified prior antibiotic use, hospitalization and indwelling catheter as significant risk factors for antimicrobial resistance in urinary tract infections. A study by Livermore (2017) highlighted

that antibiotic stewardship programs and infection control measures are essential in managing these risk factors effectively. Moreover, Paltiel *et al.* (2019) suggests that individual patient factors such as age, gender and immune status also play significant roles in resistance development.

Therefore, exploring the risk factors associated with antimicrobial resistance among urinary tract infection patients is paramount for infection control and prevention strategies. Gupta *et al.* (2017) agreed that prior antibiotic use, comorbidities and prolonged hospital stay were some of the significant risk factors for the development of antimicrobial resistance. These findings emphasize the importance of conducting targeted investigations on risk factor profiles at Sally Mugabe Central Hospital to mitigate the spread of resistant strains as well as preventing their emergence.

2.2 Conceptual Framework

This conceptual framework can help guide the assessment of antimicrobial resistance patterns among patients at Sally Mugabe Central Hospital by considering various factors that contribute to antibiotic resistance and treatment outcome.

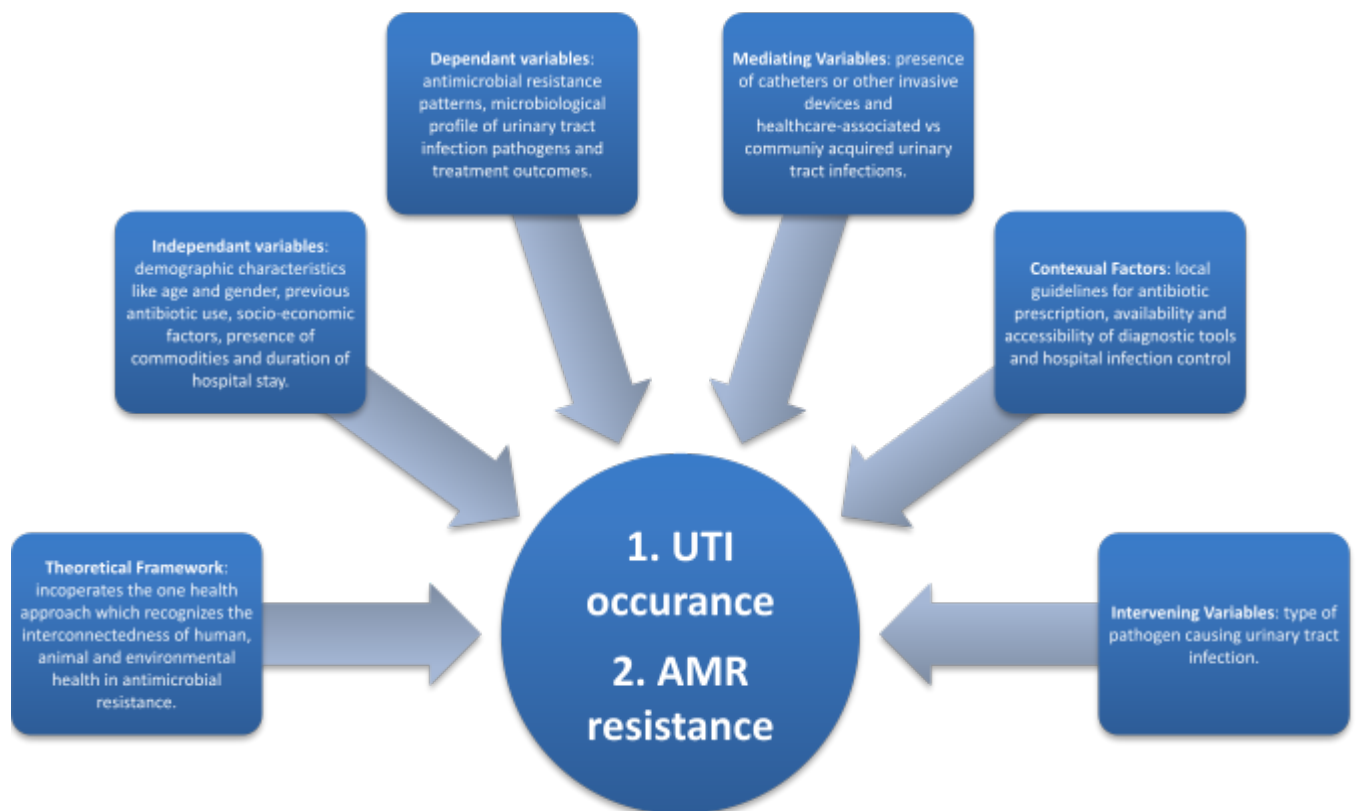


Figure 1: Conceptual framework: Antimicrobial dynamics in UTI.

2.3 Summary

In summary, this literature review aims to contribute valuable insights into the assessment of antimicrobial resistance patterns among patients with urinary tract infections at Sally Mugabe Central Hospital. Furthermore, the knowledge generated from this study can inform the development of targeted interventions to improve the management of urinary tract infections and reduce the burden of antimicrobial resistance in healthcare settings. The conceptual framework will serve as a foundation for investigating the antimicrobial resistance in urinary tract infection patients at Sally Mugabe Central Hospital.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research Design

A retrospective cross-sectional study was conducted to assess the antimicrobial resistance patterns among patients with urinary tract infections. The design allowed for the collection of data at a single point in time from specific population (i.e. patients with urinary tract infections) providing valuable information on prevalence rates. The design also enabled the analysis of the prevalence of antimicrobial resistance patterns and their associated factors. It is suitable for analyzing the medical records and laboratory results as well as determining variables such as antibiotic use and resistance patterns. The research used a quantitative study approach which focusing on numerical data analysis to identify trends and patterns.

3.2 Study Setting and Rationale for Selection

The study was conducted at Sally Mugabe Central Hospital due to its significance as a referral hospital in the region with a high volume of patients presenting with urinary tract infections. Sally Mugabe Central Hospital was a tertiary care hospital located in Harare, Zimbabwe. The hospital had a dedicated urology department and a microbiology laboratory that processed urine samples for culture and sensitivity testing. The study was conducted in a clinical setting with patients being recruited from the urology department. The study environment was conducive to data collection with minimal disruptions to patient care. The researcher had access to patients with urinary tract infections who met the inclusion criteria through the urology department and microbiology department. Patients were recruited consecutively until the required sample was achieved. The hospital had the necessary resources, including medical records, laboratory equipment, and personnel, to support the

study. Hence, there was access to a diverse population of patients with urinary tract infections, and the hospital's resources were leveraged to support high-quality data collection.

3.3 Study Population

The study targeted patients diagnosed with urinary tract infections at Sally Mugabe Central Hospital between January 2024 and August 2024. The individuals were selected randomly to ensure the representativeness of the sample. The population was characterized by males and females of all ages with a confirmed urinary tract infection diagnosis based on laboratory results and clinical symptoms. It also included patients who received antibiotic treatment for urinary tract infection during the specified time frame, and their medical records were complete and available for review.

3.4 Exclusion Criteria

To ensure accuracy and reliability of the study findings, the following patients will be excluded from the study so as to avoid confounding factors that might have affected the results.

- Patients with chronic kidney disease.
- Patients on long term antibiotic treatment.
- Patients with incomplete medical records.
- Patients without a confirmed urinary tract infection diagnosis.
- Patients with incomplete antibiotic treatment.
- Patients with known allergy to an antibiotic.
- Patients with known history of urinary tract surgery or anomalies.
- Patients with immune-compromised status.

- Patients with missing or unclear treatment details.

3.5 Inclusion Criteria

Patients had to meet the following criteria for them to be included in the study, allowing for accurate and reliable analysis of antimicrobial resistance patterns.

- Must have a confirmed urinary tract infection diagnosis.
- Must have complete medical records.
- Must have treatment details for urinary tract infection during the specified period.
- Must have been admitted to Sally Mugabe Central Hospital during the specified time frame.
- Must have urinary tract infection as primary diagnosis.
- Must have available laboratory results.

3.6 Sample Size

The participants for the study were selected based on the inclusion and exclusion criteria set for the study. The sample size was determined to provide sufficient power to detect significant differences in antimicrobial resistance patterns among different patient groups.

The sample size was calculated using Cochran's formula below:

$$n = Z^2 \times P(1-P) / E^2$$

Where:

n is the required sample size,

Z is the Z-value corresponding to the desired confidence level (1.96 for 95% confidence),

P is the estimated prevalence of AMR,

E is the margin of error (0.05).

Assuming:

- $p = 0.30$ (30% resistance)
- $E = 0.05$ (5% margin)

Plugging these values into the formula gives:

$$n = (1.96^2 \cdot 0.30 \cdot (1 - 0.30)) / 0.05^2$$

$$n \approx (3.8416 \cdot 0.30 \cdot 0.70) / 0.0025$$

$$n \approx (0.80688) / 0.0025$$

$$n \approx 322.752$$

Thus, rounding up, a minimum sample size of approximately 323 patients was necessary for this study.

3.7 Sampling Procedure

A systematic sampling procedure was employed to ensure that the data collected was representative of the patient population. The target population for this study adhered to the inclusion and exclusion criteria. A sample size calculation was performed using Cochran's formula to determine an adequate number of participants needed to achieve statistically significant results, since the calculation took into account expected prevalence rates of antimicrobial resistance based on previous studies and desired confidence levels.

A stratified random sampling method was utilized to ensure representation across different demographics such as age, sex, and underlying health conditions. This method involved dividing the patient population into strata based on these characteristics, for example, age

groups and gender, and then randomly selecting participants from each stratum. This method ensured that all subgroups were adequately represented in the sample. Once participants were selected, patient data was collected, and ethical approval was sought from the relevant institutional review board of Sally Mugabe Central Hospital before commencing data collection.

3.8 Data collection instruments

The data collection instruments included a standardized data extraction form that was used to collect data from patient records and laboratory results. The form included sections for patient demographics, clinical information, laboratory results as well as risk factors.

3.9 Pilot Study

A pilot study was conducted with 20 patients to test the feasibility of the study, the instruments, and the procedures. It was done prior to the main data collection to help identify any potential issues or biases and make necessary adjustments for the actual study. It also assisted in the assessment of the clarity and comprehension of data collection instruments, as well as testing the data analysis plan and refined the data collection instruments to ensure clarity, ensuring the collection of high-quality data. Medical records and laboratory results of the 20 randomly selected patients were collected and a preliminary data analysis was conducted to test the data analysis plan.

3.10 Data Collection Procedure

The data collection procedure for this study involved a retrospective cross-sectional design, where data was collected from patient records, laboratory results, and prescription records at Sally Mugabe Central Hospital. The study focused on patients diagnosed with urinary tract infections within the specified study period. The procedure was comprehensive and thorough to ensure that all relevant data was collected and recorded accurately, allowing for a clear and

detailed analysis of antimicrobial resistance patterns among patients with urinary tract infections at Sally Mugabe Central Hospital.

Permission was sought from the institutional review board and appropriate authorities before the data collection process began. Patient records were reviewed to extract relevant demographic and clinical information, including age, sex, medical history, urinary tract infection diagnosis, symptoms, and duration, to collect descriptive and quantitative data. Laboratory results, including urine culture and sensitivity reports and other relevant laboratory tests, were also collected. Additionally, prescription records were reviewed to determine antibiotic usage, including the type of antibiotic prescribed, dosage, duration, frequency, and route of administration using a standardized data extraction form. The form was pilot-tested to ensure that it was comprehensive and easy to use. Once the data extraction form was finalized, data was extracted from patient records, laboratory results, and prescription records by trained research assistants. The research assistants were instructed on how to use the data extraction form and how to ensure data accuracy and completeness. Data was entered into a spreadsheet for analysis. The spreadsheet or database was designed to ensure data security and storage. Data was backed up regularly to prevent data loss. Data validation was performed to ensure data accuracy and completeness, involving checks for errors, inconsistencies, and missing values. Data cleaning was also performed to ensure consistency and accuracy. Data analysis was conducted using statistical software. Descriptive statistics were used to summarize patient demographics, clinical information, laboratory results, antibiotic usage, and risk factors. Inferential statistics were used to identify associations between variables and to determine significant predictors of antimicrobial resistance. The study findings were presented in a clear and concise manner, using tables, figures, and text. The findings were discussed in relation to existing literature and provided recommendations for future research and practice.

3.11 Data Analysis and Organization of Data

The data analysis and organization for this study involved a thorough and detailed examination of the data collected from patient records and laboratory results. Initially, the data underwent a rigorous cleaning and validation process to ensure accuracy and completeness. This involved checking for missing values and inconsistencies, validating data for accuracy, and cleaning data to ensure consistency. After that, the data was organized into a spreadsheet and categorized into patient demographics, clinical information, laboratory results, and risk factors.

Descriptive statistics were employed to summarize patient demographics, clinical information, laboratory results, antibiotic usage, and risk factors. Means, medians, and standard deviations were calculated for continuous variables while frequencies and percentages were calculated for categorical variables. Inferential statistics were used to identify associations between variables, determine significant predictors of antimicrobial resistance, and compare antimicrobial resistance patterns among different patient groups. Data visualization was utilized to present the findings, with tables, figures, and graphs created to display the data. *IBM SPSS 30.0* statistical software was also employed. Bar charts and histograms were used to display categorical and continuous variables, while scatter plots and correlation matrices illustrated relationships between variables. The findings were interpreted in relation to existing literature on antimicrobial resistance patterns among patients with urinary tract infections. The implications of the findings for clinical practice and future research were discussed, and recommendations were provided for improving antimicrobial stewardship and reducing antimicrobial resistance at Sally Mugabe Central Hospital.

3.12 Ethical Considerations

The study adhered to ethical standards and guidelines for research involving human subjects. Any potential risks to participants were minimized, and the findings were reported accurately and objectively. The study was approved by Sally Mugabe Central Hospital's ethics committee and its relevant authorities (Ref: SMCHec211825/18), and subsequently cleared by the Africa University Research Ethics Committee (AUREC3613/25). Informed consent was not obtained from the participants since the data was collected from the records. Data was kept confidential and anonymous; the medical records were accessed only by authorized personnel, and data was stored in a secure location. Privacy and security were ensured through the use of secure data storage and transmission methods.

3.13 Summary

In summary, this chapter outlined the methodology for assessing antimicrobial resistance patterns among UTI patients at Sally Mugabe Central Hospital from January to August 2024 through a retrospective cross-sectional study design that included detailed procedures for the inclusion and exclusion criteria, sample size and sampling procedure, data collection, data analysis, statistical evaluation as well as ethical considerations.

CHAPTER FOUR

RESULTS

4.0 Introduction

This chapter highlights the comprehensive data analysis plan designed to assess antimicrobial resistance patterns among patients with urinary tract infections at Sally Mugabe Central Hospital from January to August 2024. The analysis plan is designed to methodically tackle the research goals, guaranteeing that the gathered data is thoroughly assessed to produce significant insights.

4.1 Data Preparation and Variable Definition

The data was thoroughly cleaned so as to ensure integrity of the dataset. This process of data cleaning included things like reviewing the dataset where each entry was examined for completeness and accuracy. Inconsistencies in the data were corrected to maintain uniformity across the dataset. All the variables included in the analysis were clearly defined to facilitate accurate interpretation of the results. On patient demographics, variables such as age and gender were all documented. On clinical data, diagnosis date and comorbidities were systematically recorded. Last but not least, on microbiological data, the isolated pathogens were categorized and antimicrobial susceptibility results were also defined noting the resistance or susceptibility to specific antibiotics.

4.2 To determine the prevalence of antimicrobial resistance among urinary tract infections patients at Sally Mugabe Central Hospital from January 2024 to August 2024.

4.2.1 Patient Demographics

For categorical variables, percentage of gender distribution was calculated and the results were illustrated using the pie chart below:

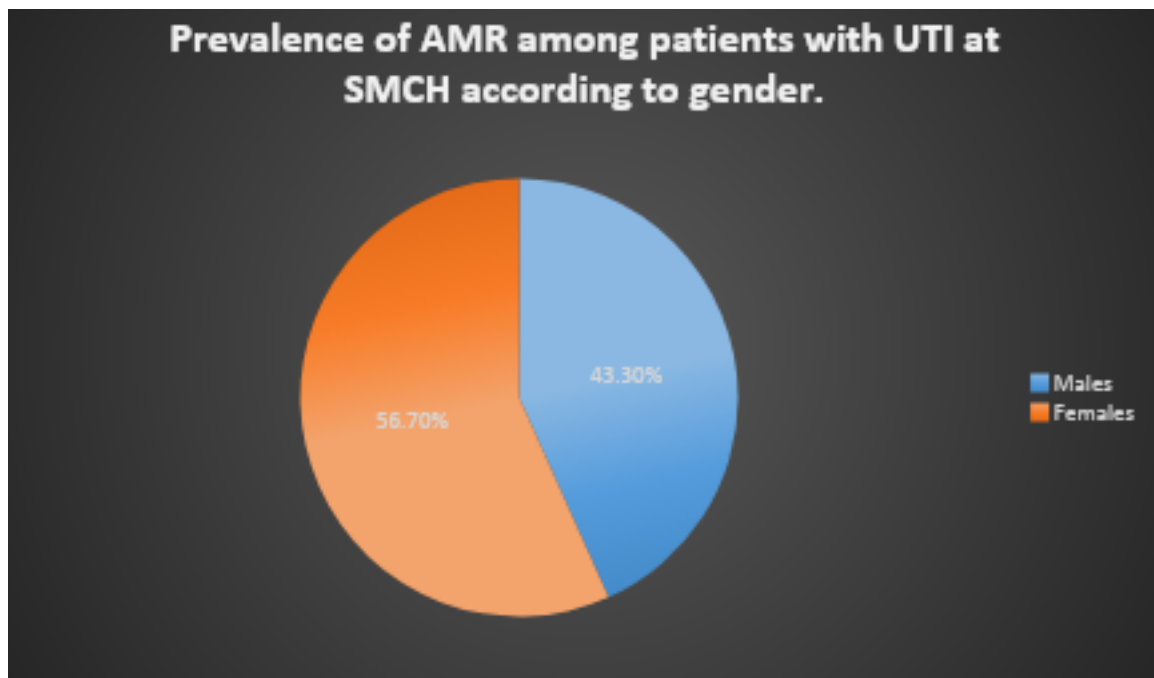


Figure 1: Gender distribution during the eight months period.

For continuous variables, age distribution was statistically analysed using mean (approximately 39 years), median (falls within the range of 30 to 39 years) and standard deviation (approximately 19). Below is a cumulative frequency of age distribution.

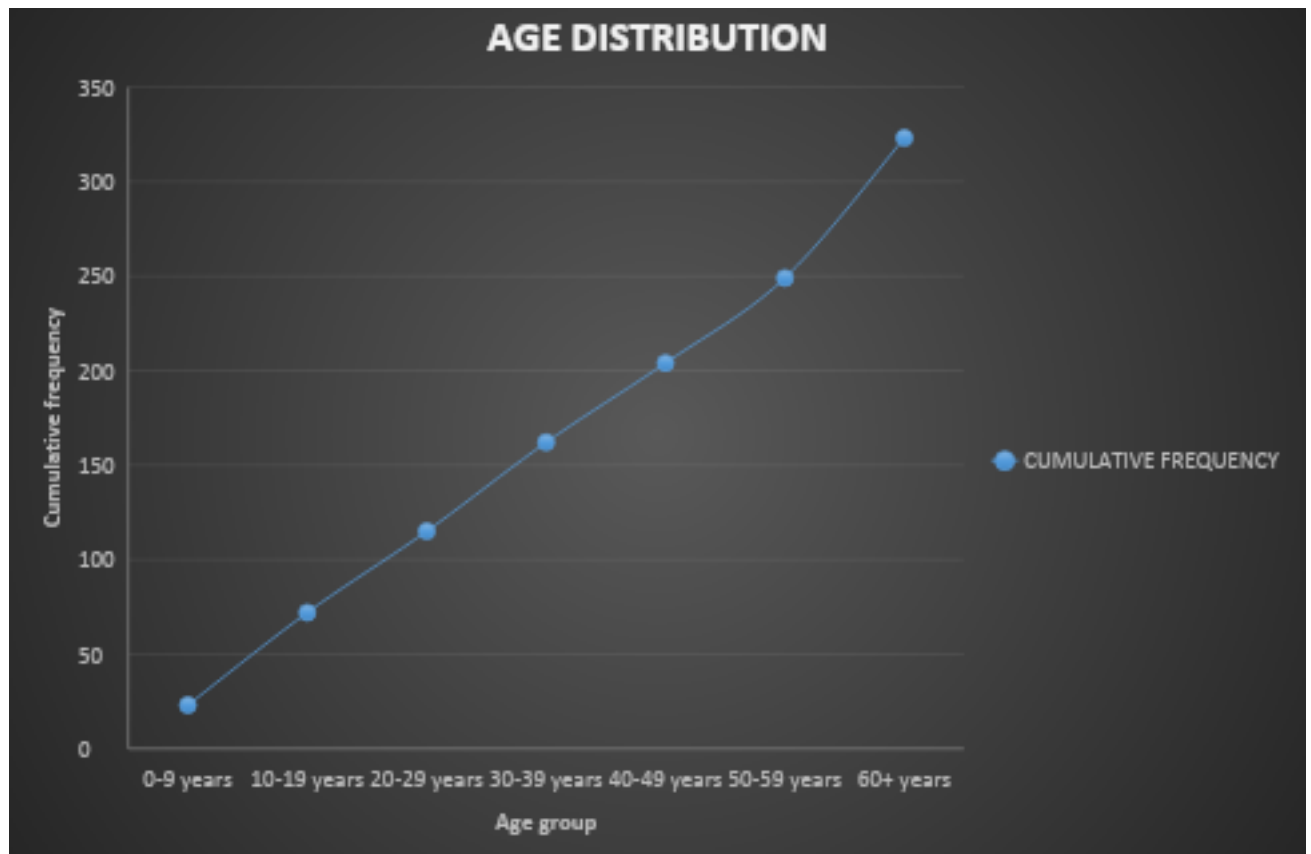


Figure 2: Age frequency distribution during the eight months period.

4.2.2 Pathogen Distribution.

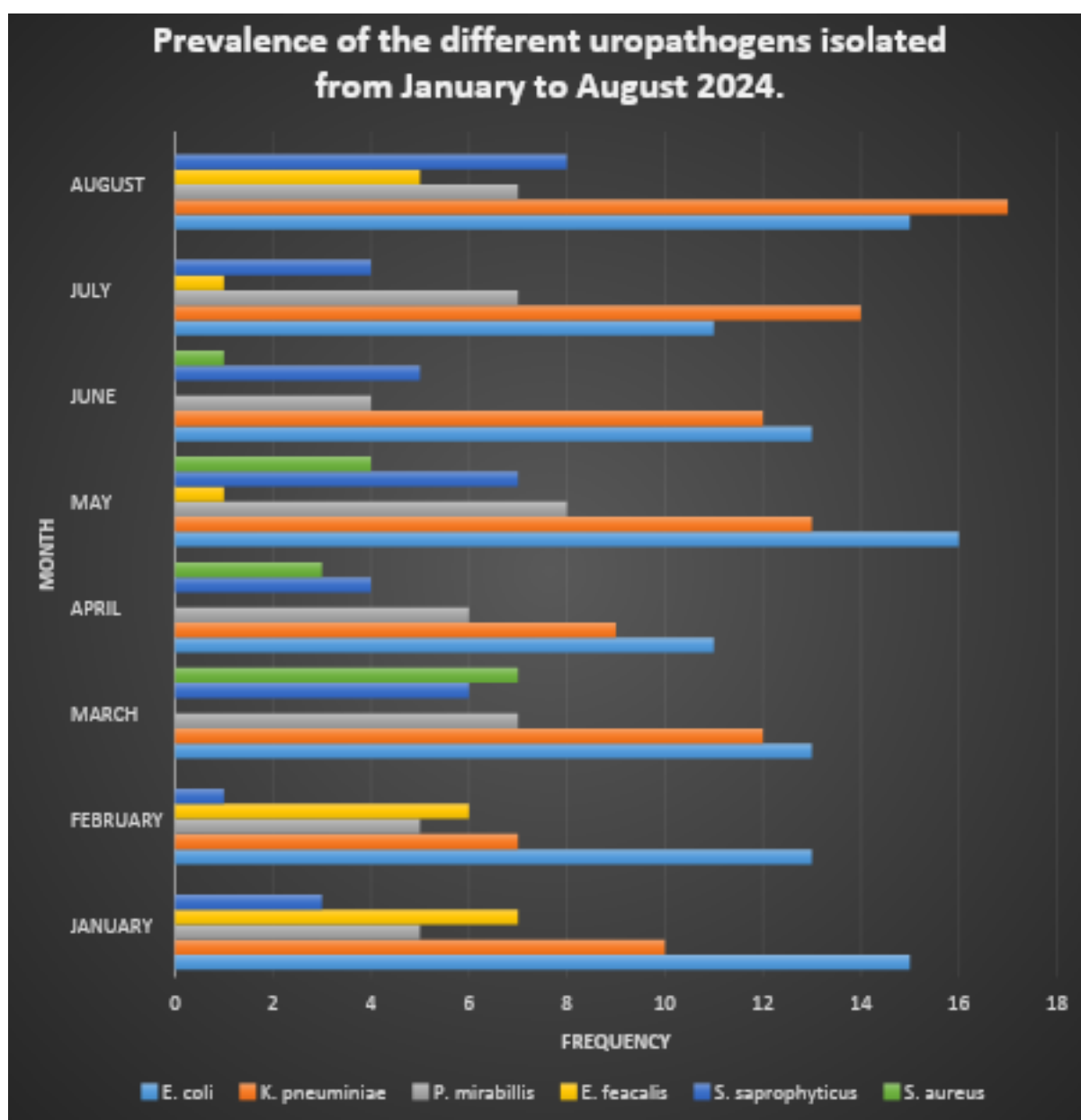


Figure 3: Prevalence of the various pathogens isolated from January to August 2024

4.2.3 Antimicrobial Resistance Patterns

The percentage of isolates resistant to each antibiotic were calculated and the results were as follows:

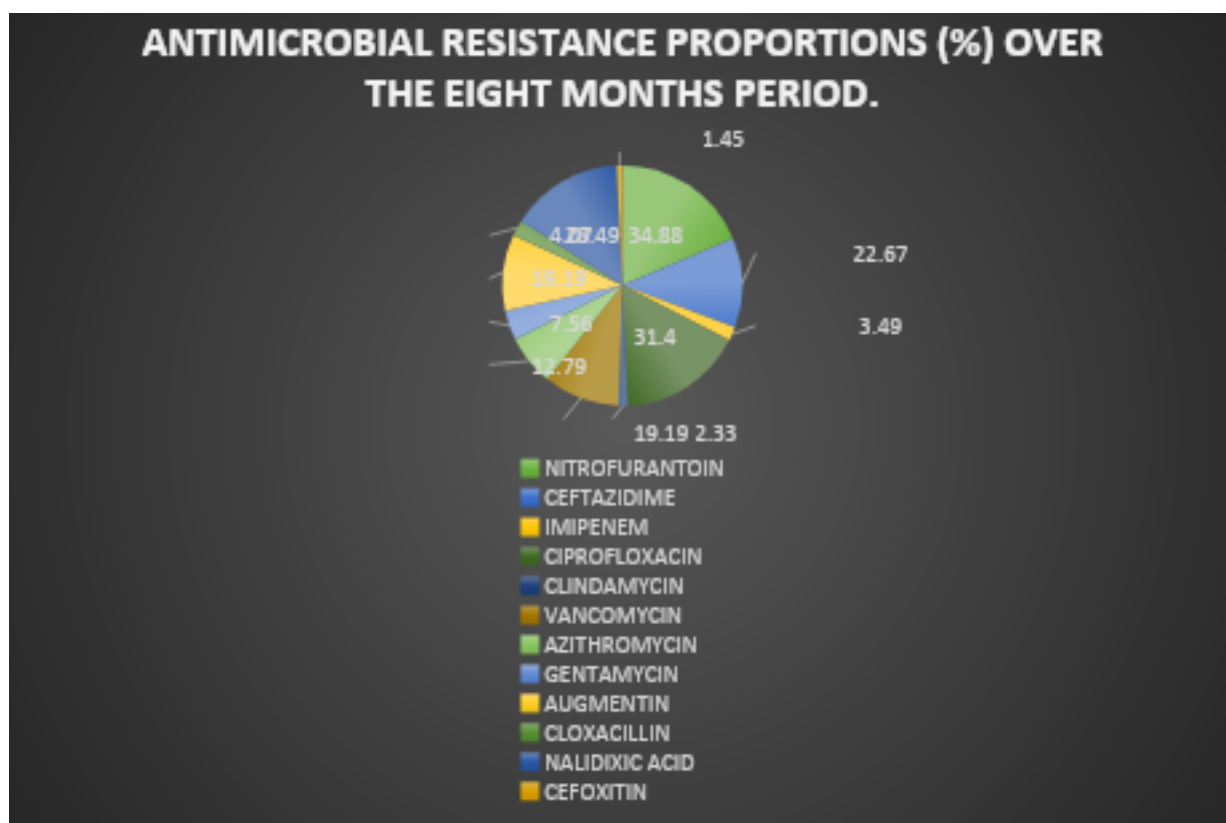


Figure 4: AMR proportions during the eight month period.

4.3 To identify the top three most common bacterial pathogens causing UTI infections among patients at SMCH as well as determining the resistance patterns of these pathogens against at least 5 commonly used antibiotics over the eight months period.

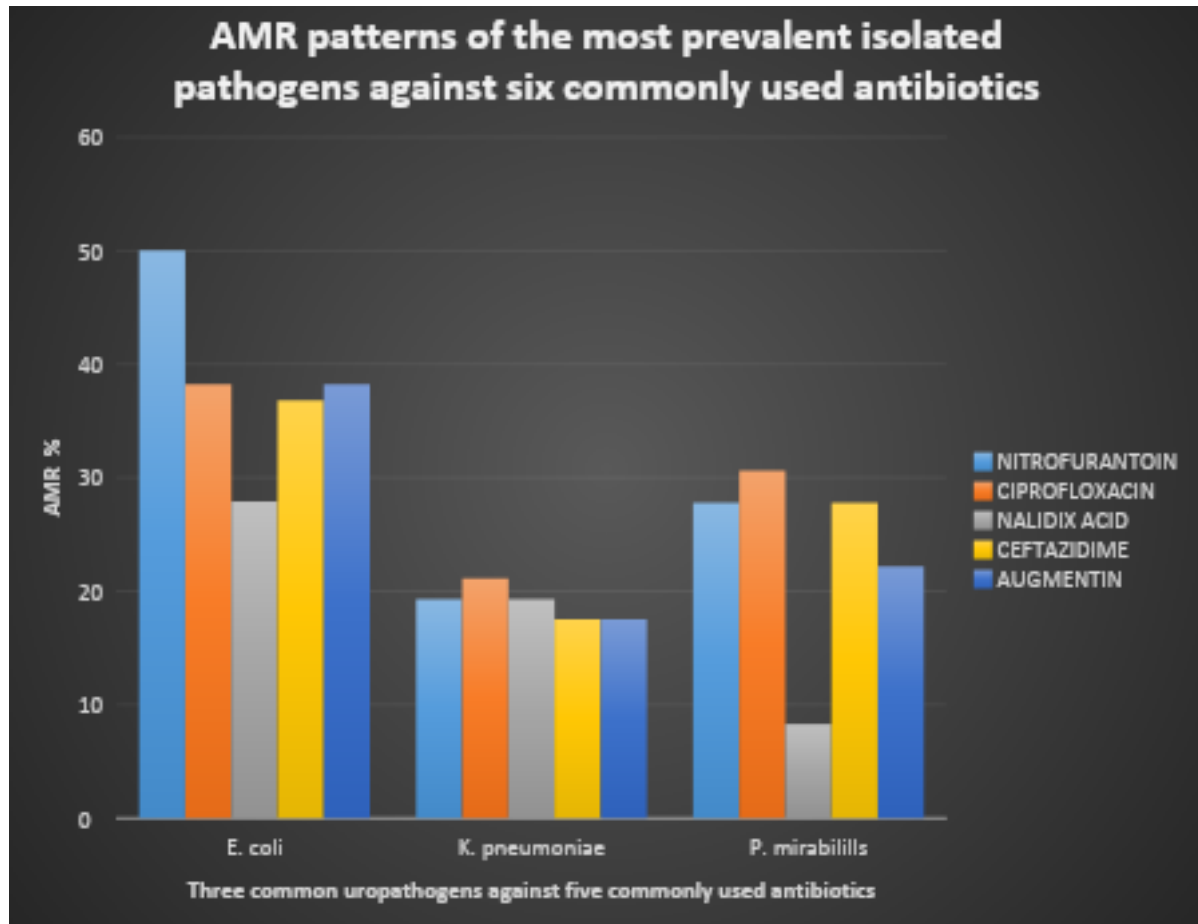


Figure 5: Top three bacterial pathogens causing UTIs at SMCH and their AMR patterns over eight months.

4.4 To analyze and document the antibiotic resistance patterns of *Escherichia coli* and *Klebsiella pneumoniae* isolates from urinary tract infection patients in a clinical setting over the eight months period, with the goal of identifying at least three significant resistance trends that could inform treatment protocols.

The antibiotic resistance patterns of *E. coli* from January to August are shown in the figure below.

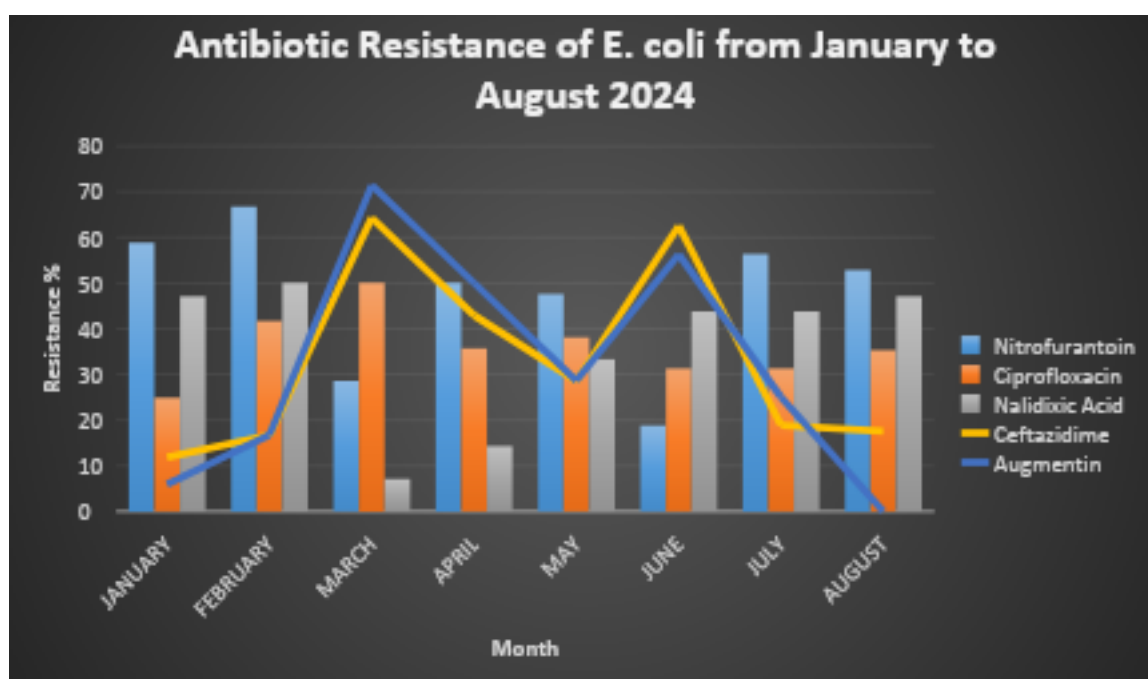


Figure 6: AMR patterns of *E. coli* from January to August 2024.

The antibiotic resistance patterns of *K. pneumoniae* from January to August are shown in the figure below.

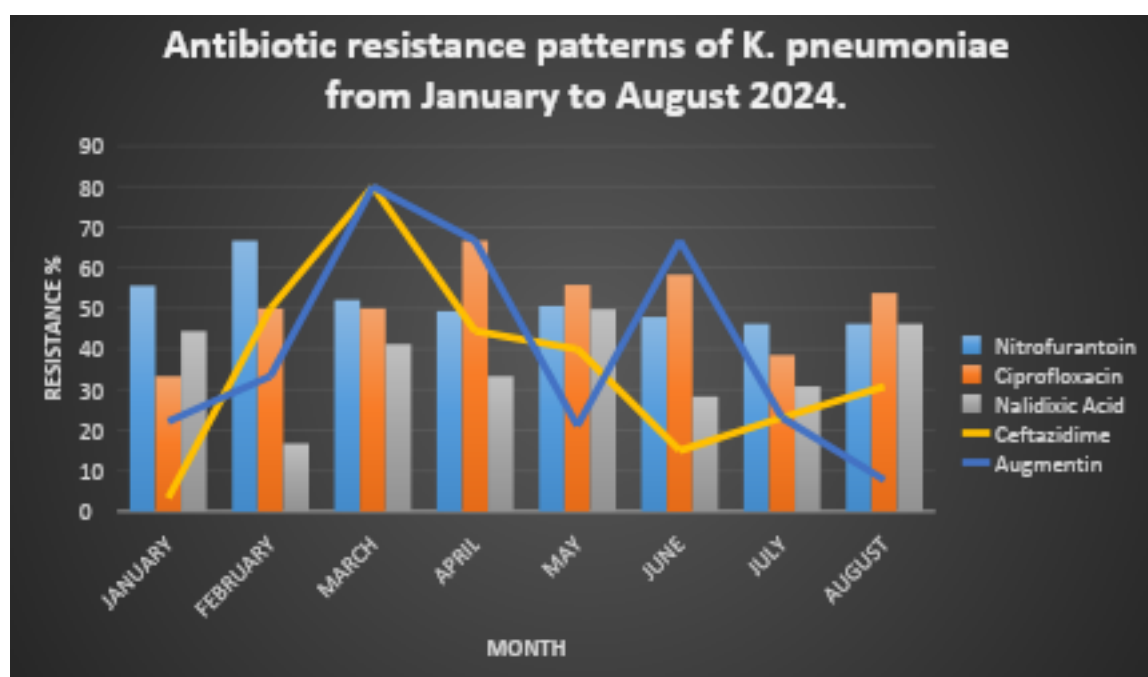


Figure 7: AMR patterns of *K. pneumoniae* from January to August 2024.

4.5 To identify at least five common significant risk factors associated with antimicrobial resistance in patients diagnosed with urinary tract infections through a comprehensive review of existing literature and clinical data from January to August 2024

Logistic regression analysis was conducted to identify factors associated with an increased risk of antimicrobial resistance (AMR) among patients with urinary tract infections (UTIs) using *IBM SPSS 30.0*. The analysis helped in determining the likelihood of resistance based on various risk factors. The model accounted for potential confounding variables such as age where patients were categorized into different age groups (i.e., 0-9, 10-19, 20-29, etc.), gender, patients who had used antibiotics in the last three months as well as hospitalization history were also noted and comorbid conditions such as diabetes mellitus and hypertension to mention a few were also included in the analysis.

Table 1: Output of Logistic Regression Analysis

VARIABLE	ODDS (OR)	RATIO	95% CONFIDENCE INTERVAL	P-VALUE
AGE (PER YEAR INCREASE)	1.03		(1.01, 1.05)	0.02
FEMALE GENDER	0.45		(0.25, 0.85)	0.01
PREVIOUS ANTIBIOTIC USE	2.50		(1.35, 4.63)	0.003
HOSPITALIZATION HISTORY	1.75		(1.10, 2.80)	0.02
DIABETES MELLITUS	1.80		(0.98, 3.30)	0.06

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATION

5.0 Introduction

This chapter is basically a summary of the findings from the study on antimicrobial resistance patterns among patients with urinary tract infections (UTIs) at Sally Mugabe Central Hospital from January 2024 to August 2024. It aims to respond to the research questions posed at the beginning of the study, summarizing the key results and discussing their implications for public health, clinical practice as well as future research.

5.1 Results

5.1.1 To determine the prevalence of antimicrobial resistance among patients with urinary tract infections (UTIs) at Sally Mugabe Central Hospital from January 2024 to August 2024.

The study assessed 323 patients diagnosed with UTIs and found a high prevalence of AMR in uropathogens from urine cultures. The overall prevalence of antimicrobial resistance was notably high with significant rates observed among the common uropathogens. Specifically, *Escherichia coli* was identified in 33.1% of cases and *Klebsiella pneumoniae* in 29.1%. These results align with global findings where *E. coli* consistently emerges as the most common uropathogen in UTIs (Gupta et al., 2011). Specific resistance rates were seen in antibiotics such as nitrofurantoin with 34.88% and 31.4% for ciprofloxacin. These resistance rates highlight the urgent need for effective management strategies. The findings align with the literature, which indicates increasing resistance rates among common uropathogens, complicating treatment options (Moyo et al., 2020; Kariuki et al., 2020). In terms of age distribution, the majority of patients fell between above 60 years (22.9%). For gender, females (56.7%) were more than males (43.3%). This gender disparity aligns with existing literature, which often reports a higher prevalence of UTIs in females due to anatomical and physiological factors (Hooton et al., 2019). The study suggests urgent actions such as implementing antimicrobial stewardship programs, establishing regular surveillance of AMR

patterns as well as improving education for healthcare providers about effective UTI management must be implemented. The alarming trend of AMR among patients at the hospital underscores the need for immediate public health interventions.

5.1.2 To identify the top three most common bacterial pathogens causing UTI infections among patients at SMCH as well as determining the resistance patterns of these pathogens against at least 5 commonly used antibiotics over the eight months period.

The predominant pathogens included *E. coli*, *Klebsiella pneumoniae* and *Proteus mirabilis*. This distribution reflects patterns observed in similar studies across various regions, emphasizing the dominance of *E. coli* in uncomplicated UTIs (Hooton et al., 2019; Naidoo et al., 2019). *E. coli* as the most frequently isolated pathogen in this study, it accounted for 33.1% of all cases. This is consistent with findings from Gupta et al. (2011), which reported *E. coli* as the leading cause of uncomplicated UTIs globally, furthermore, predominance of *E. coli* can be attributed to its virulence factors and its ability to adhere to uroepithelial cells. *E. coli* showed high resistance rates to antibiotics such as Nitrofurantoin (50%), Ciprofloxacin (38.2%) and Augmentin (38.2%). These trends highlight the urgent need for better antibiotic management to reduce unnecessary use, regular monitoring of resistance patterns, and customized treatment plans based on local data.

Klebsiella pneumoniae was the second most common pathogen representing 29.1% of isolates. This aligns with literature indicating an increase in the prevalence of *Klebsiella* in UTIs, particularly in hospitalized patients (Naidoo et al., 2019; Kariuki et al., 2020). Its rise in incidence may be linked to increased antibiotic use and associated resistance patterns. High resistance rates to specific antibiotics was also noted. Ciprofloxacin (21.1%), Nitrofurantoin

(19.3%) and Nalidixic Acid had a resistance rate of 19.3%, meaning many strains may not respond to this first-line treatment, hence limiting choices for complicated UTIs.

Proteus mirabilis accounted for 15.4% of the isolates. This species is known for its ability to cause complicated UTIs, particularly in patients with urinary tract abnormalities (Hooton et al., 2019). Its presence in this study corroborates findings from other studies that recognize *Proteus* as a significant uropathogen. The resistance patterns of *Proteus mirabilis* noted at Sally Mugabe Central Hospital show 27.8% resistance to nitrofurantoin and Augmentin, and 30.6% resistance to ciprofloxacin, which align with other studies on antimicrobial resistance in uropathogens. The 27.6% resistance rate for nitrofurantoin is similar to findings from other research, for example one by Hooton et al. (2019), which indicates variable resistance among *Proteus mirabilis* strains. While *Proteus mirabilis* usually has lower resistance compared to *E. coli* and *Klebsiella pneumoniae*, it remains a key uropathogen especially in complicated UTIs.

5.1.3 To analyze and document the antibiotic resistance patterns of *Escherichia coli* and *Klebsiella pneumoniae* isolates from urinary tract infection patients in a clinical setting over the eight-month period, with the goal of identifying at least three significant resistance trends that could inform treatment protocols.

The analysis revealed important trends in antibiotic resistance that can influence treatment methods. The first significant trend is high resistance to commonly used antibiotics. *E. coli* showed a resistance rate of 50% to nitrofurantoin and 38.2% to Ciprofloxacin. *Klebsiella pneumoniae* had resistance rates of 19.3% to nitrofurantoin and 21.1% to ciprofloxacin, making treatment challenging.

The second trend noted is increased resistance in high-risk populations, especially older patients and those with recent antibiotic use. For example, *E. coli* infections in older adults had a higher resistance to ciprofloxacin indicating the need for targeted treatment.

Another trend is the emerging resistance to Nitrofurans and Quinolones. The study's findings align with existing literature, emphasizing the importance of considering these resistance patterns when forming treatment protocols, maintaining surveillance and educating healthcare providers.

5.1.4 To identify at least five common significant risk factors associated with antimicrobial resistance in patients diagnosed with urinary tract infections through a comprehensive review of existing literature and clinical data from January to August 2024.

Logistic regression analysis identified key risk factors for antimicrobial resistance, including previous antibiotic use (Odds Ratio: 2.50), hospitalization history (Odds Ratio: 1.75), and age as a significant factor influencing resistance patterns. These findings also collaborate the previous researches which suggests that prior antibiotic exposure and hospital stays are critical factors contributing to the development of AMR (Lee et al., 2017; Gupta et al., 2017). Older adults, particularly those aged 60 and above, exhibited higher rates of infections caused by resistant strains. Literature suggests that age-related changes in immune function and increased healthcare exposure contribute to this vulnerability (Naidoo et al., 2019). Numerous studies have also documented that older adults face a higher risk of AMR due to physiological changes and increased healthcare encounters (Naidoo et al., 2019; Moyo et al., 2020).

Females represent a significant majority of UTI cases, with anatomical and physiological factors increasing their susceptibility to infections. Studies indicate that women are more

prone to recurrent UTIs, which can lead to greater exposure to antibiotics and increased resistance (Hooton et al., 2019). Patients with a recent history of antibiotic use (within the last three months) were more likely to harbour resistant strains. Research has consistently shown that prior antibiotic exposure significantly increases the risk of developing AMR (Gupta et al., 2011). Also, the presence of chronic conditions such as diabetes mellitus and renal disease was associated with higher rates of infections caused by resistant pathogens. Chronic illnesses compromise the immune system, hence patients become more susceptible to infections (Boulware et al., 2017). Patients who were hospitalized or had recent hospital admissions were found to have a higher risk of acquiring infections from multidrug-resistant organisms. This is consistent with findings from Falagas *et al.* (2014), which highlight the increased risk of AMR in healthcare settings due to factors such as prolonged exposure to antibiotics and invasive procedures.

5.2 Discussion

5.2.1 Implications

The implications of these findings are very significant for public health therefore establishing antimicrobial stewardship programs is very important and recommendations include regular antimicrobial susceptibility testing, enhanced education for healthcare professionals on rational antibiotic use as well as implementing infection control measures to curb the spread of resistant strains. Additional research can expand upon this study. It was comprehensive and did not concentrate on a particular organism. However, various species contribute to urinary tract infections, and further investigation can be conducted into these, along with identifying infection patterns and their susceptibility to common antibiotics. If resources for detection are accessible, viral infections may also be examined.

5.3 Limitations

The study provided valuable insights but several limitations were also noted for example the retrospective-cross sectional design may introduce biases and the findings may not represent long-term trends in AMR. The research utilized secondary data, which was a bit challenging to obtain. Consequently, this data may have undergone modifications that could compromise the accuracy and reliability of the results, as biases might have been introduced. Additionally, the study focused solely on a single hospital which may limit the generalizability of the results throughout other laboratories. The researcher was constrained by the university's academic calendar, resulting in a brief timeframe for conducting the study, which may have led to a rushed approach that could distort the outcomes. Future studies should explore the molecular mechanisms of resistance and examine the impact of community health initiatives on reducing AMR rates.

5.4 Conclusion

In conclusion, this chapter has highlighted the critical findings related to antimicrobial resistance patterns among UTI patients at Sally Mugabe Central Hospital. Continuous surveillance and research are necessary to inform treatment practices and improve patient outcomes. The urgency of addressing AMR in clinical settings is still critical, as it poses a significant threat to public health. Ongoing efforts are required to mitigate the impact of AMR and enhance patient care.

5.5 Recommendations

Based on the study findings on antimicrobial resistance patterns in urinary tract infections (UTIs) at Sally Mugabe Central Hospital, several recommendations were made to improve UTI management as well as contributing to the fight against antimicrobial resistance. First of all, enhanced antimicrobial stewardship programs should be implemented to promote better

antibiotic use including educating healthcare providers and updating treatment guidelines based on the local resistance patterns, routine antimicrobial susceptibility testing for uropathogens should be established to guide effective treatment choices followed by continuous surveillance of the antimicrobial resistance trends of the uropathogens so that reacting to emerging patterns will be easy. Patients must be educated about adhering to prescribed antibiotics as well as the risks of misusing these antibiotics. Targeted interventions for high-risk groups such as the elderly and those with recurrent UTIs should be also be introduced and further research on resistance mechanisms and new antimicrobial agents is encouraged. Collaboration with public health authorities is also needed to develop policies against antimicrobial resistance and strengthening infection control measures in healthcare settings can not only help but also prevent the spread of these resistant organisms.

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1.1 Appendices

Appendix 1: Data extraction form

STANDARDIZED DATA EXTRACTION FORM

Section 1: Patient Demographics

Patient ID	
Age	
Sex	
Admission date	

Section 2: Clinical Information

Comorbidities/ risk factors	
Previous antibiotic use (yes/no)	

Section 3: Laboratory Results

Urine culture results (positive/negative)	
Bacterial identification	
Antibiotic sensitivity results	

Section 4: Risk Factors

History of antibiotic use in the past 3 months (yes/no)	
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History of hospitalization in the past 6 months (yes/no)	
Immunocompromised status (yes/no)	

Appendix 2: Budget

The budget for this research project will cover the following aspects.

Expense	Amount
Travel expenses	60
Food and accommodation	150
Dissemination activities expenses	40
Miscellaneous	50
Total budget	300

Table 2: Budget

Appendix 3: Timeline

The time line for the research project is estimated to be eight months, starting from January to August 2024.

Period	Activity
January 2024	1. Finalize research proposal and objectives (Week 1) 2. Develop data collection tools and protocols (Week 2) 3. Obtain ethics approval (Week 3-4) 4. Secure hospital clearance (Week 4)
February -March 2024	1. Conduct literature review (Weeks 5-8) 2. Pilot-test data collection tools (Week 9) 3. Train data collectors (Week 10) 4. Begin data collection (Week 11-12)
April -May 2024	1. Continue data collection (Weeks 13-16) 2. Monitor data quality (Week 17) 3. Complete data collection (Week 18) 4. Clean and organize data (Week 19-20)
June - July 2024	1. Analyze data (Weeks 21-24) 2. Interpret results (Week 25-26) 3. Write research report (Week 27-28)
August 2024	1. Finalize research report (Week 29-30) 2. Submit research report (Week 31) 3. Disseminate findings (Week 32)

Appendix 4: Supervisor letter

Department of Biomedical and Medical
Laboratory Science,
Africa University,
Zimbabwe.

22nd November, 2024.

The AUREC Administrator
Africa University,
Zimbabwe.

Dear Sir/Madam,

**RE: PERMISSION TO SUBMIT TO AUREC FOR MUHOMBA SHELANCINA
KUDZAYI**

Programme: HBMLS

This letter serves to confirm the above-mentioned student has satisfied all the requirements of the faculty in developing the dissertation proposal and is ready for assessment.

Your facilitation for review of the proposal is greatly appreciated.

Thak you

Sincerely,



Prof. Emmanuel Obeagu

Appendix 5: Approval letter from data collection site

Telephone: 621100-19
Fax: 621157

Reference: SMCHL211825/18

SALLY CENTRAL MUGABE HOSPITAL
P. O. BOX 5711
SOUTHERTON
HARARE
ZIMBABWE



28 January 2025

Muhomba S Kudzayi

REF: AN ASSESSMENT OF ANTIMICROBIAL RESISTANCE PATTERNS AMONG PATIENTS WITH URINARY TRACT INFECTIONS AT SALLY MUGABE CENTRAL HOSPITAL IN 2024

I am glad to advise you that your application to conduct a study entitled: **AN ASSESSMENT OF ANTIMICROBIAL RESISTANCE PATTERNS AMONG PATIENTS WITH URINARY TRACT INFECTIONS AT SALLY MUGABE CENTRAL HOSPITAL IN 2024** (Ref: SMCHL211825/18) has been approved by the Sally Mugabe Central Hospital Ethics Committee.

This approval is premised on the submitted protocol. Should you decide to vary your protocol in any material way please submit these for further approval.

You are advised to avail the results of your study whether positive or negative to the hospital through the committee for our information.

Yours sincerely,

Dr H. Chifamba

Chairperson Sally Mugabe Central Ethics Committee

Board Members: Chairman Dr E Chagonda, Deputy Chairperson Ms A Mashamba, Members: Mr J Makiya, Mrs P Sibanda, Mrs N Hurewira, Dr Mungani (A/ Chief Medical Officer)

Appendix 6: AUREC Approval Letter



AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE (AUREC)

P.O. Box 1320 Mutare, Zimbabwe, Off Nyanga Road, Old Mutare-Tel (+263-20) 60075/60026/61611 Fax: (+263 20) 61785 Website: www.africau.edu

Ref: AU 3613/25

7 February, 2025

MUHOMBA SHELANCINA KUDZAYI

C/O Africa University

Box 1320

MUTARE

RE: **AN ASSESSMENT OF ANTIMICROBIAL RESISTANCE PATTERNS AMONG PATIENTS WITH URINARY TRACT INFECTIONS AT SALLY MUGABE CENTRAL HOSPITAL: JANUARY 2024- AUGUST 2024.**

Thank you for the above-titled proposal you submitted to the Africa University Research Ethics Committee for review. Please be advised that AUREC has reviewed and approved your application to conduct the above research.

The approval is based on the following.

a) Research proposal

- **APPROVAL NUMBER** AUREC 3613/25
This number should be used on all correspondences, consent forms, and appropriate document
- **AUREC MEETING DATE** NA
- **APPROVAL DATE** February 11, 2025
- **EXPIRATION DATE** February 11, 2026
- **TYPE OF MEETING:** Expedited
After the expiration date, this research may only continue upon renewal. A progress report on a standard AUREC form should be submitted a month before the expiration date for renewal purposes.
- **SERIOUS ADVERSE EVENTS** All serious problems concerning subject safety must be reported to AUREC within 3 working days on the standard AUREC form.
- **MODIFICATIONS** Prior AUREC approval is required before implementing any changes in the proposal (including changes in the consent documents)
- **TERMINATION OF STUDY** Upon termination of the study a report has to be submitted to AUREC.



Yours Faithfully

Mary Chinzou

MARY CHINZOU

FOR CHAIRPERSON

AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE