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AN INVESTIGATION OF ANTIBIOTIC ACTIVITY IN URINE SAMPLES SUBMITTED AT LANCET CLINICAL LABORATORY AND ITS EFFECT ON URINARY TRACT INFECTION DIAGNOSIS IN THE YEAR 2023.

BY

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE BACHELOR'S DEGREE HONORS IN MEDICAL LABORATORY SCIENCES IN THE COLLEGE OF HEALTH, AGRICULTURE AND NATURAL SCIENCES

2024

Abstract

Urinary Tract Infections(UTIs) are one of the most common bacterial infections, affecting people of all ages and genders. UTIs account for around 150 million cases each year globally . On average, the overall prevalence of UTIs in the nine countries of sub-Saharan Africa was 32.12% with South Africa ranking high (67.6%) and Senegal being 5.1%. A retrospective cross sectional study was done to investigate antibiotic activity in urine samples submitted at Lancet Clinical Laboratory and its effect on Urinary Tract Infection diagnosis from 01 January -31 December 2023 in a bid to analyze its effect on UTI diagnosis .The urine samples submitted were from both males and females, some with recurrent infections, showing symptoms, catheterized, pregnant and on routine check-up with 79% being female and 21% being male of the 351 sample size.Selection criteria involved all urine samples with ordered MCS tests. Recovery rate of UTI pathogenic bacteria was observed on culture and quantified using the number of Colony Forming Units per milliliter urine. The were more female(71%) than males (29%) reporting for UTI analysis. Study participants were pregnant women, Intensive care Unit patients, Routine checkup ,recurrent UTI patients and mostly symptomatic patients. Of the study participants 54,3% were positive for antibiotic activity and 45,7% were antibiotic activity negative. The response to culture of these urine samples was recorded. Also the presence of other indicators such as symptoms, dipstick and microscopy results was analyzed to confirm diagnosis. The researcher concludes from results obtained that the presence of antibiotic residues in urine samples has an effect on UTI diagnosis results. And thus recommends adoption of the bacillus technique method of detection of antibiotics in urine as a universal test as well as invention of rapid tests so as to control the main causes of appearance of these antibiotics in urine.

Key words: antibiotics , Urinary Tract infection ,prevalence

Declaration Page

I Tatenda Faith Mutidzawanda , hereby declare that this is my original work that has not been presented in any academic institution for any award. The other authors' work used in this dissertation have been acknowledged accordingly.

TATENDA FAITH MUTIDZAWANDA T.F MUTI 26/02/2024

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Acknowledgements

I would like to thank the following people who have helped undertake this research : My supervisor Mr. Z Chiwodza ,for his enthusiasm for the project , support , and patience.For their contributions to data collection , Mr Magaisa and Lancet Laboratory team and to my friend Tanyaradzwa Chipenzi as well as my family for the encouragement and emotional support.

List of Acronyms and Abbreviations

UTI	Urinary Tract Infection
AMR	Anti- Microbial Resistance
MCS	Microscopy Culture, Sensitivity
GLASS	Global Antimicrobial Resistance Surveillance System
AST	Antimicrobial Susceptibility Testing
DDD	Daily Defined Dose

Table of Contents

List of Tables

List of figures

List of Appendices

CHAPTER 1 INTRODUCTION

1.1 Introduction

This chapter introduces the problems associated with exposure to antibiotics and its effect on UTI diagnosis as well as its contribution to Antimicrobial Resistance. It highlights why it is important to carry out the study through the objectives and how to articulate the study so as to come up with established information on the extent of the effects and thus seek solutions.

1.2 Background of the Study

Urinary Tract Infections (UTI) affects about 150 million around the globe every year. UTIs are related to high incidence and mortality rates of 2.3% with a higher margin in hospitalized patients. The absolute number of cases of UTIs increased by 60.40% from 252.25 million in 1990 to 404.61 million (95%) in 2019. The global deaths due to UTIs were 236,790 in 2019 (WHO,2019).

Urinary tract infections (UTIs) are caused by bacteria invading the urinary system and triggering symptoms such as frequent urination, burning sensation, cloudy and strong-smelling urine, and pelvic or rectal pain. UTIs are more common in women due to their shorter urethra with up to 50% experiencing at least one in their lifetime (Malterud K,2017). Risk factors include sexual activity, certain contraceptives, menopause, urinary tract abnormalities, kidney stones, weak immune system, and catheter use. Treatment involves antibiotics to kill the bacteria and prevent complications. UTIs vary in severity and can be diagnosed through urinalysis and medical history. During urinalysis, antimicrobial substances in urine are analyzed to determine the presence of antibiotics in a patient's system using The Bacillus technique (Chomarat M,2000).`Antibiotics are used to treat several other infections daily. The global antibiotic consumption rate has risen from 9.8 to 14.3 DDDs per 1,000 population per

day between 2000 and 2018, an increase of 46 % (Brubaker L, Carbury C,2015). However , antibiotic presence in urine is due to the use of antibiotics prior to diagnosis due to self-diagnosis, poor physician prescribing habits, antibiotic misuse as well as co-morbid conditions. Misuse of antibiotics can lead to increased morbidity, mortality, healthcare costs, limited treatment options, and the spread of infections. Some studies suggest that the presence of inhibitory substances, such as antimicrobial residues in urine samples can interfere with the in vitro growth of the probable bacteria causing the infection, producing a false-negative result. Research on the presence of antibiotics in urine for UTI diagnosis is still in the early stages, and more studies are needed to validate the effectiveness and reliability of this approach. This study aims to evaluate the feasibility and accuracy of diagnosis of UTI on urine positive for antibiotics and explore the effects.

It is important to analyze if urine submitted for UTI culture has antibiotics already present because the presence of antibiotics in the urine can inhibit the growth of bacteria in the culture. This can lead to a false negative result, where the culture may not accurately reflect the presence of bacteria in the urine. This can result in improper treatment of the UTI, potentially low bacteria recovery rate ,misdiagnosis and recurrent infections .Additionally, the presence of antibiotics in the urine can also affect the sensitivity of the bacteria to antibiotics and may lead to antibiotic resistance. Antimicrobial resistance (AMR) poses a significant threat to global health and security, with an estimated 1.27 million deaths directly attributed to bacterial AMR in 2019, and a further 4.95 million deaths attributed in part to AMR. (WHO, 2019) This can complicate the treatment of the UTI and increase the risk of recurrent infections. It is important to ensure an accurate diagnosis and appropriate treatment by identifying the presence of antibiotics in the urine before conducting a culture (OECD,2015)

1.3 Problem Statement

The effectiveness of diagnosing urinary tract infections (UTIs) accurately may be affected by the presence of antibiotics in urine samples submitted for UTI testing. The presence is a result of mainly antibiotic misuse as well as co-morbid conditions that require regular antibiotic use. Physicians prescribe antibiotics using misguided empiric therapy whereby they end up exercising poor prescription habits without a confirmed diagnosis. (Barlam F.,2016). On the other hand, patients tend to have hospital hesitancy whereby an individual is reluctant to seek medical assistance and end up self diagnosing themselves, promoting the urge to use familiar antibiotics without proper medical advice. This leads to a low recovery rate of bacteria in the urine of these patients upon culture. Low recovery rates lead to potential misdiagnosis and no effective treatment increasing the burden of UTIs. There is also increased antimicrobial resistance as bacteria develop resistance mechanisms against these misused antibiotics thus shadowing their effect. The effectiveness of antibiotic treatment is compromised when a bacterial strain is resistant to the prescribed antibiotic. (Rakel D,2012)

1.4 Broad Research Objective

To investigate antibiotic activity in urine samples submitted at Lancet Clinical Laboratory and its effect on Urinary Tract Infection diagnosis from 01 January -31 December 2023.

1.4.1 Specific Objectives

1. To determine the prevalence of antibiotic activity in urine samples submitted at Lancet Clinical Laboratory in the year 01 January-31 December 2023.

2. To assess the recovery rate of bacteria from samples that tested positive for antibiotic activity compared to those with negative antibiotic activity.

3. To evaluate the presence of other UTI indicators in urine samples that are positive and those negative for antibiotic activity for confirmatory diagnosis.

1.5 Study Justification

This study was aimed to add to the body of knowledge available of antibiotic use in the treatment of Urinary Tract Infections as well as knowledge on antimicrobial resistance. Understanding the prevalence of antibiotic activity in urine samples can contribute to antibiotic stewardship efforts. By assessing the patterns of antibiotic usage, it is possible to identify areas of improvement, reduce unnecessary antibiotic prescriptions, and minimize the risk of antibiotic resistance. The detection of antibiotic activity in urine samples is an innovative approach to UTI diagnosis. Conducting this study can contribute to the development of new diagnostic methods that incorporate antibiotic activity testing, leading to improved accuracy and efficiency in UTI diagnosis, enhancing clinical practice.

1.6 Delimitations of the Study

The study was confined to patients who submitted urine samples for Urine microscopy, culture and sensitivity to Lancet Clinical Laboratory. The study was conducted in a single clinical laboratory setting (Lancet Clinical Laboratory). The findings were not generalized to other clinical laboratories or medical facilities.

1.7 Limitations of the Study

The study did not have access to the complete antibiotic use history of patients whose urine samples were analyzed. It is possible that patients may have taken antibiotics prior to sample submission, leading to false negatives or reduced antibiotic activity in the urine samples as well as sample bias.

1.8 Summary of Chapter 1

In summary study is about finding out antibiotic activity in urine samples submitted at Lancet Clinical Laboratory and its effect on Urinary Tract Infection diagnosis . This chapter mainly focuses on introducing the research study as well as explaining overally the effect of antibiotic use and how it compromises Urinary Tract Infection diagnosis as aim of the study. It gives the concise description of the currently existing problem which needs to be addressed. The objectives highlight how the study will be gradually carried out. Delimitations are emphasizing that the study is only focusing on patient urine samples submitted at Lancet Clinical Laboratory in Harare, Zimbabwe.

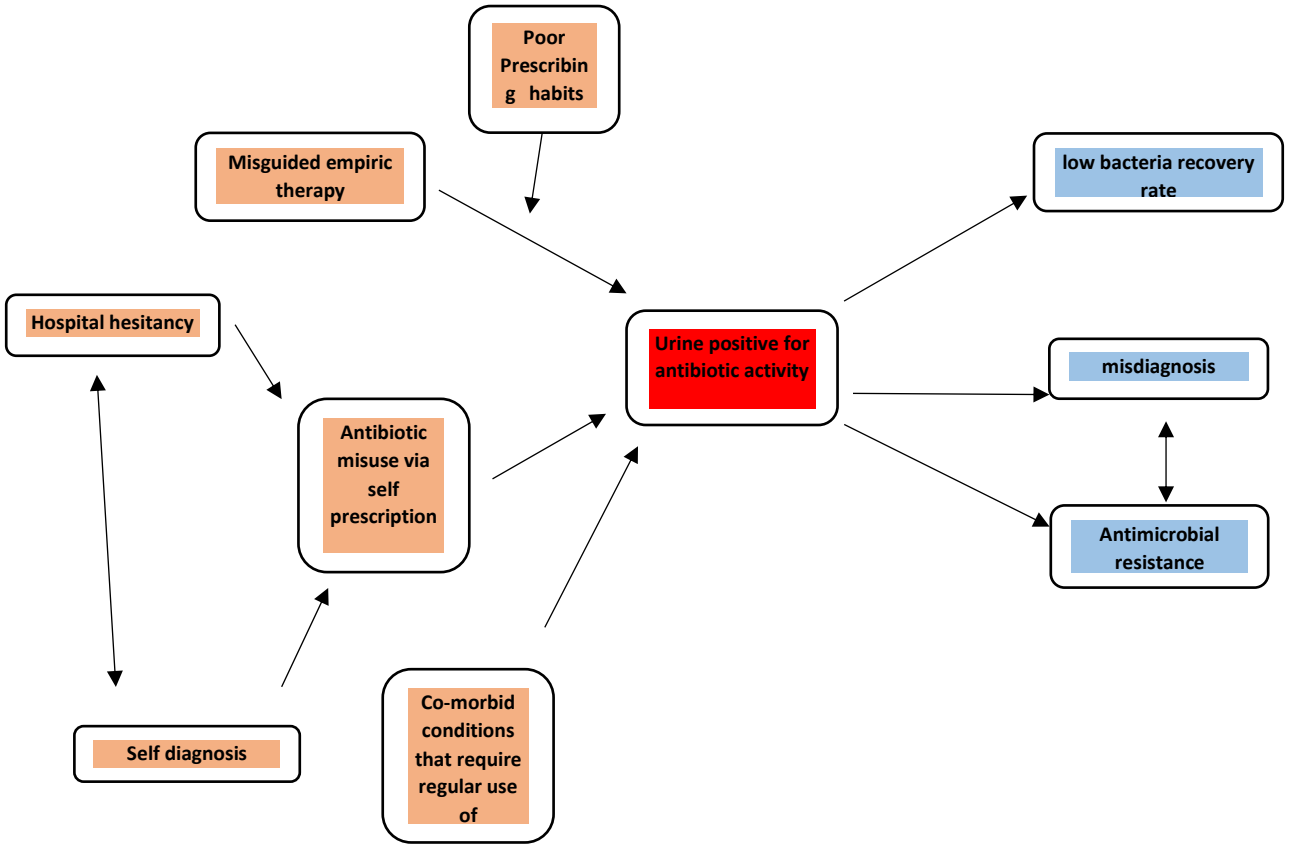
CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter demonstrates knowledge and understanding of the academic literature about the effect of antibiotics in urine and how it affects UTI diagnosis. The conceptual framework used in the formulation of strategies to control the effect of the presence of antibiotics in urine

submitted for UTI diagnosis. This is then married into the local, regional, and international context.

2.2 Conceptual framework



Adopted from Nader et al,2015

Figure 1-1 Conceptual framework of the study

The conceptual framework is focused on factors surrounding urine samples with positive antibiotic activity and the effects in diagnosis of UTIs.

2.2 Urinary Tract Infections

UTIs are one of the most common bacterial infections, affecting people of all ages and genders. According to the World Health Organization (WHO ,2019), UTIs account for around 150 million cases each year globally . On average, the overall prevalence of UTIs in the nine

countries of sub-Saharan Africa was 32.12% with South Africa ranking high (67.6%); followed by Nigeria (43.65%); Zambia (38.25); Uganda (35.66%); Ethiopia (37.47%); Tanzania(23.7%); Ghana (19.2%); Kenya (18.53%); and Senegal (5.1%). The prevalence of UTI in females is 63% and 37% in males(WHO,2019).UTIs contribute to a substantial burden on healthcare systems due to the high number of cases and associated costs. UTIs are a leading cause of hospital-acquired infections, resulting in increased healthcare utilization, longer hospital stays, and increased antibiotic use(Gould,2010). All individuals are susceptible to urinary tract infections; however, the prevalence of infection differs with age, sex and certain predisposing factors. Numerous urinary tract infection studies have been performed on different age groups including preschool, school age, young adults, and the elderly. The studies show that infections occur as early as the first few days of life and can be contracted throughout life. The incidence of infection peaks at certain times during life and is associated with both age and sex. Throughout life, the incidence of infection is greater in females than in males with two exceptions, infants and catheter-related infections . The ratio of infant male to female infection is 4:1, this changes to 1:15 to 1:>30 during adult life and finally decreases to 1:2 in the elderly population (Chomarat ,2000). Antibiotic resistance is a global concern, and UTIs contribute to the overall problem. UTIs can significantly impact an individual's quality of life, causing pain, discomfort, and inconvenience. Recurrent UTIs may lead to chronic conditions, decreased productivity, and increased healthcare costs for affected individuals.UTIs can be prevented through hygiene practices, proper sanitation, and appropriate medical care. However, challenges exist in ensuring widespread awareness, education, and access to resources for prevention. Diagnosis and effective management of UTIs require reliable diagnostic tools, appropriate antibiotic use, and tailored treatment plans.The burden of UTIs is not evenly distributed worldwide, with higher prevalence and limited resources for prevention and management in low- and middle-income countries(Nader L,2015). Lack of access to

healthcare, clean water, sanitation facilities, and education further exacerbates the global disparities in UTI prevention and management.Efforts to address the global challenge of UTIs include promoting awareness, implementing preventative measures, advocating for proper antibiotic prescribing practices, investing in research on new treatment options, improving sanitation infrastructure, and strengthening healthcare systems to provide accessible and affordable care. Collaboration between healthcare providers, researchers, policymakers, and the general public is crucial in combating the global burden of UTIs

2.3 Antibiotic use

The global burden of antibiotic use refers to the negative impacts and consequences associated with the widespread and inappropriate use of antibiotics.Total antibiotic consumption rates showed a nearly ten-fold variation between countries, ranging from as low as 5·0 DDD to 45·9 DDD per 1000 population per day. Between 2000 and 2018, global antibiotic consumption rates increased by 46% (from 9·8 to 14.3 DDD per 1000 population per day). High rates of antibiotic consumption were seen in North America, Europe and the Middle East, which were contrasted by very low rates of consumption in sub-Saharan Africa and parts of Southeast Asia.In low- and middle-income countries, there was a 76% increase observed between 2000 and 2018 from 7·4 to 13·1 DDD per 1000 per day(WHO,2021) .The antibiotics are used to treat bacterial infections but however most are being misused. Antibiotic misuse is a complex issue with various contributing factors, including cultural, behavioral, and socioeconomic status. Physcians tend to prescribe medication using misguided empiric therapy especially upon waiting on laboratory confirmations on diseases. Lack of health education is a major factor as patients tend to self diagnose and use antibiotics inappropiately. Some patients exercise hospital hesitancy and fear consulting the hospital and end up taking shortcuts.In a study conducted on Antibiotic use,Respondents were mostly males (62.5%), aged 20–29 years. Eighty-seven percent of them desired more education on antibiotic use and resistance. Majority

119 (64.7%) respondents had good knowledge of antibiotic use and resistance. Only 103 (56.0%) of them had positive practice of antibiotic use while 8.2% of respondents consulted a doctor before starting an antibiotic. 37.2% of them never discarded their remaining leftover medications and reused them.This indicates the general antibiotic use.The misuse and overuse of these drugs have contributed to inaccuracy of UTI diagnosis, by decreasing efficiency of bacteria recovery rate since these antibiotic residues inhibit bacterial growth as well as promote the emergence and spread of antibiotic-resistant bacteria(Gowon T,J,2013).As antibiotic resistance continues to grow, there is a shrinking pool of effective antibiotics. This limits treatment options for common infections, such as urinary tract infections, respiratory infections, and surgical site infections. In some cases, there may be no effective antibiotics available to treat certain infections. Addressing the global burden of antibiotic use requires concerted efforts from healthcare professionals, policymakers, and the general public. Effective strategies include promoting appropriate antibiotic prescribing practices, improving infection prevention and control measures, investing in research and development of new antibiotics, and raising awareness about the responsible use of antibiotics.

According to WHO,the global rise in antibiotic use poses a significant threat, diminishing the efficacy of common antibiotics against widespread bacterial infections. The 2022 Global Antimicrobial Resistance and Use Surveillance System (GLASS) report highlights alarming resistance rates among prevalent bacterial pathogens. Median reported rates in 76 countries of 42% for third-generation cephalosporin-resistant E. coli and 35% for methicillin-resistant Staphylococcus aureus are a major concern. For urinary tract infections caused by E. coli, 1 in 5 cases exhibited reduced susceptibility to standard antibiotics like ampicillin, co-trimoxazole, and fluoroquinolones in 2020. This is making it harder to effectively treat common infections.Klebsiella pneumoniae, a common intestinal bacterium, also showed elevated resistance levels against critical antibiotics. Increased levels of resistance potentially lead to

heightened utilization of last-resort drugs like carbapenems, for which resistance is in turn being observed across multiple regions. AMR represents a global challenge 4.95 million people who died in 2019 suffered from drug-resistant infections.AMR directly caused 1.27 million of those deaths. 1 in 5 of those deaths occurred among children under 5 years old. In Zimbabwe in 2019, there were 3,900 deaths attributable to AMR and 15,800 deaths associated with AMR.Zimbabwe was among the highest 10 countries in age-standardized mortality rate per 100,000 population associated with AMR across 204 countries. Zimbabwe faces significant and growing resistance in common infections such as TB, malaria, HIV, respiratory infections, sexually transmitted infections (STIs) and diarrheal diseases (Mhondoro et al, 2019). One major driver of resistance is increased antimicrobial consumption in both humans and animals. However the data on antimicrobial use and patterns of AMR in humans and animals in Zimbabwe is limited.In Zimbabwe there is a lack of meaningful surveillance data to help understand resistance patterns, prevalent organisms and guide policy development, due to constraints in the laboratory testing systems as the effectiveness of these last-resort drugs is compromised, the risks increase of infections that cannot be treated. Projections by the Organization for Economic Cooperation and Development (OECD) in 2018, indicate an anticipated twofold surge in resistance to last-resort antibiotics by 2035, compared to 2005 levels, underscoring the urgent need for robust antimicrobial stewardship practices and enhanced surveillance coverage worldwide.

2.4 Literature Review on Common bacteria causing UTIs

Urinary tract infections (UTIs) are common infections that affect millions of people worldwide. They occur when bacteria, mainly from the digestive system, enter the urinary tract and multiply, causing inflammation and infection. The most common bacteria responsible for UTIs

are Escherichia coli (E. coli), but other bacteria such as *Staphylococcus saprophyticu*s and Klebsiella pneumoniae can also cause these infections(Bono MJ,2023). Urinary tract infections (UTIs) are often caused by bacteria, such as Escherichia coli, Staphylococcus saprophyticus, and Klebsiella pneumoniae. S. saprophyticus is commonly associated with UTIs in young sexually active females, while *K. pneumoniae* is frequently found in the respiratory and digestive systems.In a study on the common bacterial causes of UTI, it was concluded that, the most frequent agent was *E. coli*, found in 56.9% of cases, followed by *Klebsiella pneumoniae* (18.5%) and *Enterococcus faecalis* (7.7%)(Brubarker L,2012). Only a limited amount of data has been published regarding changes in the frequency of causative agents for the past years. Enteric bacteria (in particular, *Escherichia coli*) have been and remain the most frequent cause of UTI, although there is some evidence that the percentage of UTIs caused by *E. coli* is decreasing. In contrast, significant changes in the causes of nosocomial UTI have been reported since 2000. From 2012 through 2021, the percentage of UTIs caused by E. coli, Proteus species, and Pseudomonas species decreased, whereas the percentage of UTIs caused by yeasts, group B streptococci, and *Klebsiella pneumoniae* increased(Bronsema et al,2021). Weber et al in,(2019) reported different changes in the causative agents of UTI, with a decrease in the percentage of UTIs caused by Enterobacter species, but with an increase in the percentage of UTIs caused by Acinetobacter species and *Pseudomonas aeruginosa*. Candida albicans is the most common cause of funguria, followed by *Candida glabrata, Candida tropicalis, Candida parapsilosis, Candida krusei*, and other yeasts.(Bojo, MJ,2023)

2.5 Literature review on Growth and Recovery rate for bacteria

When bacteria are placed in a medium that provides all of the nutrients that are necessary for their growth,without inhibitory substances in the medium as well as sample, the population exhibits four phases of growth that are representative of a typical bacterial growth curve i.e log,lag,stationery and death phase(Kadner,R.J, 2023).However,the growth rate of uropathogenic bacteria in the presence of antibiotics can vary depending on the specific antibiotic, the concentration used, and the susceptibility of the bacteria. In general, antibiotics are intended to inhibit or kill bacteria, which can reduce or completely halt their growth. However, in some cases, bacteria can develop resistance mechanisms to antibiotics, allowing them to continue growing despite the presence of the drug.

Bacterial growth rates are commonly measured using growth curves, which describe the increase in population size over time. In the presence of antibiotics, the growth curve may show a delay in bacterial growth, a decrease in growth rate, or a complete cessation of growth, depending on the specific antibiotic and its effectiveness against the uropathogenic bacteria. In a study on the antimicrobial residues activity in urine samples of hospitalized patients by Dianae Cardozo et al,2014, it was demonstrated that in 7.45% of studied samples, the presence of antimicrobial residues compromised the recovery of uropathogens, producing a possible false negative result. It is important to note that the growth rate of uropathogenic bacteria can vary widely depending on the bacterial species, the antibiotic used, the antibiotic concentration, and several other factors. In general, approximately 90-95% of bacterial UTIs can be diagnosed by culture-based methods.by placing the urine on a culture medium to allow bacteria to grow. In a study on urinary culture sensitivity after a single empirical antibiotic dose for upper urinary trast infection,if antibiotics have been taken prior to urine collection for testing or for some other reasons, it interferes with the interpretation of the culture results(Eric Mugnier et

al,2021). The bacteria recovery efficiency is calculated by comparing the colony count of the target microorganism recovered to the positive control. (Brubaker L,Carcbary C,2018.)

2.6 Literature review on Other clinical indicators of UTI

Besides the growth of uropathogenic bacteria on culture, the urine goes through other procedures which assist in verifying UTI diagnosis. Proper diagnosis of urinary tract infection is important to ensure prompt and accurate treatment of patients. The laboratory diagnosis of UTI hinges on a set of diagnostic assays including urine dipstick, biochemical test, microscopy, Gram staining, and quantitative urine culture. None of these diagnostic methods in itself is deemed sufficient for a sole diagnosis of UTI as their limitations are widely acknowledged . To reduce the degree of errors of diagnosis, when any of the foregoing diagnostic methods are singly used, combining two or more of these methods appears to be the ideal diagnostic practice (Bojo,ML,2023) . By doing so, it is imperative to include culture as a component of the selected set as it represents the gold standard for laboratory diagnosing of UTI however,there are several clinical parameters that can be used to confirm a UTI.Symptoms which are commonly associated with UTIs given they are provided as patient clinical data aid in diagnosis although ,alone is not always a definitive confirmation of a UTI, as other conditions can cause similar symptoms(Brubarker L,2015). The innate immune characteristic factors and the body's immune response have an important role in causing symptoms in UTI patients(Joshua Sunjaya,2024). A urinalysis can detect and measure the amount of white blood cells (leukocytes) in your urine. A high level of leukocytes is usually a sign of inflammation associated with an infection.A urinalysis can also detect nitrites produced by gram-negative bacteria such as Escherichia coli (E. coli), which is the most common cause of UTIs . Pyuria and bacteriuria are the key indicators of UTI. Nitrite and leucocyte esterase markers on the dipstick are used for the detection of pyuria and bacteriuria, respectively. Nitrite testing relies on the ability of gram negative bacteria to convert nitrate to nitrite. The Gram stain is also a

reliable methods for estimating bacteriuria at -10x5 CFU/ml. According to a study by Kass MQ (2014),it was reported that the presence of one or more organisms per oil immersion field from uncentrifuged urine had a sensitivity of 85% when correlated with a colony count of 2105 CFU/ml. In studies by the Clinical Infectious Diseases in 2004, Detection of bacteriuria by urine microscopy. Bacteriuria can be detected microscopically using Gram staining of uncentrifuged urine specimens, Gram staining of centrifuged specimens, or direct observation of bacteria in urine specimens.

A study of Clinical and laboratory features of urinary tract infections in young infants concluded that non-bacterial etiologies should be considered in empirical treatment. Fever was the main symptom. Positive nitrite is highly suggestive of UTI but has low sensitivity; whereas pyuria ≥ 10,000/mL revealed good sensitivity, but low specificity. Peripheral white blood cell count and C-reactive protein concentration have usefulness to suggest UTI(Nefrol Bras J, 2018). This is of importance in the study as it will indicate urine samples with positive antibiotic activity, no growth of uropathogenic bacteria on culture but with other significant indicators of UTI .Other diagnosis methods include cytoscopy, imaging which show the internal part of the urinary tract as well as blood tests.(Michael L,2004)

2.7 Summary of Chapter 2

In summary, this chapter shows the increase in the use of antibiotics in the population as well as marked increase in the incidence of UTIs as evidenced by the statistical values. It explains on the common bacteria causing most UTIs ,antimicrobial resistance and other indicators which can be used in the laboratory to confirm UTI diagnosis.

CHAPTER 3:RESEARCH METHODOLODY

3.1 Introduction

This chapter demonstrates several aspects on how study was carried out. It highlights the type of study design that was used, the study setting, the population and sample size including how data was collected and analysed as well as study ethical consideration procedure.

3.2 Research Design

This was a retrospective analytic cross-sectional study. The data set was collected from the microbiology department on the antibiotic activity results of urine samples at Lancet Clinical laboratory from the period of 01 January 2023 to 31 December 2023.

3.3 Study Population

The population included urine samples received and processed from 01 January to 31 December 2023 at Lancet Clinical Laboratory, Harare.

3.4 Exclusion Criteria

All urine samples all urine samples which did not have data on other indicators of UTI received and processed from 01 January to 31 December 2023 at Lancet Clinical Laboratory.

3.5 Inclusion Criteria

All urine samples with positive and negative antibiotic activity received and processed from 01 January to 31 December 2023 at Lancet Clinical Laboratory.

3.6 Sample Size

The following formula was used to calculate the sample size.

$$N = \frac{(Z^2)\,(P)\,(1-P))}{\_\_\_\_\_}$$

D^2

Where:

N= the sample size

Z= the statistic corresponding to level of confidence

P= expected prevalence (obtained from pilot study or similar studies)

D= precision.

Z=1.96%

P=Expected prevalence obtained from similar studies =42%

D=precision hence there is no enough guidelines for choosing appropriate precision hence it is then recommended to select a precision below 5% if the prevalence is going to be between 10 and 90%

$$N = \frac{(1.9x1.9)(0.42)(1-0.42)}{(0.05x0.05)}$$

N = 351

3.7 Pilot Study

A small scale preliminary study was conducted at Lancet Clinical Laboratory using data from 2022 to evaluate the feasibility, duration and the cost of the study and the data required to do the project was readily available.

3.8 Study Setting

The study was conducted at Lancet Clinical laboratory. The Laboratory`s main catchment area is Harare Province. It is one of the best private run institution laboratories in Zimbabwe with more than 50 diagnostic tests recommended by SADCAS in accordance with recognized international standard ISO 15189:2012. The laboratory also has a staff complement of professional scientists with great capacity for quality testing and an information system to store and manage data. The microbiology department of the institution receives specimens for Microscopy, culture and sensitivity from both private and public health institutions.

3.9 Data Analysis

The data collected was entered on an excel sheet and analyzed using SPSS version 22. The data for this research was presented in form tables, pie charts and bar graphs through the application of Microsoft Excel to illustrate the data statistics.Quantitative data was analyzed using measures of distribution and association.

3.10 Ethical Consideration

AUREC (Africa University Research Committee) provided an ethical approval letter which assisted in obtaining the clearance from the Lancet Clinical Administration to conduct my research study at the center. The information which was obtained in this study was kept private and confidential as well as only used for research purpose only.

3.11 Summary of Chapter 3

This chapter mainly focuses on methods which were used for this research study .A retrospective cross sectional study was conducted at Lancet Laboratory. The study population for this study were patients reporting for UTI analysis at Lancet in the year 2023.The sample size was 351.The study also considered ethics by seeking approval and ensuring information collected for this study will be used for research purpose only.

CHAPTER 4 : DATA PRESENTATION

4.1 Introduction

This chapter is going to present the findings of the study. The data will be presented in tables,pie charts,line graphs and bar graphs where applicable. A brief explanation is going to be given on each diagram.Also numerical values will be presented where applicable as absolute values or as percentages.

4.2 Description of study participants

The number of urine samples submitted were 3600 urine samples. From the lot, a sample of the population with 351 participants was considered for the study. Of the 351 urine samples,252 (71%) were from female patients and 99 (29%) were urine samples from male patients. Of the 351 patients,181 (51.6%) were showing symptoms of UTI, 101(28.7%) had history of recurrent UTI as well antibiotic history,18 (5.1%) were pregnant women,6 (1.7%) were ICU in-patients with urinary catheters,45(12.8%) were urine samples from patients on routine check-up (Out Patients Department).

Table 4.2.1 showing Demography of the study participants on specifically age and gender

Population(N)	**15-30yrs**	**30-65yrs**	**Above 65yrs**	**Total Frequency**	**Frequency %**
Male	36	42	21	99	29
Female	46	141	65	252	71

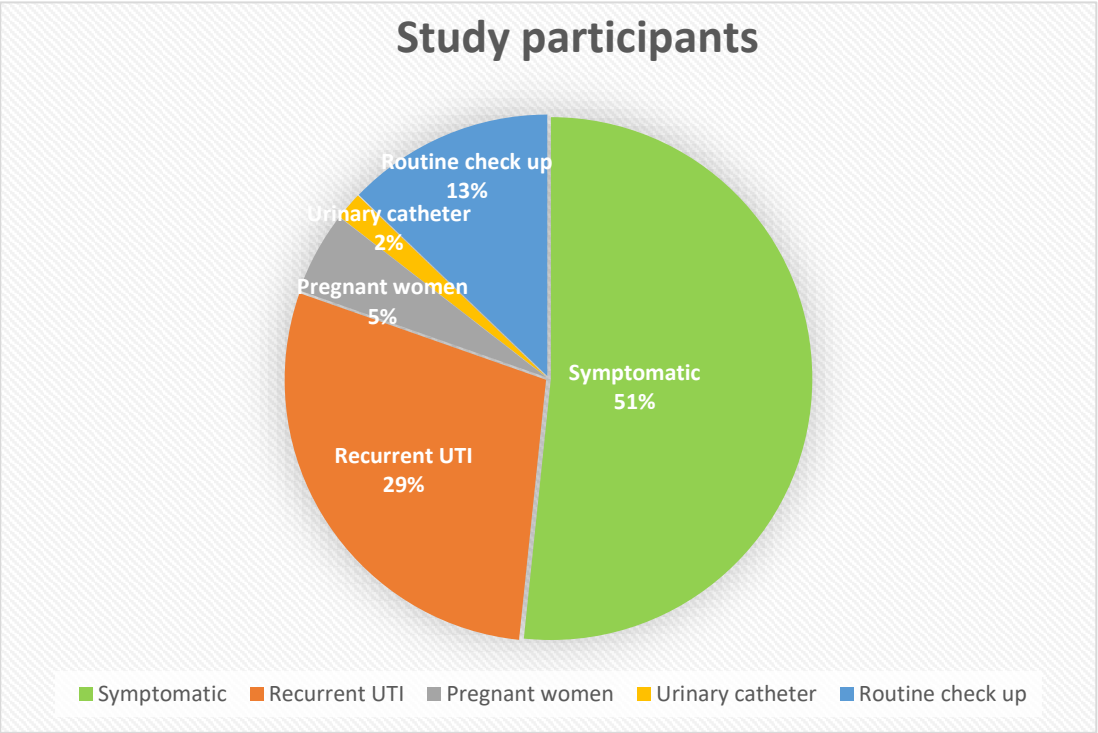


FIG 4.2.2 Pie chart showing a representation of the study participants with urine submitted for the study at Lancet Clinical laboratories in 2023.

4.3 Laboratory findings:

4.3.1 Analysis of Antibiotic activity on the submitted urine samples

From the urine samples submitted ,an antibiotic test was done as part of culture.Some urine samples showed presence of antibiotics by positive result on the test and some showed absence of any antibiotics .The frequency is represented in the table below:

Table 4.3.1 showing antibiotic activity in the urine samples submitted for MCS

Population(N)	Frequency of urine samples submitted	Frequency of urine samples with positive antibiotic activity	Frequency of urine samples with negative antibiotic activity
Routine check up	45	24	21
ICU	6	4	2
Pregnant women	18	6	12
Recurrent UTI	50	28	22
History of antibiotic therapy	51	36	15
Symptomatic	181	92	89
Total population	351	190	161
Percentage frequency(%)	100	54.3	45.7

The table shows the urine samples of different participants and the presence or absence of Antibiotics in the urine submitted for MCS. Image,see Appendix D.

Positive result was shone by a zone of clearance on the Muller Hinton plate.It is indicative of the presence of antibiotics in the urine inoculated there.Antibiotics inhibit growth of the

Bacillus spp.In zones where growth is shown,the urine does not contain antibiotics and thus negative results for the antibiotic test.

4.4 Recovery rates of bacteria from urine samples with positive antibiotic activity

From the 351 urine samples, MCS was done after test for antibiotic activity, growth of the pathogenic bacteria was analysed on Uriselect medium.Growth was quantified using the number of colony forming units and only pure growth was considered. Growth was either heavy or light or no growth as indicated in the table below.

Table 4.4.1 Table showing bacteria recovery rate from the cultured urine samples :

Population(N)	**Positive Antibiotic activity**	**Negative antibiotic activity**	**Total**
Growth on culture (UTI pathogen) (≥10*5 CFU/ml)	69	129	198
No growth (No UTI pathogen isolated)	121	32	153
Total	190	161	351

The table shows the results of the Culture done on the urine samples submitted. Both those that came out positive and negative on the test for the presence of antibiotics. Growth was quantified using the number of Colony Forming Units per millilitre of urine. Growth on culture was indicative of UTI positive diagnosis and no growth was indicative of UTI negative diagnosis.

4.4.2 Association of antibiotic activity and UTI diagnosis

Alternative hypothesis:Presence of antibiotic residues in urine has effect on UTI diagnosis

Null hypothesis:Presence of antiobiotic residues in urine has no effect on UTI diagnosis

Table 4.4.2 Table showing Expected frequencies per given associations:

Condition	**Expected Frequency(%)**
Antibiotic positive & Positive growth on culture	97.93
Antibiotic positive and No growth on culture	82.07
Antibiotic negative and Positive growth on culture	90.07
Antibiotic negative and No growth on culture	70.93
CHI SQUARED TEST RESULT = 26.05	
Degree of freedom =1	
P value =3.841	

For a significance level of 0.05 and 1 degree of freedom, the critical value is approximately 3.841.The p-value is the probability of observing a test statistic as extreme as or more extreme than the calculated χ^2 value (26.05) under the null hypothesis.Since 26.05 > 3.841, the calculated χ^2 value falls in the critical region, and the p-value is less than 0.05.Therefore, we reject the null hypothesis and conclude that there is a statistically significant association between the presence of antibiotics in urine and UTI diagnosis.

4.5 An analysis of other present UTI indicators

As follow up on the urine samples that were analysed for antibiotics and culture,an analysis on other parameters of urinalysis to check for other indicators of Urinary Tract Infection was done to see if the culture and antibiotic test results were true negatives or true positives.The parameters were from dipstick results and urine microscopy that is, the White cell count, Nitrites, pyuria, Leukoesterase, and recorded indicative symptoms. Analysis was done on both the antibiotic negative and antibiotic positive urine samples and results are shown in the graph.

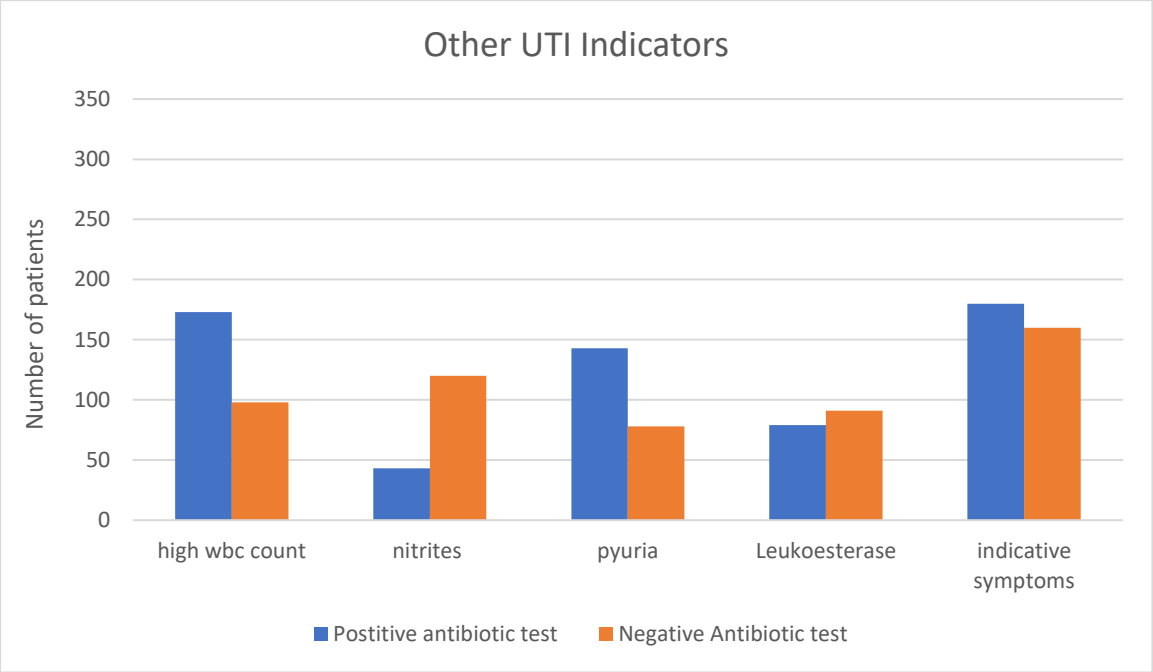


Figure 4.5.1 Graph showing a representation of other Urinary Tract infection as shown in the urine samples of the study participants.

4.6 Summary of Chapter 4

In summary this chapter shows the findings in relation to the study.The were more female(71%) than males (29%) reporting for UTI analysis.Study participants were pregnant women,Intensive care Unit patients,Routine checkup ,recurrent UTI patients and mostly symptomatic patients.Of the study participants 54,3% were positive for antibiotic activity and

45,7% were antibiotic activity negative.The response to culture of these urine samples was recorded.Results of other indicators of UTI were shown in both antibiotic scenarios.

CHAPTER 5: DISCUSSION,CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter summarises the research findings, discuss the limitation of the study. Comparison will be made in attention to literature from past study related to current study.

5.2 Population and rate of antibiotic use

The study indicated the presence of antibiotics in urine samples submitted for urine MCS with suspected Urinary Tract infection. Of the population, those with more urine samples were women, 71% and less males ,29%. In previous studies, prevalence of UTI in females was 63% and males was 37%,thus there is an increase in prevalence in females and a slight decrease in males(Cloud C.V,2009) .Women tend to have more frequent urinary tract infections (UTIs) compared to males, which often require antibiotics for treatment. This is due to the anatomy of the female urinary tract (shorter urethra) and proximity of reproductive organs. Additionally, women are more likely to seek medical care and be prescribed antibiotics for various conditions such as respiratory infections, skin infections, and other bacterial illnesses. Hormonal changes, such as fluctuations in oestrogen levels, can also make women more susceptible to infections. Pregnancy can also increase a woman's likelihood of needing antibiotics, as pregnant women are at a higher risk for certain infections. However, within the population ,some patients are having routine check-ups, some are in Intensive care Unit(with urine catheters),some are pregnant women ,some have a history of recurrent UTIs and most of the participants have distinctive signs and symptoms of UTI. Of these participants 54.3%, showed that they had antibiotic residues in their urine, with the largest population being those with recurrent UTI (33.6%)and those with distinctive symptoms(48.4%).With recurrent UTIs, patients may be prescribed multiple courses of antibiotics, leading to the build-up of antibiotic residues in their urine, self-diagnosis and misuse antibiotics or kidney failure. Presence of antibiotics in

symptomatic patients shows a sign of misguided empiric therapy whereby the doctors prescribe antibiotics to patients awaiting confirmatory diagnosis. Presence of antibiotic residues in hospitalised patients may be due to underlying comorbid conditions which require antibiotic use. Though this will affect UTI diagnosis, it will be treatment for other ailments.

5.2 Bacteria recovery rate in the presence of antibiotics

Out of 190 urine samples that had positive antibiotic activity only 69 samples had pathogenic growth on culture and 121samples had no growth. The recovery rate of bacteria on urine culture plays a crucial role in diagnosing urinary tract infections (UTIs). However, the presence of antibiotic residues in the urine can significantly impact this recovery rate and, consequently, affect the accuracy of UTI diagnosis. In a study on the antimicrobial residues activity in urine samples of hospitalized patients by Dianae Cardozo et al,(2014), it was demonstrated that in 7.45% of studied samples, the presence of antimicrobial residues compromised the recovery of uropathogens, producing a possible false negative result. Antibiotic residues in urine can exert inhibitory effects on bacterial growth, leading to false-negative culture results. This situation arises because antibiotics present in the urine can suppress the growth of bacterial pathogens, making them undetectable on routine culture plates. As a result, the recovery rate of bacteria may be compromised, potentially underestimating the true prevalence of bacterial pathogens in UTIs.The urine samples with negative antibiotic activity showed significant number of samples diagnosed of UTI, with 129 samples out of 161 (80%) showing growth of UTI pathogen, with expected frequency of negative antibiotic and growth on culture of 90.07 %,leading to a more accurate diagnosis.

5.3 Other indicators of UTI

When urine culture results show no growth of UTI pathogens due to the presence of antibiotic residues, these alternative indicators become even more valuable in aiding UTI diagnosis. Clinical symptoms, combined with urinalysis findings and dipstick test results, can provide supportive evidence for an active infection. Elevated leukocyte counts, the presence of nitrites, pyurias,leukoesterase and the characteristic symptoms of a UTI can collectively suggest the presence of infection, even without confirmed pathogen growth on urine culture.A study on the frequency of high leukocyte count in UTI positively diagnosed out patients showed the presence of a high leukocyte count in 87.6% of the patients showing that it is highly associated.(Malterud K,2017). Most of the urine that had antibiotics residues were had a high leukocyte count ,Leukoesterase well as high pyuria, which indicates an infection and immune response inside the body. Higher levels of pyuria may indicate an infection in the upper urinary tract, such as the kidneys (pyelonephritis), while lower levels of pyuria may be more consistent with a lower urinary tract infection, such as cystitis (bladder infection). Elevated levels of leukocyte esterase suggest the possibility of an inflammatory response, which is commonly associated with UTIs.Nitrites were low because nitrites are chemical compounds that are produced by certain bacteria, particularly those that possess the enzyme nitrate reductase. In the urinary tract, bacteria that cause UTIs can convert nitrates present in the urine to nitrites. Therefore, the presence of nitrites in a urine dipstick test suggests the presence of bacteria capable of converting nitrates, which is often indicative of a UTI but due to the presence of antibiotics in urine,the bacteria may fail to survive. A study of Clinical and laboratory features of urinary tract infections in young infants concluded that non-bacterial etiologies should be considered in empirical treatment. Fever was the main symptom. Positive nitrite is highly suggestive of UTI but has low sensitivity; whereas pyuria ≥ 10,000/mL revealed good sensitivity, but low specificity. Peripheral white blood cell count and C-reactive protein concentration have usefulness to suggest UTI (Nefrol Bras J, 2018).A high number of true

positive UTI diagnosis is present in the Urine samples without antibiotic residues and other indicators are aiding in the diagnosis.In the presence of these indicators but no pathogen isolated it will be difficult to carry out Antibiotic susceptibility test. When one presents with these other indicators then there is a sign of an infection in the Urinary Tract and diagnosis is a combination of these signs and culture results.Problems arise when one is showing signs and symptoms of UTI with high white cell count but no growth on culture yet they are already on empiric antibiotic therapy.

5.4 Limitations of the study

The possible limitation to the study is confounding variables which may have affected the accuracy of the study results such as the presence of other medications other than antibiotics as well as underlying conditions.

5.5 Conclusion

In conclusion ,presence of antibiotic residues in the urine samples submitted for UTI diagnosis has an effect in the accuracy of the diagnosis. In the presence of significant symptoms as well as other indicators there was no growth of the UTI pathogens on culture due to the inhibitory effect of the antibiotics. Majority of the patients were already on empiric antibiotic therapy before confirmatory diagnosis supporting the use of misguided empiric therapy by doctors ,antibiotic misuse, self-diagnosis and use of antibiotics for comorbid conditions.

5.6 Recommendations

Enforcement of health regulatory inspections is needed to improve compliance with mandatory prescription of antibiotics and thus contribute towards a culture change that would promote rational use of antibiotics. In addition, the use of the bacillus technique for testing for the presence of antibiotic residues in the urine samples submitted for UTI diagnosis should be

adopted by many other laboratories to ensure a more accurate diagnosis. A rapid diagnostic test for UTI pathogens would be a good invention so that quick response to infections is done and no antibiotics are administered prior diagnosis.

References

Barlam TF, Cosgrove SE, Abbo LM, MacDougall C, Schuetz AN, Septimus EJ, Srinivasan A, Dellit TH, Falck-Ytter YT, Fishman NO, Hamilton CW, Jenkins TC, Lipsett PA, Malani PN, May LS, Moran GJ, Neuhauser MM, Newland JG, Ohl CA, Samore MH, Seo SK, Trivedi KK. Implementing an antibiotic stewardship program: Guidelines by the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America. Clinical Infectious Diseases. 2016;62(10):e51–e77

Basber, A.E., Norton, J. P., Spivak, A. M., & Mulvey, M. A. (2013, January). Urinary tract infections: Current and emerging management strategies. Clinical Infectious Diseases.57(5), 719-724. DOI: 10.1093/cid/cit284

Belyayeva, M. and Jeong, J. M. (2020, May) Acute pyelonephritis. Stat Pearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK519537/

Bonnici, J. J., and Lentini, F. (2014, September). Urinary tract infections in the community. The Journal of Malta College of Family Doctors. 3(2). 10-17.https://www.um.edu.mt/library/oar/handle/123456789/4476

Bono MJ, Leslie SW, Reygaert WC.(2023). StatPearls Publishing; Treasure Island (FL). Uncomplicated Urinary Tract Infections

Brubaker, L., Carberry, C., Nardos, R., Carter-Brooks, C., Lowder, J. L. (2018). American Urogynecoloic society best-practice statement: Recurrent urinary tract infection inadult women. Female Pelvic Medicine & Reconstructive Surgery. 24(5). 321-335. DOI:10.1097/S.

Chomarat M(2000). Resistance of bacteria in urinary tract infections. Int J AntimicrobrialAgents. ;16:483–487. doi: 10.1016/S0924-8579(00)00281-8.

Centers for Disease Control and Prevention (CDC). (2019, August). Antibiotic prescribing and use in doctor's offices: Urinary tract infection. https://www.cdc.gov/antibioticuse/community/for-patients/common-illnesses/uti.html

Centers for Disease Control and Prevention (CDC). (2020, January). Antibiotic prescribing and use in doctor's offices: Antibiotic do's & don'ts. https://www.cdc.gov/antibioticuse/community/about/can-do.html

Cortes-Penfield, N. W., Trautner, B. W., & Jump, R. (2017, December). Urinary tract infection and asymptomatic bacteriuria in older adults. Infect Dis Clin Noth Am. 31(4), 673-688. DOI:10.1016/j.ide.2017.07.002

Davies J, Davies D. Origins and evolution of antibiotic resistance. Microbiology and Molecular Biology Review. 2010;74(3):417–433

Global Antimicrobial Resistance Surveillance System: Manual for Early Implementation. World Health Organization

Gould CV, Umscheid CA(2009), Healthcare Infection Control Practices Advisory Committee. Guideline for prevention of catheter-associated urinary tract infections . Infect Control Hosp Epidemiol(4):319-2

Malterud K, Baerheim (2017). Peeing barbed wire. Symptom experiences in women with lower urinary tract infection. Scand J Prim Health Care pg134;1-2b

Michael L. Wilson, Loretta Gaido (2004.)Clinical Infectious Diseases, Volume 38, Issue 8, Pages 1150–1158, https://doi.org/10.1086/383029

Mhondoro M, Ndlovu N, Bangure D, Juru T, Gombe NT, Shambira G, Nsubuga P, Tshimanga M. (2019).Trends in antimicrobial resistance of bacterial pathogens in Harare, Zimbabwe, 2012-2017: a secondary dataset analysis. BMC Infect Dis. 27;19(1):746.

Organization for Economic Cooperation and Development (OECD) ,2018.Projections on Antimicronial resistance epidermiology in Zimbabwe.Database 2,e33-e34.

Rakel D. Integrative Medicine. 3rd ed. Philadelphia: Elsevier Saunders; (2012) Genitourinary disorders. Natural Medicines Comprehensive Database website. https://naturalmedicines.therapeuticresearch.com

Turner S, Rumsby K, Warner G, (2019). Effectiveness of five different approaches in management of urinary tract infection: randomised controlled trial. BMJ. 2010;340:c199.

Weber G, Riesenberg K, (2017). Changing trends in frequency and antimicrobial resistance of urinary pathogens in outpatient clinics and a hospital in southern Israel,Microbiol Infect Dis, vol. 16 (pg. 834-8)

Appendix A: Timetable for Research

Activity	January	February	March	April
Identification, presentation and approval of research topic				
Proposal writing,submission and clearance of research				
Data collection,data entry, data analysis, report writing of the dissertation				
Study report presentation				

Appendix B: Budget for conducting research

ACTIVITY	AMOUNT
Transport	$20
Stationery	$10
Total	$30

APPENDIX C : DATA COLLECTION TOOL

SAMPLE ID	AGE	SEX	ANTIBIOTIC ACTIVITY	BACTERIA RECOVERY RATE		OTHER UTI INDICATORS				
				low	high	WBC	Nitrites	pyuria	Leuco .esterase	Symptoms(if indicated)

APPENDIX D : IMAGE SUPPORTING FINDINGS

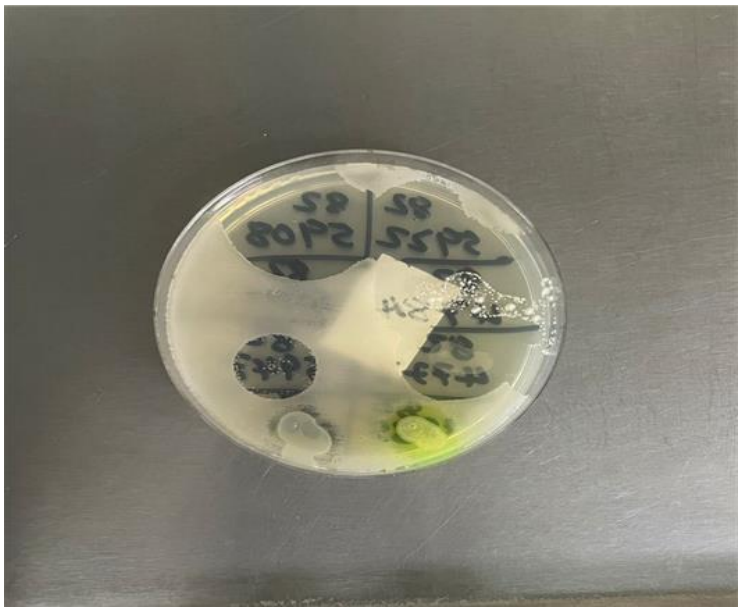


Image showing Antibiotic test on the Muller Hinton plate with innoculated urine samples from different patients.

APPENDIX E: SUPERVISOR APPROVAL LETTER

AFRICA UNIVERSITY
(A United Methodist-Related Institution)

"Investing in Africa's Future"

DEPARTMENT OF BIOMEDICAL AND LABORATORY SCIENCES
COLLEGE OF HEALTH, AGRICULTURE AND NATURAL RESOURCES

26 February 2024

The Director

AUREC

Dear Sir/ Madam

RE: APPLICATION FOR SUBMISSION OF PROJECT PROPOSAL FOR MUTIDZAWANDA TATENDA

This letter serves to confirm that I am supervising the above-mentioned student in her final year dissertation. She has satisfied the requirements of the college in developing his research proposal and it is ready for ethical review.

Your facilitation for the review of the proposal is greatly appreciated.

Thank you

Mr Z Chiwodza

Research Supervisor

zchiwodza@africau.edu

APPENDIX F:STUDY SITE APPROVAL LETTER

AFRICA UNIVERSITY

THE MANAGER LANCET CLINICAL LABORATORIES

22 Fife Ave Cnr Blakiston Ave

Harare.

Dear Sir.

RE: PERMISSION TO CONDUCT A MICROBIOLOGY RESEARCH AT LANCET LABORATORY

I am a medical laboratory science student (HBMLS) at Africa University, who as well has been attached at your Laboratory for a year.I am writing to express my strong interest in conducting a research at your lab for the fufilment of my (HIBMLS) degree requirement. With a deep passion for the microbiology department, and strong desire to contribute to the advancement of knowledge in this field , I am eager to pursue the dissertation project under the mentorship and guidance of esteemed staff members at your institution.

The research will be focused on how antibiotic use affects UTI diagnosis from urine samples submitted in the year 2023.

The research topic reads: **AN INVESTIGATION OF ANTIBIOTIC ACTIVITY IN URINE SAMPLES SUBMITTED AT LANCET CLINICAL LABORATORY AND ITS EFFECT ON URINARY TRACT INFECTION DIAGNOSIS IN THE YEAR 2023.**

My research will be mainly record based due to resource and time limitations. I therefore request for your authority to be allowed access into the microbiology archives and retrieve data essential for my research project. I am confident that my skills, dedication and perspectives will make valuable contributions to the research endeavours at Lancet laboratories as well contribute to improved diagnostics techniques. I am very eager to bring my ideas and expertise to the table and collaborate with esteemed researchers at your institution to address microbiology challenges.

Thank you for considering my application and I hope to have the chance to contribute to the impactful research conducted at Lancet laboratories.

Yours sincerely

Tatenda Faith Mutidzawanda

(Africa University Student)

LANCET
CLINICAL LABORATORIES
22 FIFE AVE / Cnr BLAKISTONE ST.
P.O. BOX BW260
BORROWDALE, HARARE

Approved 19/02/24

BRIAN MAGAIA

LABORATORY MANAGER

APPENDIX G: AUREC APPROVAL LETTER

Open with

AFRICA UNIVERSITY
A United Methodist-Related Institution
Investing in Africa's future

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: AU3171/24

11 March, 2024

TATENDA MUTIDZAWANDA
C/O Africa University
Box 1320
MUTARE

RE: **AN INVESTIGATION OF ANTIBIOTIC ACTIVITY IN URINE SAMPLES SUBMITTED AT LANCET CLINICAL LABORATORY AND ITS EFFECT ON URINARY TRACT INFECTION DIAGNOSIS IN THE YEAR 2023**

Thank you for the above-titled proposal that 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** AUREC3171/24
  This number should be used on all correspondences, consent forms, and appropriate documents.
- **AUREC MEETING DATE** NA
- **APPROVAL DATE** March 11, 2024
- **EXPIRATION DATE** March 11, 2025
- **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.

AFRICA UNIVERSITY
RESEARCH ETHICS COMMITTEE (AUREC)
APPROVED
P.O. BOX 1320, MUTARE, ZIMBABWE

Yours Faithfully

MARY CHINZOU
ASSISTANT RESEARCH OFFICER: FOR CHAIRPERSON
AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE