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A Cross sectional Investigation On The Prevalence of Multiple Drug Resistant In outpatients with Urinary Tract Infection (UTI)

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Abstract

Empirical treatments need an understanding of the current ecological setting of uropathies and rates of antibiotic resistance. The fourth most frequent illness associated with medical treatment is urinary tract infection (UTI). There is an increase in antimicrobial medication resistance worldwide. As a result, identifying individuals at high risk of acquiring a multidrug-resistant disease is essential. Because of this, the present research has been criticized for establishing the etiology of urinary tract infection and multidrug resistance among uro-pathogens in a group diagnosed with urinary tract infection. For the cross-sectional research, 1000 patients were selected for participation. Patients' urine test results were used to compile the data. To establish the etiology of the pathogenic organism producing urinary tract infection, descriptive analysis and cross-tabulation were employed in SPSS. The research study shows that common E. coli strains are becoming more resistant to prescribed antibiotics such as ampicillin/amoxicillin and trimethoprim/cotrimo. The study's findings are alarming. According to the study's findings on the age-related risk of UTI, older participants were found to be more likely to get the illness. As people become older, the urinary system becomes more vulnerable to infection.

KEYWORDS : Multiple Drug Resistance, MDR, Outpatients, Urinary Tract Infections (UTI).

Introduction

Among the most prevalent bacterial infections found in the outpatient clinic, UTIs are a frequent justification for the use of antimicrobial agents among persons otherwise considered to be healthy (Rossignol et al., 2017). The clinical and epidemiological characteristics of a UTI may be used to classify it. This is critical for determining the risk of treatment resistance as well as the pathophysiology of the illness. Uncomplicated community-acquired urinary tract infections (UTIs) may be diagnosed in healthy premenopausal, nonpregnant women who arrive with indications and medical exam findings consistent with acute cystitis. A urine culture may not be necessary in these circumstances since the uro-pathogen is unlikely to be resistant. Outpatient patients with acute cystitis may have a simple infection, but risk factors connected to the prostate, such as enlarged prostates, should be evaluated (Bryce et al., 2016). Men have a greater risk of developing drug resistance, thus a urine culture should be performed to assist determine the most appropriate empiric treatment and to aid in the prevention of subsequent infections (Fagan et al., 2015). Regardless of gender, patients who are suspected of having an MDR Ur pathogen infection should have an urine specimen conducted as part of their initial evaluation to help guide empiric treatment and inform future antimicrobial choice in the event of a future UTI (Seifu & Gebissa, 2018). MDR bacteria are generally defined as those that are no susceptible to at least one agent from at least three classes of antibiotics, because while definitions could vary by institution. When deciding on an active medication, it's important to look at earlier microbiological resistance data from the very same individual within the previous two years (Fallah, Parhiz, & Azimi, 2019).

In individuals with quadriplegia and disorders (SCI/D), bladder infections (UTIs) are quite prevalent. Fifty to seventy-five percent of the patients had a positive urine culture. Each SCI/D patient experienced an average of 2.5 urinary tract infections (UTIs) each year. Among the most prevalent side effects of long-term therapy for SCI/D patients is a urinary tract infection (UTI). It is currently a global public health concern because bacterial resistance, particularly multidrug opposition to antimicrobial medicines, has increased. Due to the synthesis of extended-spectrum early access (ESBLs) by Escherichia pneumoniae, the resistance to 3rd cephalosporins is quickly increasing. Methicillin-resistant Enterobacteriaceae are becoming more common in the treatment of patients with multidrug-resistant (MDR) E. coli (Campbell et al., 2022). More than quarter of E. coli strains and much more than a third of K. pneumonia were resistant to current one antimicrobial group in 2018, and combination resistance was also widespread. The rise in Enterococcus faecium (VRE) strains that are resistant to vancomycin is also an issue (Barry, Diallo, Kanté, & Diallo, 2017). There is a greater risk of infection and colonisation by MDR strains in SCI/D patients, particularly gram-negative bacteria, due to their frequent use of antibiotics (GNB). With MDR strains, the patient's prognosis is much poorer, and the time spent in the hospital is significantly longer, with an increased risk of kidney dysfunction and urolithiasis, particularly infectious urolithiasis. However, the rise in infections caused by multidrug-resistant bacteria is posing an increasing threat to patients, particularly those who are hospitalized (Vallejo-Torres et al., 2018). Antimicrobial treatment is often used in regular clinical practice when a patient shows indications of a urinary tract infection (UTI). Understanding the present ecological context of uropathies or antimicrobial resistance rates is essential for the use of empirical therapies that may be tailored and targeted after obtaining the results of susceptibility testing (AST).

Antimicrobial resistance and the frequency of infection in Karachi outpatients were assessed in our research (Malmartel, Ghasarossian, & Diseases, 2016).

Changing Epidemiology of Uropathogens

Studies on simple female cystitis have consistently indicated that 80–90% of causal uropathogens are Escherichia coli, and the vast bulk of E. coli really aren't multidrug resistant. The prevalence of resistance to several antimicrobials, notably sulfa drugs (TMP-SMX), fluoroquinolones, and beta-lactams, has increased in this female group. Regardless of sex, antibiotic resistance among uropathogens is more prevalent in outpatient populations, according to surveillance data (Rodrigues et al., 2016). If we look at US outpatient isolates, the prevalence of multidrug resistant E. coli rose from 9 percent in 2001 to 17% by 2010. Active early empiric treatment, particularly in complex UTIs, may improve health satisfaction. Because of this, thorough evaluation of the UTI illness and the potential of resistance depending on medical risk factors is necessary at each patient appointment (Kanda et al., 2020).

Empirical Review

UTIs are the most often reported illnesses, and as a result, antibiotic usage is on the rise all across the globe. Urinary tract infections (UTIs) are the fourth commonly prevalent infection connected with medical treatment. Bacteria that really are sensitive to one or more types of antibiotics are known as multidrug-resistant organisms (MDRO). E. coli resistance to sulfamethoxazole-trimethoprim has been found over the globe, and fluoroquinolones and cephalosporins have been used in their place. Antimicrobial resistance and the possibility of life-threatening infections caused by Gram negative elongated beta lactamase generating Enterobacteriaceae are growing concerns (Coussement et al., 2019). Antimicrobial drug resistance is on the rise all over the globe, thus identifying variables that put patients at higher risk of developing a multidrug-resistant illness is critical in order to save wide range medications for such patients (Gessese et al., 2017). Antibiotic resistance may be reduced by restricting the use of broad-spectrum empiric medicines to patients with known risk factors. Our work focuses on defining and identifying people who are more likely to get a UTI-causing infection from these multidrug-resistant organisms (Larramendy et al., 2020).

Gram-negative bacteria are the most common cause of urinary tract infections (UTIs). Escherichia coli is the most common pathogen that causes simple cystitis and pyelonephritis, but other Enterobacteriaceae species, including such Proteus mirabilis and Klebsiella pneumoniae, as well as Gram-positive pathogens like Enterococcus faecalis and Streptococci, can also cause these conditions. 2–3 Some of the most often prescribed medications for uncomplicated UTIs and pyelonephritis are nitrofurantoin monohydrate, tetracyclinesulfamethoxazole, fosfomycin trometamol, pivmecillinam, ciprofloxacin and beta-lactamases. 1,3 A high degree of resistance to antibiotics is emerging in UTI bacteria because of the extensive use of these drugs (A. Jafari-Sales, Soleimani, Moradi, & Biopharma, 2020).

More and more people are developing resistance to antibiotics other than the carbapenem group due to bacteria that produce extended spectrum beta-lactamases (ESBLs). There are few effective antimicrobials for treating infections caused by narcotic bacteria, and many are linked with serious side effects (Mitiku, Amsalu, & Tadesse, 2018). Clinical practise may now be confronted with multi- and even pan-resistant microorganisms. That's why tracking and limiting resistance growth are so important. microorganisms that produce carbapenemase. 9 E. coli strains recovered from intra-abdominal infections in 13 European countries during 2008 and 2009 were studied for the prevalence of ESBLs. ESBL-producing bacteria were found in 11 percent of samples, on average, although the frequency varied substantially (Gajdács, Burián, & Terhes, 2019). The spread and frequency of ESBLs outside of Europe is significantly greater, and it is notably noticeable in Asia, Latin America, and the Middle East. Study for Monitoring Antibiotic Resistant Trends (SMART) 2008 and 2009 gathered 2841 strains isolated of Klebsiella pneumoniae from interpersonal and inter infections globally. The total rate of ESBL-positive strains was 22.4 percent, with the greatest rates seen in Africa And latin America. The greatest ESBL positive rates were seen in Asia and South America, according to SMART data (Shrestha, Baral, Poudel, & Khanal, 2019).

Between 2009 and 2011, the SMART project assessed the prevalence and B - lactam antibiotics in Enteric bacteria commonly isolated with urinary tract infections. Asia and the Mideast not only had the greatest incidence of ESBLs, but they also had a considerable rise in ESBL prevalence between 2009 and 2011. ESBL-positive UTI bacteria were found to be 20 percent common in Europe. 12 Except for North America, all areas' molecular data reveal CTX-total M's dominance and the rise of carbapenems (Gardiner, Stewardson, Abbott, & Peleg, 2019).

Risk Factors for UTIs

As in the general population, the risk factors for urinary tract infections (UTIs) are identical. In the post-transplant time, female gender is a very well risk factor for UTIs because of the urinary tract's physical characteristics (Shrestha et al., 2019). The prevalence and frequency of post-transplant UTIs were shown to be the same in both men and women by numerous writers, however. There have been conflicting findings about the link between advanced age and the occurrence of UTIs. UTIs are more common in older kidney transplant recipients, according to a study by Chaung et al. (2018) that revealed 55% of patients aged 60 and older had UTIs compared to just 30% of patients younger than 60. Other research, on the other hand, found no connection between getting a UTI and becoming older (A. J. F. O. M. S. J. Jafari-Sales, 2018). Due to a weaker immune system, immunosuppression-related co-morbidities, and other factors, older transplant patients are at greater risk of developing urinary tract infections (UTIs). UTIs may occur in patients with a variety of co-morbidities and risk factors, including diabetes, polycystic kidney disease, uropathies, and poor hygiene (Moyo, Aboud, Kasubi, Lyamuya, & Maselle, 2010). With renal disease (CKD), the urinary tract's protective mucosa production is reduced and uraemia-induced immunosuppression causes an increased risk of urinary tract infection.

Methodology

Design

After establishing the research problem, designing the research, or research design, is perhaps the most critical step. Researchers are able to take action upon research subjects like what, when, where, how, and by what methods, for example, because of the study's design. Exploratory and conclusive research designs are the two most common types. Experimentation is often qualitative, whereas finalization is typically quantitative in this context (Mirzarazi, Rezatofighi, Pourmahdi, & Mohajeri, 2013). Descriptive and casual research designs are two of the most common forms of conclusive research designs. We took a cross-sectional strategy to our study. The current study uses a cross-sectional design and a quantitative technique. The current study obtained numerical data that may be examined statistically (Plate et al., 2019).

Deductive approach

Acceptance and refining of a subject matter hypothesis into the more precise, testable hypotheses are the first steps in the deductive process. After data has been gathered and examined, theoretical misunderstandings might be addressed by additional filtering. Therefore, the researcher may check the basic assumptions of the study by looking at the data. Saunders, Lewis, and Thornhill (2009) deductively demonstrating how an existing theory may be used to generate a new method (Thompson, Muradyan, Miller, & Ahiawodzi, 2022).

Participants

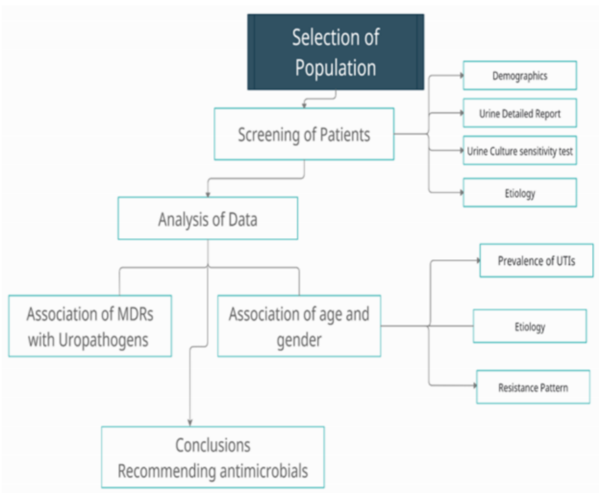
Inclusion Criteria:

- Diagnosed or suspected patients with urinary tract infections
- Either gender
- Participants who will be willing to participate in study after verbal consent • Patients of all ages.
- Patients visiting outpatient clinics.

Exclusion Criteria:

- Inpatients
- Women having periods.
- Participants who will be not willing to participate in study.

Study Layout:



Materials

The data was collected using the lab reports of the patients, which was based on the three sections. The first half focused on demographics, such as gender, age, and social class, whereas the second section examined the etiology of pathogenic organism causing urinary tract infection among population diagnosed with urinary tract infection while third was based on the multidrug resistance among uro-pathogens (Moraes, Braoios, Alves, & Costa, 2014)(Gupta, Grigoryan, & Trautner, 2017).

Analytical Procedures

The present study work used SPSS v26.0 on Windows to do the statistical analysis. For this purpose, descriptive statistics were used (Shilpakar et al., 2021). Cronbach's Alpha values and factor analysis were used to examine the scale data's believability. Following this, Pearson correlations and multiple regressions were employed to examine the influence of independent factors on dependent variables, respectively (Balkhi et al., 2018).

Results

Demographics

Gender, age, and the presence of urinary tract infections (UTIs) all played a role in the study's demographics. A total of 339 women and 133 men were found in the study's n=472 sample. Females make up 71.80 percent of the population, while men make up 28.20 percent of the population. 18.90 percent of the population is between the ages of 10 and 20, 18.40 percent is between the ages of 21 and 40, and 52.10 percent of the population is between the ages of 41 and 60. There are 460 (97.50% of the total) individuals with Urinary Tract Infection, whereas 12 (2.50%) are negative.

Table 3.1 Demographics of the Study

		Count	**Table N %**
Gender	Female	339	71.80%
	Male	133	28.20%
Age Group	10-20	89	18.90%
	21-40	87	18.40%
	41-60	246	52.10%
	61-100	50	10.60%
UTI	Negative	12	2.50%
	Positive	460	97.50%

The graphical representation of the demographics is given with a bar graph, below in the figure 3.1 which represents the above table.

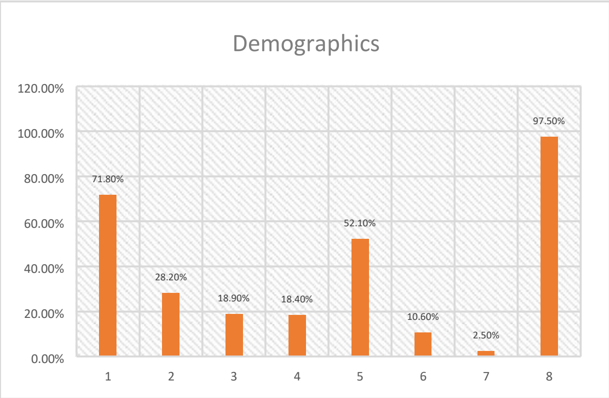


Figure 3.1 Demographics of the Study

The descriptive analysis for the age is given below which shows the minimum age year wise, and maximum, and the mean age for the respondents (n=472).

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Age Group	472	19.00	75.00	48.4120	.84081
Valid N (listwise)	472				

The below table 3.2 explains the patients with UTI with respective to the gender which results that female are more counted with UTI n=331 (72%) while less males are counted as 129 (28%) out of 460 of the total UTI positive patients.

Table 3.2 UTI patients' distribution over Gender

	Gender				
	Female		**Male**		**p-Value**
	Count	**Table N %**	**Count**	**Table N %**	0.03

UTI	Positive	331	72.0%	129	28.0%

As shown in the above table, the below diagram represents the Positive UTI patients according to the gender. The higher bar graphs can be seen for the females as compared to the male.

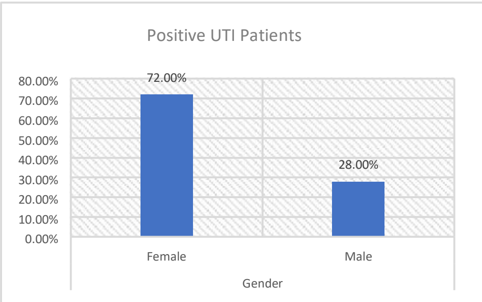


Figure 3.2 UTI patients' distribution over Gender

The distribution of the UTI patients with accordance to the age group shows that highest UTI is prevalent among the 41-60 years patients and less UTI distribution is seen in the lower age. As the age group 10-20 years shows only 8.3% population, while 18.9% population is from 21-40. Higher the age of the patients more they are susceptible in caught the UTI.

Table 3.3 UTI distribution over the Age Group

		UTI Positive Count	UTI Positive N %	p-value
Age Group	10-20	89	19.30%	0.001
	21-40	87	18.90%	
	41-60	246	53.50%	
	61-100	38	8.30%	

The below diagram represents the positive UTI patients distribution over the age groups, it can be seen that bar for the age group 10-20 is lower while highest peek can be seen from the age 41-50 (figure 3.3)

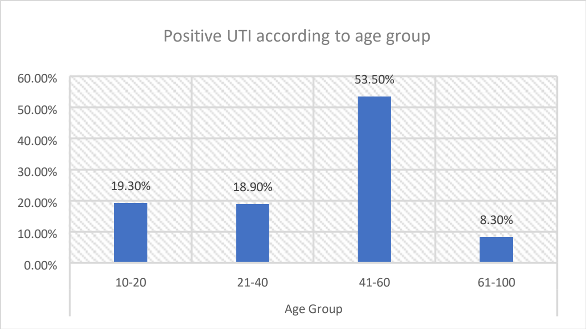


Figure 3.3 UTI distribution over the Age Group

The pathogens associated with the UTI patients can be seen in the below table 3.4, the distribution shows that highest of the UTI patients are connected with the Escherichia Coli, while less then that Acinetobacter shows a percentage of 13.3%. 9.8% distribution of the patients can be seen with Klebsiella, 8.9 with Candida, 5.7 with Staphylococcus, and 7.6% with Citrobacter (Table 3.4).

Table 3.4 UTI patients' distribution with respect to the Pathogens.

		UTI		
		Positive		**p-value**
		Count	Table N %	
Pathogens	Escherichia Coli	252	54.8%	0.000
	Acinetobacter	61	13.3%	
	Klebsiella	45	9.8%	
	Candida	41	8.9%	
	Staphylococcus	26	5.7%	
	Citrobacter	35	7.6%	

Below figure 3.4 shows the pathogen wise distribution of the population of the UTI positive patients. The highest peak can be seen for the Escherichia coli while Acinetobacter produces the second bigger peek (Figure 3.4).

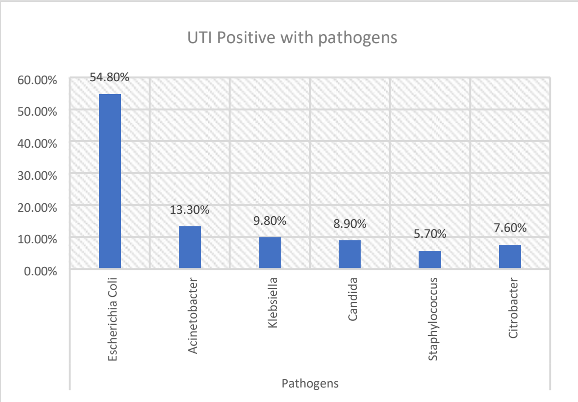


Figure 3.4 UTI patients' distribution with respect to the Pathogens

In the end the multiple drug resistance in the UTI patients were evaluated for the Escherichia Coli, Acinetobacter, Klebsiella, Candida, Staphylococcus, and Citrobacter. The below frequency and percentages show the resistance in the number of patients regarding the corresponding bacterium specie and the drug itself. It can be seen that highest resistance can be seen for all of the drugs in the Escherichia Coli, while in Candida and Staphylococcus it is also high. The Citrobacter and the Klebsiella is less resistant to most of the drugs as per the below cross-tab results. The results are more clear in the graphical representation of the current table below.

Table 3.5 Multiple Drug Resistance

	Pathogens				
	Escherichia Coli		**Acinetobacter**		**Klebsiella**
	Count	**Table N %**	**Count**	**Table N %**	**Count**
AMK	158	34.30%	33	7.20%	31
AMO	163	35.40%	29	6.30%	22
AMP	125	27.20%	29	6.30%	21
CEF	150	32.60%	38	8.30%	32
CIP	210	45.70%	54	11.70%	34
CEF	59	12.80%	10	2.20%	19
IMP	144	31.30%	33	7.20%	24
GEN	206	44.80%	53	11.50%	37
MEC	226	49.10%	55	12.00%	36
NAL	98	21.30%	23	5.00%	21
NIT	25	5.40%	5	1.10%	6
OFL	81	17.60%	17	3.70%	12

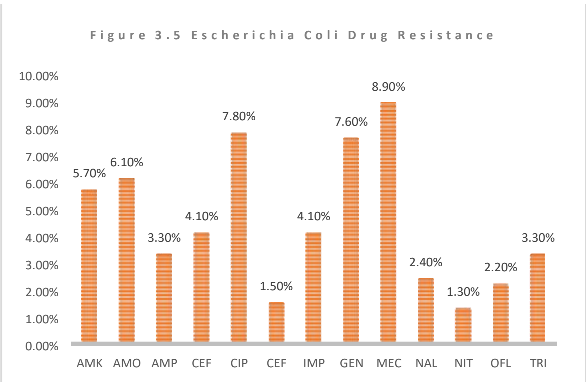
TRI	111	24.10%	29	6.30%	14

The Figure 3.5 shows the Escherichia Coli resistance on the drugs, which results that most resistant drug is AMP and NIT.

Pathogens

		Candida		Staphylococcus		Citrobacter	
	Table N %	**Count**	**Table N %**	**Count**	**Table N %**	**Count**	**Table N %**
AMK	26	5.70%	21	4.60%	19	4.10%	26
AMO	28	6.10%	13	2.80%	18	3.90%	28
AMP	15	3.30%	6	1.30%	11	2.40%	15
CEF	19	4.10%	13	2.80%	22	4.80%	19
CIP	36	7.80%	26	5.70%	34	7.40%	36
CEF	7	1.50%	6	1.30%	5	1.10%	7
IMP	19	4.10%	14	3.00%	15	3.30%	19
GEN	35	7.60%	20	4.30%	35	7.60%	35
MEC	41	8.90%	25	5.40%	33	7.20%	41
NAL	11	2.40%	12	2.60%	8	1.70%	11
NIT	6	1.30%	2	0.40%	6	1.30%	6
OFL	10	2.20%	9	2.00%	5	1.10%	10
TRI	15	3.30%	9	2.00%	10	2.20%	15

The results for the rest of the drugs can also be seen in the below chart.



The figure 3.6 shows the resistance of the Acinetobacter with accordance to the drugs, the highest resistance can be seen for the TRI and AMP in the below figure while lowest resistance to the MEC.

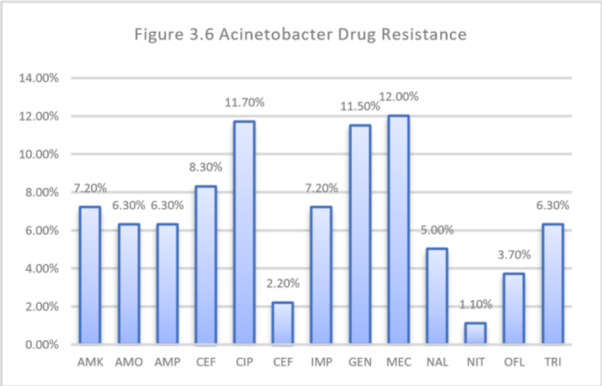


Figure 3.6 Acinetobacter Drug Resistance

Figure 3.7

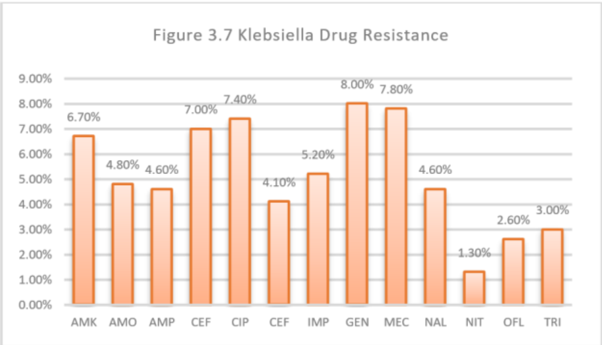


Figure 3.7 Klebsiella Drug Resistance

Figure 3.8 shows the Candida multiple drug resistance which results that NIT is the most resistant drug in this case. The Candida specie is more resistive to the NIT and AMO as depicted in the below diagram.

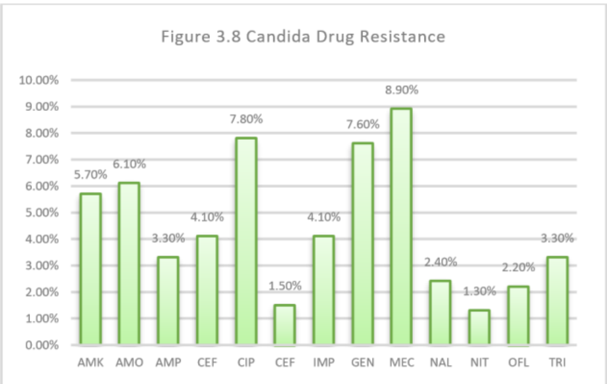


Figure 3.8 Candida Drug Resistance

Figure 3.9 represents the Staphylococcus multiple drug resistance, according the the current assessment the highest resistance can be seen for the AMK and NAL drugs.

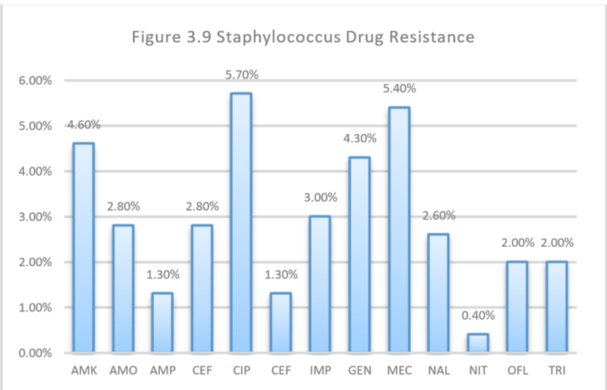
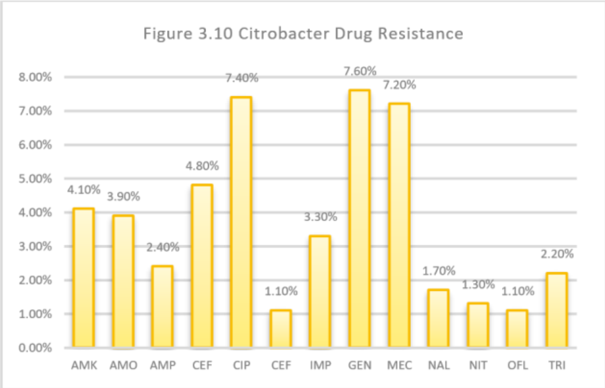


Figure 3.9 Staphylococcus Drug Resistance

Figure 3.10 shows the Citrobacter multiple drug resistance, according to the assessment NIT is the most resistive drug in case of the Citrobacter. The lowest drug resistivity for the current specie is OFL.



Discussions

The goal of the research was to identify the pathogenic bacterium responsible for urinary tract infections and investigate its pathogenesis. The study also looked at uro-pathogens' multidrug resistance. In cases of acute, community-acquired, uncomplicated urinary tract infections, Escherichia coli is the most prevalent pathogen (UTIs). Resistance to augmentin, cefazolin, and ciprofloxacin was more common in patients under 65 than in those over 65 years old. The Enterobacteriaceae family includes the gram-negative, quasi-rod Citribacteraceae.

Urinary, respiratory, blood, and other sterile bodily parts have been found to be infected by it. In this study, patients with urinary tract infections (UTIs) had the highest rate of nitrofurantoin resistance (12 percent). Antibiotic resistance is on the rise among Enterobacteriaceae, making it more difficult to choose empiric treatment regimens for MDRE infections. Imipenem is an excellent choice for treating MDRE UTIs because of its uncomplicated once-daily dosing regimen. Only a few incidences of hypersensitivity reactions, including antibiotic-associated diarrhea, have been documented with the medication. While waiting for the findings of the urine culture, amikacin might be used as a short-term empiric therapy with amikacin because of its high susceptibility.

Conclusions

Urinary tract infection (UTI) is more common in older adults, and it is also more severe . The study concluded higher the age of the respondents are more likely to have urinary tract infection. According to the findings of the present study, strains of E. coli are progressively developing increasing resistance to routinely used antibiotics such as ampicillin/amoxicillin and trimethoprim / cotrimo.

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