

Prevalence of *E. Coli* Isolates from Urinary Tract Infected Patients Attending Selected Hospitals in Kisii County, Kenya

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ABSTRACT

Urinary tract infections (UTIs) are a significant and growing global health concern, with *E. coli* being the most common causing bacterium. The advent of antibiotic resistance has worsened the difficulties associated with UTI therapy. This study looked at the prevalence of multi-drug resistant *E. coli* isolates among UTI patients in Kisii County, Kenya. A total of 203 urine samples were collected, evaluated bacteriologically, and antibiotic sensitivity tests were carried out. *E. coli* was detected in 20.87% of the samples. Notably, *E. coli* displayed considerable antibiotic resistance, with amoxicillin exhibiting 100% resistance. In contrast, *E. coli* isolates were imipenem susceptible. To avoid antibiotic abuse and treatment failures, it is critical to screen for ESBL-producing isolates before administering antibiotics.

Keywords: Urinary tract infection, *Escherichia coli*, Antibiotic resistance and Multi-drug resistance

INTRODUCTION

Urinary tract infection (UTI) is a rapidly growing major health problem with increasing incidences with time, afflicting populations of all ages. While both Gram positive and Gram-negative pathogens have been implicated in the pathogenesis of UTI, the most prevalent pathogen is *Escherichia coli* (*E. coli*). The emergency of antimicrobial resistance has exacerbated the challenges of treatment, accounting for 700,000 annual deaths globally [1].

The pathogen that infects the circulatory and urinary systems most frequently across the globe is *Escherichia coli* [2]. The second easiest sickness in the world after respiratory disorders is Urinary tract infection (UTI), a type of contamination of the urethra, ureters and bladder [3]. UTI occurs more in females, particularly in pregnant women due to body physiological differences and increase in urination level during pregnancy [4]. Although UTI-associated *E. coli* originate

from the host's intestinal tract, however *E. coli* strains involved in UTIs differ from other enterocommenseal *E. coli* because they possess virulence factors that support pathogenicity; these strains are described as Uropathogenic *E. coli* [5]. Uropathogenic *E. coli* (UPEC) is pathogenic due to a variety of pathotype-specific virulence factors. The pathogenic traits of UPEC strains that enable them to cling to and invade the urinary tract, the traits that alter the surface of the host cell, the various types of toxins and secretion system that release toxins and other factors, target the targeted host cell, and interact with that cell are all encoded by UPEC strains [6]. Over 150 million people are thought to contract UTIs annually [7]. *Escherichia coli* strains in the United States are thought to be responsible for 40,000 and \$2.6 billion in health-care costs [8]. Reports in Kenya show an increased rate of *E. coli* resistance, which is becoming a

major issue in third world countries [9]. Numerous medical facilities have been devastated by *E. coli*'s antibiotic resistance, making it difficult to eradicate infections among patients [10]. This has created a global healthcare problem, by limiting the antimicrobial medications that can be used to treat bacterial infections. To

determine antibiotic resistance, it is necessary to understand the mechanisms underlying antimicrobial resistance.

Materials and Methods

Selected Kisii County Hospitals conducted the study. Marani Sub-County Hospital, Iyabe Sub- County Hospital, Tabaka Mission Hospital and Kiogoro Sub- County Hospital were used for the study. This study used a descriptive cross-sectional design. The study's participants were enrolled by using purposeful random sampling, with strict adherence to the inclusion criteria. Outpatient adult patients willing to be part of the study gave consent voluntarily without any coercion. Up until the necessary sample size was reached, the participants were recruited in the study in order. The study included all patients visiting selected hospitals in Kisii county and those within the age of 18 to 50 years. It also included people who have not taken antibiotics in the previous 14 days. The study excluded

patients with underlying diseases like HIV and diabetes mellitus. Using the formula by [11] and a UTI prevalence rate of 15.7% provided by [12], a sample of 203 human research participants was obtained as shown below:

$$N = PQ/D^2 \times 1.96^2$$

N = Sample size expected

Z = Normal Standard Deviation (1.96), tailed from normal table.

P = Disease's prevalence.

Q = $1 - P$.

D = Accuracy required at confidence level 95% for the study (0.05).

Determining the size of the sample

$$P = 15.7\% \quad Q = 1 - 0.157, \quad D = 0.05, \quad N = 1.96^2 \times PQ/D^2$$

$$N = 1.96^2 \times (0.157 \times 0.843/0.05^2)$$

$$N = 203$$

Laboratory techniques

Collecting urine samples

During the early hours, sterile universal bottles were used to collect midstream urine samples. Patients were taught how to collect urine in a sterile container with a

capacity of at least half their body weight and send the specimen to the lab in under an hour [13].

Urine samples culturing

Cysteine lactose electrolyte deficient Agar (CLED), a selective medium, was used for isolation. Following the preparation of the media per the manufacturer's instructions, a loopful of urine sample was injected using streak plate technique onto CLED agar plates. After that, the plates were

incubated at 37°C for 24 hours. Antimicrobial treatment or other variables may hinder initial development, thus after reintroducing plates to the incubator for another 24 hours with no growth or microscopic colonies, they will be discarded [14].

Bacterium Identification

Collection, bacteriological analyzation of 203 samples was done using proven techniques [15]. A surface streak on MacConkey agar was used to isolate Uropathogens, and those cultures that turn negative after 24 hours were cultured for an additional 48 hours [16]. Colonies with a population more than 100 were regarded noteworthy. Biochemical assays such as the Indole, Methyl, Voges-Proskauer and

Citrate test, and Triple Sugar iron test. greater than 100 were used to confirm the bacteria. *E. coli* was confirmed by its pink colonies and a positive indole test whereas *K. pneumoniae* was confirmed by pink colonies with a negative oxidase and indole test. *Proteus mirabilis* was confirmed by small pale to colorless colonies testing positive for indole and urease but negative to oxidase.

Enterococcus faecalis was the only gram-positive isolate. Frequency tables were

used to determine the prevalence of urinary infection among participants [17].

Ethical considerations

An informed consent form was signed and voluntary recruitment took place. Participants' informed consent was sought when they have been properly informed about the study's specifics. Participants were not compelled against their will to enroll themselves. Participants were free to leave the study whenever they want without being forced or having their right to care violated. There were no risk factors to the participants since they were directed to get the mid-stream urine samples by themselves and the study did not involve inflicting pain. The study will benefit the participants by helping them to know their status about UTIs and how to prevent it. Identification of participants was done by means of numerical codes. For reasons of privacy and confidentiality,

information about respondents was kept secret throughout the research process. There was careful adherence to the respondents' rights and fair treatment, minimizing any injury and inconvenience to them. The participants did not receive financial or other incentives of any kind, but they may be compensated and, in certain cases, have money used for their participation in the study returned to them. The methods used in this study did not violate the customs, traditions, or culture of the surrounding area. The Kisii County government will be informed of the study findings as a form of feedback. The study's authorization to proceed was requested from Research Ethics Committee of Bishop Stuart University (REC Number BSU-REC-2023-143)

RESULTS

Participants in the current study provided 203 samples, and of those, 115 (56.65%) samples yielded bacterial growth culture while 88 (43.35%) didn't. Out of these, 91 (79.13%) were non-*E. coli* while 24 (20.87%). *E. coli* pathogens were isolated from patients attending selected four hospitals suffering from UTI infections in

Kisii County, Kenya as shown in the figure below. Among the four hospitals, *E. coli* isolates were most prevalent in Marani Sub- County Hospital 11(45.83%), followed by Tabaka Mission Hospital 7(29.17%), Kiogoro Sub- County Hospital 4(16.67%) and Iyabe Sub- County Hospital 2(8.33%).

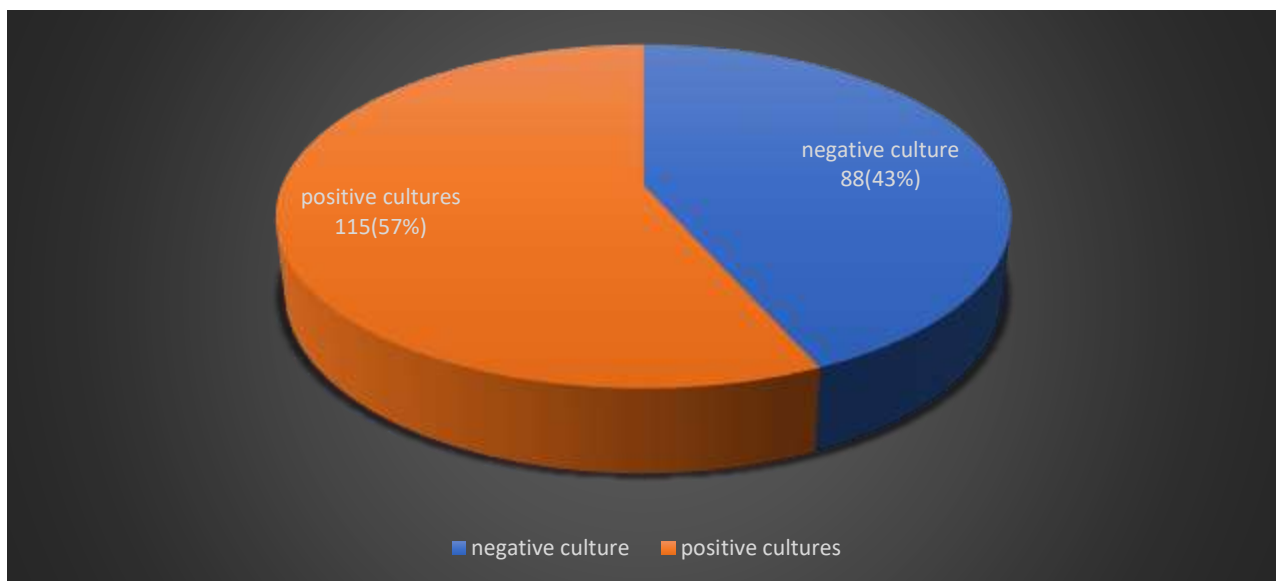


Figure 1: Cultured samples

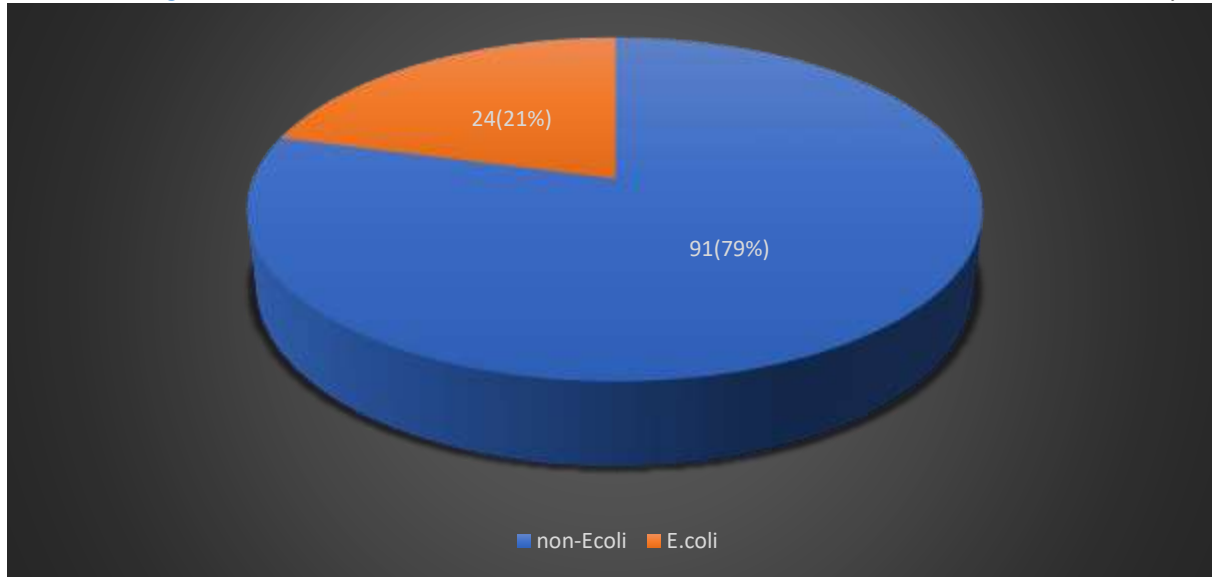


Figure 2: *E. coli* and non-*E. coli* isolates

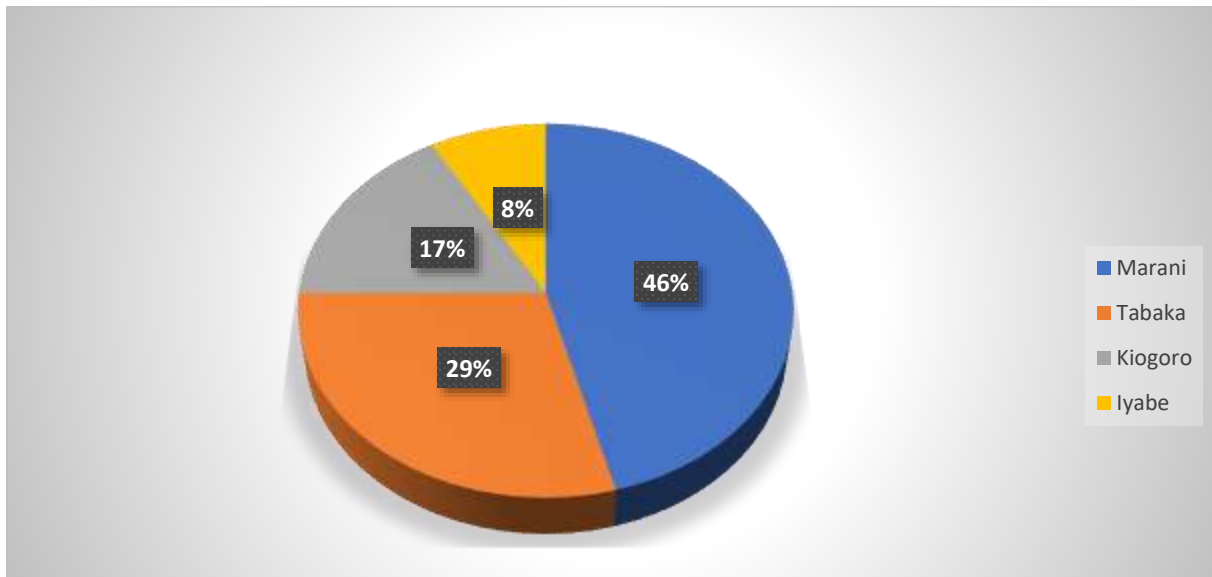


Figure 3: Distribution of *E. coli* isolates in different hospitals

DISCUSSION

Uropathogenic *Escherichia coli* (UPEC) is the responsible party for the majority of UTIs. Although *E. coli* are thought to be a typical part of the gastrointestinal and distal urogenital flora, they have the ability to ascend the urethra and enter the urine tract. *E. coli* has unique virulence characteristics that enable it to cling to and penetrate host cells, create toxins, use resources from the host, and avoid the

host's immune system. The primary and frequently the only form of treatment recommended for women of all ages with an uncomplicated UTI is antibiotic therapy [18]. This study's findings regarding the prevalence of uropathogenic *E. coli* are 20.9%, which is less than 32.2% as reported in Uganda [13] and 32.12% in Tanzania [19]. However, it is higher than 15.97% as reported in Ethiopia [20-21].

CONCLUSION

Uropathogenic *Escherichia coli* (UPEC) is a significant contributor to UTIs, with a prevalence of 20.87% in Kisii County,

Kenya. The high antibiotic resistance observed underscores the urgency of prudent antibiotic use and the importance

of continuous monitoring of bacterial resistance patterns. To address the growing global healthcare problem posed by antibiotic-resistant *E. coli*, efforts should be made to enhance health education and awareness, promoting

effective strategies for UTI prevention and management. It is imperative that healthcare providers and policymakers remain vigilant in addressing this critical public health issue.

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