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Original Article

Klebsiella Pneumoniae among pregnant women attending antenatal care at Entebbe regional referral hospital in Wakiso district, A cross-sectional study.

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ABSTRACT

Background:

Klebsiella pneumoniae (*K. Pneumoniae*) accounts for nearly one-third of gram-negative bacterial infections in hospitals, and pregnant women are at a higher risk. Structural and physiological changes in the urinary tract facilitate bacterial movement into the bladder. This study aimed at determining the prevalence of *K. Pneumoniae* among pregnant women attending antenatal care at Entebbe Regional Referral Hospital in Wakiso district.

Methodology:

A hospital-based cross-sectional design was used among 120 pregnant women attending ANC at Entebbe Regional Referral Hospital from August 2025 to November 2025. Data was collected using a structured questionnaire. Prevalence of *K. Pneumoniae* and its microbial sensitivity was determined by urine culture and sensitivity.

Results:

Overall, 41.7% were aged 16-25 years, 26-35 years, 36.7%, 36-45 years, 21.6%. Of the 57 mothers, 47.5% were single, 42.5% married, and 10.0% were divorced. In addition, 21.6% of pregnant mothers had no formal education, 27.5% primary, 25.8% secondary level, and 25.0% tertiary level. 45.0% mothers were in the second trimester, 34% in the third trimester, and 20.8% in the first trimester. The prevalence of *K. Pneumoniae was* 10.5% from 47.5% of UTI urine samples. *K. Pneumoniae* isolates were 100% sensitive to Amoxicillin-Clavulanic acid and Meropenem, moderately sensitive to Nitrofurantoin (66.7%), but showed high resistance to Levofloxacin and Ciprofloxacin (66.7%), as well as Ceftriaxone and Gentamicin (50.0%). Younger maternal age (16–25 years, 50.0%), secondary level of education (66.7%), third trimester of pregnancy (50.0%), and history of recurrent UTIs (83.3%) were identified as risk factors associated with *K. Pneumoniae* infection among pregnant women.

Conclusion:

Growing concern of antimicrobial resistance among uropathogens in pregnancy, underscoring the importance of targeted screening and preventive strategies among high-risk groups to reduce maternal morbidity and adverse pregnancy outcomes.

Recommendation:

Urine culture and sensitivity should be incorporated into the routine screening of UTIs for pregnant women during antenatal care.

Keywords: *Klebsiella Pneumoniae,Pregnant women, Antenatal care, Entebbe Regional Referral Hospital, Wakiso district*
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BACKGROUND

Klebsiella pneumoniae (*K. Pneumoniae*) is a non-motile, encapsulated, gram-negative, rod-shaped bacterium belonging to the Enterobacteriaceae family (Amani *et al*, 2020). It is an opportunistic pathogen associated with a wide range of infections, including urinary tract infections (UTIs), meningitis, respiratory tract infections (RTIs), pneumonia, bloodstream infections, and surgical site infections (Mohd *et al*, 2021). *K. Pneumoniae* transmission occurs through contaminated food, water, or direct contact, and the organism is recognized as a major cause of both hospital-acquired and community-acquired infections (Zamarano *et al*, 2021).

Globally, *K. Pneumoniae* accounts for nearly one-third of gram-negative bacterial infections in hospitals (WHO, 2024) and is the second leading cause of UTIs after Escherichia coli (E. coli), particularly in immunocompromised individuals and those with chronic conditions (Piazzolla *et al*, 2024). UTIs are among the most common bacterial infections worldwide, disproportionately affecting women (Czajkowski *et al*, 2021). Approximately 50–60% of women experience at least one UTI episode in their lifetime, with pregnant women at higher risk due to structural and physiological changes in the urinary tract that facilitate bacterial movement into the bladder (Barnawi *et al*, 2024). *K. Pneumoniae* contributes significantly to the burden, being isolated in up to 25% of UTIs globally (Mike-Ogburia *et al*, 2023). In sub-Saharan Africa, *K. Pneumoniae* varies across countries: 19.1% in Cameroon (Ngong *et al*, 2021), 16.0% in Nigeria (Ifenyi *et al*, 2021), 14.3% in Ethiopia (Derebe *et al*, 2025), 20.0% in Kenya (Kisuba *et al*, 2025), and 7.89% in Uganda (Ifrah *et al*, 2025).

Pregnant women with UTIs may present with burning sensation during urination, urgency at urination, lower abdominal pain, frequent urination, foul-smelling or turbid urine, and pressure or tenderness. When infection ascends to the kidneys, symptoms may include back pain, fever, chills, nausea, and vomiting; however, many cases remain

asymptomatic. Asymptomatic bacteriuria in pregnancy is defined by a significant bacterial count of >10^5 colony-forming units per millilitre of urine without urinary symptoms (Houlihan *et al*, 2023).

Several risk factors have been associated with UTIs in pregnancy, including a prior history of UTI, gestational diabetes mellitus, and poor personal hygiene. These factors, combined with the increasing prevalence of multidrug-resistant *K. Pneumoniae*, underscore the importance of targeted surveillance and management strategies in maternal health (Rafat *et al*, 2024). According to Piazzolla et al. (2024), failing to treat a urinary tract infection during pregnancy can trigger severe health issues, including kidney infection (pyelonephritis), systemic sepsis, and various stages of septic shock. These complications can be decreased by proper and prompt diagnosis and treatment of UTI in pregnancy (Nteziyaremye *et al*, 2020).

In low-and middle-income countries such as Uganda, management of UTI has been largely empirical without the use of a urine culture and susceptibility testing to guide therapy. Practices like the one mentioned create a risk for the evolution of antimicrobial resistance (AMR) in uropathogens (Mostafa et al., 2021). This growing global threat poses significant risks to both the mother and the fetus (Rafat et al., 2024). Locally, reports from the Entebbe Regional Referral Hospital's antenatal clinic (April-June 2025) indicate that one-fifth (20%) of pregnant women experience persistent UTIs shortly following a course of treatment. and there lacks enough evidence to justify the increasing rate of recurrent urinary tract infections among pregnant women at Entebbe Regional Referral Hospital. This 2study sought to determine the prevalence of *K. Pneumoniae* and its antimicrobial susceptibility profiles against commonly prescribed antibiotics used to treat UTIs among pregnant women seeking antenatal care at Entebbe Regional Referral Hospital in Wakiso district.

METHODOLOGY

Study design

The study was cross-sectional in nature, where both quantitative and qualitative data were collected. In this, a representative subset of the study population was studied at a specific point in time. This study design was used because it is inexpensive and fast when collecting data.

Study Area

The study was conducted at Entebbe Regional Referral Hospital in Entebbe town in Wakiso district. The hospital is approximately 44km by road, southwest of Kampala, the capital city of Uganda. It is a private, not-for-profit community hospital under the Uganda Catholic Church. It provides antenatal care for pregnant women. The hospital also provides inpatient and outpatient services, including laboratory, maternity, theater, radiology, and other services.

Entebbe Regional Referral Hospital was chosen for the study because it is a Regional Referral Hospital and therefore it receives a big number of pregnant women attending ANC services due to the many services offered at this facility.

Study population

All pregnant women who attended antenatal care at Entebbe Regional Referral Hospital during the study period.

Sample size estimation

The sample size was determined using the Kish and Lisle formula (1965)

$$n=\frac{z^2PQ}{e^2}$$

Where,

N is the sample size

Z =score corresponding to the set 95% confidence interval = 1.96

P = the prevalence of *K. Pneumoniae* among pregnant women in Uganda, according to Johnson et al (2025), is at 37.4%.

D = the expected level of error = 5% = 0.05.

$n= 1.96^2 [0.374*0.626]/0.05^2$

N =359 participants

However, due to limited time to collect data, low attendance by pregnant mothers who turn up for antenatal care, and financial constraints, 120 pregnant mothers were examined.

Therefore, 120 pregnant women were enrolled in the study.

Selection criteria

Pregnant mothers were selected according to the inclusion and exclusion criteria.

Inclusion criteria

All pregnant women who attended the antenatal clinic at Entebbe Regional Referral Hospital during the period of study and consented to participate willingly were included in the study.

Exclusion criteria

Pregnant women who were in need of emergency care were excluded from participating in the study.

All pregnant women who were on antibiotics for a period of 3 months were not included in the study.

Study variables

Independent variables

Participants' social demographics (age, marital status, occupation, level of education, and gestation age) and risk factors.

Dependent variables

Prevalence of *K. Pneumoniae* among pregnant mothers

Sampling Technique

A simple random sampling technique was used, which enabled each participant in the study population to have an equal chance of participating in the study.

Sampling procedure

A simple lottery method was used, where small papers double the required sample size were made (120x2 = 240). Half of them were written on "YES" and the remaining half written

on "NO". These papers were folded very well, covering the words, and then placed in a tin and mixed very well. Pregnant women were then approached during their antenatal classes. There was a self-introduction, an explanation to the pregnant women about the purpose of the study, and those willing to participate in the study were asked to randomly pick one paper from the tin. After every pick, the flooded papers were mixed in a tin. Pregnant women whose papers read "YES" were asked to consent and recruited for the study. In case of the decline to participate of any participant, a pregnant woman was picked randomly to replace the participant. This was done on each day of data collection until the desired sample size was achieved. Pregnant women whose papers read NO were thanked for their willingness to join the study, however not enrolled in the study.

Data collection tools

Data was collected using questionnaires, which consisted of open and closed-ended questions. These questionnaires were pre-tested prior to data collection.
Laboratory results for urine culture were used to determine the prevalence of *K. Pneumoniae.*

Data collection method

The purpose of the study was explained to the selected study subjects, and participants who had met the inclusion criteria were asked to consent to be recruited in this study.
Oral interviews using a pre-tested semi-structured questionnaire were used to collect information about demographic data and risk factors associated with *K. Pneumoniae* among study participants. Filling the questionnaire required about 15-30 minutes
To enable the illiterates also to participate, the interviewer interpreted for them to understand the questions and give the appropriate response.

Laboratory diagnosis of *K. Pneumoniae*

Sample collection

Pregnant women were instructed to collect mid-stream urine samples of about 10ml in sterile, clean plastic urine containers with air-tight screw cap tops. Each urine sample bottle was labelled with a participant's study number.

Laboratory examination of urine for UTIs

Macroscopic appearance

Urine was observed to note the color and turbidity.

Microscopic examination:

Wet preparation examination:
Approximately 3ml of urine was picked aseptically from the urine container into a plastic test tube and centrifuged at 3000RPM for 2 minutes. After centrifuging, the supernatant fluid was poured away, and the sediment was left with the sediment, which was transferred to a glass slide.
The sediment was examined using a light microscope first by X10 to look for parasite larvae and ova, then high power (X40 objective) for: leukocytes, red cells, epithelial cells, casts, crystals, bacteria, yeast cells, and reported the findings.

Urine samples that had <5 WBC/HPF were regarded as negative, and urine samples with >5 WBC/HPF were positive for UTI and prepared for urine culture.

Culturing, Isolation, and Identification of *K. Pneumoniae*

Each of the UTI-positive urine samples was streaked using a sterilized wire loop onto the surface of MacConkey and blood agar plates. The plates were incubated at 37 °C for 24 hours to isolate the growing microorganisms. Colonies from cultures with significant growth were obtained and used for biochemical tests aiming at identifying *K. Pnueumoniae* from the bacterial isolates. Isolates were particularly subjected to Gram staining, methyl-red, indole, and citrate utilization tests.

Gram's Stain

Smears were made from isolates from each grown culture plate on a clean, grease-free glass slide and allowed to air dry and fix. The smears were flooded with crystal violet as a primary stain and were allowed to stain for 2 minutes, and then rinsed with water. A mordant (Lugol's iodine) was then flooded and allowed to stay for 1 minute, and rinsed with water. Smears were then flooded with secondary stain (neutral red) and were allowed to stain for 2 minutes, and then rinsed in water and allowed to air dry. The stained smear was then examined using a light microscope under an X100 objective for the Gram stain reaction.

Indole Test

The indole test was performed to test the isolated organism's ability to produce indole. Tryptophan broth was inoculated with an isolate of the test organism and incubated at 370 °C for 24 hours. After incubation, 0.5 mls of Kovack's reagents was added to the broth culture and observed for any color reaction. The presence of a red-pink ring at the surface of the media was indicative of the organism producing indole (Positive result), and the absence of a red-pink ring at the surface of the media or solution remaining yellow was a Negative result (no indole-producing organism).

Methyl Red Test

The Methyl Red test was performed to test the bacteria's ability to ferment glucose and produce large amounts of stable mixed acids that keep the pH low. Methyl Red- Voges Proskauer (MR- VP) broth was inoculated with an isolate of the test organism using a sterile inoculating loop and incubated at 370 °C for 24 hours. About 5 drops of Methyl-red reagent were added to the broth culture and observed for a color change. Red color was interpreted as a positive result, and yellow color was interpreted as a negative result.

Voges Proskauer Test

Voges Proskauer test was performed to detect the bacteria's ability to metabolize the pyruvate into a neutral intermediate product called acetoin (acetylmethylcarbinol). MR-VP broth was inoculated with an isolate of the test organism using a sterile inoculating loop and incubated at 370 °C for 24 hours. 6ml of 5% alpha-naphthol was added, followed by 0.2 ml of KOH. The tube was shaken gently and remained undisturbed

for 5 minutes, observed for any colour change. The presence of a red-pink ring at the surface of the media was indicative of the organism.
Positive result and absence of a red-pink ring at the surface of the media or solution, remains yellow was a Negative result.

Citrate Utilization Test

A citrate utilization test was done to determine the ability of an organism to utilize sodium citrate as its only carbon source and inorganic ammonium salts as its only nitrogen source. The surface of the Simmons citrate agar slant was streaked with a portion of a well isolated colonies. The cap of the slant was left on loosely and was incubated at 370 °C for 18-24 hours. After incubation, it was observed for a color change. Change of colour from green to intense blue was a positive result, and when the medium that remained green was a negative result.

Culture and biochemical results interpretation for *K. Pneumoniae*

Table 1: Showing the Culture and biochemical results interpretation for *K. Pneumoniae*

Test	***K. Pneumoniae***
MacConkey	large, pink-red, and mucoid, with a rounded, and Dome-shaped elevated colonies were observed.
Blood agar plate	Large, grey-white, and mucoid, with a rounded, dome-shaped elevation and a non-hemolytic surface, colonies were observed.
Gram staining	Gram-negative rods
Indole Test	Negative
Methyl Red Test	Negative
Voges Proskauer Test	Positive
Citrate Utilization Test	Positive

Antibiotic Sensitivity Test

The urine samples were cultured using Antibiotic sensitivity of the isolates was determined by a suspension of a pure colony from each confirmed culture isolate was performed by using 0.85% sterile normal saline, and the suspension. Using a sterile wire loop, the suspension was distributed evenly on Muller-Hinton agar.
Using a sterile wire loop, the suspension was distributed evenly on Muller-Hinton agar. The disk diffusion technique was implemented for antibiotic susceptibility patterns using different antibiotics. Then, we applied those antibiotics on a Mueller-Hinton agar plate and incubated them for 18 - 24 hours at 37˚C. Then, we applied those antibiotics on a Mueller-Hinton agar plate and incubated them for 18 - 24 hours at 37˚C. Inhibition zone diameters (IZDs) were measured. Drug tests were Levofloxacin (Lev), Ciprofloxacin, Gentamycin (CN), Meropenem, Nitrofurantoin, Ceftriaxone (CRD), Amoxicillin-Clavulanic-acid, and Cefixime (CTX).

Data collection procedures

Approval was sought from the research and ethics committee to conduct a study to determine the prevalence of *K. Pneumoniae* among pregnant women attending Entebbe Regional Referral Hospital in Wakiso District, whereupon approval was granted. The committee wrote an introductory letter.
An introductory letter was submitted from Mildmay Institute of Health Sciences to the person in charge of Entebbe Regional Referral Hospital, seeking permission to conduct the study.
Upon written approval, the person in charge of Entebbe Regional Referral Hospital introduced the investigator to the midwives, who later introduced the study participants.
The purpose of the study was explained to the selected study participants who had met the inclusion criteria and were asked to consent to participate in the study.
A self-administered questionnaire was given to each respondent who could read and write, while for respondents who could not read and write, the questionnaire was interpreted for them to understand and give appropriate answers that were filled out on their behalf.
Pregnant women were asked to provide urine samples for laboratory investigation for *K. Pneumoniae*. Urine samples were first investigated for UTIs microscopically, and then those that were positive for UTIs were cultured for bacterial growth, and then identification tests were performed to isolate *K. Pneumoniae*, and then microbial sensitivity was done.
The results obtained were recorded on the results tally sheet. All patients with positive UTIs were referred to clinicians for management.

Piloting the study

A pilot study was carried out in a small group of 5 to 10 pregnant women.

Quality Control

Laboratory standard operating procedures were followed. This was ensured through pre-testing of the questionnaire, training of a research assistant, giving ample time for data collection, not less than a month, piloting the study, and having very clear inclusion and exclusion criteria. Cross-checking the questionnaires whether it was filled out and also during data analysis to ensure correct entry

Data analysis and presentation

The questionnaires were sorted; data retrieved and entered into a computer Excel spreadsheet, and later analyzed using SPSS for Windows version 20 with the help of a Biostatistician. The summarized data were presented in the form of tables, percentages, and charts with a narrative under each.

Ethical considerations

Informed consent was obtained from the pregnant woman.
The names of the respondents did not appear on the data sheet except for the unique study number.
Information collected from pregnant women remained confidential, and only those directly linked to the study had access to the research data.
The data was kept under lock and key while in hard copies, and using a password when in soft copies to access it.
An introductory letter was obtained from the Principal, Mildmay Medical Laboratory Training School, to Entebbe Regional Referral Hospital.
Permission was obtained to carry out the study at Entebbe Regional Referral Hospital from the laboratory In-charge.

RESULTS

Participants Socio-demographic data

Table 2: Showing the study participants' socio-demographic data

Characteristic	Category	Number Examined	Percentage
		N = 120	(%)
Age	16 – 25	50	41.7
	26 – 35	44	36.7
	36 – 45	26	21.6
Marital status	Single	57	47.5
	Married	51	42.5
	Divorced	12	10.0
Education level	Informal education	26	21.6
	Primary	33	27.5
	Secondary	31	25.8
	Tertiary	30	25.0
Occupation	House wives	45	37.5
	Business women	25	20.8
	Students	19	15.8
	Civil servants	31	25.8

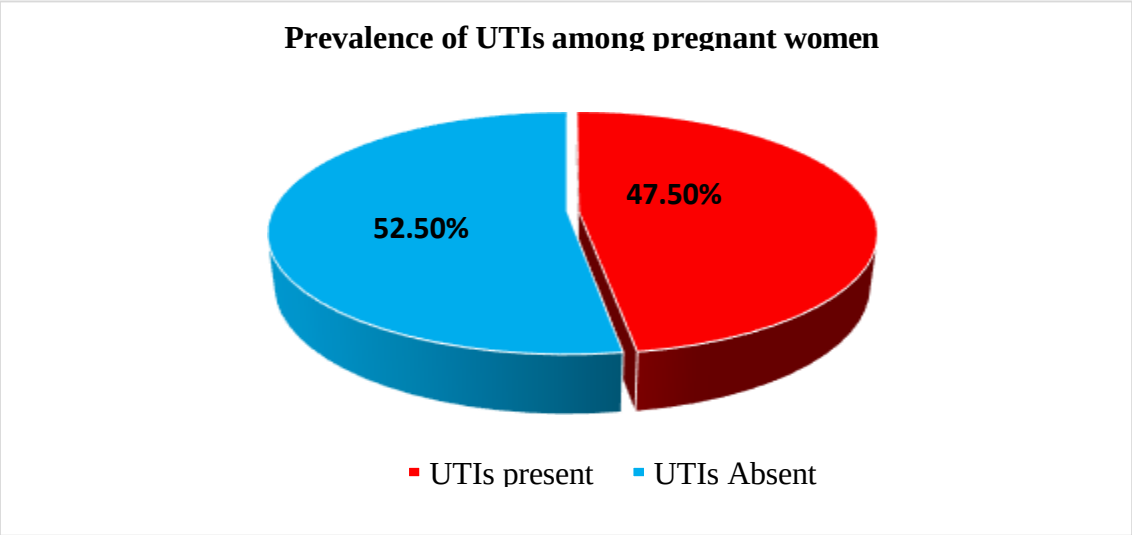
Source: Primary data

Table 2 shows that out of 120 study participants, the age group (16-25) years was represented the most, 41.7% (50/120), (26-35) years 36.7% (44/120), and the least was (36-45) years 21.6% (26/120).

The majority of the pregnant mothers, 47.5% (57/120), were single mothers, 42.5% (51/120) were married, and 10.0% (12/120) were divorced. 21.6% (26/120) of pregnant mothers had no formal education, 27.5% (33/120) had primary, 25.8% (31/120) had secondary level, and 25.0% (30/120) had tertiary level. Most of the pregnant mothers, 37.5% (45/120) were housewives, 20.8% (25/120) business women, 15.8% (19/120) students, and 25.8 % (31/120) civil servants. Most of the pregnant mothers were in the second trimester of the pregnancy, 45.0% (54/120), followed by those in the third trimester, 34.1% (41/120), and the least represented were those in the first trimester, 20.8% (25/120).

Prevalence of *K. Pneumoniae* among pregnant women

Figure 1: Showing the prevalence of UTIs among pregnant women



Source: Primary data

Figure 1 shows that 47.5% of the pregnant women had a UTI, while 52.5% of the pregnant women had no UTI.

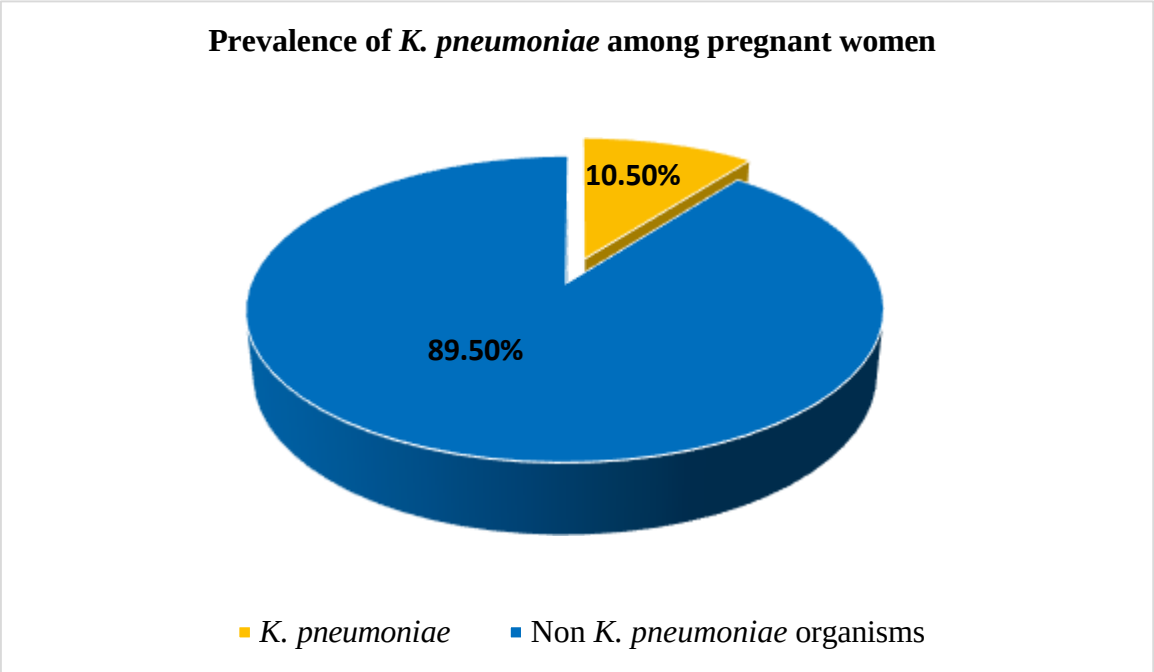
Table 3: Showing distribution of *K. Pneumoniae*

Urine Culture results	Number examined	Percentage (%)
K. Pneumoniae isolated	6	10.5
Non *K. Pneumoniae* organisms	51	89.5
Total	**57**	**100**

Source: Primary data

Table 3 shows that out of 51 urine samples cultured, 6 (10.5%) were positive for *K. Pneumoniae* and 51 (89.5%) were positive for non-K. *Pneumoniae* organisms.

Figure 2: Showing the prevalence of *K. Pneumoniae* among pregnant women



Source: Primary data

Figure 2 shows that out of 57 urine samples cultured, 10.5% were positive for *K. Pneumoniae*, while 85.5% were for non-K. *Pneumoniae* organisms.

Antimicrobial Susceptibility Patterns of *K. Pneumoniae*

Table 4: Showing sensitivity patterns of *K. Pneumoniae*

Antibiotic	Sensitive (%)	Intermediate (%)	Resistant (%)
Levofloxacin (Lev)	1 (16.1)	1 (16.1)	4 (66.7)
Ciprofloxacin	2 (33.3)	0 (0)	4 (66.7)
Gentamycin (CN)	1 (16.1)	2 (33.3)	3 (50.0)
Meropenem	6 (100)	0 (0)	0 (00
Nitrofurantoin	4 (66.7)	1 (16.1)	1 (16.1)
Ceftriaxone (CRD)	1 (16.1)	2 (33.3)	3 (50.0)
Amoxicillin-Clavulanic-acid	6 (100)	0 (0)	0 (00
Cefixime (CTX)	2 (33.3)	1 (16.1)	3 (50.0)

Source: Primary data

Table 4 shows that *K. Pneumoniae* is highly sensitive 6 (100%0 to Amoxicillin-Clavulanic- acid and Meropenem, 4 (66.7%) sensitive to Nitrofurantoin, and highly 4 (66.7%) resistant to Levofloxacin and Ciprofloxacin, 3 (50.0%) to Ceftriaxone and Gentamycin 3 (50.0%).

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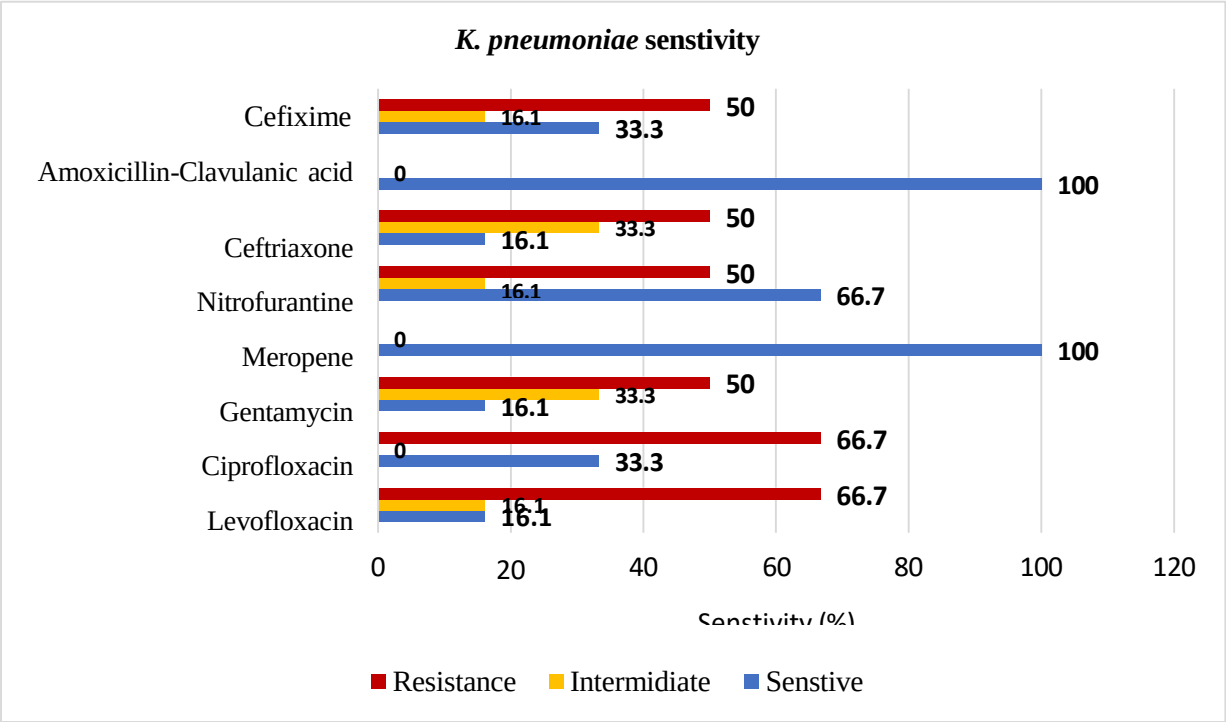
Figure 3: Showing *K. Pneumoniae* sensitivity



Source: Primary data

Figure 3 shows that *K. Pneumoniae* was 100% sensitive to Amoxicillin-Clavulanic acid and Meropenem, 66.7% sensitive to Nitrofurantoin, and highly 66.7% resistant to Levofloxacin and Ciprofloxacin, 50.0% to Ceftriaxone and Gentamycin.

Risk factors associated with the prevalence of *K. Pneumoniae*

Table 5: Showing risk factors for *K. Pneumoniae*

Characteristic	Category	Number examined	*K. Pneumoniae* positive n=6	Percentage (%)
Age (years)	16 – 25	50	3	50.0
	26 – 35	44	1	16.7
	36 – 45	26	2	33.3
Education Level	Informal education	26	1	16.7
	Primary	33	1	16.7
	Secondary	31	4	66.7
	Tertiary	30	0	0
Occupation	House wives	45	1	16.7
	Students	19	3	50.0
	Business women	19	1	16.7

	Civil servants	31	1	16.7
Gestational age	First trimester	25	2	33.3
	Second trimester	54	1	16.7
	Third trimester	41	3	50.0
Chronic illness	Diabetes mellitus	15	2	33.3
	HIV	11	1	16.7
	Other conditions	6	1	16.7
	None	88	2	33.3
Recurrent UTIs	Yes	36	5	83.3
	No	84	1	16.7

Source: Primary data

Table 5 shows that age group 16-25 years, 3 (50.0%), secondary level of education 3 (66.7%), third trimester 3 (50.0%), and recurrent UTIs 5 (83.3%) were risk factors for *K. Pneumoniae* among pregnant women.

DISCUSSION

Prevalence of *K. Pneumoniae* among pregnant women

The objective of this study was to determine the prevalence of *K. Pneumoniae* among pregnant women who attended the antenatal clinic at Entebbe Regional Referral Hospital in Entebbe District. Findings from the study showed that out of 120 pregnant women examined, 47.5% (57/120) were diagnosed with UTI. *K. Pneumoniae* was isolated from 10.5% (6/57) of the positive UTI samples. The prevalence of *K. Pneumoniae* reported in this study is comparable to findings by Opare-Asamoah *et al*. (2025), in Ghana, and Nteziyaremye *et al*. (2020), in Uganda, who documented *K. Pneumoniae* prevalence rates of 7.7% and 7.1%, respectively, among pregnant women.

However, the study findings are relatively high compared to those of Abebe *et al* (2025), who found a prevalence of 4.5% of *K. Pneumoniae* among pregnant women in Ethiopia. The observed difference is attributed to different study areas and the sample size. This study enrolled a low sample size compared to the other. The study findings were relatively lower compared to a recent study done in Uganda by Johnson *et al.* (2025), who isolated 37.41% *K. Pneumoniae* from asymptomatic pregnant women. The observed difference in results is due to the sample size, which was high, and the study population was the study population, which only focused on asymptomatic patients, compared to this study, which might have increased the prevalence.

Antimicrobial Susceptibility Patterns of *K. Pneumoniae*

The study determined the antimicrobial susceptibility patterns of *K. Pneumoniae* among pregnant women. The study found that *K. Pneumoniae* had 100% sensitivity to Amoxicillin-Clavulanic acid and Meropenem; the study findings are in agreement with findings of Hadi and Al-husseini. (2022) and Romyasamit *et al* (2021), who also reported *K. Pneumoniae* to be 100% sensitive to Meropenem. This could be because Meropenem and clavulanic acid are not normally dispensed at the counter; they are less misused, hence their high sensitivity.

However, the study findings disagree with Abebe *et al* (2025), who reported that *K. Pneumoniae*
showed 100% sensitivity to ampicillin and trimethoprim-sulfamethoxazole.

The study also found 50% of *K. Pneumoniae* resistant to Ceftriaxone, which was in agreement with Opare-Asamoah *et al* (2025), who reported a 14.3% sensitivity of *K. Pneumoniae* to Ceftriaxone. However, Johnson *et al* (2025) in Uganda reported a high resistance of 98.1% and 96% of K. pneumonia to Ampicillin and Amoxicillin, respectively, and a high sensitivity to Gentamicin, Ceftriaxone, Ciprofloxacin, and Cefotaxime (Johnson *et al*, 2025). The observed differences in the findings are due to the different study populations that have different health behaviors (drugs miss use) and lifestyles that can create resistance to some drugs.

Risk factors associated with *K. Pneumoniae*

The study identified risk factors associated with the prevalence of *K. Pneumoniae* and found that recurrent UTIs 83.3% was the major risk factor for *K. Pneumoniae* among pregnant women. The study finding was similar to the findings of Johnson *et al* (2025), who reported that a history of a previous diagnosis of UTI was the only significant risk factor for *K. Pneumoniae*. This is due to ineffective treatment of the previous infection that led to the development of resistant

strains. However, Odindo *et al* (2025) found no significant association between *K. Pneumoniae* and previous infection.
Educational level was also identified as a second risk factor of *K. Pneumoniae*. Pregnant mothers with a secondary level of education had 66.7% of acquiring *K. Pneumoniae*, which was similar to that found in Kenya by Odindo *et al* (2025), who reported a high prevalence among those who had a secondary level of education.20.6%.
Additionally, the age group 16-25 years 50.0% was associated with the prevalence of *K. Pneumoniae* among pregnant women. This finding was in agreement with the findings of Laari *et al* (2022), who reported a high prevalence of *K. Pneumoniae* among the age group 16-25. This could be because at this age most of them are first-time mothers and they haven't learnt who care for their pregnancies and lack competent skills in maternal hygiene. Howevere Trupthi and Rajini (2021) reported a high prevalence among 26-30 years, and Nteziyaremye *et al* (2020), among the age group < 20 years.
Besides age, gestation age was also a risk factor for *K. Pneumoniae*. Pregnant women in their third trimester of pregnancy were more likely to have *K. Pneumoniae* than in other trimesters. This is because at this stage, when the pregnancy has progressed, women find challenges in cleaning themselves and maintaining good hygiene. This finding disagrees with the findings of Laari *et al*. (2022), who reported a high prevalence of with in the first trimester.

CONCLUSION

There was a high prevalence of *K. Pneumoniae* at 10.5% from 47.5% UTI urine samples. Key risk factors associated with *K. Pneumoniae infection* included younger maternal age (16–25 years, 50.0%), secondary level of education (66.7%), third trimester of pregnancy (50.0%), and a history of recurrent UTIs (83.3%). Findings further highlight the growing concern of antimicrobial resistance among uropathogens in pregnancy, underscoring the importance of targeted screening and preventive strategies among high-risk groups to reduce maternal morbidity and adverse pregnancy outcomes.

RECOMMENDATION

Urine culture and sensitivity should be incorporated in the routine screening of women's UTIs for pregnant women during antenatal care to guide treatment.
Health education should be encouraged during antenatal visits.

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LIST OF ABBREVIATIONS

ASB: Asymptomatic Bacteriuria Antimicrobial Susceptibility Test
AST: Antimicrobial Susceptibility Test
BA: Blood Agar
CFU: Colony Forming Unit
***K. Pneumoniae*:** *K. Pneumoniae*
RTIs: Respiratory tract infections
UTIs: Urinary tract infections
E. Coli **:** Escherichia coli

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CONFLICT OF INTEREST

The author declares no conflict of interest.

AUTHOR CONTRIBUTIONS

FA- Study developer, pretested research tools, Data collector, Data entry, and analysis.
FS- Supervised the Study.
JFN-Supervised the Study.
AS-Supervised the Study.
JFN-Supervised the Study.

DATA AVAILABILITY

Data is available upon request.

INFORMED CONSENT

There was full disclosure; full comprehension, and respondents voluntarily consented to participate in the study.

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