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Assessing Antibiotic Prescriptions and Incidence of Urinary Tract Infection in Pregnant Women Attending Primary Health Care in Nablus City – Palestine

Lara Zahi Khatatba

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Assessing Antibiotic Prescriptions and Incidence of Urinary Tract Infection in Pregnant Women Attending Primary Health Care in Nablus City – Palestine

Prepared by:

Lara Zahi Khatatba, MD

Supervised byDr. Dala Daragmeh, Ph.D

Thisthesis is submitted in partial fulfillment of the requirements for the degree of Master of Infectious Diseases Prevention and Control inthe Faculty of Public Health, Al Quds University.

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Prepared by: Lara Zahi Khatatba

Registration No.: 22312332

Supervisor: Dr.Dala Daragmeh

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The names and signatures of the examining committee members as follows:

1. **HeadofCommittee: Dr.Dala Daraghmeh Signature** Dala Daraghmeh
2. **InternalExaminer: Dr.Mohammad Qadi Signature**
3. **ExternalExaminer:Dr.Hussein Hallak Signature:**

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آية قرآنية

بسم الله الرحمن ا لرحيم

{يَرْفَعِ اللَّهُ الَّذِينَ آمَنُوا مِنْكُمْ وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ}

صدق الله العظيم

الإهداء

{وآخر دعواهم أن الحمدلله رب العالمين}

الى من دعمني بلا حدود وأعطاني بلا مقابل.. الى من علمني ان الدنيا كفاح وسلاحها العلم والمعرفة.. داعمي الأول في مسيرتي وسندي وقوتي بعد الله "والدي الغالي"

الى من جعل الله الحنة تحت أقدامها.. الى من كان دعاؤها سر نجاحي .. قدوتي ومعلمتي الأولى وصديقة أيامي " والدتي الحنونة "

الى من كان لي خير عون وسند وامدني بالقوة وآمن بي ودعمني في كل الأوقات سندي وكتفي الذي استند عليه دائما " زوجي الغالي "

الى قرة عيني ونبض قلبي.. الى من تحملوني واعطوني الدافع للإستمرار..زينة حياتي ومصدر الهامي "ابنائي الصغار تيم وآيلين"

الى من شد الله بهم عضدي فكانو خير معين الرفقة الطيبة والدعاء الخفي " اخي واخواتي"

الى من ساندوني ودعموني في اوقاتي الصعبة وكانو خير معين لابنائي عائلتي الثانية " أهل زوجي "

الى مشرفتي العزيزة د. دالا دراغمة وكل عضو في هيئة التدريس كان لي خير معلم وساهم في بلوغي لهذا الهدف ادامكم الله

والى من هم اعظم منا جميعاً الى اللذين ضحو بحياتهم في سبيل الحرية شهداءنا الابرار الى غزة الصامدة الى فلسطين كل فلسطين

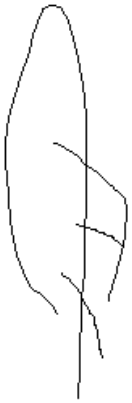
Lara Zahi Khatatba

Declaration

Icertifythatthisthesissubmittedforthedegreeofmasteristheresultofmyresearch,except whereotherwiseacknowledged,andthatthisthesisoranyofitspartshasnotbeensubmitted for a higher degree to any other university or institution.

Student'sName: **Lara Zahi Khatatba**

Signature:



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Abstract

Background: Urinary tract infections (UTIs) are a common complication during pregnancy, with up to 20% of pregnant women affected. Empirical antibiotic prescribing is frequent, yet often lacks microbiological confirmation, which contributes to the rising incidence of antimicrobial resistance (AMR). In Palestine, limited data exist on the appropriateness of antibiotic use and resistance patterns among pregnant women.

Aim: This study aims to assess the appropriateness of existing antibiotic prescribing practices for UTIsamong pregnant women within Nablus's primary healthcare system. It also seeks to identify the prevalence of recurrent and antibiotic-resistant UTIs.

Methodology: A prospective cohort study was conducted between December 2024 and May 2025 in primary healthcare clinics in Nablus, Palestine. A total of 485 pregnant women were enrolled. Data were collected using structured questionnaires and laboratory analyses, including urine cultures and antibiotic susceptibility testing. Antibiotic prescriptions were evaluated against international guidelines, particularly those from the American College of Obstetricians and Gynecologists (ACOG).

Results: Among participants who underwent urine culture (n = 279), 115 (41.2%) had culture-confirmed UTIs. *Escherichia coli* (38.3%) and *Staphylococcus aureus* (22.6%) were the most commonly isolated pathogens. Multidrug resistance was observed in 52% of isolates. Empirical antibiotic treatment was common (55.5%),while 77.3% of prescribed antibiotics followed appropriate dosing and duration, with only 22.7% aligned with ACOG-recommended first-line therapies for pregnancy. Among the 120 participants followed for 90 days, recurrent UTI was identified in 18 cases (15%). However, recurrence was not significantly associated with age, income, parity, trimester, or history of abortion.

Conclusions: Although empirical prescribing practices generally met standards for dosage and duration, antibiotic selection often diverged from first-line recommendations. The high rate of multidrug resistance underscores the urgent need for improved diagnostic practices and adherence to evidence-based guidelines. Strengthening antimicrobial stewardship in antenatal care is essential to improving maternal outcomes and reducing AMR in resource-limited settings.

Keywords:
Antibiotic prescribing, Antibiotic stewardship, Antimicrobial resistance, Asymptomatic bacteriuria, *Escherichia coli*, Multidrug resistance, Palestine, Pregnancy, Primary health care, Urinary tract infection.

List of abbreviations

ACOG	American College of Obstetricians and Gynecologists
AMR	Antimicrobial Resistance
AS	Antimicrobial Stewardship
ASB	Asymptomatic Bacteriuria
CAUTI	Catheter-Associated Urinary Tract Infection
CDC	Centers for Disease Control and Prevention
CFU	Colony Forming Unit
CLSI	Clinical and Laboratory Standards Institute
CNS	*Coagulase-Negative Staphylococci*
E. coli	*Escherichia coli*
FDA	Food and Drug Administration
HCW	Health Care Worker
IRB	Institutional Review Board
IV	Intravenous
MDR	Multidrug Resistance
MOH	Ministry of Health
PCR	Polymerase Chain Reaction
SPSS	Statistical Package for the Social Sciences
UTI	Urinary Tract Infection
WHO	World Health Organization

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ChapterOne

1.1. Introduction:

A urinary tract infection (UTI) refers to both microbial colonization of the urine and tissue invasion of any structure of the urinary tract(Obeagu EI, 2023). Women are more susceptible to UTIs than men due to physiological variations; 50%–60% of women will get an infection at least once in their lifetime. The risk rises to 20% during pregnancy (Medina & Castillo-Pino, 2019). Acute cystitis occurs in 1-2% of pregnant women. Approximately 1–2% of pregnant women experience pyelonephritis. Asymptomatic bacteriuria constitutes 2–7% of infections in pregnant individuals (Nicolle et al., 2019). Typical indications and symptoms of a UTI include increased frequency, urgency to urinate and dysuria, suprapubic pain, and hematuria. Acute symptoms of pyelonephritis may encompass fever, chills, nausea, and vomiting (Al Lawati et al., 2024). The bacteria responsible for UTIs are frequently commensal and typically enter the urinary tract through the fecal-oral route or can ascend the urethra, leading to bladder infection(Meštrović et al., 2020, Al Lawati et al., 2024). *Escherichia coli (E. coli)* is the most prevalent pathogen, followed by *Klebsiella pneumoniae (K. pneumoniae*), *Proteus mirabilis (P. mirabilis*) (Morganellaceae), and *Enterococcus* species (Ejerssa et al., 2021; Zhou et al., 2023). Both symptomatic and asymptomatic UTIs have detrimental effects, particularly when associated with pyelonephritis, which increases the likelihood of premature birth. Infants have increased rates of low birth weight and fetal demise(Ranjan et al., 2017). Preeclampsia, gestational hypertension, anemia, thrombocytopenia, transient renal insufficiency, and postpartum endometritis are recognized as complications associated with UTIsin pregnant women (Nicolle et al., 2019). Recurrent UTIsprimarily result from reinfection by the same

microorganisms. A UTI is considered recurrent if it has manifested at least three times, accompanied by three positive urine cultures within the preceding 12 months, or if there have been two infections within the last six months(Sgarabotto et al., 2025).

The National Institute for Health and Care Excellence (NICE) provided guidelines for antibiotic prescriptions that advocate prudent use based on evidence-based treatment for infections. Approximately 80% of drug prescriptions during pregnancy are antibiotics(Gamberini et al., 2023). Research indicates that the majority of these antibiotics are prescribed for UTIs (Ghouri & Hollywood, 2020). It is typically administered empirically in practice, often disregarding the outcomes of urine culture tests(Al Kady et al., 2024. Choosing an antibiotic for use during pregnancy necessitates selecting one with a favorable safety profile for both the mother and fetus, alongside high effectiveness and low resistance rates(Chardavoyne & Kasmire, 2020). Antimicrobial resistance (AMR) occurs as a natural consequence of genetic alterations in pathogens throughout time(Salam et al., 2023). The inappropriate use and overuse of antibiotics designed for treating, preventing, or managing diseases in humans, animals, and plants play a substantial role in this problem. The frequency and spread have increased (World Health Organization, 2023).This will lead to various consequences, including prolonged hospitalizations, elevated morbidity and mortality rates, and unsuccessful treatment outcomes. This consequently elevates the risk associated with other medical procedures and treatments, including surgery and cesarean sections(Chinemerem Nwobodo et al., 2022).

1.2. Problem statement:

It is essential during pregnancy to treat UTIs promptly due to the increased risk of pyelonephritis, which can lead to complications for both the mother and the baby, such as premature birth, low birth weight, and sepsis(Bilgin et al., 2021). Recent antibiotic resistance has rendered many treatments ineffective, including*E. coli* producing extended-spectrum beta-lactamase and *Staphylococcusaureus (S. aureus*)exhibiting resistance to methicillin. This complicates therapy, especially during pregnancy, due to the limited availability of safe antibiotics(Salam et al., 2023).

Despite these diverse negative outcomes for pregnant women and fetuses, studies focusing on pregnant women in Palestine are limited and mostly unpublished. Two small studies have been conducted in Palestine about UTIs in pregnant women. One of them investigated lower urinary tract symptoms (LUTS) during pregnancy; It revealed that LUTS are a prevalent problem among Palestinian pregnant women, and it is directly related to women's age, gestational age, and parity(Saffarini et al., 2021).An unpublished 2020 study at Ramallah Governmental Hospital reported that 33.6% of

high-risk pregnant women had significant bacteriuria ($\geq 10^5$ CFU/mL). However, the study excluded women with diabetes mellitus and did not assess the appropriateness of prescribed antibiotics, limiting its generalizability to all pregnant women (Majd Milhem, 2020).

Research initiatives should prioritize the collection and analysis of data specific to pregnant women to tailor treatment strategies that are both effective and safe for this vulnerable group. Collaborative efforts between healthcare providers, microbiologists, and public health officials are essential to identify the most common pathogens and resistance patterns in the region. Additionally, educational programs for healthcare professionals and expectant mothers can help in the early recognition and management of UTIs, reducing the reliance on antibiotics by emphasizing preventive measures.

1.3. Aim of the study:

Evaluating the appropriateness of current antibiotic prescribing practices for treating UTIsand determining the prevalence of recurrent and antibiotic-resistant UTIs among pregnant women within the primary healthcare system in Nablus, Palestine.

1.4. Objectives for this study:

- Assess the incidence of UTIs in pregnant womenattending primary healthcare clinics in Nablus.
- Assess the appropriateness of antibiotic prescriptions for UTIs in pregnant women using diagnostic guidelines established by the American College of Obstetricians and Gynecologists (ACOG) as a reference point and evaluate compliance with these standards.
- Determine the incidence of antimicrobial resistance among the participating pregnant women, and explore the connection between specific antibiotic classes and their resistance patterns.
- Identify the sociodemographic, clinical, and behavioral factors associated with UTI incidence and recurrence.

1.5. Study Justification and Significance:

Among the population, pregnant women are more vulnerable to UTIs due to hormonal changes in the urinary tract, immunologic changes, and practices like overusing antibiotics to treat (Ledger & Blaser, 2013). Strong data show that pregnant women frequently receive excessive antibiotic prescriptions for UTIs, which increases the

prevalence of UTIs resistant to these antibiotics (Sekikubo et al., 2017).According to recent epidemiological studies, strains showed a high prevalence of resistance (50–60%) against commonly used antibiotics; these strains have a substantial clinical impact on pregnant patients, so it is important to evaluate the distribution of antibiotic resistance patterns among them (Ntirenganya et al., 2015).

In 2019, a study revealed that in Palestine, there were 346 deaths attributable to AMR and 1,400 deaths associated with AMR. Across 204 countries, Palestine has the 104th highest age-standardized mortality rate per 100,000 population related to AMR. The study concluded that the number of AMR deaths in Palestine is higher than deaths from maternal and neonatal disorders and other diseases. The most common pathogens associated with AMR in Palestine, leading to the number of deaths are: *S. aureus* (345), *E. coli* (217), and *Klebsiella pneumonia* (203) (Institute for Health Metrics and Evaluation, 2019).
However, there is a lack of information about the influence of pregnancy on the rate of AMR and the appropriateness of antibiotic prescriptions used in Palestine's antenatal care clinics.

Therefore, this study serves as foundational research that could significantly impact the development or enhancement of specifically tailored treatment protocols. It could also assist policymakers and clinicians in formulating guidelines for more rational prescribing.

Chapter Two

Literature Review

2.1Overview of UTIs in Pregnant Women:

The American Urological Association defines UTIs as "a combination of a pathogen(s) within the urinary system and symptoms and/or inflammatory response to the pathogen(s) requiring treatment."(Brubaker et al., 2018).

UTIs are notably prevalent among pregnant women, with a notable increase in recurrence and acute pyelonephritis risk. This vulnerability is due to physiological changes during pregnancy. An updated overview published in 2016 showed that 2-10% of pregnant women have been affected at least by one of the three clinical types of pregnancy-related UTI. This includes: asymptomatic bacteriuria (ASB), cystitis, and pyelonephritis. All clinical types often lead to complications that can affect both the mother and the developing fetus(Szweda & Jóźwik, 2016).

2.2 Burden of UTI:

The burden of UTI in pregnancy varies widely. Globally, the cumulative incidence of UTI during pregnancy is estimated to range between 3% and 10%**,** with acute cystitis occurring in approximately 1–2% of pregnancies and acute pyelonephritis in about 0.5%(The American College of Obstetricians and Gynecologists, 2023).However, the incidence varies widely across countries. For instance, studies from Nigeria have reported high incidence rates of 47.5% (N. G. et al., 2013). These variations may be attributed to differences in population characteristics, study design, diagnostic criteria, and healthcare practices across settings.

A study done in 2022 revealed an alarming 70.4% prevalence of ASB among pregnant women attending antenatal care services. Pregnant women in the second trimester (28.16%) and first

trimester (25.35%) were the most affected, while women aged 24–29 (28.16%) were the most affected (Yadufashije et al., 2022).

Cross-sectional studies in Ghana (Vicar et al., 2023), Hargeisa (Ali et al., 2022), Zambia (Yeta et al., 2021), and Ethiopia (Gessese et al., 2017)reported significant bacteriuria among both symptomatic and asymptomatic pregnant women. They also documented variations in AMR patterns and highlighted the risks of undiagnosed or untreated UTIs. These findings underscore the importance of performing urine cultures and susceptibility testing before treatment, as well as conducting periodic surveillance to guide clinical management.

2.3 Causative Organisms:

A large 18-year retrospective cohort study identified E. coli in 82.5% of culture-confirmed acute pyelonephritis cases in pregnancy, with another three-year retrospective Irish cohort documenting a 60% prevalence of E. coli as the causative pathogen in antenatal pyelonephritis*(Barry et al., 2023; Wing et al., 2014)*. Other bacteria that may be seen include *Klebsiella pneumonia* (11%), *Proteus*(5%), *Staphylococcus*, *Streptococcus*, and *Enterococcus species*. A recent investigation of 210 pregnant women with confirmed UTI (out of 350 total) found that *E. coli* was the predominant pathogen—identified in 42.9% of cases—while *Pseudomonas aeruginosa (P. aeruginosa*),*K. pneumoniae*, and other strains also contributed to the bacterial profile(Dautt- Leyva et al., 2018).

2.4 Risk factors:

The existing literature has revealed that many factors influence the risk of UTI among pregnant women, including age, literacy, residence, gestational age, parity, anemia, incomplete bladder emptying, history of UTIs, and low socioeconomic status(Emiru et al., 2013; Haider et al., 2010; Labib Al-Kashif, 2019; Obeagu EI, 2023). Other risk factors for UTIs related to sexual practices and hygiene behaviorsinclude: washing the genitalia from back to front, using non-cotton underwear, using soap for the vaginal area, not drying genitals after washing, and not changing underwear regularly(Hatamleh et al., 2024a).

2.5 Recurrent UTIs:

Recurrent UTI refers to the occurrence of more than two symptomatic episodes within 6 months or more than three symptomatic episodes within 12 months(Sgarabotto et al., 2025).
Studies report recurrence rates ranging from 20–40% within 6 months of a UTI diagnosis. An example: in a study evaluating the appropriateness of antibiotic prescribing for UTI patients, it was found that the recurrence rate was significantly higher in pregnant women, especially with the frequent use of antibiotics(Brubaker et al., 2018).Another retrospective study in Abu Dhabi showed that recurrent UTI was observed in 26.6% of pregnant women with UTI (Balachandran et al., 2022).

2.6 Antibiotic Prescribing Practices in Primary Health Care:

Antibiotic prescriptions for UTIs are a common practice in healthcare settings. Choosing the appropriate antibiotic is crucial in pregnant women to protect against recurrent infections, resistant strains and ensure successful treatment outcomes, and prevent complications(Chardavoyne & Kasmire, 2020).

A review of international guidelines, "Which Antibiotic for Urinary Tract Infections in Pregnancy?", emphasized that antibiotics used during pregnancy must be safe for both mother and fetus. Guidelines from multiple continents agree that first-line treatments for lower and upper UTIs are generally similar worldwide. However, selecting the appropriate antibiotic should consider local antimicrobial resistance patterns and be guided by both literature and international recommendations(Corrales et al., 2022).

Some studies have examined antibiotic use in pregnancy on a global scale. For example, the survey "Antibiotic Use in Pregnancy" highlighted variability in prescribing practices across different regions and emphasized the importance of following national and international guidelines to ensure safe and appropriate antibiotic use (Gamberini et al., 2023). Other studies focused on national practices; an audit in London found that although a large number of antibiotics were prescribed during pregnancy, only 44% aligned with recommended first-line options, suggesting room for improvement in guideline adherence within primary care (Ghouri & Hollywood, 2020).

Other studies have shown that the incidence of optimal empiric antibiotic therapy for UTIs in outpatient clinics is not always met, leading to recurrent infections despite adequate treatment (Walters et al., 2020).

A prospective study in South Lebanon (April–July 2022) evaluated whether incorporating urine culture after a positive dipstick could reduce unnecessary antibiotic use in pregnant women with suspected UTIs. Among 449 participants, 81 (18%) had positive cultures. Relying solely on dipstick results would have led to unnecessary antibiotic treatment in 368 women (82%). Of the 197 symptomatic women treated empirically, 155 (79%) received fosfomycin and 42 (21%) received cefixime. *E. coli* (79%) and *Proteus* species (11%) were the most commonly isolated bacteria. Resistance was observed in 5% of isolates to fosfomycin and 48% to cefixime. These findings highlight the risk of antibiotic overprescription and its potential contribution to antimicrobial resistance in pregnant populations (Al Kady et al., 2023).

Antibiotic stewardship programs are essential for optimizing antibiotic use, ensuring accurate diagnosis, evidence-based treatment of UTIs, and protecting patients from unnecessary exposure. One such outpatient program, theFive Ds, emphasizes the right diagnosis, drug, dose, duration, and de-escalation to guide clinicians and reduce inappropriate prescribing in primary care. In pregnant women, recurrent uncomplicated UTIs are often linked to a higher prevalence of antibiotic-resistant strains, underscoring the importance of prudent antibiotic use (Goebel et al., 2021).

2.7 UTI treatment guidelines:

UTI treatment guidelines as recommended by the American College of Obstetricians and Gynecologists (ACOG) Committee on Clinical Consensus:

Asymptomatic Bacteriuria (ASB) treatment

Clinicians should prescribe a 5–7-day course of targeted antibiotics to treat ASB with colony counts of 100,000 CFU/mL or higher. There is insufficient evidence to recommend for or against repeat screening after appropriate treatment of an initial episode of ASB.

Acute Cystitis treatment:

Clinicians should treat acute cystitis in pregnant individuals with a 5–7-day course of a targeted antibiotic. If empiric therapy is started before culture and sensitivity results are available, amoxicillin or ampicillin regimens should be avoided due to the high rates of resistance in *E.coli* to these antibiotics in most areas.

Clinicians may consider repeating a urine culture 1–2 weeks after completing treatment for acute cystitis or evaluating only if symptoms recur.

Pyelonephritis treatment:

Clinicians initially should manage pyelonephritis in pregnancy in an inpatient setting. Empiric antibiotics must penetrate renal tissue and target likely infections. Based on urine culture and sensitivity, antibiotics must be adjusted. The patient must receive parenteral antibiotics until clinical improvement. Patients should complete a total of 14 days of antibiotic therapy.

Clinicians may consider suppressive therapy for the remainder of the pregnancy for recurrent UTI.

Table 2.1: Summary table for antibiotic regimens used to treat asymptomatic bacteriuria and acute cystitis in pregnant women.

Condition	**Antibiotic**	**Dosage**	**Duration**	**FDA Pregnancy Category**
Asymptomatic Bacteriuria and Acute Cystitis	Nitrofurantoin	100 mg orally twice daily	5-7 days	B (avoid after 38 weeks)
	Amoxicillin Amoxicillin\ Clavulanic Acid	500 mg orally three times daily	5-7 days	B
	Cephalexin	500 mg orally twice daily	5-7 days	B
	Fosfomycin	3 g orally as a single dose	Single dose	B
References: ACOG, Centers for Disease Control and Prevention (CDC),World Health Organization (WHO), and FDA				

Chapter Three

Methodology

3.1 Study Design

A prospective cohort study was conducted in primary healthcare clinics in Nablus from December 2024 to May 2025. This study incorporated both questionnaires and laboratory analyses of samples collected from the participants.

3.2 Study Setting

The study was conducted in the primary health care clinics in Nablus City, West Bank. The selected clinics are governed by the Palestinian MOH and serve as central and referral clinics (Table 2).

Table 3.2: Routine ANC schedules by clinic.

Clinic	Routine ANC Schedule
Muhammad Al-Maktoum Clinic (Balata)	Weekly
Al-Makhfiya Clinic	Weekly
Beit Furik Clinic	Monthly
Aqraba Clinic	Monthly
Madama Clinic	Monthly
Jamma'in Clinic	Monthly
Huwwara Clinic	Monthly
Qabalan Clinic	Monthly
Urif Clinic	Monthly
Duma Clinic	Monthly
Beit-Iba Clinic	Monthly
Asira Al-Shamaliya Clinic	Monthly

3.3 Study population: Sample Frame and Sampling Method

The sample consisted of all pregnant women aged 18 years and above who attended primary healthcare clinics governed by the Palestinian Ministry of Health and had consented to participate in this study.

3.4 Inclusion-exclusion criteria:

- **Inclusion criteria:**

All pregnant women aged 18 years and above who attended an antenatal clinic and consented toparticipate in this study.

- **Exclusion Criteria:**

We excluded any pregnant women who had been under antimicrobial treatment for a UTI within the two weeks before selection, who provided inadequate urine samples (less than 10 ml urine), whose urine specimens were collected more than 2 hours before receipt for laboratory diagnosis, with specimens submitted in leaking or dirty unsterile containers, and specimens revealing growth of more than two types of bacteria on culture.

3.5 Study Tools:

Study questionnaire and its validation procedure:

The data were collected using a questionnaire originally written in English (Appendix 2) and then translated into the native Arabic language (Appendix 3). The questionnaire was prepared after an extensive review of the literature, (Emiru et al., 2013; Ezugwu et al., 2021; Kant et al., 2017; Labib Al-Kashif, 2019)but some modifications were implemented, such as adding and excluding certain questions.To validate these changes, the questionnaire was reviewed by a panel of specialists in the fields of urology, gynecology, and clinical pharmacy. Initially, a pilot study was conducted using a primary survey. During this pilot study period, questionnaires were given to only 10 respondents who did not participate in the full study to measure the respondents' comprehension of the questions. Following the pilot study, further adjustments were considered.
The finalized structured questionnaire consists of four sections and contains a total of 39 questions divided into 2 parts.

- **The baseline part, which includes:**

  Section 1: Sociodemographic characteristics, including age, residency, education level, and monthly income.

Section 2: Medical and obstetrical information, covering pregnancy, gestational age, gravidity, parity, allergies, comorbidities, history of previous UTIs, and history of catheterization due to UTI

Section 3: Behavioral characteristics, focusing on adequate fluid intake, the consumption of salty foods and pickles, and the use of certain complementary and alternative therapies such as cranberry, vitamin C, and probiotics.

- **The follow-up part, which includes:**

Section 4: Clinical characteristics, detailing symptoms of UTIs, the method used for diagnosing UTI (whether the urine culture was accepted or rejected by the participant), whether the antibiotic was prescribed or not, its name, route, dose, and duration, whether it was changed after culture results, and the compliance of the participants. And finally, if the symptoms improved after completing the course for symptomatic cystitis.

This study was conducted in five consecutive parts as follows (Figure 1):

Part 1: Baseline data collection

At the time of enrollment, after obtaining informed consent, baseline data were collected through face-to-face interviews and review of the participants' medical files by the researcher. She was then personally administered the structured questionnaire, which is anticipated to take approximately 10 to 20 minutes to complete.

Part 2: Laboratory sample collection.

Urine cultures were processed in selected private laboratories that strictly adhered to the Clinical and Laboratory Standards Institute (CLSI) 2023 edition guidelines for specimen processing, culture, and antimicrobial susceptibility testing. These laboratories were chosen for their compliance with standardized procedures and their proximity to the study clinics.

Participants were given verbal instructions based on CLSI guidelines on the steps for collecting a 10-milliliter clean-catch mid-stream urine (MSU) sample in a wide-mouthed sterile container. A volume of 10 mL was requested to ensure adequate urine for culture, microscopy, and possible repeat testing from the same specimen. The collected urine sample was labeled and transported to the laboratory.

Part 3: Urine Culture and Microbiological Analysis

Samples were inoculated using a calibrated loop (0.001 mL), which standardizes the inoculum and enables the accurate calculation of CFU/mL. They were then plated on blood agar and MacConkey agar for isolation and quantification(Clinical and Laboratory Standards Institute,

n.d.). Urine samples were also centrifuged to produce sediment for microscopic analysis, which included counts of red and white blood cells (pyuria), squamous epithelial cells, and bacteria.
After overnight incubation at 37 °C for 24–48 hours, colony counts were counted to check for significant growth.
Bacterial identification was conducted through:

- Colony morphology
- Gram staining
- Biochemical tests (e.g., indole, citrate, urease) based on standard microbiological protocols.

Diagnostic thresholds were applied as follows: significant bacteriuria (asymptomatic): $\geq 10^5$ CFU/mL of a single organism; acute cystitis (symptomatic): $\geq 10^3$–10^4 CFU/mL with pyuria and compatible urinary symptoms; negative culture: absence of pyuria and bacterial growth $<10^3$ CFU/mL.
The antibiotic panel tested included amoxicillin-clavulanic acid, ampicillin, cefuroxime, cefixime, ceftriaxone, nitrofurantoin, fosfomycin, trimethoprim-sulfamethoxazole, and ciprofloxacin.

Part 4:Antibiotic Susceptibility Testing

Antibiotic susceptibility testing was performed using the disk diffusion method and sub-culturing on Mueller-Hinton media. And results were interpreted according to CLSI (2023) guidelines. The sterile antibiotic disks were utilized according to their availability in the laboratory during the study period. The plates were allowed to stand for a few minutes and subsequently incubated at 37°C for 24 hours, within 15 minutes of application. Antibiotic sensitivity was assessed by measuring the zone of inhibition from the back of the plate to the nearest millimeter using a ruler or caliper. That was measured to determine the resistance, intermediate susceptibility, or susceptibility of the bacterial isolates.
Bacteria were classified into each of the antibiotics used in the test as:

- Sensitive (S)
- Intermediate (I)
- Resistant (R)

Part 5:Assessment of n Prescribed Antibiotics

The chosen antibiotic was reviewed to determine whether it wasprescribed based on culture results and whether it was changed as appropriate to a narrow-spectrum antibiotic if the empirical one was broad-spectrum. then,assisted if itcorresponded with the recommendations based on ACOG guidelines, as shown in Table 1. This included examining whether the prescribed antibiotic is among the safe treatments that can be used during pregnancy (including

nitrofurantoin, amoxicillin, cephalexin, amoxicillin-clavulanic acid, and Fosfomycin), which are recommended as first-line treatment for UTI in pregnancy. Thisinformationwas then documented on the questionnaire (The American College of Obstetricians and Gynecologists, 2023) (The American College of Obstetricians and Gynecologists, 2023).

Follow-up

Afollow-up section of the questionnaire had been completed, and the participants underwent urine analysis for follow-up within three months of data collection.

3.6 Study tools validation

Urine samples were validated using control samples, and accreditation was done in a chosen Palestinian quality testing laboratory accredited by the Clinical Laboratory Improvement Amendments (CLIA). Finally, statistical methods were used to assess the validity of results, including the calculation of the mean, standard deviation, and confidence intervals to represent data variability. And regularly analyze error rates and discrepancies to identify potential issues and areas for improvement.

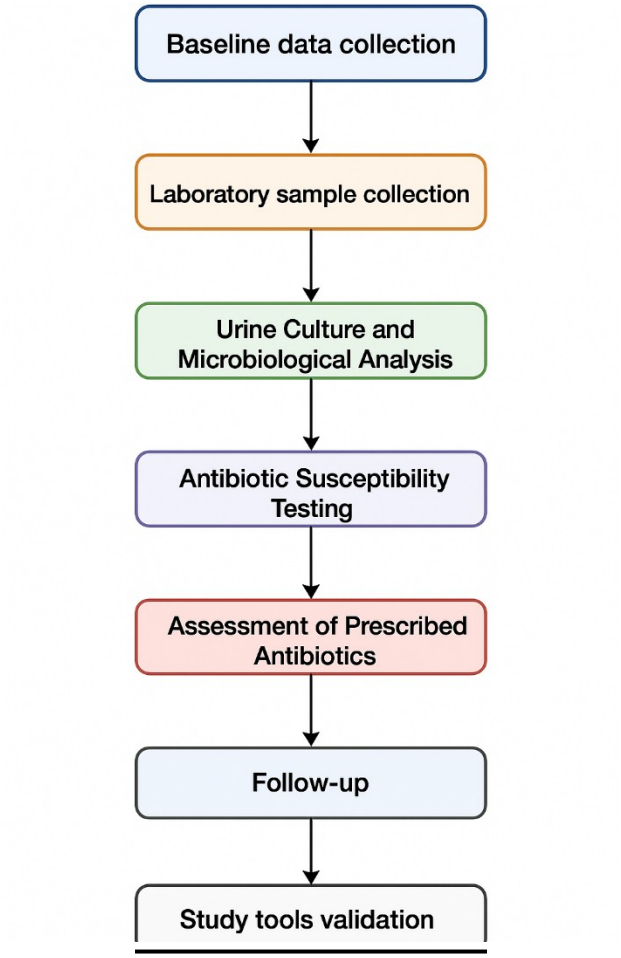

Figure 3.1: Study workflow.

3.7 Ethical Consideration:

The study protocol was given ethical approval from the ethical committee at Al-Quds University, archive number (461/REC/2024) (Appendix 4), and the local health authorities that had jurisdiction over the local study population (Appendix 5). Before each participant participated in the study, informed consent was acquired. The information they shared for this study was kept confidential. No identifying information will be disclosed in the reporting process.

3.8 Data analysis

After data collection was done, it was extracted and recorded in an Excel workbook (Microsoft Office, 2024). Before analysis, data cleaning, coding, and grouping were conducted. Data was

then summarized using descriptive statistics. All variables collected through the questionnaire and lab data were summarized by calculating the frequency (%) for binary variables.

Statistical Tests: Employed statistical techniques such as chi-square tests for categorical data.The corresponding 95% confidence interval (CI). Significance was considered at a p-value of <0.05. All analyses were carried out using SPSS version 27.

Chapter Four
Results

4.1 Sociode mographic and clinical characteristics of participants

Table 4.1 presents the sociodemographic data collected from study participants. The results showed that the largest age group was 25–34 years, comprising 51.1% of the participants.This was followed by the 18–24 age group at 33.2%, the 35–44 age group at 14.8%, and the >45 category,which comprised only 0.8%.

Regarding educational levels, the largest proportion held a Bachelor's degree (50.9%), followed by those who completed high school (44.5%), then those with primary education (3.3%). The smallest groups were participants with Master's/PhD degrees (0.8%) and illiterate individuals (0.4%). Most participants were housewives (87%), while 13% were employed or in business. In terms of income, the largest group reported earning 2,000–4,000 NIS per month (61.4%), which we defined as middle income based on PCBS poverty and household needs data. About 27.8% fell below 2,000 NIS (low income), and only 10.7% reported more than 4,000 NIS (high income) (Palestinian Central Bureau of Statistics, 2004).

Regarding smoking habits, the findings showed that a significant majority of the participants were non-smokers (81.2%), with 12.6% identified as ex-smokers, and current smokers represented the lowest proportion at 6.2%.

When it comes to residency, most participants lived in villages (72.2%), followed by those residing in cities (23.9%), and the smallest portion lived in camps (3.9%). The table also pointed out current medication use and medical history among participants. The results showed that only 19.8% of participants were taking medications at the time of the study, while the majority didn't take any medications (80.2%). Among those taking drugs, the most frequently reported were anticoagulants by 32 participants (6.88%), followed by thyroid medications by 15 (3.22%), and antihypertensive pills by 6 (1.29%). 6.8% of all participants had an unknown type of antibiotic allergy. Additionally, 6.0% of participants reported a history of catheterization, while 94.0% had no such history.

Table (4.1): Sociodemographic and clinical characteristics of participants (N=485)

Variables	Categories	N (%)
Age (years)	18-24	161 (33.2)
	25-34	248 (51.1)
	35-44	72 (14.8)
	>45	4 (0.8)
Educational Level	Illiterate	2 (0.4)
	Primary	16 (3.3)
	Higher school	216 (44.5)
	Bachelor's	247 (50.9)
	Master/ PhD	4 (0.8)
Occupation	Housewife	422 (87)
	Employee	63 (13)
Socioeconomic status (income in shekels)	Low (<2000)	135 (27.8)
	Middle (2000-4000)	298 (61.4)
	High (>4000)	52 (10.7)
Smoking status	Smoker	30 (6.2)
	Ex-smokers	61 (12.6)
	Never-smoker	394 (81.2)
Geographic Location of the residence	City	116 (23.9)
	Village	350 (72.2)
	Camp	19 (3.9)
Are you currently taking any medications?	Yes	96 (19.8)
	No	389 (80.2)
If yes, please sort them (n=96)	Anti-coagulant drugs	32 (6.88)
	Diabetic drugs	1 (0.21)
	Hypertensive drugs	6 (1.29)
	Thyroid drugs	15 (3.22)
	Epileptic drugs	2 (0.43)
	Unknown	56(58.33)
Do you have a history of catheterization?	Yes	29 (6)
	No	456 (94)
Do you have any known allergies to antibiotics?	Yes	33 (6.8)
	No	452 (93.19)
If yes, what is the type of antibiotic causing the allergy?	Unknown	33 (6.8)

N: number of the subject.

4.2 Obstetrical history among the study participants

Table 4.2 provides an overview of the pregnancy and reproductive history among the study participants. The results showed that the largest percentage of participants were in the second trimester (13–26 weeks) at 41.2%, followed by 37.5% in the third trimester (27–40 weeks), while the smallest group was in the first trimester (1–12 weeks) at 21.2%. The results also demonstrated that the majority (61.0%) of participants had been pregnant 2 to 5 times, followed by 27.0% who had only one pregnancy, and 12.0% who reported six or more pregnancies. This relatively high proportion of women with a history of abortion may reflect that a portion of the study population attending the high-risk antenatal clinic had previous obstetric complications or risk factors, such as prior miscarriages or medical conditions, which increase the likelihood of adverse pregnancy outcomes.

Table (4.2): Pregnancy and reproductive history among the study participants (N=485).

Variables	Categories	N (%)
What trimester are you currently in?	First trimester (1-12 weeks)	103 (21.2)
	Second trimester (13-26 weeks)	200 (41.2)
	Third trimester (27-40 weeks)	182 (37.5)
How many times have you been pregnant, including all pregnancies, whether live births, miscarriages, or stillbirths? (Gravidity)	1	131 (27)
	2-5	296 (61)
	≥ 6	58 (12)
How many children have you given birth to? (Parity)	0	125 (25.8)
	1	91 (18.8)
	2-5	251 (51.8)
	≥ 6	18 (3.7)
Have you ever experienced an abortion?	Yes	191 (39.4)
	No	294 (60.6)

N: number of the subject.

4.3 Hydration, urination, and hygiene practices among participants

Table 4.3 summarizes hygiene, hydration, and daily behaviours among the study participants. The results illustrated that the largest percentage (51.5%) of participants reported drinking 4 to 8 cups of water daily. This was followed by 28% who drank less than 4 cups, and 20.4% who drank more than 8 cups each day. Regarding fluid consumption beyond water, 72.8% of participants indicated that they consumed other beverages, such as juice or tea, when thirsty, while 27.2% did not.

The results showed that the majority of participants indicated urinating 4 to 8 times on a regular day (63.1%), followed by 25.2% who urinated more than 8 times, and the lowest group urinated less than 4 times daily (11.8%). The data set also pointed out that 58.8% of participants sometimes delayed urination when they felt the urge, while 28.2% reported never delaying, 12.0% often delayed, and only 1.0% always delayed urination.

Results showed that 94.2% the overwhelming majority, always washed their hands after using the toilet, whereas 5.8% did not. While 57.3% of participants reported not consuming salty foods and pickles in their daily diet, 42.7% indicated they did. When examining wiping protocols, 63.7% of participants reported wiping from front to back, followed by 25.2% who wiped from back to front, and 11.1% were unsure. The data further showed that the majority of participants (65.2%) engaged in sexual activity 1–5 times per week, followed by 28.9% who reported less than once per week, and a small portion (6.0%) who engaged in more than five times weekly. Finally, 96.1% of participants reported changing their underwear daily, while only 3.9% did not.

Table (4.3): Hygiene, hydration, and daily behaviors among the study articipants (N=485)

Variables	**Categories**	**N (%)**
Daily water intake	Less than 4	136 (28.0)
	4-8	250 (51.5)
	More than 8	99 (20.4)
Daily urination frequency	Less than 4	57 (11.8)
	4-8	306 (63.1)
	More than 8	122 (25.2)
Delay of urination	Never	137 (28.2)
	Sometimes	285 (58.8)
	Often	58 (12.0)
	Always	5 (1.0)
Drink other liquids when thirsty	Yes	353 (72.8)
	No	132 (27.2)
Wash hands with soap before/after toilet use	Yes	457 (94.2)
	No	28 (5.8)
Eat a lot of salty foods and pickles in your daily diet?	Yes	207 (42.7)
	No	278 (57.3)
What method do you use when wiping after using the toilet?	From front to back	309 (63.7)
	From back to front	122 (25.2)
	Unsure	54 (11.1)
How many times do you do sexual activity per week?	Less than 1	140 (28.9)
	1-5	316 (65.2)
	More than 5	29 (6.0)
Have you changed your underwear daily?	Yes	466 (96.1)
	No	19 (3.9)

N: number of the subject.

4.4 Prophylactic complementary treatments, education among the study participants

Table 4.4 summarizes the use of complementary treatments, education, and symptoms among participants. Vitamin C was the most commonly used product (50.1%), followed by Cranberry (6.4%). Other treatments—Probiotics, Cystenium 2, Hyaluronic acid, and Canefron N—were not used, likely due to cost or limited prescription. These treatments were included because a comprehensive review supports their potential safety and efficacy for preventing or managing UTIs in pregnant women (Hudson et al., 2022). Additionally, 65.8% of participants had received education on UTI prevention, with 34.8% confirming counselling.

Table (4.4): Complementary treatments, education among the study participants (N=485)

Variables	**Categories**	**N (%)**
Do you regularly consume complementary and alternative treatments?		
Yes		274
No		211
Do you consume any of these types of complementary treatments:		
Vitamin C	Yes	243 (50.1)
	No	242 (49.9)
Cranberry	Yes	31 (6.4)
	No	454 (93.6)
Probiotics	Yes	0 (0)
	No	485 (100)
Hyalurenic acid	Yes	0 (0)
	No	485 (100)
Canephron N	Yes	0 (0)
	No	485 (100)
Cystenium 2	Yes	0 (0)
	No	485 (100)
Were you educated on how to prevent UTIs?	Yes	319 (65.8)
	No	166 (34.2)
Did you receive counselling on the risks of antibiotic resistance?	Yes	169 (34.8)
	No	316 (65.2)

N: number of the subject.

4.5 UTI symptoms among the study participants

Table 4.5 pointed out UTI symptoms and diagnostic methods among the study participants. The findings showed that the most commonly reported symptom was frequent urination, experienced by 485 participants (66.2%), followed by lower abdominal pain (39.0%) and back pain (39.7%). Also, the table illustrated that Painful urination was reported by 16.3% of participants, while only 3.3% of participants experienced fever, and 3.1% had blood in the urine. When participants were asked whether they suffered from vaginal discharge and internal itching, 63.3% reported no symptoms, 36.7% reported experiencing them, and only 2.5% a small proportion, responded with uncertainty.

Table (4.5):UTI symptoms among the study participants (N=485)

Variables	Categories	N (%)
Describe the symptoms experienced		
Frequent urination	Yes	321 (66.2)
	No	164 (33.8)
Lower abdominal pain	Yes	189 (39)
	No	296 (61)
Back pain	Yes	191 (39.4)
	No	294 (60.6)
Painful urination	Yes	79 (16.3)
	No	406 (83.7)
Blood in urine	Yes	15 (3.1)
	No	470 (96.9)
Fever	Yes	16 (3.3)
	No	469 (96.7)
Do you suffer from vaginal discharge and internal itching?		
	Yes	178 (36.7)
	No	307 (63.3)

N: number of the subject.

4.6 UTI Diagnostic Approaches and Laboratory Findings

Table 4.6 indicates the incidence of UTI among pregnant women. Among the total participants (n=485), the majority (80.4%) were diagnosed by urine analysis testing, while only 1.6% were diagnosed by rapid dipstick testing. The results from the 185 participants who did the urine culture test showed that 23.7% of them (n=115) had culture-positive results. Additionally, 164 participants (33.8%) had negative cultures or no indication of culture due to the absence of pyuria, and the largest group comprised 206 participants (42.5%) who presented with UTI

symptoms but declined to undergo culture testing. Among those who completed the culture test in a Governmental or private lab (n=185), 62.2% showed bacterial growth, 4.9% had Candida, and 33.0% had negative results. Further analysis of bacterial isolates revealed that among the positive cases (n=115), 62.6% were gram-negative bacteria and 37.4% were gram-positive. The results also indicate that 8.7% (n = 10) of the study sample of pregnant women with positive urine cultures had asymptomatic bacteriuria, while 91.3% (n = 105) presented with symptomatic infections.

Table (4.6): Summary of UTI diagnostic approaches and laboratory findings among participants (N=485)

Variables	**Total**	**Categories**	**N (%)**
Methodsof diagnosis	485	1. Rapid test – Dipstick	8 (1.6)
		2. Urine analysis test	390 (80.4)
		3. Urine culture test	185 (38.1)
		4. Symptom Inspection without tests	30(6.2)
Doing a bacterial culture	485	Culture-positive cases	115 (23.7)
		Negative culture or negative pus (no need for culture)	164 (33.8)
		UTI symptoms and refuse to do a culture	206 (42.5)
If growth for culture	185	Bacteria	115 (62.2)
		Candida	9 (4.9)
		Negative	61 33)
Gram stain	115	Gram positive	43 (37.4)
		Gram negative	72 (62.6)
Confirmed UTI	115	Asymptomatic Bacteriuria	10 (8.7%)
		Symptomatic Bacteriuria	105 (91.3%)

N: number of the subject.

4.7 Microbial Profile of Confirmed UTI Cases Stratified by Gram Staining

Table 4.7 demonstrates the distribution of microbial isolates according to Gram stain classification. Among the Gram-negative bacteria (n = 72), *E. coli* was the most prevalent isolate, accounting for 61.1% of Gram-negative cases, followed by *K. pneumoniae* (31.9%), *P. aeruginosa* (4.2%), *Enterobacter cloacae (E. cloacae*) (1.4%), and *Proteus species* (1.4%). On

the other hand, among the Gram-positive bacteria (n = 43), *S. aureus* was the most dominant species, accounting for 60.5% of the Gram-positive isolates. Other notable Gram-positive organisms included *Staphylococcus coagulase-negative* (16.3%), *Enterococcus species* (14.0%), *Staphylococcus saprophyticus (S. saprophyticus*)(4.7%), *Streptococcus agalactiae*(*S. agalactiae*)(2.3%), and *Staphylococcus epidermidis (S. epidermidis*) (2.2%). These findings highlight a clear distinction in microbial profiles between Gram stain groups, with *E. coli* and S. aureus being the leading pathogens, which aligns with common patterns in clinical infections, particularly urinary tract and hospital-acquired infections.

Table (4.7) Distribution of Uropathogens by Gram Stain among Confirmed UTI Cases (n = 115).

Variables	Categories	Total (115)	Gram stain	
			Negative (n=72)	Positive (n=43)
Microbe	*E. coli*	44 (38.3)	44 (61.1)	
	K. pneumoniae	23 (20)	23 (31.9)	
	P. aeruginosa	3 (2.6)	3 (4.2)	
	E. cloacae	1 (0.9)	1 (1.4)	
	Proteus	1 (0.9)	1 (1.4)	
	S. aureus	26 (22.6)		26 (60.5)
	Staphylococcus coagulase-negative	7 (6.1)		7 (16.3)
	Enterococcus	6 (5.2)		6 (14.0)
	S. agalactiae	1 (0.9)		1 (2.3)
	S. saprophyticus	2 (1.7)		2 (4.7)
	S. epidermidis	1 (0.9)		1 (2.2)

4.8 Susceptibility Patterns and Multidrug Resistance Among Uropathogens Isolated from Pregnant Women

Table 4.8. a and 4.8.b present the antibiotic susceptibility patterns of bacteria isolated from pregnant women with UTIs. The results reveal varied responses across different pathogens. *E.*

coli, the most common isolate, showed good sensitivity to nitrofurantoin (81.6%) and fosfomycin (64.7%), making them reliable treatment options.

However, resistance was notable to commonly used antibiotics such as amoxicillin clavulanate and cefuroxime, both with resistance rates above 30%. *K. pneumoniae* and *S. aureus* also showed mixed susceptibility, with lower sensitivity to several first-line agents but better response to drugs like amikacin and ceftriaxone. Other organisms, such as *Enterococcus* and *coagulase-negative staphylococci*, displayed inconsistent patterns, further emphasizing the need for culture-based diagnosis.

Table4.8.c demonstrates antibiotic resistance; 55.7% of the isolates were classified as multidrug-resistant (MDR), showing non-susceptibility to at least one agent in three or more antimicrobial classes, while 44.3% were non-MDR.When stratified by Gram stain, resistance was more pronounced among Gram-negative uropathogens. *E. coli* remained the leading resistant species, with nearly half of isolates (46.4%) resistant to ≥5 antibiotics, followed by *K. pneumoniae* (25%). Gram-positive bacteria showed comparatively lower resistance, although *S. aureus*accounted for 10.7% of isolates resistant to five or more agents.

Table (4.8.a): Antimicrobial susceptibility pattern of bacteria isolated from urine specimens.

Bacterial isolates	Pattern	Antimicrobial susceptibility pattern, n (%)											
		Amoxicillin + Clavulanic Acid	Cefuroxime	Nitrofurantoin	Ceftriaxone	Trimethoprim-Sulfamethoxazole	Cefixime	Fosfomycin	Cephalexin	Amikacin	Cefotaxime	Cefpodoxime	Meropenem
Gram negative													
E. coli	**S**	22 (55)	22 (57.9)	31 (81.6)	18 (56.3)	13 (44.8)	14 (56)	11 (64.7)	3 (21.4)	11 (78.6)	9 (64.3)	5 (41.7)	10 (100)
	I	5 (12.5)	3 (7.9)	2 (5.3)	0 (0)	1 (3.4)	1 (4)	0 (0)	2 (14.3)	0 (0)	1 (7.1)	1 (8.3)	0 (0)
	R	13 (32.5)	13 (34.2)	5 (13.2)	14 (43.8)	15 (51.7)	10 (40)	6 (35.3)	9 (64.3)	3 (21.4)	4 (28.6)	6 (50)	0 (0)
K. pneumoniae	**S**	22 (55)	22 (57.9)	18 (56.3)	31 (81.6)	25 (83.3)	3 (21.4)	22 (84.6)	5 (83.3)	9 (64.3)	11 (78.6)	10 (100)	14 (56)
	I	5 (12)	3 (7.9)	0 (0)	2 (5.3)	0 (0)	2 (14.3)	0 (0)	0 (0)	1 (7.1)	0 (0)	0 (0)	1 (4)
	R	13 (32.5)	13 (34.2)	14 (43.8)	5 (13.2)	5 (16.7)	9 (64.3)	4 (15.4)	1 (16.7)	4 (28.6)	3 (21.4)	0 (0)	10 (40)
P. aeruginosa	**S**	1 (33.3)	1 (33.3)	0 (0)	1 (50)	1 (50)	0 (0)	0 (0)	0 (0)	1 (100)	1 (33.3)	0 (0)	2 (100)
	I	1 (33.3)	0 (0)	1 (33.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	R	1 (33.3)	2 (66.7)	2 (66.7)	1 (50)	1 (50)	0 (0)	1 (100)	0 (0)	0 (0)	2 (66.7)	0 (0)	0 (0)
E. cloacae	**S**	1 (100)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	I	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	R	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Proteus	**S**	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	I	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	R	1 (100)	1 (100)	1 (100)	0 (0)	1 (100)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)

Table (4.8.b): Antimicrobial susceptibility pattern of bacteria isolated from urine specimens (cont).

Gram Positive													
S. aureus	**S**	24 (92.3)	20 (80)	20 (87)	14 (58.3)	7 (50)	3 (23.1)	5 (27.8)	0 (0)	0 (0)	2 (100)	6 (46.2)	2 (100)
Staph CNS	**I**	0 (0)	1 (4)	0 (0)	0 (0)	1 (7.1)	0 (0)	2 (11.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	R	1 (16.7)	3 (50)	2 (33.3)	1 (100)	1 (20)	6 (100)	3 (75)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Enterococcus	**S**	4 (66.7)	6 (100)	4 (100)	0 (0)	3 (100)	0 (0)	0 (0)	3 (50)	1 (100)	0 (0)	0 (0)	0 (0)
	I	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	1 (16.7)	0 (0)	1 (50)	0 (0)	0 (0)
	R	2 (33.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (33.3)	0 (0)	1 (50)	0 (0)	0 (0)
S. agalactiae	**S**	1 (100)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	I	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	R	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	1 (100)	1 (100)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)
S. Saprophyticus	**S**	1 (50)	2 (100)	1 (100)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	I	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	R	1 (50)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Staph Epidermidis	**S**	1 (100)	1 (100)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)
	I	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	R	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)

Table (4.8.c): Antimicrobial susceptibility pattern of bacteria isolated from urine specimens (cont).

Bacterial isolates	Pattern	Antimicrobial susceptibility pattern, n (%)						
		Cefdinir	Cefadroxil	Cefaclor	Ceftazidime	Piperacillin	Ampicillin	Cefepime
Gram Negative								
E. coli	**S**	4 (40)	5 (83.3)	0 (0)	3 (60)	0 (0)	0 (0)	1 (100)
	I	1 (10)	0 (0)	1 (20)	0 (0)	0 (0)	0 (0)	0 (0)
	R	5 (50)	1 (16.7)	4 (80)	2 (40)	3 (100)	1 (100)	0 (0)
K. pneumoniae	**S**	2 (18.2)	3 (60)	0 (0)	5 (41.7)	0 (0)	0 (0)	3 (60)
	I	0 (0)	0 (0)	0 (0)	1 (8.3)	0 (0)	1 (20)	0 (0)
	R	9 (81.8)	2 (40)	3 (100)	6 (50)	1 (100)	4 (80)	2 (40)
P. aeruginosa	**S**	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	I	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	R	0 (0)	0 (0)	0 (0)	2 (100)	0 (0)	0 (0)	0 (0)
E. cloacae	**S**	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)
	I	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	R	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Proteus	**S**	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	I	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	R	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gram positive								
S. aureus	**S**	13 (72.2)	5 (62.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	I	2 (11.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	R	3 (16.7)	3 (37.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Staph CNS	**S**	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	I	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	R	0 (0)	0 (0)	0 (0)	0 (0)	3 (100)	0 (0)	0 (0)
Enterococcus	**S**	0 (0)	0 (0)	1 (50)	0 (0)	1 (100)	0 (0)	0 (0)
	I	0 (0)	0 (0)	1 (50)	0 (0)	0 (0)	0 (0)	0 (0)
	R	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
S. agalactiae	**S**	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	I	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	R	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
S. Saprophyticus	**S**	1 (100)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	I	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	R	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Staph Epidermidis	**S**	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	I	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	R	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)

Table (4.8.d): Classification of Uropathogens by Antimicrobial Resistance Categories (N=115).

	Number of antibiotics resistance N (%)					
	No resistance	**1**	**2**	**3**	**4**	**5 or more**
Gram-negative bacteria						
E. coli	6 (42.9)	8 (44.4)	4 (21.1)	4 (19)	9 (60)	13 (46.4)
K. pneumoniae	3 (21.4)	1 (5.6)	6 (31.6)	5 (23.8)	1 (6.7)	7 (25)
P. aeruginosa	1 (7.1)	0 (0)	0 (0)	0 (0)	0 (0)	2 (7.1)
E. cloacae	0 (0)	1 (5.6)	0 (0)	0 (0)	0 (0)	0 (0)
Proteus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (3.6)
Gram-positive bacteria						
S. aureus	2 (14.3)	5 (27.8)	5 (26.3)	8 (38.1)	3 (20)	3 (10.7)
Coagulase negative	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Staph CNS	0 (0)	0 (0)	2 (10.5)	3 (14.3)	1 (6.7)	1 (3.6)
Enterococcus	1 (7.1)	2 (11.1)	1 (5.2)	1 (4.8)	1 (6.6)	0 (0)
S. agalactiae	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (3.6)
S. Saprophyticus	1 (7.2)	1 (5.5)	0 (0)	0 (0)	0 (0)	0 (0)
Staph Epidermidis	0 (0)	0 (0)	1 (5.3)	0 (0)	0 (0)	0 (0)

4.9 Follow-up of treatment and antibiotic use among the study participants

Table 4.9 pointed out treatment and antibiotic use among the study participants using a follow-up part of the study's questionnaire after 3 months from the baseline data collection. The results showed that antibioticswere prescribedempiricallyto 55.5% of participants, while 44.5% did not receive a prescription. Among them, only 115 (42% of whom received antibiotics) have been confirmed diagnosis using urine culture. Regarding prescribed antibiotics, cefuroxime was the most commonly used, followed by Cefixime, Amoxicillin, Clavulanic acid, and Nitrofurantoin. The majority (87.4%) followed an oral dosage, while only 9.3% received injections and 3.3% received vaginal or rectal suppositories. Most participants (91.5%) reported completing the prescribed course. The results show that 66.6% of participants statedthat their symptoms resolved, and 33.4% did not experience fullsymptom relief.

Table (4.9): Follow-up of treatment and antibiotic Use among the study participants(N=485).

Variables	**Categories**	
Were antibiotics prescribed?	Yes	269 (55.5)
	No	216 (44.5)
If yes, what is the name of the prescribed antibiotic?	Cefuroxime	114 (23.5%)
	Nitrofurantoin	17 (3.5%)
	Cephalexin	1 (0.2%)
	Ceftriaxone (IV)	10 (2.06%)
	Amoxicillin & Clavulanic acid	25 (5.15%)
	Cefpodoxime	2(0.41%)
	Fosfomycin	10 (2.06%)
	Cefixime	28 (5.77%)
	Cefadroxil	2 (0.41%)
	Metronidazole	4 (0.82%)
	Azithromycin	2 (0.41%)
	Miconazole vaginal Suppositories	18 3.71%)
If yes, what is the Type of treatment route used?	Oral use	201 (41.4%)
	Injection Use	10 (2.06%)
	Vaginal Suppositories	18 3.71%)
Did you complete the course as prescribed?	Yes	444 (91.5)
	No	41 8.5)
Did your symptoms resolve after completing the antibiotics?	Yes	323 (66.6)
	No	162 (33.4)

N: number of the subject.

4.10 Appropriateness of Antibiotic Prescription

1. Appropriateness of Antibiotic Prescriptions According to Guidelines:

Among the 269 pregnant women treated for UTI, the majority were prescribed cefuroxime (42.4%) or cefixime (28.6%), while only 22.7% received nitrofurantoin, amoxicillin–clavulanic acid, or fosfomycin—the first-line agents recommended by ACOG and NICE. This indicates that nearly three-quarters of prescriptions (77.3%) were inconsistent with international guidelines.

Regarding treatment practices, the route, dose, and duration were generally consistent with guidelines. Most prescriptions followed the recommended 5–7 day regimen. An additional 20 cases involved either single-dose fosfomycin or short-course ceftriaxone (1–3 days), both considered guideline-approved regimens, although ceftriaxone is recommended as an alternative rather than a first-line therapy. Oral therapy accounted for 41% of prescriptions, while the remainder were administered via injections or vaginal formulations.

2. Matching prescriptions with the study results of antimicrobialsusceptibility patterns data

When prescribing patterns were compared with the study results of antimicrobial susceptibility data, a substantial mismatch was observed. Among 115 culture-confirmed bacterial cases, the prescribed antibiotic was in vitro susceptible in only 58.0% of evaluable cases (65 of 112). This indicates that in 42% of cases, the initial treatment may have been ineffective.

E. coli, the most frequently isolated pathogen, was often treated with antibiotics that are not considered first-line according to ACOG and NICE guidelines. Although highly susceptible first-line agents, such as nitrofurantoin and fosfomycin, were available, they were rarely prescribed.

These results indicate that physicians frequently prescribed antibiotics with lower local efficacy while underutilizing agents with demonstrated higher activity, leaving a substantial proportion of women at risk of receiving suboptimal treatment.

4.11 Relationship between Gram stain and Sociodemographic data among the study participants.

Table 4.11 presents the relationship between Gram stain classification and sociodemographic characteristics among the study participants. The chi-square analysis revealed no statistically significant associations between Gram stain results and any of the assessed variables. Specifically, there were no significant differences in Gram stain type by age group ($p = 0.373$), educational level ($p = 0.511$), occupation ($p = 0.883$), socioeconomic status ($p = 0.527$), smoking status ($p = 0.544$), or geographic location of residence ($p = 0.161$).

Table (4.11-a): Relationship between Gram stain and Sociodemographic data among the study participants (n=115)

Variables	Categories	Total (115)	Gram stain Negative (n=72)	Gram stain Positive (n=43)	χ^2	P-value
Age (years)	18–24	53 (46.1)	35 (48.6)	18 (41.9)	3.121	0.373
	25–34	49 (42.6)	31 (43.1)	18 (41.9)		
	35–44	12 (10.4)	5 (6.9)	7 (16.3)		
	>45	1 (0.9)	1 (1.4)	0 (0)		
Educational Level	Illiterate	2 (1.7)	2 (2.8)	0 (0)	2.310	0.511
	Primary	13 (11.3)	7 (9.7)	6 (14)		
	Higher school	62 (53.9)	41 (56.9)	21 (48.8)		
	Bachelor's	38 (33)	22 (30.6)	16 (37.2)		
	Master/PhD	0 (0)	0 (0)	0 (0)		

Table (4.11-b): Relationship between Gram stain and other Sociodemographic data among the study participants(n=115).

Variables	Categories	Total (115)	Gram stain Negative (n=72)	Gram stain Positive (n=43)	χ^2	P-value
Occupation	Housewife	112 (97.4)	70 (97.2)	42 (97.7)	0.022	0.883
	Employee / Businesswoman	3 (2.6)	2 (2.8)	1 (2.3)		
Socioeconomic status (income in shekel)	Low (<2000)	34 (29.6)	19 (26.4)	15 (34.9)	1.280	0.527
	Middle (2000–4000)	73 (63.5)	47 (65.3)	26 (60.5)		
	High (>4000)	8 (7)	6 (8.3)	2 (4.7)		
Smoking status	Smoker	4 (3.5)	3 (4.2)	1 (2.3)	1.219	0.544
	Ex-smokers	12 (10.4)	9 (12.5)	3 (7)		
	Not smoker	99 (86.1)	60 (83.3)	39 (90.7)		
Geographic Location of Residence	City	22 (19.1)	11 (15.3)	11 (25.6)	3.642	0.161
	Village	85 (73.9)	54 (75)	31 (72.1)		
	Camp	8 (7)	7 (9.7)	1 (2.3)		

*Indicates a statistically significant difference at P<0.05; **N:** number of the subject &**χ^2:** chi-square test.

4.12 Relationship between Gram stain and obstetrical information among the study participants

Table 4.12 presents the relationship between Gram stain classification and obstetrical information among the study participants. The chi-square analysis identified statistically significant associations between Gram stain type and both parity (p = 0.046) and abortion history (p = 0.035). These findings suggest that the number of children a woman has delivered and whether she has experienced a previous abortion may influence the type of bacterial

infection, Gram-positive or Gram-negative, detected during pregnancy. On the other hand, no significant associations were observed between Gram stain results and trimester of pregnancy (p = 0.888) or gravidity (p = 0.822), as their p-values exceeded the 0.05 significance threshold.

Table (4.12): Relationship between Gram stain and obstetrical information among the study participants (N=115)

Variables	Categories	Total (115)	Gram stain		Statistical test	
			Negative (n=72)	Positive (n=43)	$\chi 2$	P-value
What trimester are you currently in?	First Trimester (1-12 weeks)	44 (38.3)	28 (38.9)	16 (37.2)	0.237	0.888
	Second Trimester (13-26 weeks)	47 (40.9)	30 (41.7)	17 (39.5)		
	Third Trimester (27-40 weeks)	24 (20.9)	14 (19.4)	10 (23.3)		
How many times have you been pregnant, including all pregnancies, whether live births, miscarriages, or stillbirths? (Gravidity)	1	30 (26.1)	18 (25)	12 (27.9)	0.391	0.822
	2-5	76 (66.1)	49 (68.1)	27 (62.8)		
	≥ 6	9 (7.8)	5 (6.9)	4 (9.3)		
How many children have you given birth to? (Parity)	0	32 (27.8)	19 (26.4)	13 (30.2)	7.983	**0.046 ***
	1	19 (16.5)	14 (19.4)	5 (11.6)		
	2-5	60 (52.2)	39 (54.2)	21 (48.8)		
	≥ 6	4 (3.5)	0 (0)	4 (9.3)		
Have you ever experienced an abortion?	Yes	51 (44.3)	27 (37.5)	24 (55.8)	7.659	**0.035 ***
	No	64 (55.7)	45 (62.5)	19 (44.2)		

*Indicates a statistically significant difference at P<0.05; **N:** number of the subject &χ^2**:** chi-square test.

4.13 Relationship between UTI and Sociodemographic data among the study participants

Table 4.13 presents the relationship between UTIstatus and sociodemographic variables among the study participants. The chi-square analysis revealed statistically significant associations between UTI status and the following variables: age group ($p = 0.023$), educational level ($p = 0.001$), occupation ($p < 0.001$), income level ($p = 0.049$), and geographic location of residence ($p = 0.024$). In contrast, no significant association was observed between UTI status and smoking status ($p = 0.380$), as the p-value exceeded the 0.05 significance threshold.

Table (4.13): Relationship between UTI and Sociodemographic data among the study participants (N=279)

Variables	Categories	Total (279)	UTI Groups N (%)		Statistical test	
			Positive (n=115)	Negative (n=164)	$\chi 2$	P-value
Age (years)	18-24	105 (37.6)	53 (46.1)	52 (31.7)	9.550	0.023*
	25-34	128 (45.9)	49 (42.6)	79 (48.2)		
	35-44	35 (12.5)	12 (10.4)	23 (14)		
	>45	11 (3.9)	1 (0.9)	10 (6.1)		
Educational Level	Illiterate	2 (0.7)	2 (1.7)	0 (0)	17.588	0.001*
	Primary	16 (5.7)	13 (11.3)	3 (1.8)		
	Higher school	148 (53)	62 (53.9)	86 (52.4)		
	Bachelor's	110 (39.4)	38 (33)	72 (43.9)		
	Master/ PhD	3 (1.1)	0 (0)	3 (1.8)		
Occupation	Housewife	248 (88.9)	112 (97.4)	136 (82.9)	14.320	0.000*
	Employee \ Businesswoman	31 (11.1)	3 (2.6)	28 (17.1)		
Socioeconomic status (income in shekels)	Low (<2000)	67 (24)	34 (29.6)	33 (20.1)	6.017	0.049*
	Middle (2000-4000)	180 (64.5)	73 (63.5)	107 (65.2)		
	High (>4000)	32 (11.5)	8 (7)	24 (14.6)		
Smoking status	Smoker	14 (5)	4 (3.5)	10 (6.1)	1.935	0.380
	Ex-smokers	35 (12.5)	12 (10.4)	23 (14)		
	Not smoker	230 (82.4)	99 (86.1)	131 (79.9)		
Geographic Location of the residence	City	64 (22.9)	22 (19.1)	42 (25.6)	7.450	0.024*
	Village	205 (73.5)	85 (73.9)	120 (73.2)		
	Camp	10 (3.6)	8 (7)	2 (1.2)		

* Indicates a statistically significant difference at P<0.05; **N:** number of the subject &**χ^2:** chi-square test.

4.14Relationship between UTI and obstetrical history among the study participants

Table 4.14 presents the relationship between UTI status and obstetrical history among the study participants. The chi-square analysis revealed statistically significant associations between UTI status and both the trimester of pregnancy ($p < 0.001$) and abortion history ($p = 0.002$). On the other hand, no significant associations were found between UTI status and gravidity ($p = 0.382$) or parity ($p = 0.385$), as their p-values exceeded the 0.05 significance threshold. These findings highlight that both the pregnancy trimester and a history of abortion may be considered risk factors for UTIs among pregnant women.

Table (4.14): Relationship between UTI and obstetrical history among the study participants (N=279).

Variables	Categories	Total (279)	UTI Groups N (%)		Statistical test	
			Positive (n=115)	Negative (n=164)	χ^2	P-value
What trimester are you currently in?	First Trimester (1-12 weeks)	60 (21.5)	44 (38.3)	16 (9.8)	41.684	0.000 *
	Second Trimester (13-26 weeks)	111 (39.8)	47 (40.9)	64 (39)		
	Third Trimester (27-40 weeks)	108 (38.7)	24 (20.9)	84 (51.2)		
How many times have you been pregnant, including all pregnancies, whether live births, miscarriages, or stillbirths? (Gravidity)	1	79 (28.3)	30 (26.1)	49 (29.9)	1.920	0.382
	2-5	172 (61.6)	76 (66.1)	96 (58.5)		
	≥ 6	28 (10)	9 (7.8)	19 (11.6)		
How many children have you given birth to? (Parity)	0	70 (25.1)	32 (27.8)	38 (23.2)	3.042	0.385
	1	58 (20.8)	19 (16.5)	39 (23.8)		
	2-5	144 (51.6)	60 (52.2)	84 (51.2)		
	≥ 6	7 (2.5)	4 (3.5)	3 (1.8)		
Have you ever experienced an abortion?	Yes	94 (33.7)	51 (44.3)	43 (26.2)	9.944	0.002 *
	No	185 (66.3)	64 (55.7)	121 (73.8)		

* Indicates a statistically significant difference at P<0.05; **N:** number of the subject &**χ^2:** chi-square test.

4.15 Relationship between UTI and Behavioral characteristics among the study participants

Table 4.15presents the relationship between UTI status and behavioral characteristics among the study participants. The chi-square analysis revealed statistically significant associations between UTI status and several behavioral variables. These include: daily water intake ($p < 0.001$), urination frequency ($p < 0.001$), urination delay habits ($p < 0.001$), consumption of other fluids ($p < 0.001$), wiping method after toilet use ($p < 0.001$), frequency of sexual activity per week ($p < 0.001$), washing hands with soap and water before and after using the toilet ($p < 0.001$), vaginal discharge and internal itching ($p < 0.001$), vitamin C intake ($p = 0.023$), and receiving counselling on the risks of antibiotic resistance ($p = 0.021$). In contrast, no statistically significant associations were found between UTI status and the following variables: changing underwear daily ($p = 0.126$), cranberry consumption ($p = 0.908$), eating salty foods and pickles ($p = 0.657$), and receiving education on UTI prevention ($p = 0.393$). These findings underscore the importance of certain personal hygiene and behavioral practices in influencing the risk of UTI among pregnant women, while also highlighting that not all preventive measures (such as education or cranberry use) are statistically associated with infection status in this population.

Table (4.15-a): Relationship between UTI and Behavioral characteristics among the study participants (N=279) .

Variables	Categories	Total (279)	Positive (n=115)	Negative (n=164)	χ^2	P-value
How many cups of water do you drink daily?	Less than 4	79 (28.3)	51 (44.3)	28 (17.1)	45.422	0.000*
	4–8	147 (52.7)	61 (53)	86 (52.4)		
	More than 8	53 (19)	3 (2.6)	50 (30.5)		
How many times do you urinate on a regular day?	Less than 4	40 (14.3)	7 (6.1)	33 (20.1)	32.999	0.000*
	4–8	165 (59.1)	58 (50.4)	107 (65.2)		
	More than 8	74 (26.5)	50 (43.5)	24 (14.6)		
Do you usually delay urination when you feel the need to urinate?	Never	76 (27.2)	10 (8.7)	66 (40.2)	77.696	0.000*
	Sometimes	157 (56.3)	62 (53.9)	95 (57.9)		
	Often	43 (15.4)	41 (35.7)	2 (1.2)		
	Always	3 (1.1)	2 (1.7)	1 (0.6)		
Do you drink other liquids besides water (juice, tea, etc.) when you feel thirsty?	Yes	211 (75.6)	69 (60)	142 (86.6)	25.920	0.000*
	No	68 (24.4)	46 (40)	22 (13.4)		

Table (4.15-b): Relationship between UTI and Behavioral characteristics among the study participants (N=279) .

Variables	Categories	Total (279)	Positive (n=115)	Negative (n=164)	χ^2	P-value
Do you always wash your hands well with soap and water before and after using the toilet?	Yes	251 (90)	87 (75.7)	164 (100)	44.385	0.000*
	No	28 (10)	28 (24.3)	0 (0)		
Do you eat a lot of salty foods and pickles in your routine daily diet?	Yes	133 (47.7)	53 (46.1)	80 (48.8)	0.197	0.657
	No	146 (52.3)	62 (53.9)	84 (51.2)		
What method do you use when wiping after using the toilet?	From front to back	162 (58.1)	48 (41.7)	114 (69.5)	25.369	0.000*
	From back to front	90 (32.3)	56 (48.7)	34 (20.7)		
	Unsure	27 (9.7)	11 (9.6)	16 (9.8)		
How many times do you do sexual activity per week?	Less than 1	73 (26.2)	8 (7)	65 (39.6)	65.086	0.000*
	1–5	177 (63.4)	79 (68.7)	98 (59.8)		
	More than 5	29 (10.4)	28 (24.3)	1 (0.6)		
Have you change your underwear daily?	Yes	260 (93.2)	104 (90.4)	156 (95.1)	2.340	0.126
	No	19 (6.8)	11 (9.6)	8 (4.9)		
Do you regularly consume complementary and alternative treatments?	Vitamin C — Yes	144 (51.6)	50 (43.5)	94 (57.3)	5.184	0.023*
	Vitamin C — No	135 (48.4)	65 (56.5)	70 (42.7)		
	Cranberry — Yes	20 (7.2)	8 (7)	12 (7.3)	0.013	0.908
	Cranberry — No	259 (92.8)	107 (93)	152 (92.7)		
Were you provided with education on preventing UTIs?	Yes	178 (63.8)	70 (60.9)	108 (65.9)	0.727	0.393
	No	101 (36.2)	45 (39.1)	56 (34.1)		
Did you receive counselling on the risks of antibiotic resistance?	Yes	92 (33)	29 (25.2)	63 (38.4)	5.327	0.021*
	No	187 (67)	86 (74.8)	101 (61.6)		
Do you suffer from vaginal discharge and internal itching?	Yes	101 (36.2)	69 (60)	32 (19.5)	54.207	0.000*
	No	173 (62)	42 (36.5)	131 (79.9)		
	Maybe	5 (1.8)	4 (3.5)	1 (0.6)		

* Indicates a statistically significant difference at P<0.05; **N:** number of the subject &**χ^2:** chi-square test.

4.16 Relationship between UTI and clinical characteristics among the study participants

Table 4.16 presents the relationship between UTI status and clinical characteristics among the study participants. The chi-square analysis revealed statistically significant associations between UTI and several clinical symptoms. Participants with UTI reported significantly higher occurrences of frequent urination ($p < 0.001$), lower abdominal pain ($p < 0.001$), back pain ($p < 0.001$), painful urination ($p < 0.001$), blood in urine ($p < 0.001$), and fever ($p < 0.001$), as compared to those without UTI.

Regarding diagnosis methods, no significant associations were found with the type of diagnostic test used, including dipstick testing ($p = 0.491$), urine analysis ($p = 0.695$), urine culture ($p = 0.590$), or symptom inspection without tests ($p = 0.433$). Likewise, prior history of UTI ($p = 0.066$), frequency of previous infections ($p = 0.069$), and whether antibiotics were prescribed ($p = 0.491$) showed no significant difference between UTI and non-UTI groups. However, the type of prescribed antibiotic was significantly associated with UTI status ($p = 0.009$), with cefuroxime being more frequently used among UTI-positive participants. Additionally, a significant association was observed between current use of anticoagulant medications and UTI status ($p = 0.032$). Other clinical characteristics including dosage form of antibiotics ($p = 0.740$), completion of the antibiotic course ($p = 0.773$), antibiotic allergy history ($p = 0.721$), symptom resolution ($p = 0.955$), current medication use ($p = 0.084$), and history of catheterization ($p = 0.171$) were not statistically associated with UTI status.

Table (4.16-a): Relationship between UTI and clinical characteristics among the study participants (N=279).

Variables	Categories	Total (279)	Positive UTI (n=115)	Negative (n=164)	χ^2	P-value
Frequent urination	Yes	115 (41.2)	115 (100)	0 (0)	279.000	0.000*
	No	164 (58.8)	0 (0)	164 (100)		
Lower abdominal pain	Yes	89 (31.9)	89 (77.4)	0 (0)	186.375	0.000*
	No	190 (68.1)	26 (22.6)	164 (100)		
Back pain	Yes	91 (32.6)	91 (79.1)	0 (0)	192.590	0.000*
	No	188 (67.4)	24 (20.9)	164 (100)		
Painful urination	Yes	72 (25.8)	72 (62.6)	0 (0)	138.392	0.000*
	No	207 (74.2)	43 (37.4)	164 (100)		
Blood in urine	Yes	15 (5.4)	15 (13)	0 (0)	22.607	0.000*
	No	264 (94.6)	100 (87)	164 (100)		
Fever	Yes	16 (5.7)	16 (13.9)	0 (0)	24.206	0.000*
	No	263 (94.3)	99 (86.1)	164 (100)		
Rapid test – Dipstick	Yes	7 (2.5)	2 (1.7)	5 (3)	0.474	0.491
	No	272 (97.5)	113 (98.3)	159 (97)		

Table (4.16-b): Relationship between UTI and clinical characteristics among the study participants (N=279) .

Variables	Categories	Total (n=279) N (%)	Positive UTI (n=115) N (%)	Negative UTI (n=164) N (%)	χ^2	P-value
Urine analysis test	Yes	231 (82.8)	94 (81.7)	137 (83.5)	0.153	0.695
	No	48 (17.2)	21 (18.3)	27 (16.5)		
Urine culture test	Yes	92 (33)	40 (34.8)	52 (31.7)	0.289	0.590
	No	187 (67)	75 (65.2)	112 (68.3)		
Symptom Inspection without tests	Yes	18 (6.5)	9 (7.8)	9 (5.5)	0.612	0.433
	No	261 (93.5)	106 (92.2)	155 (94.5)		
Have you had UTIs before this pregnancy?	Yes	185 (66.3)	84 (73)	101 (61.6)	5.424	0.066
	No	91 (32.6)	29 (25.2)	62 (37.8)		
	Unsure	3 (1.1)	2 (1.7)	1 (0.6)		
If yes, how frequently?	Occasionally	125 (67.6)	51 (60.7)	74 (73.3)	3.298	0.069
	Often	60 (32.4)	33 (39.3)	27 (26.7)		
Were antibiotics prescribed?	Yes	210 (75.3)	89 (77.4)	121 (73.8)	0.473	0.491
	No	69 (24.7)	26 (22.6)	43 (26.2)		
Name of precribed antibiotic	Cefuroxime	88 (41.9)	42 (47.2)	46 (38)	22.111	0.009*
	Nitrofurantoin	22 (10.5)	10 (11.2)	12 (9.9)		
	Cefixime	16 (7.6)	7 (7.9)	9 (7.4)		
	Ceftriaxone (IV)	14 (6.7)	7 (7.9)	7 (5.8)		
	Amoxicillin & Clavulanic acid	10 (4.8)	2 (2.2)	8 (6.6)		
	Cefpodoxime	7 (3.3)	6 (6.7)	1 (0.8)		
	Fosfomycin	5 (2.4)	4 (4.5)	1 (0.8)		
	Cephalexin	1 (0.5)	1 (1.1)	0 (0)		
	Cefadroxil	2 (1)	0 (0)	2 (1.7)		
	Metronidazole	45 (21.4)	10 (11.2)	35 (28.9)		
Type of dosage of treatment	Oral	182 (86.7)	79 (88.8)	103 (85.1)	0.603	0.740
	Injection	20 (9.5)	7 (7.9)	13 (10.7)		
	Vaginal Suppositories	8 (3.8)	3 (3.4)	5 (4.1)		
Did you complete the course as prescribed?	Yes	261 (93.5)	107 (93)	154 (93.9)	0.083	0.773
	No	18 (6.5)	8 (7)	10 (6.1)		
Do you have any known allergies to antibiotics?	Yes	20 (7.2)	9 (7.8)	11 (6.7)	0.127	0.721
	No	259 (92.8)	106 (92.2)	153 (93.3)		

Table (4.16-c): Relationship between UTI and clinical characteristics among the study participants (N=279).

Variables	Categories	Total (n=279) N (%)	Positive UTI (n=115) N (%)	Negative UTI (n=164) N (%)	χ^2	P-value
Did your symptoms resolve after completing the antibiotics?	Yes	179 (64.2)	74 (64.3)	105 (64)	0.003	0.955
	No	100 (35.8)	41 (35.7)	59 (36)		
Are you taking any medications currently?	Yes	61 (21.9)	31 (27)	30 (18.3)	2.970	0.084
	No	218 (78.1)	84 (73)	134 (81.7)		
If yes, type of medications	Anti-coagulant drugs	32 (11.46)	23 (20)	9 (5.48)	10.562	0.032*
	Diabetic drugs	1 (0.35)	1 (0.86)	0 (0)		
	Hypertensive drugs	6 (2.15)	1 (0.86)	5 (3.04)		
	Thyroid drugs	15 (5.37)	8 (6.95)	7 (4.26)		
	Epileptic drugs	2 (0.43)	1 (0.86)	1 (0.6)		
Do you have a history of catheterization?	Yes	19 (6.8)	5 (4.3)	14 (8.5)	1.869	0.171
	No	260 (93.2)	110 (95.7)	150 (91.5)		

* Indicates a statistically significant difference at P<0.05; **N:** number of the subject &**χ^2:** chi-square test.

4.17 Drug susceptibility pattern of Gram stain in pregnant women

Table 4.17 presents the drug susceptibility pattern among pregnant women with UTIsbased on Gram stain results. The chi-square analysis revealed a statistically significant association between Gram stain type and multidrug resistance (MDR) levels (p = 0.048). Notably, Gram-negative isolates were more frequently associated with higher levels of resistance, particularly among those resistant to five or more antibiotics (31.9%), compared to Gram-positive isolates (11.6%).

Table (4.17): Drug susceptibility pattern of UTIsin pregnant women (N=115)

Variables	Categories	Total (115)	Gram stain		Statistical test	
			Negative (n=72)	Positive (n=43)	χ^2	P-value
MDR	No resistance	14 (12.2)	10 (13.9)	4 (9.3)	15.825	0.048
	1	18 (15.7)	10 (13.9)	8 (18.6)		
	2	19 (16.5)	10 (13.9)	9 (20.9)		
	3	21 (18.3)	9 (12.5)	12 (27.9)		
	4	15 (13)	10 (13.9)	5 (11.6)		
	5 or more	28 (24.3)	23 (31.9)	5 (11.6)		

* Indicates a statistically significant difference at P<0.05; **N:** number of the subject χ^2**:** chi-square test.

4.18 Association Between Gram Stain Results and Antibiotic Susceptibility

Table 4.18 examines the association between Gram stain results and antibiotic susceptibility patterns among the study participants. The chi-square analysis revealed statistically significant associations for several antibiotics, including Cefuroxime (p = 0.042), Amoxicillin + Clavulanic Acid (p = 0.000), Cefixime (p = 0.003), Doxycycline (p = 0.020), Colistin (p = 0.014), Cefaclor (p = 0.047), and Piperacillin (p = 0.025). These findings indicate that susceptibility to certain antibiotics varies significantly between Gram-negative and Gram-positive bacterial isolates. In contrast, the remaining antibiotics, including Ciprofloxacin, Levofloxacin, Gentamicin, Nitrofurantoin, and others, showed no significant differences in susceptibility based on Gram stain classification (p > 0.05).

Table (4.18-a): Association Between Gram Stain Results and Antibiotic Susceptibility (N=115).

Variables	Categories	Total (n=115)	Gram Stain Negative (n=72)	Gram Stain Positive (n=43)	χ^2	P-value
Cefotaxime	S	18 (60%)	15 (60%)	3 (60%)	1.920	0.383
	I	2 (6.7%)	1 (4%)	1 (20%)		
	R	10 (33.3%)	9 (36%)	1 (20%)		
Cefuroxime	S	65 (63.7%)	33 (54.1%)	32 (78%)	6.326	0.042*
	I	6 (5.9%)	4 (6.6%)	2 (4.9%)		
	R	31 (30.4%)	24 (39.3%)	7 (17.1%)		
Trimethoprim-Sulfamethoxazole (TMP-SMX)	S	36 (50.7%)	21 (43.8%)	15 (65.2%)	3.580	0.167
	I	2 (2.8%)	1 (2.1%)	1 (4.3%)		
	R	33 (46.5%)	26 (54.2%)	7 (30.4%)		

Table (4.18-b): Association Between Gram Stain Results and Antibiotic Susceptibility (N=115).

Antibiotic	Susceptibility	Total (n=115)	Gram-negative (n=72)	Gram-positive (n=43)	χ^2	P-value
Amoxicillin + Clavulanic Acid	S	68 (63)	32 (48.5)	36 (85.7)	16.059	0.000*
	I	7 (6.5)	7 (10.6)	0 (0)		
	R	33 (30.6)	27 (40.9)	6 (14.3)		
Ceftriaxone	S	49 (60.5)	33 (63.5)	16 (55.2)	2.119	0.347
	I	1 (1.2)	0 (0)	1 (3.4)		
	R	31 (38.3)	19 (36.5)	12 (41.4)		
Cefdinir	S	26 (66.7)	10 (58.8)	16 (72.7)	1.502	0.472
	I	3 (7.7)	1 (5.9)	2 (9.1)		
	R	10 (25.6)	6 (35.3)	4 (18.2)		
Nitrofurantoin	S	68 (70.1)	38 (62.3)	30 (83.3)	8.943	0.044
	I	7 (7.2)	6 (9.8)	1 (2.8)		
	R	22 (22.7)	17 (27.9)	5 (13.9)		
Levofloxacin	S	48 (76.2)	35 (77.8)	13 (72.2)	2.552	0.279
	I	1 (1.6)	0 (0)	1 (5.6)		
	R	14 (22.2)	10 (22.2)	4 (22.2)		
Ciprofloxacin	S	45 (80.4)	35 (79.5)	10 (83.3)	0.086	0.770
	I	0 (0)	0 (0)	0 (0)		
	R	11 (19.6)	9 (20.5)	2 (16.7)		
Gentamicin	S	24 (66.7)	20 (71.4)	4 (50)	1.286	0.526
	I	3 (8.3)	2 (7.1)	1 (12.5)		
	R	9 (25)	6 (21.4)	3 (37.5)		
Fosfomycin	S	25 (44.6)	18 (56.3)	7 (29.2)	4.260	0.119
	I	3 (5.4)	1 (3.1)	2 (8.3)		
	R	28 (50)	13 (40.6)	15 (62.5)		
Cefixime	S	22 (39.3)	19 (54.3)	3 (14.3)	11.345	0.003*
	I	2 (3.6)	2 (5.7)	0 (0)		
	R	32 (57.1)	14 (40)	18 (85.7)		
Cefpodoxime	S	13 (43.3)	7 (46.7)	6 (40)	0.144	0.931
	I	2 (6.7)	1 (6.7)	1 (6.7)		
	R	15 (50)	7 (46.7)	8 (53.3)		

Table (4.18-c): Association Between Gram Stain Results and other Antibiotic Susceptibility (N=115).

Antibiotic	Susceptibility	Total (n)	Gram-negative (n=72)	Gram-positive (n=43)	χ^2	P-value
Gentamicin	S	24 (66.7)	20 (71.4)	4 (50)	1.286	0.526
	I	3 (8.3)	2 (7.1)	1 (12.5)		
	R	9 (25)	6 (21.4)	3 (37.5)		
Fosfomycin	S	25 (44.6)	18 (56.3)	7 (29.2)	4.260	0.119
	I	3 (5.4)	1 (3.1)	2 (8.3)		
	R	28 (50)	13 (40.6)	15 (62.5)		
Cefixime	S	22 (39.3)	19 (54.3)	3 (14.3)	11.345	0.003*
	I	2 (3.6)	2 (5.7)	0 (0)		
	R	32 (57.1)	14 (40)	18 (85.7)		
Cefpodoxime	S	13 (43.3)	7 (46.7)	6 (40)	0.144	0.931
	I	2 (6.7)	1 (6.7)	1 (6.7)		
	R	15 (50)	7 (46.7)	8 (53.3)		
Doxycycline	S	10 (47.6)	6 (35.3)	4 (100)	5.435	0.02*
	I	0 (0)	0 (0)	0 (0)		
	R	11 (52.4)	11 (64.7)	0 (0)		
Tetracycline	S	5 (71.4)	4 (66.7)	1 (100)	0.467	0.495
	I	0 (0)	0 (0)	0 (0)		
	R	2 (28.6)	2 (33.3)	0 (0)		
Meropenem	S	27 (100)	25 (100)	2 (100)	NA	NA
	I	0 (0)	0 (0)	0 (0)		
	R	0 (0)	0 (0)	0 (0)		
Amikacin	S	24 (88.9)	22 (88)	2 (100)	0.270	0.603
	I	0 (0)	0 (0)	0 (0)		
	R	3 (11.1)	3 (12)	0 (0)		
Nalidixic Acid	S	3 (37.5)	3 (50)	0 (0)	1.600	0.206
	I	0 (0)	0 (0)	0 (0)		
	R	5 (62.5)	3 (50)	2 (100)		
Azithromycin	S	8 (47.1)	2 (28.6)	6 (60)	3.730	0.155
	I	2 (11.8)	2 (28.6)	0 (0)		
	R	7 (41.2)	3 (42.9)	4 (40)		
Clindamycin	S	1 (50)	1 (100)	0 (0)	2.000	0.157
	I	0 (0)	0 (0)	0 (0)		
	R	1 (50)	0 (0)	1 (100)		

Table (4.18-d): Association Between Gram Stain Results and other Antibiotic Susceptibility (N=115).

Antibiotic	Susceptibility	Total (n)	Gram-negative (n=72)	Gram-positive (n=43)	χ^2	P-value
Clindamycin	I	0 (0)	0 (0)	0 (0)		
	R	1 (50)	0 (0)	1 (100)		
Cephalexin	S	8 (32)	4 (22.2)	4 (57.1)	3.269	0.195
	I	3 (12)	2 (11.1)	1 (14.3)		
	R	14 (56)	12 (66.7)	2 (28.6)		
Ampicillin	S	1 (20)	1 (20)	0 (0)	0.000	
	I	0 (0)	0 (0)	0 (0)		
	R	4 (80)	4 (80)	0 (0)		
Penicillin	S	3 (33.3)	0 (0)	3 (37.5)	1.406	0.495
	I	2 (22.2)	0 (0)	2 (25)		
	R	4 (44.4)	1 (100)	3 (37.5)		
Cefadroxil	S	13 (68.4)	7 (70)	6 (66.7)	0.024	0.876
	I	0 (0)	0 (0)	0 (0)		
	R	6 (31.6)	3 (30)	3 (33.3)		
Cefepime	S	3 (100)	3 (100)	0 (0)	NA	NA
	I	0 (0)	0 (0)	0 (0)		
	R	0 (0)	0 (0)	0 (0)		
Ceftazidime	S	7 (50)	7 (50)	0 (0)	NA	NA
	I	0 (0)	0 (0)	0 (0)		
	R	7 (50)	7 (50)	0 (0)		
Colistin	S	5 (83.3)	5 (100)	0 (0)	6.000	0.014*
	I	0 (0)	0 (0)	0 (0)		
	R	1 (16.7)	0 (0)	1 (100)		
Cefaclor	S	1 (11.1)	0 (0)	1 (50)	6.107	0.047*
	I	2 (22.2)	1 (14.3)	1 (50)		
	R	6 (66.7)	6 (85.7)	0 (0)		
Moxifloxacin	S	4 (57.1)	4 (57.1)	0 (0)	NA	NA
	I	1 (14.3)	1 (14.3)	0 (0)		
	R	2 (28.6)	2 (28.6)	0 (0)		
Piperacillin	S	1 (20)	0 (0)	1 (100)	5.000	0.025*
	I	0 (0)	0 (0)	0 (0)		
	R	4 (80)	4 (100)	0 (0)		

*Indicates a statistically significant difference at $P<0.05$; **N:** number of the subject &**χ^2:** chi-square test.

4.19 Relationship between recurrent UTI and studied parameters among the study participants

Figure 4.1 illustrates the follow-up diagram of the study participants. Table 4.19demonstrates the relationship between recurrent UTI and the studied parameters among them. The chi-square test revealed that there was no statistically significant association between recurrent UTI and all studied parameters ($p > 0.05$).

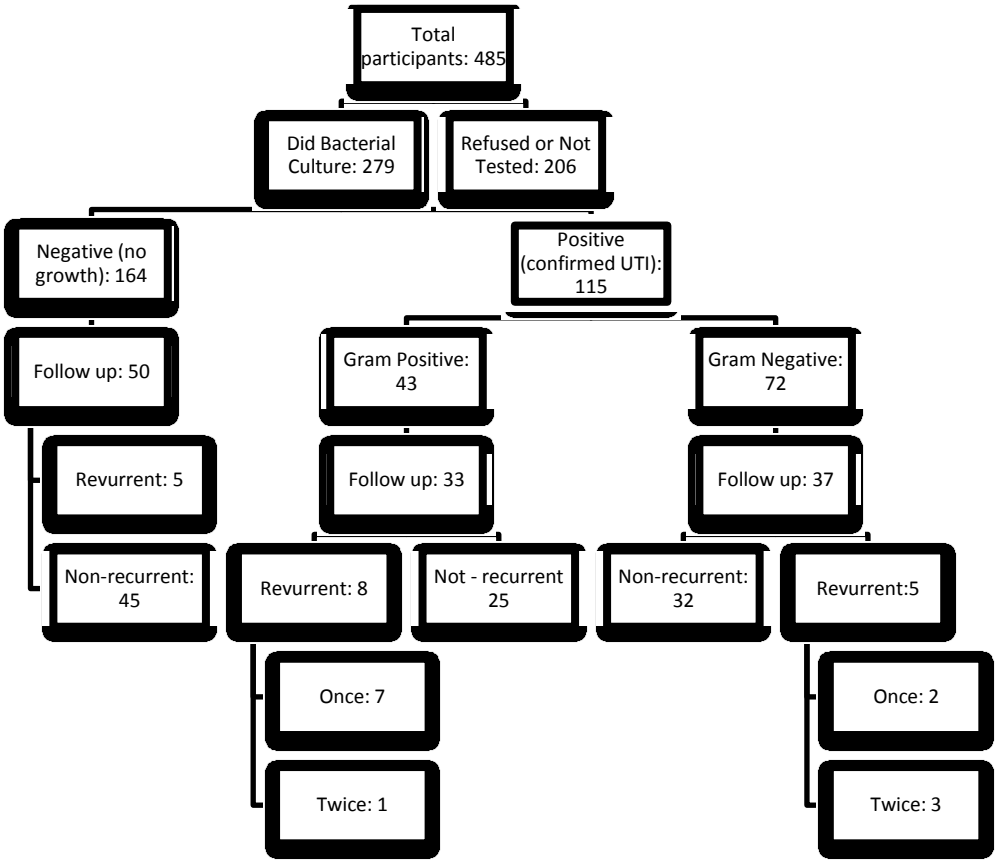

Figure 4.1 Bacterial Culture Results and Patient Follow-up Overview

Table (4.19-a) Relationship between recurrent UTI and studied parameters among the study participants .

Variables	Categories	Total (N=120) N (%)	Non-Recurrent (N=102) N (%)	Recurrent (N=18) N (%)	χ^2	P-value
Age (years)	18-24	52 (43.3)	45 (44.1)	7 (38.9)	0.371	0.946
	25-34	47 (39.2)	40 (39.2)	7 (38.9)		
	35-44	16 (13.3)	13 (12.7)	3 (16.7)		
	>45	5 (4.2)	4 (3.9)	1 (5.6)		
Educational Level	Illiterate	2 (1.7)	2 (2)	0 (0)	3.178	0.365
	Primary	10 (8.3)	10 (9.8)	0 (0)		
	Higher school	62 (51.7)	50 (49)	12 (66.7)		
	Bachelor's	46 (38.3)	40 (39.2)	6 (33.3)		
	Master/PhD	0 (0)	0 (0)	0 (0)		
Occupation	Housewife	100 (83.3)	85 (83.3)	15 (83.3)	0.000	1.000
	Employee	20 (16.7)	17 (16.7)	3 (16.7)		
Socioeconomic status (income in shekel)	Low (<2000)	33 (27.5)	28 (27.5)	5 (27.8)	0.224	0.894
	Middle (2000-4000)	71 (59.2)	61 (59.8)	10 (55.6)		
	High (>4000)	16 (13.3)	13 (12.7)	3 (16.7)		
Smoking status	Smoker	5 (4.2)	3 (2.9)	2 (11.1)	3.131	0.209
	Ex-smokers	14 (11.7)	13 (12.7)	1 (5.6)		
	Not smoker	101 (84.2)	86 (84.3)	15 (83.3)		
Geographic location of residence	City	25 (20.8)	21 (20.6)	4 (22.2)	0.736	0.692
	Village	91 (75.8)	77 (75.5)	14 (77.8)		
	Camp	4 (3.3)	4 (3.9)	0 (0)		
Current trimester	First Trimester (1-12 weeks)	34 (28.3)	27 (26.5)	7 (38.9)	2.127	0.345
	Second Trimester (13-26 weeks)	50 (41.7)	42 (41.2)	8 (44.4)		
	Third Trimester (27-40 weeks)	36 (30)	33 (32.4)	3 (16.7)		
Gravidity (number of pregnancies)	1	29 (24.2)	24 (23.5)	5 (27.8)	3.994	0.136
	2-5	72 (60)	59 (57.8)	13 (72.2)		
	≥6	19 (15.8)	19 (18.6)	0 (0)		

Table (4.19-b) Relationship between recurrent UTI and studied parameters among the study participants .

Variables	Categories	Total (N=120) N (%)	Non-Recurrent (N=102) N (%)	Recurrent (N=18) N (%)	χ^2	P-value
Parity (number of children)	0	51 (42.5)	44 (43.1)	7 (38.9)	0.959	0.619
	1	0 (0)	0 (0)	0 (0)		
	2-5	65 (54.2)	54 (52.9)	11 (61.1)		
	≥6	4 (3.3)	4 (3.9)	0 (0)		
Have you ever experienced an abortion?	Yes	46 (38.3)	41 (40.2)	5 (27.8)	0.998	0.317
	No	74 (61.7)	61 (59.8)	13 (72.2)		
Daily water intake	Less than 4 cups	44 (36.7)	34 (33.3)	10 (55.6)	3.352	0.187
	4-8 cups	63 (52.5)	56 (54.9)	7 (38.9)		
	More than 8 cups	13 (10.8)	12 (11.8)	1 (5.6)		
Frequency of urination per day	Less than 4	13 (10.8)	11 (10.8)	2 (11.1)	0.034	0.983
	4-8	69 (57.5)	59 (57.8)	10 (55.6)		
	More than 8	38 (31.7)	32 (31.4)	6 (33.3)		
Do you usually delay urination?	Never	20 (16.7)	18 (17.6)	2 (11.1)	1.093	0.779
	Sometimes	67 (55.8)	56 (54.9)	11 (61.1)		
	Often	30 (25)	25 (24.5)	5 (27.8)		
	Always	3 (2.5)	3 (2.9)	0 (0)		
Do you drink other liquids besides water?	Yes	81 (67.5)	70 (68.6)	11 (61.1)	0.394	0.530
	No	39 (32.5)	32 (31.4)	7 (38.9)		
Do you always wash your hands before and after using the toilet?	Yes	104 (86.7)	89 (87.3)	15 (83.3)	0.204	0.652
	No	16 (13.3)	13 (12.7)	3 (16.7)		
Do you eat a lot of salty foods and pickles daily?	Yes	60 (50)	51 (50)	9 (50)	0.000	1.000
	No	60 (50)	51 (50)	9 (50)		
Wiping method after toilet use	From front to back	65 (54.1)	52 (51)	13 (77.8)	3.233	0.198
	From back to front	55 (45.8)	50 (49)	5 (27.8)		
Frequency of sexual activity per week	Less than 1	23 (19.2)	20 (19.6)	3 (16.7)	0.248	0.884
	1-5	81 (67.5)	69 (67.6)	12 (66.7)		
	More than 5	16 (13.3)	13 (12.7)	3 (16.7)		

Table (4.19-c) Relationship between recurrent UTI and studied parameters among the study participants.

Variables	Categories	Total (N=120) N (%)	Non-Recurrent (N=102) N (%)	Recurrent (N=18) N (%)	χ^2	P-value
Do you change your underwear daily?	Yes	113 (94.2)	96 (94.1)	17 (94.4)	0.003	0.957
	No	7 (5.8)	6 (5.9)	1 (5.6)		
Regular consumption of complementary/alternative treatments: Vitamin C	Yes	55 (45.8)	45 (44.1)	10 (55.6)	0.806	0.369
	No	65 (54.2)	57 (55.9)	8 (44.4)		
Cranberry	Yes	10 (8.3)	7 (6.9)	3 (16.7)	1.925	0.165
	No	110 (91.7)	95 (93.1)	15 (83.3)		
Education on preventing UTIs	Yes	73 (60.8)	61 (59.8)	12 (66.7)	0.302	0.582
	No	47 (39.2)	41 (40.2)	6 (33.3)		
Counselling on antibiotic resistance	Yes	39 (32.5)	31 (30.4)	8 (44.4)	1.377	0.240
Vaginal discharge and internal itching	Yes	55 (45.8)	45 (44.2)	10 (55.6)	1.378	0.502
	No	65 (54.2)	57 (55.9)	8 (44.4)		
Symptoms experienced: Frequent urination	Yes	83 (69.2)	69 (67.6)	14 (77.8)	0.736	0.390
	No	37 (30.8)	33 (32.4)	4 (22.2)		
Lower abdominal pain	Yes	68 (56.7)	56 (54.9)	12 (66.7)	0.862	0.353
	No	52 (43.3)	46 (45.1)	6 (33.3)		
Back pain	Yes	69 (57.5)	57 (55.9)	12 (66.7)	0.728	0.393
	No	51 (42.5)	45 (44.1)	6 (33.3)		
Painful urination	Yes	46 (38.3)	40 (39.2)	6 (33.3)	0.224	0.636
	No	74 (61.7)	62 (60.8)	12 (66.7)		
Blood in urine	Yes	13 (10.8)	13 (12.7)	0 (0)	2.573	0.109
	No	107 (89.2)	89 (87.3)	18 (100)		

Table (4.19-d): Relationship between recurrent UTI and studied parameters among the study participants.

Variables	Categories	Total (N=120) N (%)	Non-Recurrent (N=102) N (%)	Recurrent (N=18) N (%)	χ^2	P-value
Were antibiotics prescribed?	Yes	87 (72.5)	74 (72.5)	13 (72.2)	0.001	0.977
	No	33 (27.5)	28 (27.5)	5 (27.8)		
If yes, name of prescribed antibiotic	Cefuroxime	48 (55.2)	45 (60.8)	3 (23.1)	3.053	0.106
	Nitrofurantoin	11 (12.6)	9 (12.2)	2 (15.4)		
	Cefixime	7 (8)	5 (6.8)	2 (15.4)		
	Amoxicillin-Clavulanic acid	5 (5.7)	5 (6.8)	0 (0)		
	Ceftriaxone (IV)	2 (2.3)	2 (2.7)	0 (0)		
	Cefpodoxime	4 (4.6)	3 (4.1)	1 (7.7)		
	Fosfomycin	4 (4.6)	1 (1.4)	3 (23.1)		
	Cefadroxil	1 (1.1)	1 (1.4)	0 (0)		
	Metronidazole	4 (4.6)	3 (4.1)	1 (7.7)		
Route of prescribed treatment	Oral use	80 (86.2)	74 (86.5)	12 (84.6)	2.917	0.572
	Injection use	2 (2.3)	2 (2.7)	0 (0)		
	Vaginal suppositories	5 (5.7)	4 (5.4)	1 (7.7)		
Did you complete the course as prescribed?	Yes	111 (92.5)	95 (93.1)	16 (88.9)	0.398	0.528
	No	9 (7.5)	7 (6.9)	2 (11.1)		
Known allergies to antibiotics	Yes	11 (9.2)	11 (10.8)	0 (0)	2.137	0.144
	No	109 (90.8)	91 (89.2)	18 (100)		
Symptoms resolved after antibiotics	Yes	84 (70)	73 (71.6)	11 (61.1)	0.797	0.372
	No	36 (30)	29 (28.4)	7 (38.9)		
Currently taking any medications	Yes	24 (20)	21 (20.6)	3 (16.7)	0.147	0.701
	No	96 (80)	81 (79.4)	15 (83.3)		
Type of medications	Anti-coagulant drugs	7 (35)	5 (27.8)	2 (100)	0.000	1.000
	Hypertensive drugs	5 (25)	5 (27.8)	0 (0)		
	Diabetic drugs	1 (5)	1 (5.6)	0 (0)		
	Thyroid drugs	2 (10)	2 (11.1)	0 (0)		
	Epileptic drugs	1 (5)	1 (5.6)	0 (0)		
History of catheterization	Yes	6 (5)	6 (5.9)	0 (0)	0.000	1.000
	No	114 (95)	96 (94.1)	18 (100)		

Table (4.19-e): Association Between Recurrent UTI and Antibiotic Resistance/Susceptibility Profiles in the Study Population.

Variables	Categories	Total (N=120)	Non-Recurrent (N=102)	Recurrent (N=18)	χ^2	P-value
Cefotaxime	S	12 (70.6)	11 (73.3)	1 (50)	0.000	1.000
	I	1 (5.9)	1 (6.7)	0 (0)		
	R	4 (23.5)	3 (20)	1 (50)		
Cefuroxime	S	43 (64.2)	36 (65.5)	7 (58.3)	0.000	1.000
	I	4 (6)	3 (5.5)	1 (8.3)		
	R	20 (29.9)	16 (29.1)	4 (33.3)		
Trimethoprim–Sulfamethoxazole (TMP-SMX)	S	26 (54.2)	24 (58.5)	2 (28.6)	0.000	1.000
	I	2 (4.2)	1 (2.4)	1 (14.3)		
	R	20 (41.7)	16 (39)	4 (57.1)		
Amoxicillin + Clavulanic Acid	S	48 (67.6)	41 (68.3)	7 (63.6)	0.000	1.000
	I	5 (7)	4 (6.7)	1 (9.1)		
	R	18 (25.4)	15 (25)	3 (27.3)		
Ceftriaxone	S	32 (58.2)	26 (59.1)	6 (54.5)	0.000	1.000
	I	1 (1.8)	1 (2.3)	0 (0)		
	R	22 (40)	17 (38.6)	5 (45.5)		
Cefdinir	S	19 (63.3)	17 (73.9)	2 (28.6)	0.000	1.000
	I	2 (6.7)	1 (4.3)	1 (14.3)		
	R	9 (30)	5 (21.7)	4 (57.1)		
Nitrofurantoin	S	48 (75)	39 (75)	9 (75)	0.000	1.000
	I	5 (7.8)	4 (7.7)	1 (8.3)		
	R	11 (17.2)	9 (17.3)	2 (16.7)		
Levofloxacin	S	31 (81.6)	28 (84.8)	3 (60)	0.000	1.000
	I	1 (2.6)	1 (3)	0 (0)		
	R	6 (15.8)	4 (12.1)	2 (40)		
Ciprofloxacin	S	31 (83.8)	27 (87.1)	4 (66.7)	0.000	1.000
	I	0 (0)	0 (0)	0 (0)		
	R	6 (16.2)	4 (12.9)	2 (33.3)		
Gentamicin	S	11 (61.1)	8 (53.3)	3 (100)	0.000	1.000
	I	3 (16.7)	3 (20)	0 (0)		
	R	4 (22.2)	4 (26.7)	0 (0)		
Fosfomycin	S	19 (51.4)	16 (55.2)	3 (37.5)	0.000	1.000
	I	3 (8.1)	1 (3.4)	2 (25)		
	R	15 (40.5)	12 (41.4)	3 (37.5)		

Table (4.19-f): Association Between Recurrent UTI and Antibiotic Resistance/Susceptibility Profiles in the Study Population.

Antibiotic	Category	Total n (%)	Non-Recurrent n (%)	Recurrent n (%)	χ^2	p-value
Cefixime	S	17 (43.6)	13 (40.6)	4 (57.1)	0.000	1.000
	I	2 (5.1)	2 (6.3)	0 (0)		
	R	20 (51.3)	17 (53.1)	3 (42.9)		
Cefpodoxime	S	11 (45.8)	8 (44.4)	3 (50)	0.000	1.000
	I	2 (8.3)	2 (11.1)	0 (0)		
	R	11 (45.8)	8 (44.4)	3 (50)		
Doxycycline	S	7 (43.8)	4 (30.8)	3 (100)	0.000	1.000
	I	0 (0)	0 (0)	0 (0)		
	R	9 (56.3)	9 (69.2)	0 (0)		
Tetracycline	S	3 (60)	3 (60)	0 (0)	0.000	1.000
	I	0 (0)	0 (0)	0 (0)		
	R	2 (40)	2 (40)	0 (0)		
Meropenem	S	14 (100)	10 (100)	4 (100)	0.000	1.000
	I	0 (0)	0 (0)	0 (0)		
	R	0 (0)	0 (0)	0 (0)		
Amikacin	S	14 (93.3)	13 (92.9)	1 (100)	0.000	1.000
	I	0 (0)	0 (0)	0 (0)		
Nalidixic Acid	S	2 (33.3)	2 (33.3)	0 (0)	0.000	1.000
	I	0 (0)	0 (0)	0 (0)		
	R	4 (66.7)	4 (66.7)	0 (0)		
Azithromycin	S	7 (53.8)	7 (63.6)	0 (0)	0.000	1.000
	I	1 (7.7)	1 (9.1)	0 (0)		
	R	5 (38.5)	3 (27.3)	2 (100)		
Clindamycin	S	0 (0)	0 (0)	0 (0)	0.000	1.000
	I	0 (0)	0 (0)	0 (0)		
	R	0 (0)	0 (0)	0 (0)		
Cephalexin	S	6 (40)	6 (42.9)	0 (0)	0.000	1.000
	I	3 (20)	2 (14.3)	1 (100)		
	R	6 (40)	6 (42.9)	0 (0)		

Table (4.19-h): Association Between Recurrent UTI and other AntibioticResistance/Susceptibility Profiles in the Study Population.

Antibiotic	Category	Total n (%)	Non-Recurrent n (%)	Recurrent n (%)	χ^2	p-value
Ampicillin	S	1 (50)	1 (50)	0 (0)	0.000	1.000
	I	0 (0)	0 (0)	0 (0)		
	R	1 (50)	1 (50)	0 (0)		
Penicillin	S	2 (25)	2 (25)	0 (0)	0.000	1.000
	I	2 (25)	2 (25)	0 (0)		
	R	4 (50)	4 (50)	0 (0)		
Cefadroxil	S	8 (72.7)	7 (70)	1 (100)	0.000	1.000
	I	0 (0)	0 (0)	0 (0)		
	R	3 (27.3)	3 (30)	0 (0)		
Cefepime	S	2 (100)	1 (100)	1 (100)	0.000	1.000
	I	0 (0)	0 (0)	0 (0)		
	R	0 (0)	0 (0)	0 (0)		
Ceftazidime	S	4 (66.7)	2 (66.7)	2 (66.7)	0.000	1.000
	I	0 (0)	0 (0)	0 (0)		
	R	2 (33.3)	1 (33.3)	1 (33.3)		
Colistin	S	1 (100)	1 (100)	0 (0)	0.000	1.000
	I	0 (0)	0 (0)	0 (0)		
	R	0 (0)	0 (0)	0 (0)		
Cefaclor	S	0 (0)	0 (0)	0 (0)	0.000	1.000
	I	0 (0)	0 (0)	0 (0)		
	R	3 (100)	3 (100)	0 (0)		
Moxifloxacin	S	2 (50)	2 (50)	0 (0)	0.000	1.000
	I	0 (0)	0 (0)	0 (0)		
	R	2 (50)	2 (50)	0 (0)		
Piperacillin	S	0 (0)	0 (0)	0 (0)	0.000	1.000
	I	0 (0)	0 (0)	0 (0)		
	R	1 (100)	1 (100)	0 (0)		

ChapterFive

Discussion

5.1 UTI Burden, Clinical Presentation, and Diagnostic Methods

This study found a 23.7% incidence of culture-confirmed UTIs among 279 pregnant women who underwent urine culture at baseline, and the cumulative incidence of new-onset UTIs among 164 initially culture-negative pregnant womenduгing the follow-up period was observed to be 3.0%. These rates are substantially higher than global pooled prevalence estimates for asymptomatic bacteriuria (2–10%) and symptomatic UTI (up to 15%) reported in systematic reviews (Szweda & Jóźwik, 2016).Notably, 39.4% of participants reported a previous history of abortion, which also exceeds both the global prevalence of miscarriage as reported by studies (15.3% of clinically recognized pregnancies)(Quenby et al., 2021) and the (17.9 %) reported in regional studies from Jordan (Al-Alami et al., 2024).

These elevated rates may reflect multiple interacting factors, including prior obstetric complications, limited access to culture-based diagnostic services, delays in antenatal care, and suboptimal sanitation in rural areas and refugee camps(Al-Alami et al., 2024). Behavioral risks, such as low fluid intake and inadequate perineal hygiene(Khadra et al., 2022), combined with the high burden of multidrug resistance (55.7%) among bacterial isolates, likely further increases susceptibility, recurrence, and the risk of treatment failure.

Comparable findings have been reported in the region, with a 21.5% prevalence of UTI during pregnancy in Jordan (Hatamleh et al., 2024a)and a 33.6% prevalence of asymptomatic bacteriuria in Ramallah city in Palestine (33.6% asymptomatic bacteriuria) (Majd Milhem, 2020) suggest broader regional challenges. Studies from other low- and middle-income countries, including Ethiopia and Ghana, have documented somewhat lower but still elevated

prevalence estimates (9–25%), underscoring the shared challenges of managing UTI in resource-limited healthcare settings(Gessese et al., 2017; Vicar et al., 2023).

Frequent urination (66.2%), lower abdominal pain (39.0%), and back pain (39.4%) were the most reported symptoms, consistent with global patterns (Waters, 1969). However, 42.5% of participants with symptoms declined urine culture testing, relying instead on urine analysis (80.4%) or dipstick testing (1.6%). This difference in diagnosis, also seen in a study of pregnant refugees in Lebanon (where 18% had positive cultures but 82% were possibly overprescribed antibiotics based on dipstick results), shows the danger of misdiagnosis and the wrong use of antibiotics (Al Kady et al., 2024). The over-reliance on empirical diagnosis shown in this study, driven by limited laboratory capacity and cost barriers, contrasts with ACOG guidelines recommending urine culture as the gold standard for UTI confirmation (The American College of Obstetricians and Gynecologists, 2023).

5.2 Causative Organisms and Resistance Patterns

E. coli (61.1% of Gram-negative isolates) and *S. aureus* (60.5% of Gram-positive isolates) were the most common microbes causing UTIs, which matches global and regional research showing that *E. coli* is responsible for 60–82% of UTIs during pregnancy in various countries (Adeel et al., 2024; Taha, 2024; Wing et al., 2014).

This study found a significant prevalence of MDR uropathogens (55.7% of isolates), that defined as exhibiting resistance to a minimum of three antibiotic classes (Magiorakos et al., 2012). This aligns with the middle-income countries, like a study in East Africa found 50% MDR rates in pregnant women with UTIs (Maldonado-Barragán et al., 2023). Similarly, a retrospective observational study found that out of 371 pregnant women with UTIs, 70 (18.9%) experienced MDR infections. And these were primarily caused by *E. coli, Enterococcus faecalis, and Klebsiella spp*., which exhibit nearly universal resistance to several frequently used antibiotics, including ampicillin (80%), cefixime (57.1%), and fosfomycin (50%)(Anton et al., 2024). Additionally, it demonstrated that MDR status is independently associated with notable maternal and neonatal complications, such as preterm birth, premature rupture of membranes, neonatal respiratory distress syndrome, and NICU admission (Anton et al., 2024).

On the other hand, carbapenems such as meropenem demonstrated 100% susceptibility, indicating their potential utility as second-line treatments. However, their use during pregnancy should be used with caution and only when safer alternatives are not available due to limited safety data, potential risks to the fetus, and cost considerations (Brian J. Werth & Brenda L. Tesini, 2024).

5.3 Recurrent UTIs Prevalence and Predictors

The recurrence rate during the 3-month follow-up found to be 15%, consider lower than global estimates (20–40%) from various studies (Balachandran et al., 2022), possibly due to high loss to follow-up or the short follow-up period. No statistically significant associations were found between recurrence and demographic, behavioral, or clinical factors ($p > 0.05$), contrasting with studies identifying inadequate hydration, frequent sexual activity, and prior UTIs as predictors (Al-Badr & Al-Shaikh, 2013; Mohamed et al., 2024).This lack of significance may be due to the small number of recurrent cases (n=18) or unmeasured confounders, such as genetic predisposition or biofilm formation, which can sustain subclinical infections.

In this study, cases involving MDR organisms frequently exhibited persistent symptoms post-treatment, indicating insufficient infection clearance, suggests that recurrence may be driven by treatment failure due to prevalent resistant strains.

5.4 Appropriateness of Antibiotic Prescriptions

Despite that urine culture screening is advised by the Ministry of Health policy in Palestine both during the booking visit and at 24 weeks of pregnancy, mainly to identify silent bacteriuria(Palestinian Ministry of Health, 2023), this technique is frequently not followed in the current clinical practice. The presence of urinary symptoms and the results of a urine analysis are usually used to diagnose UTI in pregnant women, and empirical antibiotic prescription is the established method. Because of limitations in laboratory capacity as well as related expenses, urine cultures are typically saved for cases of recurrent infection or failure to respond to initial medication.

This was obviously shown in this study, that reveals an exceesive using of empirical treatment (55.5%) for suspected UTI without doing urine culture (the gold standered test to confirm UTI diagnosis), that was utilized in only 38.1% of cases. This approach may elevate the risk of inappropriate antibiotic use and subsequent treatment failure due to the lack of microbiological confirmation.

Guideline from the National Institute for Health and Care Excellence (NICE) stated that pregnant women should start empirical antibiotic therapy immediately if they have symptoms indicative of a lower UTI, especially if lab access is delayed. Taking into account prior urine culture and susceptibility, and past antibiotic use. But this can be done during the waiting time for the results of the urine culture and sensitivity tests. Afterthat, changing the antibiotic if it was not suscebitible and using narrow-spectrum antibiotics have to be done. This method is suggested to prevent the infection from becoming more severe and minimize the risk of complications like pyelonephritis, while ensuring that urine culture is still performed (The National Institute for Health and Care Excellence (NICE), 2023).

The results showed that 41.4% of patients were prescribed oral medications at the appropriate dose and duration. Injectable or suppository routes were also used for additional therapeutic indications, such as concurrent vaginitis and refractory or severe infections. Despite the majority (91.5%) of them reporting adherence to their prescribed antibiotic regimen, only two-thirds reported symptom remission, revealing an treatment failure in 34% of cases.

In this study, adherence to ACOG-recommended first-line antibiotics for cystitis and asymptomatic bacteriuria in pregnancy, like nitrofurantoin, amoxicillin–clavulanic acid, cephalexin, and fosfomycin, was observed in only 22.7% of prescriptions issued in the primary healthcare setting. This finding aligns with reports from comparable low- and middle-income countries, where adherence rates remains suboptimal and ranged from 20% to 40% (Gamberini et al., 2023; Ghouri & Hollywood, 2020). The low adherence observed may be attributed to empirical prescribing without microbiological confirmation, limited availability of first-line agents, and prescribers preference for broader-spectrum antibiotics such as cefuroxime and cefixime.

5.5 Sociodemographic, Clinical, and Behavioral Risk Factors

The study identified significant associations between the risk of UTI occurrence and many factors, including younger age category (18–24 years), residence in camps or villages, low income, and unemployment status. This aligns with previous studies that demonstrate socioeconomic status and educational attainment influence the risk for UTI (Ahmad et al., 2020; Hatamleh et al., 2024b)(Ahmad et al., 2020; Hatamleh et al., 2024b, (Saffarini et al., 2021))

History of previous UTI and multiparity, despite being prevalent among patients who tested positive for UTI, our findings lacked statistical significance for it. This suggests a non-significant pattern ($p > 0.05$) as a potential risk factor. Similarly, a study in Lebanon also showed a non-significant trend of these factors toward increased UTI risk (Abu Aleinein & Salem Sokhn, 2024). Conversely, many studies identified it as a significant factor(Haider et al., 2010).

Interestingly, consuming vitamin C supplementation and receiving education about antibiotic resistance were significantly associated with lower rates of UTIs ($p = 0.023$ and $p = 0.021$, respectively). This supports the conclusions of some studies that have explored the role of vitamin C as a supportive therapy for UTI management due to its potential to acidify urine and exert antimicrobial effects, particularly against *E. coli*(Hassuna et al., 2023).

Previous studies have investigated cranberry products as a non-antibiotic option to prevent UTIs. but one of them found inconsistent evidence for cranberries' effectiveness in the general population, primarily non-pregnant women, with limited data on pregnant women, and later

reviews noted that cranberries' benefits vary by formulation, dose, and population (Jepson et al., 2012; Luís et al., 2017). While another study specifically examined cranberry use in susceptible populations and highlighted potential preventive effects, although variability in outcomes remains (Wang et al., 2012). Current guidelines do not recommend cranberries for UTI prevention in pregnant women due to limited and low-quality evidence in pregnancy (NG109, 2018). That can be supported by this study, which did not find any statistical association, but it could also be due to insufficient representation of cranberry users, with only 6.4% included, to determine a protective effect.

Moreover, despite personal hygiene remaining a widely recommended preventive strategy in other global studies, the lack of association between daily underwear changing and reducing UTI occurrence is also notable. Recent literature emphasizes that behavioral patterns such as delaying urination, wiping direction after using the toilet, and insufficient hydration also play a role in altering the urogenital flora and facilitating ascending bacterial infections(Hatamleh et al., 2024b; Mohamed et al., 2024). This is supported by our study, which found that participants who often or always delayed urination, who wiped from back to front, or who drank fewer than 4 cups of water each day had a significantly higher risk of developing UTI compared to others.

Furthermore, the findings indicated a statistical association between awareness of antibiotic resistance and a reduced risk of infection. On the other hand, there was no such association between general education about hygiene and UTI prevention. This aligns with the findings of a previous study indicated that provider-led AMS education in primary care significantly reduced the risk of UTIs and enhanced the prescription practices for pregnant women(Goebel et al., 2021). Similarly, another study showed that enhancing patients' awareness of the consequences of resistance increased their adherence to therapy and diminished the likelihood of self-medication practices(Walters et al., 2020). Moreover, a study reported that although pregnant women are generally aware of UTIs, they often lack a clear understanding of appropriate preventive behaviors, highlighting the importance of implementing educational interventions that focus on behavioral practices(Szweda & Jóźwik, 2016).

Chapter Six

6.1 Conclusions

This study highlights critical gaps in the management of UTIs among pregnant women attending primary healthcare centers in Nablus. Although most antibiotic prescriptions demonstrated appropriate dosing and duration, only 22.7% aligned with first-line agents recommended by the ACOG guidelines, indicating a significant deviation from evidence-based prescribing standards.

The high prevalence of MDR uropathogens—particularly *E. coli* and *S. aureus*, which were the most predominant pathogens in the sample —further emphasizes the need for improved diagnostic and therapeutic strategies. Over half of all bacterial isolates exhibited resistance to three or more antibiotics, underscoring the growing threat of AMR in the antenatal population. Additionally, the study identified a range of sociodemographic, obstetrical, and behavioral factors that significantly affected the risk of UTI. Variables such as trimester of pregnancy, history of abortion, poor hygiene practices (e.g., improper wiping methods), low fluid intake, delayed urination, and lack of education on antibiotic resistance were statistically significant contributors to increased infection susceptibility.

Despite widespread antibiotic use among participants, only two-thirds experienced symptom resolution, which suggests the need for reassessment of treatment efficacy and promotion of evidence-based prescribing using urine culture confirmation. Moreover, the limited use of preventive strategies such as vitamin C and the lack of awareness among patients about antibiotic resistance risks mean there are educational gaps that warrant public health interventions.

6.2 Recommendations:

- **Promote Culture-Based Diagnosis**
- Encourage urine culture and sensitivity testing before prescribing antibiotics to reduce unnecessary and ineffective treatments.
- **Adhere to Clinical Guidelines**
- Ensure antibiotic prescriptions align with updated local and international guidelines, particularly regarding drug choice and treatment duration.
- **Implement Antibiotic Stewardship**
- Introduce stewardship programs to monitor antibiotic use and resistance trends in primary healthcare settings.
- **Enhance Patient Education:** Provide pregnant women with clear guidance on UTI prevention, personal hygiene, hydration, and the risks of antibiotic misuse during antenatal visits.
- **Monitor Resistance Trends:** Maintain regular surveillance of local antimicrobial resistance patterns to guide empiric treatment choices.
- **Support Further Research:**Encourage broader studies to evaluate intervention outcomes and explore safe alternatives for UTI prevention in pregnancy.

6.3Limitationsofthe Study:

- Conducted only in Nablus, limiting generalizability to other Palestinian regions.
- Not all participants consented to urine culture testing.
- Some information, particularly on hygiene and behavioral habits, was self-reported, introducing potential reporting bias.
- A small number of participants were lost to follow-up, restricting full assessment of treatment outcomes and recurrence rates.
- Urine cultures could not be performed at the university laboratory due to distance and Israeli checkpoints, which risked compromising sample integrity; therefore, nearby CLSI-accredited private laboratories were used.
- Laboratory tests were not performed in the same clinics due to conflict-related restrictions, reduced clinic hours, and additional costs, resulting in reliance on private laboratories and the inability to perform analyses personally.

References

- Abu Aleinein, I., & Salem Sokhn, E. (2024). Knowledge and prevalence of urinary tract infection among pregnant women in Lebanon. Heliyon, 10(17), e37277. https://doi.org/10.1016/j.heliyon.2024.e37277
- Adeel, M., Fahad Ishaq Ameer, Waqar Habib, Muhammad Yousef, Aizaz Ajmal, Muhammad Adeel, Obaid Ullah, & Iqbal Ahmad Alvi. (2024). Bacterial profile, antimicrobial susceptibility pattern and associated risk factors of urinary tract infection among pregnant women attending tertiary care hospital in Rawalpindi. THE JOURNAL OF MICROBIOLOGY AND MOLECULAR GENETICS, 5(1), 73–82. https://doi.org/10.52700/jmmg.v5i1.160
- Ahmad, Q. T., Saffarini, J. H., Samara, A. M., Jabri, D. S., Safarini, Z. H., Banijaber, Y. M., Jaradat, A., Abushamma, F., & Zyoud, S. H. (2020). The impact of lower urinary tract symptoms on the quality of life during pregnancy: a cross-sectional study from Palestine. BMC Urology, 20(1), 191. https://doi.org/10.1186/s12894-020-00761-9
- Al Kady, C., Moussally, K., Caluwaerts, S., Chreif, W., Dibiasi, J., Soukarieh, D., Farra, A., Gordillo Gomez, F., & Lenglet, A. (2023). Are antibiotics being over-prescribed for the treatment of urinary tract infections? A prospective study among pregnant refugees in Beirut, Lebanon. Are Antibiotics Being Over-Prescribed for the Treatment of Urinary Tract Infections? A Prospective Study among Pregnant Refugees in Beirut, Lebanon. https://doi.org/10.57740/73jr-dg45
- Al Kady, C., Moussally, K., Chreif, W., Farra, A., Caluwaerts, S., Wertheim, H., Soukarieh, D., Gordillo Gomez, F., Dibiasi, J., & Lenglet, A. (2024). Overuse of antibiotics for urinary tract infections in pregnant refugees, Lebanon. Bulletin of the World Health Organization, 102(06), 389–399. https://doi.org/10.2471/BLT.23.291235
- Al Lawati, H., Blair, B. M., & Larnard, J. (2024). Urinary Tract Infections: Core Curriculum 2024. American Journal of Kidney Diseases, 83(1), 90–100. https://doi.org/10.1053/j.ajkd.2023.08.009
- Al-Alami, Z., Abu-Huwaij, R., Hamadneh, S., & Taybeh, E. (2024). Understanding Miscarriage Prevalence and Risk Factors: Insights from Women in Jordan. Medicina (Kaunas, Lithuania), 60(7). https://doi.org/10.3390/medicina60071044
- Al-Badr, A., & Al-Shaikh, G. (2013). Recurrent Urinary Tract Infections Management in Women : A Review Sultan Qaboos University Medical Journal, 13(3), 359–367. https://doi.org/10.12816/0003256
- Ali, A. H., Reda, D. Y., & Ormago, M. D. (2022). Prevalence and antimicrobial susceptibility pattern of urinary tract infection among pregnant women attending Hargeisa Group Hospital, Hargeisa, Somaliland. Scientific Reports, 12(1), 1419. https://doi.org/10.1038/s41598-022-05452-z

- Anton, G.-I., Gheorghe, L., Radu, V.-D., Scripcariu, I.-S., Vasilache, I.-A., Carauleanu, A., Condriuc, I.-S., Socolov, R., Onofrei, P., Pruteanu, A.-I., Ursu, R.-G., Gisca, T., & Socolov, D. (2024). Multidrug-Resistant Urinary Tract Infections in Pregnant Patients and Their Association with Adverse Pregnancy Outcomes—A Retrospective Study. Journal of Clinical Medicine, 13(22), 6664. https://doi.org/10.3390/jcm13226664
- Balachandran, L., Jacob, L., Al Awadhi, R., Yahya, L. O., Catroon, K. M., Soundararajan, L. P., Wani, S., Alabadla, S., & Hussein, Y. A. (2022). Urinary Tract Infection in Pregnancy and Its Effects on Maternal and Perinatal Outcome: A Retrospective Study. Cureus. https://doi.org/10.7759/cureus.21500
- Barry, R., Houlihan, E., Knowles, S. J., Eogan, M., & Drew, R. J. (2023). Antenatal pyelonephritis: a three-year retrospective cohort study of two Irish maternity centres. European Journal of Clinical Microbiology & Infectious Diseases, 42(7), 827–833. https://doi.org/10.1007/s10096-023-04609-6
- Bilgin, H., Yalinbas, E. E., Elifoglu, I., & Atlanoglu, S. (2021). Maternal Urinary Tract Infection: Is It Associated With Neonatal Urinary Tract Infection? Journal of Family & Reproductive Health. https://doi.org/10.18502/jfrh.v15i1.6067
- Brian J. Werth, & Brenda L. Tesini. (2024, May). Carbapenems.
- Brubaker, L., Carberry, C., Nardos, R., Carter-Brooks, C., & Lowder, J. L. (2018). American Urogynecologic Society Best-Practice Statement: Recurrent Urinary Tract Infection in Adult Women. Female Pelvic Medicine & Reconstructive Surgery, 24(5), 321–335. https://doi.org/10.1097/SPV.0000000000000550
- Chardavoyne, P., & Kasmire, K. (2020). Appropriateness of Antibiotic Prescriptions for Urinary Tract Infections. Western Journal of Emergency Medicine, 21(3). https://doi.org/10.5811/westjem.2020.1.45944
- Chinemerem Nwobodo, D., Ugwu, M. C., Oliseloke Anie, C., Al- Ouqaili, M. T. S., Chinedu Ikem, J., Victor Chigozie, U., & Saki, M. (2022). Antibiotic resistance: The challenges and some emerging strategies for tackling a global menace. Journal of Clinical Laboratory Analysis, 36(9). https://doi.org/10.1002/jcla.24655
- Clinical and Laboratory Standards Institute. (n.d.). Performance standards for antimicrobial susceptibility testing, 33rd edition (M100-Ed33). 2023.
- Corrales, M., Corrales-Acosta, E., & Corrales-Riveros, J. G. (2022). Which Antibiotic for Urinary Tract Infections in Pregnancy? A Literature Review of International Guidelines. Journal of Clinical Medicine, 11(23), 7226. https://doi.org/10.3390/jcm11237226
- Dautt- Leyva, J. G., Canizalez- Román, A., Acosta Alfaro, L. F., Gonzalez- Ibarra, F., & Murillo- Llanes, J. (2018). Maternal and perinatal complications in pregnant women with urinary tract infection caused by <scp> Escherichia coli </scp>. Journal of Obstetrics and Gynaecology Research, 44(8), 1384–1390. https://doi.org/10.1111/jog.13687

- Emiru, T., Beyene, G., Tsegaye, W., & Melaku, S. (2013). Associated risk factors of urinary tract infection among pregnant women at Felege Hiwot Referral Hospital, Bahir Dar, North West Ethiopia. BMC Research Notes, 6(1), 292. https://doi.org/10.1186/1756-0500-6-292
- Ezugwu, I. A., Afunwa, R. A., Onyia, F. C., Chukwunwejim, C. R., Offe, I. M., Onyia, C. O., Unachukwu, M. N., & Eze, E. A. (2021). Prevalence of Urinary Tract Infections and Associated Risk Factors among Pregnant Women in Enugu Metropolis, Nigeria. Journal of Biosciences and Medicines, 09(10), 156–171. https://doi.org/10.4236/jbm.2021.910014
- Gamberini, C., Donders, S., Al-Nasiry, S., Kamenshchikova, A., & Ambrosino, E. (2023). Antibiotic Use in Pregnancy: A Global Survey on Antibiotic Prescription Practices in Antenatal Care. Antibiotics, 12(5), 831. https://doi.org/10.3390/antibiotics12050831
- Gessese, Y. A., Damessa, D. L., Amare, M. M., Bahta, Y. H., Shifera, A. D., Tasew, F. S., & Gebremedhin, E. Z. (2017). Urinary pathogenic bacterial profile, antibiogram of isolates and associated risk factors among pregnant women in Ambo town, Central Ethiopia: a cross-sectional study. Antimicrobial Resistance & Infection Control, 6(1), 132. https://doi.org/10.1186/s13756-017-0289-6
- Ghouri, F., & Hollywood, A. (2020). Antibiotic Prescribing in Primary Care for Urinary Tract Infections (UTIs) in Pregnancy: An Audit Study. Medical Sciences, 8(3), 40. https://doi.org/10.3390/medsci8030040
- Goebel, M. C., Trautner, B. W., & Grigoryan, L. (2021). The Five Ds of Outpatient Antibiotic Stewardship for Urinary Tract Infections. Clinical Microbiology Reviews, 34(4). https://doi.org/10.1128/CMR.00003-20
- Haider, G., Zehra, N., Munir, A. A., & Haider, A. (2010). Risk factors of urinary tract infection in pregnancy. JPMA. The Journal of the Pakistan Medical Association, 60(3), 213–216.
- Hassuna, N. A., Rabie, E. M., Mahd, W. K. M., Refaie, M. M. M., Yousef, R. K. M., & Abdelraheem, W. M. (2023). Antibacterial effect of vitamin C against uropathogenic E. coli in vitro and in vivo. BMC Microbiology, 23(1), 112. https://doi.org/10.1186/s12866-023-02856-3
- Hatamleh, R., Al-Trad, A., Abuhammad, S., Aljabari, M., & Joseph, R. (2024b). Urinary tract infection among pregnant Jordanian women: role of hygiene and sexual practices. BMC Pregnancy and Childbirth, 24(1), 694. https://doi.org/10.1186/s12884-024-06902-4
- Hudson, R. E., Job, K. M., Sayre, C. L., Krepkova, L. V., Sherwin, C. M., & Enioutina, E. Y. (2022). Examination of Complementary Medicine for Treating Urinary Tract Infections Among Pregnant Women and Children. Frontiers in Pharmacology, 13. https://doi.org/10.3389/fphar.2022.883216

- Institute for Health Metrics and Evaluation. (2019). The burden of antimicrobial resistance (AMR) in Palestine.
- Jepson, R. G., Williams, G., & Craig, J. C. (2012). Cranberries for preventing urinary tract infections. Cochrane Database of Systematic Reviews, 2014(6). https://doi.org/10.1002/14651858.CD001321.pub5
- Kant, S., Lohiya, A., Kapil, A., & Gupta, S. (2017). Urinary tract infection among pregnant women at a secondary level hospital in Northern India. Indian Journal of Public Health, 61(2), 118. https://doi.org/10.4103/ijph.IJPH_293_15
- Khadra, M. M., Suradi, H. H., Amarin, J. Z., El-Bassel, N., Kaushal, N., Jaber, R. M., Al-Qutob, R., & Dasgupta, A. (2022). Risk factors for miscarriage in Syrian refugee women living in non-camp settings in Jordan: results from the Women ASPIRE cross-sectional study. Conflict and Health, 16(1), 32. https://doi.org/10.1186/s13031-022-00464-y
- Labib Al-Kashif, M. M. (2019). Urinary Tract Infection among Pregnant Women and its Associated Risk Factors: A Cross-Sectional Study. Biomedical and Pharmacology Journal, 12(04), 2003–2010. https://doi.org/10.13005/bpj/1832
- Ledger, W., & Blaser, M. (2013). Are we using too many antibiotics during pregnancy? BJOG: An International Journal of Obstetrics & Gynaecology, 120(12), 1450–1452. https://doi.org/10.1111/1471-0528.12371
- Luís, Â., Domingues, F., & Pereira, L. (2017). Can Cranberries Contribute to Reduce the Incidence of Urinary Tract Infections? A Systematic Review with Meta-Analysis and Trial Sequential Analysis of Clinical Trials. Journal of Urology, 198(3), 614–621. https://doi.org/10.1016/j.juro.2017.03.078
- Magiorakos, A.-P., Srinivasan, A., Carey, R. B., Carmeli, Y., Falagas, M. E., Giske, C. G., Harbarth, S., Hindler, J. F., Kahlmeter, G., Olsson-Liljequist, B., Paterson, D. L., Rice, L. B., Stelling, J., Struelens, M. J., Vatopoulos, A., Weber, J. T., & Monnet, D. L. (2012). Multidrug-resistant, extensively drug-resistant and pandrug-resistant bacteria: an international expert proposal for interim standard definitions for acquired resistance. Clinical Microbiology and Infection, 18(3), 268–281. https://doi.org/10.1111/j.1469-0691.2011.03570.x
- Majd Milhem, A. K. (2020). "Prevalence of Asymptomatic Bacteriuria Among High Risk Group of Pregnant Women Attending Antenatal Clinic At Ramallah Governmental Hospital / Palestine''." Faculty of Graduate Studies, An- Najah National University.

- Medina, M., & Castillo-Pino, E. (2019). An introduction to the epidemiology and burden of urinary tract infections. Therapeutic Advances in Urology, 11, 175628721983217. https://doi.org/10.1177/1756287219832172
- Meštrović, T., Matijašić, M., Perić, M., Čipčić Paljetak, H., Barešić, A., & Verbanac, D. (2020). The Role of Gut, Vaginal, and Urinary Microbiome in Urinary Tract Infections:

From Bench to Bedside. Diagnostics, 11(1), 7. https://doi.org/10.3390/diagnostics11010007

- Mohamed, F. Y., Dahie, H. A., Mohamoud, J. H., Adam, M. H., & Dirie, H. M. (2024). Prevalence, antimicrobial susceptibility profile, and associated risk factors of uropathogenic Escherichia coli among pregnant women attending Dr. Sumait Hospital Mogadishu, Somalia. Frontiers in Public Health, 11. https://doi.org/10.3389/fpubh.2023.1203913
- N. G., M., Math, G. C. ., Patil, A., Gaddad, S. M., & Shivannavar, C. T. (2013). Incidence of Urinary Tract Infections and Its Aetiological Agents among Pregnant Women in Karnataka Region. Advances in Microbiology, 03(06), 473–478. https://doi.org/10.4236/aim.2013.36063
- NG109. (2018, October 31). Urinary tract infection (lower): antimicrobial prescribing. The National Institute for Health and Care Excellence (NICE) .
- Nicolle, L. E., Gupta, K., Bradley, S. F., Colgan, R., DeMuri, G. P., Drekonja, D., Eckert, L. O., Geerlings, S. E., Köves, B., Hooton, T. M., Juthani-Mehta, M., Knight, S. L., Saint, S., Schaeffer, A. J., Trautner, B., Wullt, B., & Siemieniuk, R. (2019). Clinical Practice Guideline for the Management of Asymptomatic Bacteriuria: 2019 Update by the Infectious Diseases Society of Americaa. Clinical Infectious Diseases. https://doi.org/10.1093/cid/ciy1121
- Ntirenganya, C., Muvunyi, C. M., Manzi, O., & Ogbuagu, O. (2015). High Prevalence of Antimicrobial Resistance Among Common Bacterial Isolates in a Tertiary Healthcare Facility in Rwanda. The American Journal of Tropical Medicine and Hygiene, 92(4), 865–870. https://doi.org/10.4269/ajtmh.14-0607
- Obeagu EI, O. A. O. C. (2023). A review of urinary tract infections in pregnant women: Risks factors. J Pub Health Nutri, 6(1), 137.
- Palestinian Central Bureau of Statistics. (2004). Press Conference on the Initial Survey Results: Demographic and Health Survey.
- Palestinian Ministry of Health. (2023). National maternal health protocol: Antenatal care guidelines.
- Quenby, S., Gallos, I. D., Dhillon-Smith, R. K., Podesek, M., Stephenson, M. D., Fisher, J., Brosens, J. J., Brewin, J., Ramhorst, R., Lucas, E. S., McCoy, R. C., Anderson, R., Daher, S., Regan, L., Al-Memar, M., Bourne, T., MacIntyre, D. A., Rai, R., Christiansen, O. B., … Coomarasamy, A. (2021). Miscarriage matters: the epidemiological, physical, psychological, and economic costs of early pregnancy loss. The Lancet, 397(10285), 1658–1667. https://doi.org/10.1016/S0140-6736(21)00682-6
- Ranjan, A., Sridhar, S. T. K., Matta, N., Chokkakula, S., & Ansari, R. K. (2017). Prevalence of UTI among Pregnant Women and Its Complications in Newborns. Indian Journal of Pharmacy Practice, 10(1), 45–49. https://doi.org/10.5530/ijopp.10.1.10

- Saffarini, J. H., Ahmad, Q. T., Samara, A. M., Jabri, D. S., Safarini, Z. H., Banijaber, Y. M., Jaradat, A., Abushamma, F., & Zyoud, S. H. (2021). Assessment of lower urinary tract symptoms during pregnancy: an observational cross-sectional study from Palestine. BMC Pregnancy and Childbirth, 21(1), 84. https://doi.org/10.1186/s12884-021-03567-1
- Salam, M. A., Al-Amin, M. Y., Salam, M. T., Pawar, J. S., Akhter, N., Rabaan, A. A., & Alqumber, M. A. A. (2023). Antimicrobial Resistance: A Growing Serious Threat for Global Public Health. Healthcare (Basel, Switzerland), 11(13). https://doi.org/10.3390/healthcare11131946
- Sekikubo, M., Hedman, K., Mirembe, F., & Brauner, A. (2017). Antibiotic Overconsumption in Pregnant Women With Urinary Tract Symptoms in Uganda. Clinical Infectious Diseases, 65(4), 544–550. https://doi.org/10.1093/cid/cix356
- Sgarabotto, D., Andretta, E., & Sgarabotto, C. (2025). Recurrent Urinary Tract Infections (UTIs): A Review and Proposal for Clinicians. Antibiotics, 14(1), 22. https://doi.org/10.3390/antibiotics14010022
- Szweda, H., & Jóźwik, M. (2016). Urinary tract infections during pregnancy - an updated overview. Developmental Period Medicine, 20(4), 263–272.
- Taha, A. B. (2024). Bacteriological profile, antimicrobial susceptibility, and factors associated with urinary tract infection in pregnant women. The Journal of Infection in Developing Countries, 18(03), 391–398. https://doi.org/10.3855/jidc.18239
- The American College of Obstetricians and Gynecologists. (2023, August). Urinary Tract Infections in Pregnant Individuals.
- The National Institute for Health and Care Excellence (NICE). (2023, February 15). New NICE quality standard identifies improvements in urinary tract infection diagnosis for women.
- Vicar, E. K., Acquah, S. E. K., Wallana, W., Kuugbee, E. D., Osbutey, E. K., Aidoo, A., Acheampong, E., & Mensah, G. I. (2023). Urinary Tract Infection and Associated Factors among Pregnant Women Receiving Antenatal Care at a Primary Health Care Facility in the Northern Region of Ghana. International Journal of Microbiology, 2023, 1–10. https://doi.org/10.1155/2023/3727265
- Walters, J., Kim, J., & Stevens, M. (2020). 1677. Evaluation of Optimal Treatment for Urinary Tract Infections in Outpatient Clinics at an Academic Medical Center. Open Forum Infectious Diseases, 7(Supplement_1), S824–S824. https://doi.org/10.1093/ofid/ofaa439.1855

- Wang, C.-H., Fang, C.-C., Chen, N.-C., Liu, S. S.-H., Yu, P.-H., Wu, T.-Y., Chen, W.-T., Lee, C.-C., & Chen, S.-C. (2012). Cranberry-Containing Products for Prevention of Urinary Tract Infections in Susceptible Populations. Archives of Internal Medicine, 172(13). https://doi.org/10.1001/archinternmed.2012.3004

- Waters, W. E. (1969). Prevalence of symptoms of urinary tract infection in women. Journal of Epidemiology & Community Health, 23(4), 263–266. https://doi.org/10.1136/jech.23.4.263
- Wing, D. A., Fassett, M. J., & Getahun, D. (2014). Acute pyelonephritis in pregnancy: an 18-year retrospective analysis. American Journal of Obstetrics and Gynecology, 210(3), 219.e1-219.e6. https://doi.org/10.1016/j.ajog.2013.10.006
- World Health Organization. (2023). Surveillance System for Attacks on Health Care.
- Yadufashije, C., Ishimwe, A., Mucumbitsi, J., Muhimpundu, L., Twagirumukiza, G., Ndayambaje, M., Migabo, H., & Mwanzia, L. (2022). Determinants and bacteria associated with asymptomatic bacteriuria among women attending antenatal care service at muhoza health centre, Rwanda. Advances in Human Biology, 12(3), 298. https://doi.org/10.4103/aihb.aihb_56_22
- Yeta, K. I., Michelo, C., & Jacobs, C. (2021). Antimicrobial Resistance among Pregnant Women with Urinary Tract Infections Attending Antenatal Clinic at Levy Mwanawasa University Teaching Hospital (LMUTH), Lusaka, Zambia. International Journal of Microbiology, 2021, 1–9. https://doi.org/10.1155/2021/8884297

Appendix

Annex(1):StructuralFramework

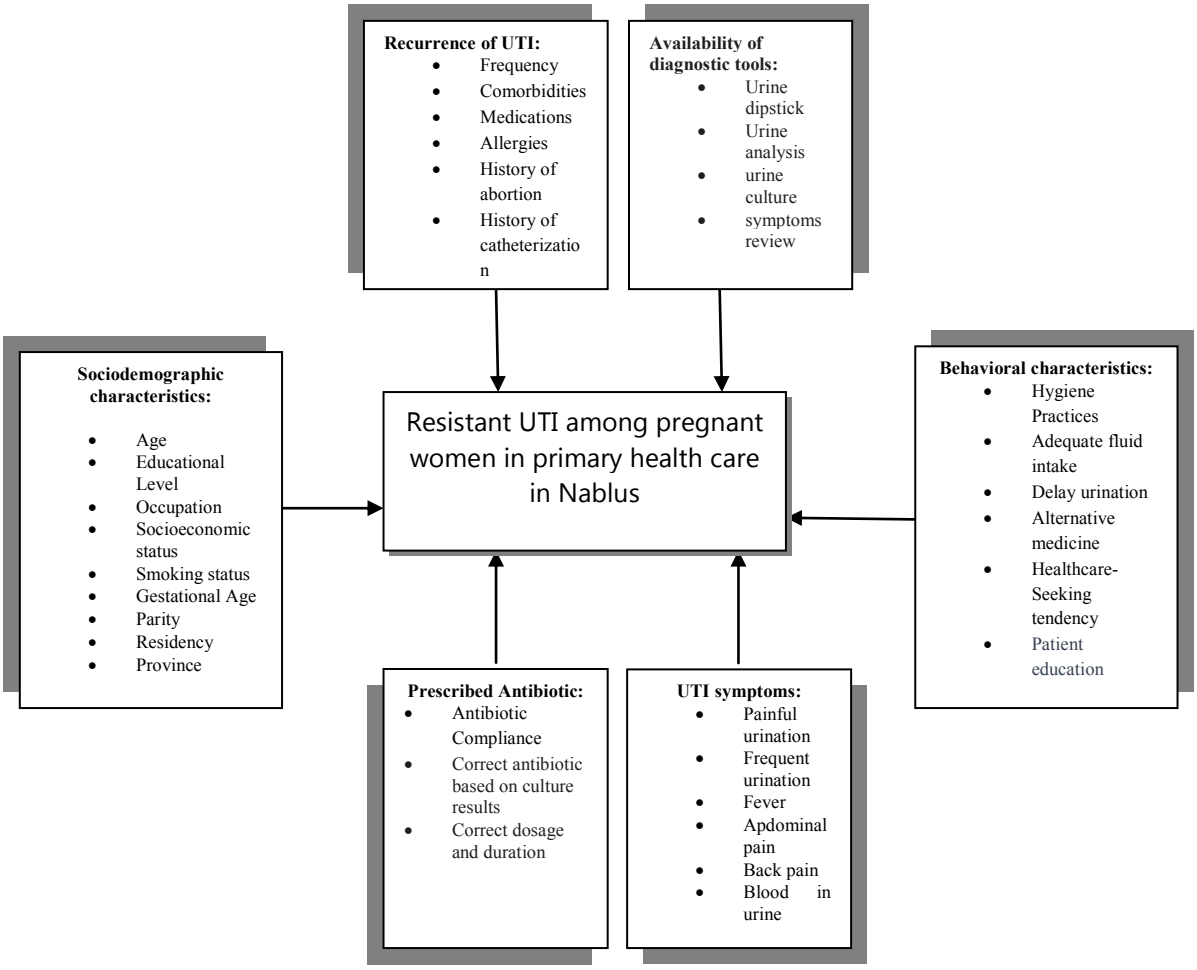

Figure A1: Study Conceptual Framework.

The study utilizes a conceptual framework to guide the research, highlighting the interplay between UTI, antibiotic prescription, and antimicrobial resistance in pregnant women. This framework considers various factors influencing the study, including patient characteristics, antibiotic use, and environmental factors.

Operational definitions:

- Gestational Age: a measure of the age of a pregnancy taken from the beginning of the woman's last menstrual period (LMP). Continuous variable, reported in weeks.
- Parity: the number of times a woman has given birth to a live neonate (any gestation) or at 24 weeks or more, regardless of whether the child was viable or non-viable (i.e. stillbirths).Discrete variables are reported as whole numbers.
- Abortion: Documentation of spontaneous or induced termination of pregnancy before fetal viability.Categorical variable, reported as a binary outcome.

Annex(2): StudyQuestionnaire(Englishversion)

"Assessing Antibiotic Prescriptions and Incidence of Urinary Tract Infection in Pregnant Women Attending Primary Health Care in Nablus City – Palestine "

NAMES OF RESEARCHERS:
Lara Khatatba
NAMES OF SUPERVISORS:
Dr. Dala Daraghmeh

I am a student from the faculty of public health, the infectious disease department. I am conducting this study in partial fulfillment of the requirements for the Master's Degree in Infectious Disease Prevention and control (MID).

You are being invited to take part in this study. Knowing that, the confidentiality of the answers will be maintained, and the results will be presented for the research study only.

This study focused on pregnant women who will attend antenatal care at primary health care clinics governed by the Palestinian Ministry of Health.

This questionnaire is designed to collect information about the appropriateness of antibiotic prescriptions and the incidence of recurrent and resistant UTIs in pregnant women. Your participation is valuable and will contribute to improving healthcare practices in our community by sharing your experiences and viewpoints.

This form consists of eight sections. It will take a few minutes of your appreciated time to fill out.

Please commit to answering all questions to ensure accuracy in dealing with the existing data.

Please make your selection below:

The "I agree" option indicates the following:

1. You have read the above information
2. You agree to participate

If you do not wish to participate in the research study, please choose not to participate "I do not agree"

I agree ❑

I do not agree ❑

Section one: Sociodemographic and clinical characteristics:

Please tick the ONE box that best describes you.

Category	Options
1. Age (years)	☐ 15–24
	☐ 25–34
	☐ 35–44
	☐ Equal or more than 50
2. Educational Level	☐ Illiterate
	☐ Primary
	☐ Higher school
	☐ Bachelor's
	☐ Master/ PhD
3. Occupation	☐Housewife
	☐Empolyee \ Business woman
4. Socioeconomic status (income in shekel)	
	☐ Low (<2000)
	☐ Middle (2000-4000)
	☐ High (>4000)
5. Smoking status	☐ Smoker
	☐ Ex-smokers
	☐ Not smoker
6. Geographic Location of the residence	☐ City
	☐ Village
	☐ Camp

Section 2: Medical and obstetrical information:

Question 1: What trimester are you currently in?	
First Trimester (1-12 weeks)	☐
Second Trimester (13-26 weeks)	☐
Third Trimester (27-40 weeks)	☐
I dont know	☐
Question 2: How many times have you been pregnant, including all pregnancies; whether live births, miscarriages, or stillbirths? (Gravidity)	
1	☐
2-5	☐
>\= 6	☐
Question 3: How many children have you given birth to?(Parity)	
0	☐
1	☐
2-5	☐
>\= 6	☐
Question 4: Have you ever experienced an abortion?	
Yes	☐
No	
Question 5: Are you currently taking any medications?	☐
Yes	☐
No	☐
Question 6: If yes, please sort it/ them: …….	
Question 7: Do you have any known allergies to antibiotics?	
Yes	☐
No	☐
Question 8: Do you have any History of catheterization?	
Yes	

Question 1: What trimester are you currently in?	
First Trimester (1-12 weeks)	☐
Second Trimester (13-26 weeks)	☐
Third Trimester (27-40 weeks)	☐
I dont know	☐
Question 2: How many times have you been pregnant, including all pregnancies; whether live births, miscarriages, or stillbirths? (Gravidity)	
1	☐
2-5	☐
>\= 6	☐
Question 3: How many children have you given birth to?(Parity)	
0	☐
1	☐
2-5	☐
>\= 6	☐
No	
Question 4: Haveyou had UTIspriorto this pregnancy?	
Yes	☐
No	☐
Question 5: If yes, how frequently?	
Occasionally	☐
Often	☐

Section 3: Behavioral characteristics:

Question 1: How manycups of water do youdrinkdaily?	
Less than 4	☐
4-8	☐
More than 3	☐

Question 2: How manytimes do youurinate on a regularday?	
Less than 4	☐
4-8	☐
More than 8	☐
Question 3: Do youusuallydelayurinationwhenyoufeeltheneedtourinate?	
Never	☐
Sometimes	☐
Often	☐
Always	☐
Question 4: Do youdrinkotherliquidsbesideswater (juice, tea, etc.) whenyoufeelthirsty?	
Yes	☐
No	☐
Question 5: Do youalwayswashyourhandswellwithsoapandwaterbeforeandafterusingthetoilet?	
Yes	☐
No	☐
Question 6: Do you eat a lot of salty foods and pickles in your routine daily diet?	
Yes	☐
No	☐
Question 7: Whatmethod do youusewhenwipingafterusingthetoilet?	
Fromfronttoback	☐
Frombacktofront	☐
Question 8: How many times do you do sexal activity per week?	
Less than 1	☐
1-5	☐
More than 5	☐
Question 9: Have you changed your underwear daily?	
Yes	☐

No	☐
Question 10: Doyouregularlyconsumecomplementary and alternative treatments?(check all that apply):	
Cranberry	☐
Vitamin C	☐
Probiotics	☐
Hyalurenic acid	☐
Canephron N	☐
Cystenium 2	☐
Question 11: Were you provided with education on preventing UTIs?	
Yes	☐
No	☐
Question 12: Did you receive counseling on the risks of antibiotic resistance?	
Yes	☐
No	☐

Section 4: Follow-up questions:

Question 1: Describe the symptoms experienced (check all that apply):	
Painful urination	☐
Frequent urination	☐
Fever	☐
Lower abdominal pain	☐
Back pain	☐
Blood in urine	☐
None	☐
Question 2: Have you suffered from abnormal vaginal discharge or itching?	
Yes	☐

No	☐
Question 3: What was the method of diagnosis?	
Rapid test (dipstick)	☐
Urine Analysis	☐
Urine culture	☐
Symptoms review	☐
Question 4: Were antibiotics prescribed?	
Yes	☐
No	☐
Question 5: If yes, what is the name of the prescribed antibiotic?	
Question 6: What is the dosage and duration of treatment?	
Question 7: Did you complete the course as prescribed?	
Yes	☐
No	☐
Question8: Did your symptoms resolve after completing the antibiotics?	
Yes	☐
NO	☐

Annex(3):StudyQuestionnaire (Arabicversion)

تقييم ملاءمة وصفات المضادات الحيوية وحالات تكرار والتهابات المسالك البولية المقاومة لدى النساء الحوامل المراجعاتلمرافق الرعاية الصحية الأولية في مدينة نابلس في الضفة الغربية.

أسماء الباحثين:
لارا خطاطبة
أسماء المشرفين:
د. دالا دراغمة

أنا طالبة في كلية الصحة العامة، قسم الأمراض المعدية. أجري هذه الدراسة كجزء من متطلبات الحصول على درجة الماجستير في الوقاية من الأمراض المعدية ومكافحتها. أدعوكم للمشاركة في هذه الدراسة التي تركز على النساء الحوامل اللاتي يحضرن رعاية ما قبل الولادة في عيادات الرعاية الصحية الأولية التي تديرها وزارة الصحة الفلسطينية.
تم تصميم هذا الاستبيان لجمع المعلومات حول ملاءمة وصفات المضادات الحيوية ووتيرة حدوث التهابات المسالك البولية المتكررة والمقاومَة لدى النساء الحوامل مساهمتك في هذه الدراسة قيمة وتخلق مستقبلًا أفضل لنظام الرعاية الصحية في مجتمعنا من خلال مشاركة تجاربك ووجهات نظرك. من المفترض أن يستغرق استكمال هذا الاستبيان بضع دقائق فقط لأنه من المفترض أن يكون بسيطًا ومراعيًا لوقتك. يرجى التأكد من أننا سنحافظ على سرية إجاباتك ولن يتم مشاركة أي معلومات شخصية. وسيكون فريق البحث هو الطرف الوحيد الذي سيقوم بمراجعة النتائج.
يرجى الالتزام بالإجابة على جميع الأسئلة لضمان الدقة في التعامل مع البيانات الموجودة.
اختار الإجابة المناسبة:
اختيار "أوافق" يعني:

1. قرأت المعلومات أعلاه.
2. توافق على المشاركة في الاستبيان.

في حال كنت لا تريد المشاركة في هذه الدراسة البحثية، اختار" لا أوافق ".

أوافق ☐
لا أوافق ☐

القسم 1: الخصائص الاجتماعية، يرجى وضع علامة في المربع الذي يصفك بشكل أفضل:

العمر (سنوات):
☐ 15-24
☐ 25-34
☐ 35-44
فأكثر 45 ☐

المستوى التعليمي:
أمّي☐
ابتدائي☐
ثانوي☐
بكالوريوس☐
(دراسات عليا (ماجستير، دكتوراة☐

العمل / الوظيفة:
ربة منزل☐
موظفة / عاملة☐

الحالة الاجتماعية والاقتصادية (الدخل بالشيقل):
(منخفض (أقل من 2000☐
(متوسط (2000 – 4000☐
(مرتفع (أكثر من 4000☐

هل أنت مدخنة؟
نعم، مدخنة☐
كنت مدخنة في السابق☐
لا، لست مدخنة☐

مكان الإقامة:
مدينة☐
قرية☐

القسم الثاني: التاريخ الطبي وتاريخ الولادات:

السؤال 1: في أي مرحلة من مراحل الحمل أنتِ حاليًا؟	
الثلث الأول (من 1 إلى 12 أسبوعًا)	☐
الثلث الثاني (من 13 إلى 26 أسبوعاً)	☐
الثلث الثالث (من 27 إلى 40 أسبوعًا)	☐
لا أعلم	☐
السؤال 2: كم مرة كنتِ حاملًا، بما في ذلك جميع حالات الحمل؛ سواء الولادات الحية، أو الإجهاضات، أو الولادات الميتة؟ (الحمولات السابقة)	
1	☐
2-5	☐
6 أو اكثر	☐
السؤال 3: كم عدد الأطفال الذين أنجبتيهم؟ (الولادات)	
0	☐
1	☐
2-5	☐
6 أو اكثر	☐
السؤال 4: هل سبق لكِ أن تعرضتِ للإجهاض؟	
نعم	☐
لا	☐
السؤال 5: هل أنتِ تتناولي أي أدوية في الوقت الحالي؟	
نعم	☐
لا	☐
السؤال 6: إذا كانت الإجابة بنعم، يُرجى ذكرها...	
السؤال 7: هل لديكِ أي حساسية معروفة تجاه المضادات الحيوية؟	
نعم	☐
لا	☐
السؤال 8: هل لديك أي تاريخ مرضي لإجراء قسطرة بولية؟ (تركيب كيس بول)	
نعم	☐

السؤال 1: في أي مرحلة من مراحل الحمل أنتِ حاليًا؟	
الثلث الأول (من 1 إلى 12 أسبوعًا)	☐
الثلث الثاني (من 13 إلى 26 أسبوعاً)	☐
الثلث الثالث (من 27 إلى 40 أسبوعًا)	☐
لا أعلم	☐
السؤال 2: كم مرة كنتِ حاملًا، بما في ذلك جميع حالات الحمل؛ سواء الولادات الحية، أو الإجهاضات، أو الولادات الميتة؟ (الحمولات السابقة)	
1	☐
2-5	☐
6 أو اكثر	☐
السؤال 3: كم عدد الأطفال الذين أنجبتيهم؟ (الولادات)	
0	☐
1	☐
2-5	☐
6 أو اكثر	☐
لا	☐
السؤال 9: هل أصبتِ بالتهاب المسالك البولية قبل هذا الحمل؟	
نعم	☐
لا	☐
السؤال 10: إذا كانت الإجابة بنعم، كم كانت وتيرة تكرار حدوثها؟	
من حين لآخر	☐
بشكب متكرر	☐

القسم 3: الخصائص السلوكية:

السؤال 1: كم عدد أكواب الماء التي تشربينها يوميًا؟	
أقل من 4	☐
4-8	☐
أكثر من 8	☐

السؤال 2: كم عدد مرات التبول في اليوم العادي؟	
أقل من 4	☐
4-8	☐
أكثر من 8	☐
السؤال 3: هل تقومين عادةً بتأخير التبول عندما تشعرين بالحاجة إلى التبول؟	
أبداً	☐
أحياناً	☐
غالباً	☐
دائماً	☐
السؤال 4: هل تشربين سوائل أخرى غير الماء (عصير، شاي، إلخ) عندما تشعرين بالعطش؟	
نعم	☐
لا	☐
السؤال 5: هل تغسلين يديك دائماً بالماء والصابون جيداً قبل وبعد استخدام المرحاض؟	
نعم	☐
لا	☐
السؤال 6: هل تتناولين الكثير من الأطعمة المالحة والمخللات في نظامك الغذائي اليومي الروتيني؟	
نعم	☐
لا	☐
السؤال 7: ما هي الطريقة التي تستخدمينها عند القيام بالمسح بعد استخدام المرحاض؟	
من الأمام إلى الخلف	☐
من الخلف إلى الأمام	☐
السؤال 8: عدد مرات الجماع في الأسبوع؟	
أقل من 1	☐
1-5	☐
أكثر من 5	☐
السؤال 9: هل تبدلين ملابسك الداخلية يومياً؟	
نعم	☐
لا	☐

السؤال 10: هل تتناولين بانتظام العلاجات التكميلية والبديلة؟ (ضع علامة على كل ما ينطبق)	
لتوت البري	☐
فيتامين سي	☐
البروبيوتيك ,البروبيوتيك	☐
حمض الهيالورينيك	☐
كانيفرون ن	☐
السيستينيوم	☐
السؤال 11: هل تم تزويدك بالتوعية حول الوقاية من التهابات المسالك البولية؟	
نعم	☐
لا	☐
السؤال 12: هل تلقيت إرشادات حول مخاطر مقاومة المضادات الحيوية؟	
نعم	☐
لا	☐

القسم 4: الخصائص السريرية والمتابعة ما بعد الفحص والتشخيص:

السؤال 1: يرجى وصف الأعراض التي تعاني منها (ضع علامة على كل ما ينطبق):	
ألم خلال التبول	☐
تبول متكرر	☐
ارتفاع بدرجة الحرارة (الحمى)	☐
ألم في أسفل البطن	☐
ألم في الظهر	☐
وجود دم في البول	☐
لا يوجد اعراض	☐
السؤال 2: هل تعانيين من وجود افرازات مهبلية غير معتادة؟	
نعم	☐
لا	☐
السؤال 3: ما الطريقة التي تم استخدامها لتشخيص إصابتك بهذا الالتهاب؟	
اختبار سريع (مقياس الغمس)	☐

فحص تحليل البول	☐
فحص زراعة البول	☐
معيانة الأعراض (دون عمل فحوصات)	☐
السؤال 4: هل تم وصف لك مضادات حيوية؟	
نعم	☐
لا	☐
السؤال 5: إذا كانت الإجابة بنعم، فما اسم المضاد الحيوي الذي تم وصفه لك؟	
السؤال 6: ما هي الجرعة الموصوفة ومدة العلاج؟	
السؤال 7: هل أكملت دورة العلاج كما هو موصوف لك؟	
نعم	☐
لا	☐
السؤال 8: هل زالت الأعراض لديك بعد تناول المضاد الحيوي؟	
نعم	☐
لا	☐

Annex(4):IRB Approval

Al-Quds University
Jerusalem
Deanship of Scientific Research

بسم الله الرحمن الرحيم

جامعة القدس
القدس
عمادة البحث العلمي

Research Ethics Committee
Committee's Decision Letter

Date: November 26, 2024
Ref No: 461/REC/2024

Dears Dr. Dala Daraghmeh, Ms. Lara Khatatba,

Thank you for submitting your application seeking approval for research ethics. After a thorough review of your submission titled "Assessing the Appropriateness of Antibiotic Prescriptions and the Incidence of Recurrent and Resistant UTIs in Pregnant Women in Primary Health Care Settings in the West Bank", the Research Ethics Committee (REC) at Al-Quds University is pleased to confirm that your application aligns with our research ethics guidelines.
Please be aware that while this approval authorizes your research, it does not replace any departmental or other necessary approvals. These may include permissions for sample shipment, data sharing, or administrative approval to distribute questionnaires.

Additionally, we kindly request that you provide us with a copy of your final research report or publication once it is available.

Thank you once again for your commitment to conducting ethical research. We extend our best wishes for a productive research endeavor that benefits your research subjects.

Please note that this ethical approval letter is valid for two years from the date of issuance.
If your research extends beyond this timeframe, a renewal request will be necessary. This approval remains valid as long as there are no changes to the data collection procedures or any aspect of the research protocol.

Sincerely,

Suheir Ereqat, PhD
Associate Professor of Molecular Biology
Research Ethics Committee Chair

Cc. Prof. Imad Abu Kishek - President
Cc. Members of the committee
Cc. file

Annex(6):Facilitatethetask

State of Palestine
Ministry of Health
Education in Health and Scientific Research Unit

دولة فلسطين
وزارة الصحة
وحدة التعليم الصحي والبحث العلمي

Ref.: ....
Date:..................

الرقــــم: ٢٠٢٥/٤٣٣/١٦٦
التــاريخ: ٢٠٢٥/٢/٢٥

عطوفة الوكيل المساعد لشؤون الصحة العامة وصحة الاسرة المحترم،،،

الاخ مدير عام الادارة العامة للمستشفيات المحترم،،،

تحية واحترام،،،

<u>الموضــوع: تسهيل مهمة بحث</u>

يرجى تسهيل مهمة الطالبة: **لارا زاهي خطاطبة** – برنامج ماجستير الوقاية وضبط الامراض المعدية– جامعة القدس، تحت اشراف د. دالا دراغمة، في عمل بحث بعنوان:

تقييم ملاءمة وصفات المضادات الحيوية وحالات تكرار والتهابات المسالك البولية المقاومة لدى النساء الحوامل في مرافق الرعاية الصحية الأولية في مدينة نابلس .

من خلال السماح للطالبة بجمع المعلومات وتوزيع استبانة على النساء الحوامل المراجعات:

- **مستشفى رفيديا**
- **مديرية صحة نابلس**

على ان يتم الالتزام باساليب واخلاقيات البحث العلمي، والحفاظ على سرية المعلومات.

على ان يتم تزويد الوزارة بنسخة PDF من نتائج البحث، التعهد بعدم النشر لحين الحصول على موافقة الوزارة على نتائج البحث.

مع الاحترام،،،

د. عبد الله القواسمي
رئيس وحدة التعليم الصحي والبحث العلمي

نسخة: عميد الصحة العامة المحترم/ جامعة القدس

Telfax.:09-2333901 scientificresearch.dep@gmail.com تلفاكس: 09-2333901

الملخص

"تقييم وصف المضادات الحيوية وانتشار التهابات المسالك البولية لدى النساءالحوامل المراجعات لمراكز الرعاية الصحية الأولية في مدينة نابلس – فلسطين"

الباحثة: لارا زاهي خطاطبة

بإشارف: د. دالا دراغمة

الخلفية

تُعَدّ التهابات المسالك البولية من أكثر المشاكل الصحية شيوعاً أثناء الحمل، إذ قد تصيب ما يقارب خمس النساء الحوامل. وغالباً ما تُعالج هذه الحالات بالمضادات الحيوية بشكل تجريبي قبل الحصول على نتائج الفحوصات المخبرية، مما يساهم في زيادة معدلات مقاومة البكتيريا للمضادات. في فلسطين ما زالت المعلومات محدودة حول مدى ملاءمة وصف المضادات الحيوية لدى الحوامل، وكذلك حول أنماط المقاومة وانتشار العدوى المتكررة.

الهدف

سعت هذه الدراسة إلى تقييم ممارسات وصف المضادات الحيوية لعلاج التهابات المسالك البولية عند النساء الحوامل في مراكز الرعاية الصحية الأولية بمدينة نابلس، إضافة إلى تحديد معدل تكرار العدوى ومدى شيوع المقاومة البكتيرية للمضادات.

المنهجية

أُجريت دراسة مستقبلية بين كانون الأول/ديسمبر 2024 وأيار/مايو 2025، شملت 485 امرأة حامل

تمت متابعتهن في عيادات الرعاية الأولية. جُمعت البيانات من خلال استبيانات منظمة وفحوصات مخبرية تضمنت زراعة البول واختبارات الحساسية للمضادات الحيوية. كما جرى تقييم وصف المضادات الحيوية مقارنة بالتوصيات العالمية، خصوصاً إرشادات الكلية الأمريكية لأطباء النساء والتوليد (ACOG) .

النتائج

من أصل 279 مشاركة أُجري لهن فحص زراعة البول، تبين أن 115 امرأة (41.2%) مصابة بعدوى مؤكدة. وكانت الإشريكية القولونية (38.3%)والمكورات العنقودية الذهبية (22.6%)أكثر الجراثيم شيوعاً. أظهرت النتائج أن أكثر من نصف العزلات (52%) كانت مقاومة لعدة مضادات في آن واحد. الوصف التجريبي للمضادات كان شائعاً (55.5%)، بينما التزمت معظم الوصفات (77.3%) بالجرعة والمدة الصحيحة، في حين أن أقل من ربعها (22.7%) فقط كانت متوافقة مع العلاجات الموصى بها كخيار أول خلال الحمل حسب إرشادات .ACOG وخلال متابعة 120 مشاركة لمدة 90 يوماً، ظهرت حالات عدوى متكررة في 18 امرأة (15%)، دون وجود علاقة واضحة مع العمر، الدخل، عدد الولادات، الثلث من الحمل، أو تاريخ الإجهاض.

الاستنتاجات

رغم أن معظم الوصفات التزمت بالجرعة والمدة الصحيحة، إلا أن اختيار نوع المضاد الحيوي لم يكن دائماً وفق التوصيات العالمية للحمل. كما أن نسبة المقاومة العالية للمضادات المتعددة تبرز الحاجة إلى تعزيز التشخيص المخبري الدقيق، والالتزام بالعلاجات المبنية على الأدلة. إن تحسين ترشيد استخدام المضادات الحيوية في رعاية الحوامل يُعَدّ خطوة أساسية لحماية الأمهات والحد من تفاقم مشكلة المقاومة البكتيرية في بيئات تعاني من محدودية الموارد.