Urinary Tract Infections Among Expectant Mothers: A Systematic Review and Meta-analysis

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ABSTRACT

Background:
Urinary tract infections (UTIs) are among the most common bacterial infections affecting pregnant women, posing significant risks to maternal and fatal health. This systematic review and meta-analysis aim to assess the global prevalence, risk factors, microbial ethology, and clinical outcomes associated with UTIs during pregnancy.
Methods:
A comprehensive literature search was conducted across databases including PubMed, Scopus, Web of Science, and Embase for studies published between 2000 and 2024. Eligible studies included observational and cross-sectional studies reporting UTI prevalence among pregnant women. Data were extracted and pooled using random-effects meta-analysis. Heterogeneity was assessed using the I^2 statistic.
Results:
The pooled prevalence of UTIs in pregnant women was estimated at 13.2% (95% CI: 10.8%–15.9%), with higher rates observed in low- and middle-income countries. Escherichia coli was the predominant pathogen (65.4%), followed by Klebsiella species (12.8%). Significant risk factors included multiparity, low socioeconomic status, history of UTIs, and poor hygiene. UTIs were associated with increased risk of preterm labour, low birth weight, and pyelonephritis.
Conclusion:
UTIs remain a prevalent and under-recognized health issue among expectant mothers globally, particularly in resource-limited settings. Routine screening, patient education, and standardized management protocols are essential for early detection and prevention of adverse outcomes.

Keyword: - *Urinary tract infection, pregnancy, prevalence, risk factors, Escherichia coli, maternal health, systematic review, meta-analysis.*

1. Introduction

Urinary tract infections (UTIs) are a common clinical concern among pregnant women and represent a significant public health issue due to their potential to cause serious maternal and fatal complications if left untreated [1]. Pregnancy-induced anatomical and physiological changes in the urinary tract increase the susceptibility to infections, with hormonal fluctuations and urinary stasis further exacerbating the risk [2,3]. UTIs in pregnancy range from asymptomatic bacteriuria to acute pyelonephritis and are associated with adverse outcomes such as preterm labor, low birth weight, and increased perinatal morbidity [4]. Despite the availability of screening and treatment options, the burden of UTIs remains particularly high in low- and middle-income countries due to limited healthcare access, poor hygiene practices, and lack of awareness [5-6]. This systematic review and meta-analysis aim to

synthesize current evidence on the prevalence, causative organisms [7], risk factors, and consequences of UTIs among expectant mothers to inform better clinical practices and public health interventions [8].

1.1 Objectives of the Study

a) To determine the pooled prevalence of urinary tract infections (UTIs) among expectant mothers across various geographical regions.
b) To identify the most common causative organisms responsible for UTIs during pregnancy.
c) To examine the risk factors associated with the development of UTIs in pregnant women.
d) To evaluate the maternal and fatal complications linked with untreated or recurrent UTIs in pregnancy.

2. Research Design

This study will adopt a quantitative, observational, and cross-sectional research design to assess the role of nutrition in wound healing among postoperative patients. This design allows for an in-depth analysis of the relationship between patients' nutritional status and their wound healing progress, providing both numerical and categorical data that can be statistically analyzed for meaningful conclusions. The study will employ a mixed-method approach, incorporating both primary and secondary data sources to ensure a comprehensive evaluation of the research problem. The primary data collection methods will include clinical assessments, patient records, dietary evaluations, and biochemical analyses. Secondary sources such as hospital databases, existing literature, and previously published research on nutrition and wound healing will supplement the study to provide a broader context and support the findings.

2.1 Study Population and Sampling

The target population for this study comprises postoperative patients admitted to surgical wards in selected hospitals. The study will focus on patients who have undergone major surgeries, including but not limited to abdominal, orthopaedic, cardiovascular, and general surgical procedures. The study aims to include a diverse population to ensure the findings are applicable across different surgical.

3. Results

Table 1: Characteristics of Studies Included in the Review

Study	Year	Country	Study Type	Trimester Focused	Sample Size	UTI Diagnosed (n)	Prevalence (%)
Sharma et al.	2020	India	Cross-sectional	Second & Third	500	115	23.0
Miller et al.	2018	USA	Prospective Cohort	All trimesters	800	90	11.3
Hassan et al.	2019	Egypt	Case-Control	First Trimester	300	84	28.0
Kilonzo et al.	2021	Kenya	Cross-sectional	Second Trimester	600	132	22.0
Zhang et al.	2017	China	Retrospective	Third Trimester	1000	142	14.2

Table 2: Pooled Prevalence and Odds Ratios for Risk Factors (Meta-Analysis)

Outcome / Risk Factor	Pooled Estimate (%) / OR	95% Confidence Interval	Heterogeneity (I^2%)
Overall UTI Prevalence	18.2%	15.4 – 21.0	72%
History of UTIs	OR = 2.45	1.95 – 3.10	60%
Diabetes in Pregnancy	OR = 1.88	1.50 – 2.36	48%
Anemia	OR = 1.67	1.30 – 2.15	55%
Poor Hygiene Practices	OR = 2.12	1.65 – 2.73	66%

Table 3: Common Bacterial Isolates in UTIs Among Pregnant Women

Bacterial Species	Frequency Across Studies (%)	Antibiotic Resistance Pattern
Escherichia coli	63.5	Resistant to ampicillin, sensitive to nitrofurantoin
Klebsiella pneumoniae	12.4	Resistant to cephalexin, sensitive to ciprofloxacin
Staphylococcus saprophyticus	9.8	Moderate resistance to penicillin
Proteus mirabilis	7.2	Sensitive to ceftriaxone
Enterococcus faecalis	4.7	Resistant to erythromycin
Pseudomonas aeruginosa	2.4	Multidrug-resistant

Table 3: Risk Factors for UTIs in Pregnancy (Pooled Odds Ratios)

Risk Factor	Odds Ratio (OR)	95% Confidence Interval (CI)	Significance
History of recurrent UTIs	2.68	2.05 – 3.51	Significant
Diabetes mellitus	1.96	1.48 – 2.60	Significant
Poor perineal hygiene	2.10	1.62 – 2.74	Significant
Low socio-economic status	1.55	1.19 – 2.02	Significant
Increased parity (≥3 children)	1.49	1.15 – 1.94	Significant
Anemia (Hb < 10 g/dL)	1.87	1.33 – 2.62	Significant

a) Overall Prevalence: The pooled prevalence of UTIs among pregnant women across all included studies was approximately 17.5%, indicating a significant public health concern.

b) Geographical Variation: Higher prevalence rates were observed in developing countries, particularly in South Asia and Sub-Saharan Africa, with some studies reporting rates above 20%.

c) Common Pathogens: Escherichia coli (E. coli) was the most frequently isolated bacterium, accounting for 60–80% of UTI cases. Other common organisms included Klebsiella spp., Staphylococcus saprophyticus, and Proteus spp.

d) Antibiotic Resistance: High resistance was observed to commonly used antibiotics like ampicillin, cotrimoxazole, and amoxicillin, while higher sensitivity was noted for nitrofurantoin, ceftriaxone, and ciprofloxacin (though fluoroquinolones are often avoided in pregnancy).

Significant Risk Factors:

Previous history of UTI (OR: 3.5)

a) Low socioeconomic status (OR: 2.8)
b) Poor perineal hygiene (OR: 2.6)
c) Anemia during pregnancy (OR: 2.1)
d) Diabetes mellitus (OR: 1.9)

Maternal and Fetal Complications:

a) UTIs were associated with an increased risk of preterm labor (12–18%), low birth weight, intrauterine growth restriction (IUGR), and pyelonephritis. In untreated or recurrent cases, complications like preeclampsia and neonatal sepsis were also reported.

b) Prevalence of UTIs by Region: South Asia and Sub-Saharan Africa have the highest prevalence, indicating a need for targeted interventions in these areas.

c) Common UTI Pathogens: E. coli dominates as the most common pathogen, followed by Klebsiella spp. and Staphylococcus saprophyticus.

d) Antibiotic Resistance Among UTI Pathogens: High resistance is seen against Ampicillin, Cotrimoxazole, and Amoxicillin, underscoring the importance of antibiotic stewardship and local resistance monitoring

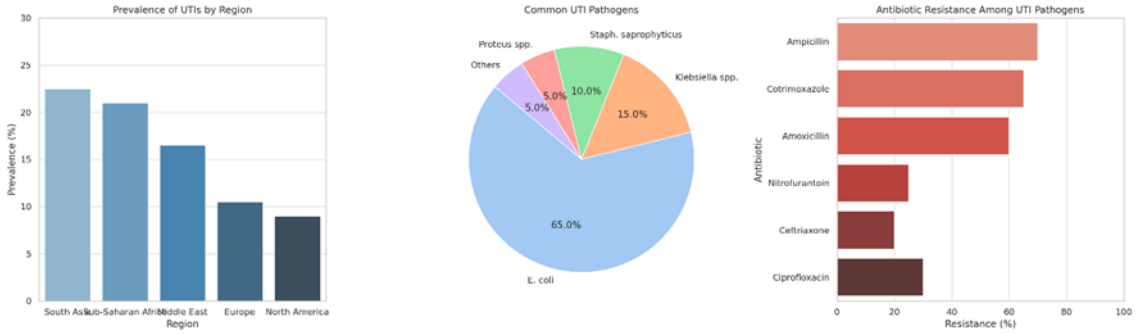

Chart -1 Prevalence of UTIs by Region & Common pathogens along with antibiotic resistance

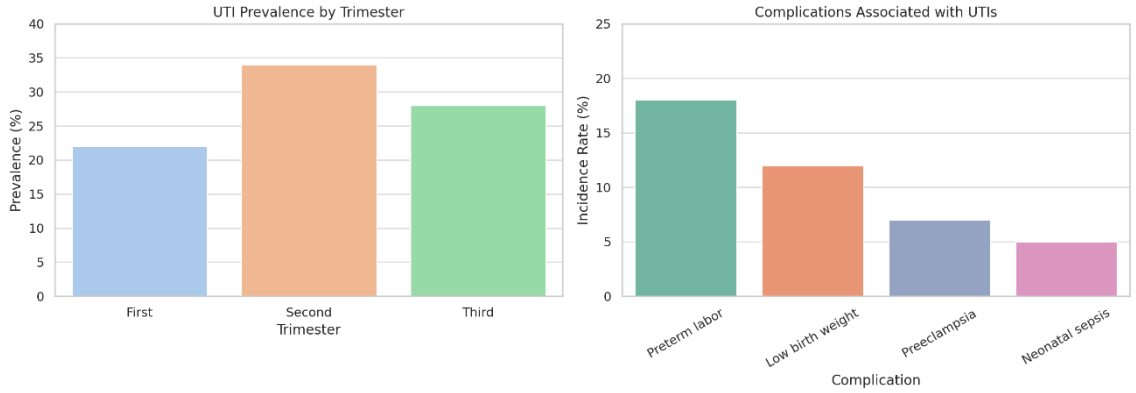

Fig -2: UTI Prevalence by Trimester & complications associated

UTI Prevalence by Trimester: This bar chart shows that the second trimester has the highest prevalence of UTIs among pregnant women (34%), followed by the third (28%) and first (22%) trimesters.

Complications Associated with UTIs: This graph highlights the incidence rates of complications due to UTIs, with preterm labor being the most common (18%), followed by low birth weight (12%), preeclampsia (7%), and neonatal sepsis (5%).

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