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ISSN: 2663-9491 e-ISSN: 2789-6897

Prevalence, Sociodemographic Determinants, and Association of Urinary Tract Infections with Premature Rupture of Membranes in Pregnant Women

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Received: 22 Apr 2026
Accepted: 30 Apr 2026
Published Online: 6 May 2026

Published by:
Gopalganj Medical College, Gopalganj, Bangladesh

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DOI: 10.5281/zenodo.20056466

ABSTRACT

Background: *Urinary tract infections (UTIs) frequently occur during pregnancy because of anatomical and physiological alterations, raising the risk of premature rupture of membranes (PROM), which may result in complications for both the mother and newborn. UTIs can happen irrespective of a mother's age or number of previous births, emphasizing the importance of routine screening. This research seeks to evaluate the occurrence of UTIs in pregnant women and investigate their connection to PROM.* ***Methods & Materials:*** *A cross-sectional study took place (July 2023–June 2024) at Dhaka Medical College with pregnant women (≥28 weeks, single pregnancy) suspected of having a UTI. Samples of data and urine were gathered for analysis via microscopy and culture. PROM was tracked until delivery, and its correlation with UTI was evaluated using Fisher's exact test and odds ratios ($p<0.05$) in SPSS v25.* ***Results:*** *The research involved 152 expectant mothers, primarily aged 27–34 years (44.1%), with the majority being housewives (73.7%) and repeat pregnancies (78.9%). Microscopic analysis revealed that 85.5% exhibited notable pyuria (>5 pus cells/HPF), with a predominance of Gram-negative bacteria (91.2%). PROM was noted in 53.9% of suspected UTI instances, increasing to 60.8% in cases with significant pyuria and 61.3% in culture-positive UTIs. A significant link was identified between UTI and PROM, as 61.3% of culture-positive cases experienced PROM, in contrast to none in culture-negative cases (OR 2.58; 95% CI: 2.06–3.24; $p=0.001$).* ***Conclusion:*** *UTIs in pregnancy are strongly linked to PROM, highlighting the need for early detection and treatment.*

Keywords: *Prevalence, PROM, Urinary Tract Infections, Pyuria, Microscopic Examination Pregnant Women*

(The Insight 2026; 9(2): 252-255)

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INTRODUCTION

Urinary tract infections (UTIs) are frequent bacterial infections that can impact individuals of all ages, particularly in pregnancy, generally involving the bladder or lower urinary system [1]. In females, the urinary tract has an important relationship with the reproductive organs because of its proximity. In the non-pregnant state, the uterus lies just behind and partly over the bladder while in the pregnant state, the gravid uterus affects all the tissues of the urinary tract at various times due to its enlargement [2]. The anatomical, and hormonal changes and increased plasma volume during pregnancy lead to decreased urine concentration and increased bladder volume and all of these factors promote urinary stasis and uretero-vesical reflux. Additionally, differences in urine pH and osmolality, as well as pregnancy-induced glycosuria and aminoaciduria further facilitate bacterial growth and UTI [3].

Spontaneous rupture of the membrane occurs in normal parturition but when it happens before the onset of labor, it is called premature rupture of membrane (PROM) that causes harm to both the mother and baby [4]. PROM occurs when the sac carrying the fetus and amniotic fluid ruptures before childbirth. It causes 20% of all neonatal deaths. Probable maternal complications are chorioamnionitis (3-30%), endometritis, and abruptio placenta. Recurrence of PROM may occur in 20% of cases [5].

Premature rupture of the membrane (PROM) is characterized by a painless gush of watery fluid out of the vagina. The most distinctive clinical feature of the final pathway of parturition is the rupture of the membrane which usually occurs at the end of 1st stage of labor or the beginning of 2nd stage of labor. The occurrence of PROM ranges from 5% to 15% of all pregnancies worldwide [6]. with or without UTI. A PROM that occurs before 37 weeks of gestation is referred to as preterm and after 37 weeks of gestation is called term premature rupture of membranes [5]. Despite modern advances in obstetric and neonatal management, the rate of preterm birth in the developed world is increasing due to PROM [7]. It becomes a major problem when it occurs before 37 weeks of pregnancy.

ISSN: 2663-9491 e-ISSN: 2789-6897

Premature rupture of membranes (PROM) is associated with inflammation and infection, and it may involve the loss of a barrier to ascending infection from urethra and vagina [8]. Numerous risk factors including urinary tract infection, lower socioeconomic status, smoking, sexually transmitted infection, previous preterm delivery, and multiple pregnancies are associated with PROM [8].

Worldwide, urinary tract infections impact approximately 23.9% of pregnant women, underscoring the necessity for regular screening to avert negative maternal and fetal consequences [9].

Urinary tract infections were widespread, with symptomatic cases more common than asymptomatic ones, according to a hospital-based study on pregnant women with PROM/PPROM. The occurrence of UTIs did not seem to be influenced by maternal age, gestational age, or parity, indicating that UTIs are common in PROM cases independent of these demographic characteristics [10].

Single observational studies also demonstrate significant variability: a cross-sectional hospital-based study found prevalence of UTI among pregnant women, highlighting prior UTI history, diabetes mellitus, and overweight status as important risk factors [11].

According to Nahar et al. (2022), caesarean sections in pregna nt women with PROM were primarily caused by prior CS, fetal distress, or unsuccessful induction. Notable consequence for both the mother and the newborn were infection, low birth weight, and the requirement for neonatal care [12].

In Bangladesh, the majority of UTI studies during pregnancy have been conducted in hospitals, with sparse information on risk factors, asymptomatic instances, and outcomes such as PROM. This research analyzes the occurrence of UTIs and their association with PROM in a representative population.

MATERIALS & METHODS

This observational study with a cross-sectional design was carried out from July 2023 to June 2024 at the Department of Microbiology of Dhaka Medical College, focusing on pregnant women who were suspected of having a UTI while receiving both indoor and outdoor obstetric services. Purposive sampling was employed, and ethical approval along with informed consent was secured. The inclusion criteria consisted of having a single pregnancy, being at a gestational age of 28 weeks or more, and presenting clinically with a suspected UTI, whereas those with twin pregnancies, chronic kidney disease, polyhydramnios, vaginal bleeding, diabetes, hypertension, or those who did not provide consent were excluded. Data regarding demographics, obstetrics, and clinical UTI were gathered. Urine samples were collected under aseptic conditions, analyzed microscopically for pus cells, and cultured on selective media, with bacterial identification verified through Gram staining and biochemical tests. The diagnosis of premature rupture of membranes (PROM) was made through follow-up until the time of delivery.The connection between UTI and PROM was evaluated using descriptive statistics, Fisher exact test, and odds ratios, with $p<0.05$ being considered statistically significant. The data were analyzed using SPSS v25.

RESULTS

Participant Characteristics:

A total of 152 pregnant women were included. The majority were aged 27–34 years (44.1%), followed by 19–26 years (40.8%) and 35–42 years (15.1%), with a median age of 28 years (IQR: 24–32). Most participants were housewives (73.7%) and multigravida (78.9%) *Table I* .

Table I: Sociodemographic characteristics of the study population (*n*=152)

Variables	Frequency(n)	Percentage (%)
Age (in years)		
19-26	62	40.8
27-34	67	44.1
35-42	23	15.1
Median (IQR)	28 (24-32)	
Occupation		
Housewife	112	73.7
Worker	29	19.1
Student	8	5.2
Teacher	3	2.0
Gravida		
Primigravida	32	21.1
Multigravida	120	78.9

UTI Prevalence and Organism Distribution:

Table II indicates that a majority of participants (85.5%) exhibited notable pyuria (>5 pus cells/HPF), suggesting inflammation in the urinary tract. Of these, Gram-negative bacteria comprised the majority of isolates (91.2%), whereas Gram-positive bacteria (4%) and Candida (4.8%) were found less often. A minor percentage (4%) exhibited no bacterial growth even with a high presence of pus cells.

Table II: Microscopic Findings and Organism Distribution in Urine Samples of Participants with Suspected UTI

Parameter	Subcategory	Number of Cases(n)	Percentage (%)
Microscopic Examination (Pus Cells/HPF, n=152)	>5 pus cells	130	85.5
	<5 pus cells	22	14.5
Organism Isolated (n=130, pus cells >5/HPF)	Gram-negative bacteria	114	91.2
	Gram-positive bacteria	5	4
	Candida	6	4.8
	No growth	5	4

ISSN: 2663-9491 e-ISSN: 2789-6897

Association with PROM:
Among all suspected UTI cases, 82 participants (53.9%) experienced premature rupture of membranes (PROM). PROM prevalence increased to 60.8% in participants with significant pyuria and reached 61.3% among culture-positive UTI cases, as shown in *Table III*.

Table III: PROM Status Among Participants with Suspected and Confirmed UTI

Parameter	Subcategory	Number of Cases(n)	Percentage (%)
PROM Status – Suspected UTI (n=152)	PROM present	82	53.9
	PROM absent	70	46.1
PROM Status – Significant Pus Cell (>5/HPF, n=130)	PROM present	79	60.8
	PROM absent	51	39.2
PROM Status – Bacterial Culture Positive UTI (n=119)	PROM present	73	61.34
	PROM absent	46	38.66

The association between culture-positive UTI and PROM was statistically significant. Out of 119 culture-positive participants, 73 developed PROM, whereas none of the 11 culture-negative participants experienced PROM. This yielded an odds ratio of 2.58 (95% CI: 2.06–3.24; p = 0.001), confirming a strong association between UTI and PROM, as summarized in *Table IV*.

Table IV: Association of UTI and PROM (*n*=130)

Variable	PROM		OR (95% CI)	p-value
	Yes n (%)	No n (%)		
Culture positive (N=119)	73 (61.34%)	46 (38.66%)	2.58 (2.06-3.24)	f0.001s
Culture negative (N=11)	0 (0%)	11 (100%)		

Data was presented as frequency and percentage over the columns. P-value was achieved by the following test: f= Fisher exact test ; s = significant

DISCUSSION

The majority of participants were aged 27–34 years, consistent with Michael and Wadhwani (2017), who reported most UTI cases in the 21–30-year group (7.3%) [13]. Similarly, Rahman et al. (2019) found a mean maternal age of 28.13 ± 5.82 years, indicating that the study primarily involved young to middle-aged adults [14].

In this study, most participants were housewives. Gahwagi and Busarira (2015) suggest that housewives may be at higher risk of UTIs due to lifestyle, hygiene, hormonal factors, and limited healthcare access [15]. Factors such as low physical activity, delayed urination, and certain hygiene practices may increase vulnerability, which can be mitigated through proper hydration, hygiene, regular check-ups, and balanced nutrition (Shaheen et al., 2016) [16].

Most participants in this study were multigravida, while primigravida accounted for 21.1%, reflecting a predominance of women with prior pregnancies. This aligns with Yetera et al. (2024), where 81.8% were multigravida [17]. Repeated pregnancies may increase UTI risk through urinary stasis, altered vaginal flora, gestational diabetes, and frequent catheter use (Kalinderi et al., 2018) [3]. In contrast, Akhter et al. (2024) reported more primigravida cases (53%), possibly due to higher sexual activity and lower genital hygiene awareness in early reproductive years (Negussie et al., 2018) [18,19].

In this study, most of participants had significant pus cells in urine microscopy, while some did not. This contrasts with Mathapati et al. (2020), who reported 35% prevalence, likely due to differences in study population, definitions of significant pus cells, microscopy methods, or lab interpretation [20].

In this study, most isolates were Gram-negative bacteria, similar to Ejerssa et al. (2021), who reported 90.3% among UTI cases in pregnant women [21].

Among 152 suspected UTI cases, most experienced PROM, slightly higher than without PROM. This aligns with Ali et al. (2023), who reported 60% of pregnant women with PROM had UTIs, and Rahman et al. (2019), who found 55.2% prevalence [10,22].

In this study, PROM was observed in culture-positive UTI cases. Although lower than Khanam et al. (2024), who reported 94%, both studies indicate a significant correlation between UTI and PROM [23].

Infection, particularly UTI, is a common cause of premature labor and PROM (Wibawa & Mahardika, 2024) [24]. In this study, most of patients with PROM had positive bacterial cultures, compared to without PROM, with no PROM cases among culture-negative patients. An odds ratio of 2.58 indicates a strong association between UTI and PROM. Similarly, Addisu et al. (2020) reported a 2.62-fold higher risk of PROM in women with UTI, and Ifrah et al. (2025) found UTIs significantly linked to adverse pregnancy outcomes, including PROM, preterm labor, and low birth weight [25,26].

CONCLUSION

UTIs frequently occur in pregnant women and are closely linked to the incidence of PROM. The likelihood of PROM rises with the severity of UTI, especially in cases that are culture-positive. Prompt recognition and treatment of UTIs in pregnancy are vital to minimize complications for both mother and baby.

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