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## Maternal UTI as a risk factor for neonatal sepsis

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## List of Abbreviations

<b>Abbreviation</b>	<b>Definition</b>
UTI	Urinary Tract Infection
EOS	Early Onset Sepsis
LOS	Late Onset Sepsis
PROM	Prolong Rapture Of Membrane
ASB	Asymptomatic Bacteriuria
CBC	Complete Blood Count
CSF	Cerebrospinal Fluid
IgG	Immunoglobulin G
RDS	Respiratory Distress Syndrome
CRP	C-Reactive protein
LBW	Low Birth Weight

# Abstract

## Background:

Neonatal sepsis poses a significant threat to newborns, particularly in low-income countries, leading to high rates of illness and death. It can manifest as early-onset or late-onset sepsis, commonly caused by bacteria like *E. coli*. Preterm infants and the use of invasive medical devices increase vulnerability. During pregnancy, urinary tract infections (UTIs) can have serious consequences for both the mother and the developing fetus, with maternal UTIs associated with adverse outcomes such as low birth weight and preterm delivery. However, further research is necessary to fully comprehend the intricate connection between maternal UTIs and neonatal sepsis. Infections contracted by the mother can be transmitted vertically to the fetus, emphasizing the urgent need for effective preventive measures and management strategies. By understanding and addressing these challenges, we can improve the health outcomes of both mothers and newborns

## Objectives:

Determine the association between maternal UTI and neonatal sepsis

## Methods:

This is an observational cross-sectional study, which has been carried out on neonates admitted to the neonatal care unit at Al-Elwiya pediatric teaching hospital from the fifteenth of November 2022 till the end of January 2023. A total of 151 neonates, ages ranging from (1-28) days were included in the study. (After excluding those who had no sepsis and their mothers have not encountered UTIs during pregnancy, and neonates' obvious congenital anomalies).

Information about the neonates was collected from the patient records and register. while a semi-structured interview with mothers was conducted to assess information on their socio-demographic characteristics and antenatal care.

## **Results:**

A total of 151 neonates and their mothers took part in this study. The mean age of neonates was 12.76 days with ( $\pm 6.8$  SD), while the mean of mothers' age was 26.63 years with ( $\pm 5.7$  SD). more than 80% of the mothers were between 20-34 years old, and only 8.6% were under the age of 20. more than half of the mothers (58.7%) were either illiterate or only completed primary school and (42.4%) completed secondary school or higher education. moreover, the site of delivery was a hospital in 146 deliveries (96.7%), while only 5 deliveries were done outside of the hospital. In terms of gender, female neonates comprised 76 (50.3%) of the total, while male neonates comprised 75 (49.7%).

Maternal UTIs were found as a highly significant factor for neonatal sepsis ( $p$  value= 0.009), maternal UTIs were three times more significant with EOS ( $p$  value= 0.006) than LOS ( $p$  value= 0.022) which was also considered as significant.

## **Conclusion:**

This study showed a significant association between maternal UTI and neonatal sepsis

**Keywords:** Sepsis, Neonates, Urinary tract infection (UTI)

## **Introduction:**

### **A/ Neonatal sepsis**

Neonatal sepsis is characterized by a bloodstream infection in newborns who are under 28 days old. It remains a leading cause of morbidity and mortality among neonates, particularly in middle and lower-income nations [1]. Based on the timing of its occurrence after birth, neonatal sepsis is categorized into two types: early-onset sepsis (EOS) and late-onset sepsis (LOS). EOS is caused by organisms acquired before and during delivery (or maternal-fetal infection), while LOS is caused by organisms acquired after delivery from the environment (nosocomial or community sources). EOS refers to sepsis in neonates that takes place on or before day 7, whereas LOS refers to sepsis occurring after day 7. [2].

The global prevalence of neonatal sepsis is estimated to range from 1 to 10 cases per 1000 live births [3]. A study conducted in Iraq showed an incidence of suspected neonatal sepsis 54.67%, with 53.66% of the neonates classified as early-onset sepsis (EOS) and 46.34% as late-onset sepsis (LOS). [4]

Fetus are susceptible to infections during pregnancy or delivery when they pass through the vaginal canal. Sepsis can result from viral, fungal, or bacterial infections, with bacterial infections being the most prevalent. Among bacterial pathogens, *Escherichia coli* (*E. coli*) accounts for 37% of early-onset sepsis (EOS), followed by *Klebsiella pneumonia* and *Staphylococcus* species, each constituting 12.5% of cases. For late-onset sepsis (LOS), *E. coli* constitutes 38.7% of cases, followed by *Staphylococcus* species at 17.3% and *Klebsiella pneumonia* at 10.7%. Gram-negative bacteria (G negative) were more common than gram-positive bacteria (G positive) in both EOS (81.2%) and LOS (74.7%) cases [5].

Several risk factors contribute to the occurrence of neonatal sepsis, including preterm birth, maternal history of infections, prolonged rupture of membranes (PROM), and the need for resuscitation at birth [6].

Preterm neonates face a higher risk of sepsis and infection compared to term neonates. This heightened susceptibility in preterm neonates primarily arises from:



1. Deficient immune system: Preterm neonates exhibit decreased levels of IgG antibodies and impaired opsonization and complement activation, which contribute to their compromised immune response.
2. Impaired innate immune system: The immature epithelial barrier in preterm neonates compromises their innate immune system, making them more susceptible to infections.
3. Increased need for invasive devices: Preterm neonates often requires the use of invasive devices such as vascular access, endotracheal tubes, feeding tubes, and urinary tract catheters due to associated severe illnesses. These devices serve as potential entry points for infections.

The combination of these factors contributes to the increased vulnerability of preterm neonates to sepsis and infections [7].

Early-onset and late-onset sepsis are assessed through various laboratory studies, including a complete blood cell (CBC) count and differential, measurement of levels of C-reactive protein (CRP) and other infection markers. The gold standard for diagnosis still relies on the culture of blood, urine, and cerebrospinal fluid (CSF) samples [8].

## **B/ Urinary Tract Infections during pregnancy**

Urinary tract infections (UTIs) are commonly observed medical complications during pregnancy, often leading to substantial morbidity for both the pregnant woman and the fetus. While bacteria are the primary cause of UTIs, certain viruses, fungi, and parasites can also infect the urinary tract. Bacterial sources from the intestine or vagina account for over 85% of UTIs, impacting up to 10% of pregnant women [9].

The term UTIs includes both asymptomatic bacteriuria (ASB) and lower tract (acute cystitis) or upper tract (acute pyelonephritis) infections.

Structural and functional changes in the urinary tract during pregnancy elevate the risk of progression from asymptomatic bacteriuria (ASB) to pyelonephritis in pregnant women. Physiological hydronephrosis and hydroureteronephrosis occur due to hormonal influences, external pressure from the expanding uterus, and

inherent alterations in the ureteral wall. The elevated concentrations of progesterone in maternal circulation during pregnancy lead to a relaxation of bladder smooth muscles (increasing bladder capacity) and reduced detrusor tone and ureteral peristalsis. These factors contribute to ureteral dilation and urinary stasis, potentially creating a reservoir for bacterial growth. Additionally, the pressure exerted by the enlarging uterus on the bladder may facilitate the ascent of infections from the urethra to the kidneys, thereby predisposing women to the development of symptomatic UTIs [10]. Furthermore, the increase in glomerular filtration rate during pregnancy induces changes in urine composition, such as glycosuria (presence of glucose in the urine), alkalization of pH, and a decreased concentration capacity of the urine. These alterations create an environment that facilitates bacterial proliferation [11].

Asymptomatic bacteriuria (ASB) refers to the presence of significant bacteriuria in women without symptoms of a urinary tract infection. ASB is considered a significant concern for reproductive women, as it is recognized as an independent risk factor for perinatal mortality, abortion, and preterm delivery [12,13]. The prevalence of ASB in pregnant women ranges from 2% to 7%, which is similar to the prevalence in non-pregnant women. Failure to treat bacteriuria during pregnancy can lead to acute pyelonephritis in up to 25% of women, a severe form of urinary tract infection with an incidence of 0.5-2% occurring during the second and third trimesters [14,15]. On the other hand, acute cystitis, with a prevalence of 1-2% typically occurring in the first trimester of pregnancy, has not been found to be associated with an increased risk of preterm delivery or perinatal mortality [16]. perhaps because pregnant women with symptomatology of low urinary tract infection receive timely treatment.

The organisms responsible for urinary tract infections (UTIs) during pregnancy are typically the same uropathogens that commonly cause UTIs in non-pregnant individuals. Among these organisms, *Escherichia coli* (*E. coli*) is the most frequently isolated pathogen. A retrospective analysis spanning 18 years revealed that *E. coli* was identified as the causative agent in 82.5% of pyelonephritis cases in pregnant patients [17]. Other bacteria that may be seen include *Klebsiella pneumoniae*, *Staphylococcus*, Group B *Streptococcus*, *Proteus*, and *Enterococcus* species. Evaluation of UTIs will include urinalysis and clean catch urine culture

## **C/ Maternal infections and Neonatal sepsis**

In a recent study, the effect of maternal urinary tract infection was investigated. Maternal urinary tract infection was found to be associated with prematurity [18] and birth defects, which were found to be more common in babies exposed to maternal UTI.

Maternal urinary tract infections (UTIs) have been associated with various adverse outcomes for both the mother and the baby. These include low birth weight, prematurity, intrauterine growth retardation, pre-eclampsia, amnionitis, and perinatal death [19].

However, the relationship between maternal UTI and neonatal sepsis has not been investigated in the above studies.

Acute maternal infection during pregnancy can be transmitted to the fetus in either of two ways:

- Vertical transmission during pregnancy: which can result in congenital infection, intrauterine death, or permanent disability.
- Perinatal transmission during delivery: which can lead to severe neonatal diseases.

According to our literature search, only a few studies have investigated the association between maternal UTI and neonatal sepsis in Iraq. However, there is one study on the association between maternal genito-urinary infections and mortality outcome in neonatal sepsis that showed no significant association[20].

## **Aim of the study:**

The aim and objective of this cross-sectional study is to identify the association between maternal UTIs and neonatal sepsis and determine if maternal UTIs can be considered a risk factor for neonatal sepsis among Iraqi women attending Al-Elwiya pediatric teaching hospital in Baghdad.

## **Materials and methods**

This is an observational cross-sectional study, which has been carried out on neonates admitted to the neonatal care unit at Al-Elwiya pediatric teaching hospital from the fifteenth of November 2022 till the end of January 2023. A total of 151 neonates, ages ranging from (1-28) days were included in the study. (After excluding those who had no sepsis and their mothers have not encountered UTIs during pregnancy, and neonates' obvious congenital anomalies).

Information about the neonates was collected from the patient records. while a semi-structured interview with mothers was conducted to assess information on their socio-demographic characteristics and antenatal care.

### **Study variables:**

Socio-demographic, maternal, obstetric and neonatal characteristics were collected through data extraction and semi-structured interviews.

- **Maternal age**  
Maternal age was categorized as less than 20 years, 20–35 years and 35 years and above.
- **Maternal infections**  
Mothers who had UTIs during pregnancy were asked about the trimester in which UTI occurred
- **Maternal education**  
Mothers who are illiterate or have received education through informal trainings other than in schools were categorized as having 'no formal education' while those who had gone to school for education were categorized as primary, secondary and higher education.
- **Parity**  
Mothers who are primipara (had one birth) or multipara (had more than one births)

- **Mode of delivery**  
Mothers who gave birth vaginally or through caesarean section.
- **Site of delivery**  
Mothers who gave birth out of a hospital or at a hospital.
- **History of prolonged rupture of membranes**  
Mothers were asked if they had a membrane rupture more than 18 hours prior to delivery
- **Gender of the baby**  
The sex of the baby as: male or female.
- **Weight of the baby**  
Birth weight is categorized as less than 2500 g, 2500–4000 g or 4000 g and more.
- **Gestational age**  
Gestational age is calculated using the last menstrual period and categorized as less than 37 weeks, 37–42 weeks or 42 weeks and more.
- **The onset of clinical features**  
Neonates with clinical features occurring between birth and 7 days were considered as early onset sepsis, while neonates of clinical features occurring between 8 and 28 days after birth were considered as late onset sepsis
- **Requirement for resuscitation**  
Mothers were asked if their neonate needed resuscitation or any other invasive procedures after birth.

## **Data analysis**

The correlation between maternal UTI and neonatal sepsis and time of infection during pregnancy were tested by the chi-square test. data analysis was done using the SPSS software (Statistical Package for the Social Sciences, Version 24). A P value less than 0.05 was considered significant.

## **Results**

### **socio-demographic characteristics**

A total of 151 neonates and their mothers took part in this study. The mean age of neonates was 12.76 days with ( $\pm 6.8$  SD), while the mean of mothers' age was 26.63 years with ( $\pm 5.7$  SD). more than 80% of the mothers were between 20-34 years old, and only 8.6% were under the age of 20. more than half of the mothers (58.7%) were either illiterate or only completed primary school and (42.4%) completed secondary school or higher education. moreover, the site of delivery was the hospital in 146 of the deliveries (96.7%), while only 5 deliveries were done outside of the hospital. In terms of gender, female neonates comprised 76 (50.3%) of the total, while male neonates comprised 75 (49.7%).

<b><i>Table (1)- socio-demographic characteristics</i></b>			
<b><i>Variables</i></b>	<b><i>Categories</i></b>	<b><i>Frequency</i></b>	<b><i>Percentage</i></b>
<b>Maternal Age</b>	< 20	13	8.6%
	20 - 34	121	80.1%
	> 34	17	11.3%
<b>Maternal education</b>	No formal education	35	23.2%
	Primary	69	45.7%
	Secondary	27	17.9%
	Higher education	20	13.2%
<b>Site of delivery</b>	At hospital	146	96.7
	Out of hospital	5	3.3%
<b>Neonatal Sex</b>	Female	76	50.3%
	Male	75	49.7%

## Gynecologic and obstetric characteristics of the mother

In terms of delivery method, 92 of mothers had caesarian Section delivery (60.9%). while 59 had a vaginal delivery (39.1%). In terms of UTIs 113 (74.2%) of the mothers had UTI (90) of them had UTI during the third trimester and (6,17) had UTI during the first and second trimesters, respectively. 34 of the mothers reported having PROM of 18 hours and more. 76 women had Previous delivery and 75 had No previous delivery

<b>Table (2)- Gynecologic and obstetric characteristics of the mother</b>				
<b>Variables</b>	<b>Categories</b>	<b>Frequency</b>	<b>Percentage</b>	
<b>Type of delivery</b>	Caesarean section	92	60.9%	
	Vaginal delivery	59	39.1%	
<b>Urinary tract infection (UTI) prevalence</b>	First trimester	6	5.3%	Total UTI (74.8%)
	Second trimester	17	15.0%	
	Third trimester	90	79.6%	
	Do not have UTI	38		25.2%
<b>Prolong rupture of membrane (PROM)</b>	Yes	34	22.5%	
	No	117	77.5%	
<b>Parity</b>	Primipara	76	50.3%	
	Multipara	75	49.7%	



## Neonate characteristics

A total of 133 neonates had sepsis, 83(62.4%) of them were considered as early onset sepsis and 50(37.6%) as late onset sepsis, while 18 (11.9%) had no sepsis.

<i>Table (3)- Sepsis prevalence</i>		
<i>Categories</i>	<i>Frequency</i>	<i>Percentage</i>
Total sepsis	133	88.1%
<i>EOS</i>	83	62.4 %
<i>LOS</i>	50	37.6%
Do not have sepsis	18	11.9%

In terms of gestational age, the majority of the study participants 110 (72.8%) were born between 37 and 42 weeks after the last menstrual period, regarding birth weight 89(58.9%) were considered as normal weight, while 62 (41.1%) were considered as low weight. 61 (40.4%) of neonates needed resuscitation after birth.

<i>Table (4)- Neonate characteristics</i>			
<b>Variables</b>	<b>Categories</b>	<b>Frequency</b>	<b>Percentage</b>
Gestational age	<i>37 – 42 W</i>	110	72.8%
	<i>&lt; 37 W</i>	41	27.2%
Birth weight	<i>Normal birth weight</i>	89	58.9%
	<i>Low birth weight</i>	62	41.1%
Need of resuscitation	<i>Yes</i>	61	40.4%
	<i>No</i>	90	59.6%

## UTIs and neonatal sepsis:

Maternal UTIs were found as a highly significant factor for neonatal sepsis ( $p$  value= 0.009), maternal UTIs were three times more significant with EOS ( $p$  value= 0.006) than LOS ( $p$  value= 0.022) which was also considered as significant.

Table (5) - UTIs and neonatal sepsis										
		EOS		P value	LOS		P value	Total sepsis		P value
		Yes	No		Yes	No		Yes	No	
UTI	Yes	57	18	0.006	38	18	0.022	95 (62.9%)	18 (11.9%)	0.009
	No	26	0		12	0		38 (25.2%)	0	

## **Other Variables association with neonatal sepsis**

parity was found to be significantly associated with EOS, while for LOS it was statically not significant.

In terms of prolonged rupture of membrane (PROM) it was found as a significant factor for neonatal sepsis ( $p$  value=0.015), being more significant for EOS than LOS.

in terms of birth weight, Low birth weight was found significantly associated with EOS, but it was not significant for LOS.

in terms of the requirement of resuscitation after birth was also found highly significant for EOS, while being not significant for LOS.

Other variables including (Maternal age, Maternal education, Site of delivery, Type of delivery, Neonatal sex, Gestational age) was found statically not significant

Table (6) - Other Variables association with neonatal sepsis

Variables	Categories	EOS		P value	LOS		P value	Total sepsis		P value
		Yes	No		Yes	No		Yes	No	
<b>1- Maternal age</b>	<i>&lt;20</i>	11	0	0.179	2	0	0.675	13	0	0.314
	<i>20-34</i>	65	15		41	15		106	15	
	<i>&gt;34</i>	7	3		7	3		14	3	
<b>2- Maternal education</b>	<i>No formal education</i>	18	5	0.950	12	5	0.982	30	5	0.964
	<i>Primary</i>	38	8		23	8		61	8	
	<i>Secondary</i>	16	3		8	3		24	3	
	<i>Higher education</i>	11	2		7	2		18	2	
<b>3- Site of delivery</b>	<i>At Hospital</i>	79	18	0.342	49	18	0.546	128	18	0.403
	<i>Outside hospital</i>	4	0		1	0		5	0	
<b>4- Type of delivery</b>	<i>Caesarean section</i>	50	10	0.714	32	10	0.527	82	10	0.619
	<i>Vaginal delivery</i>	33	8		18	8		51	8	
<b>5- Parity</b>	<i>Previous birth</i>	28	13	0.003	35	13	0.859	63	13	0.048
	<i>No previous birth</i>	55	5		15	5		70	5	
<b>6- PROM</b>	<i>Yes</i>	22	0	0.014	12	0	0.022	34	0	0.015
	<i>No</i>	61	18		38	18		99	18	
<b>7- Sex</b>	<i>Male</i>	42	8	0.636	25	8	0.686	67	8	0.637
	<i>Female</i>	41	10		25	10		66	10	
<b>8- Weight</b>	<i>Normal birth weight</i>	39	15	0.005	35	15	0.272	74	15	0.025
	<i>Low birth weight</i>	44	3		15	3		59	3	
<b>9- Gestational age</b>	<i>≥37 W</i>	63	12	0.416	36	12	0.670	98	12	0.530
	<i>&lt;37 W</i>	20	6		14	6		35	6	
<b>10- Resuscitation</b>	<i>Yes</i>	49	3	0.001	9	3	0.899	58	3	0.029
	<i>No</i>	34	15		41	15		75	15	

## **Discussion**

The aim of this study was to determine if maternal urinary tract infections (UTIs) considered as a risk factor for neonatal sepsis and identify other possible factors among neonates admitted to neonatal care unit of Al-Elwiya pediatric teaching hospital in Baghdad. The data analysis of our study shows that neonates born to mothers with urinary tract infections during pregnancy especially during the third trimester were at high risk of neonatal infection. The association was more obvious with early-onset sepsis(EOS) than with late-onset sepsis(LOS). which is consistent with the study conducted in Iraq by Douaa M. et al(2020). which reported that there was high risk of neonatal sepsis in babies born to mothers with UTI .[21] Another study conducted in Iran by Fatemeh E. et al(2012), which also showed an association between maternal UTIs and neonatal sepsis.[ 22], This might be due to poor sanitation and hygiene and limited access to healthcare in developing countries. The incidence of early-onset sepsis in our study was 62.4% while the incidence of late-onset sepsis was 37.6% which is close to the study conducted in Iraq by Al-Mayah QS et al in 2017 [4]. which state the incidence of 52.73 % for early-onset sepsis and 47.7 for late-onset sepsis, while another study conducted by Batool A. et al. found an incidence of 32% for EOS and 68% for LOS[23]. These variations may be related to the place and time of the study or to the diagnostic criteria.

Overall, this finding may support the reason that pregnancy causes numerous changes in the woman's body that increase the likelihood of urinary tract infections (UTIs), These changes increase the risk of serious infectious complications from symptomatic and asymptomatic UTIs, even in healthy pregnant women. This maternal health problem is often associated with neonatal sepsis, especially if untreated during the third-trimester pregnancy or labour.

Therefore, neonatal sepsis may result from colonization of the birth canal by the infectious agent.[24]

The findings of our study suggest an association between prolonged rupture of membrane (PROM) and early-onset sepsis but no association between PROM and LOS, These results are similar to the study of Woranart R. et al in Thailand (2005)

and study by Zhuang L. et al. in china (2020). That linked PROM to EOS, And showed no significant association between PROM and LOS.[25,34].Mainly due to direct exposure of the neonate to the maternal pathogens. In contrast, A study conducted by Drassinower D. et al in USA (2016), Showed no association between PROM and neonatal sepsis.[26]. This is probably due to improved antenatal care in the developed countries that caused minimising this risk factor.

Our study found that there is a higher association between early-onset neonatal sepsis and primiparous mothers compared to multiparous mothers, this is consistent with study conducted by Basem S. et al, which has found an increased risk of neonatal sepsis with nulliparous women compared to multiparous [27]. It may be explained by prolonged delivery duration among nulliparous compared to multiparous, which increases exposure to infection.

The occurrence of neonatal sepsis shown to be associated with low birth weight when compared to normal birth weight, this is consistent with the study conducted by Amare B. et al. which showed that LBW neonates had a prevalence of sepsis 1.4 times more than normal birth weight neonates [28]. And with the study of P. Hornik et al.[33]. Which is mainly due to immature immune system, unable to feed, easily lose their heat, low store of glucose and more likely risk to develop hypoglycemia may increases the likelihood of neonatal infections.

Another factor that showed association with EOS is requirement of resuscitation after birth compared to those who did not need resuscitation. this finding was supported by the study of Zelalem A.in Ethiopia in 2019 and the study of Douaa M.[29,21], which found that the odds of developing neonatal sepsis among neonates who have a history of neonatal resuscitation at birth were six times higher as compared to those who were not resuscitated. This happens probably due to the invasive producers that may introduce bacteria from the environment or medical equipment into bloodstream leading to sepsis and might result from poor practices and non-adherence to guideline by health professionals during resuscitation that may predispose the neonate with a greater risk of developing sepsis.

Regarding maternal age, this study found no association between the age of the mother and neonatal sepsis. this finding is consistent with study of Yaya Y, in 2019, which showed no significance between maternal age and sepsis.[30]. this results contradicted by the study of Basem S. et al. in Egypt in 2023 .which resulted that maternal age above 35 years was a predisposing factor for neonatal sepsis.[27]

This difference can be due to multiple factors including study design and population characteristics.

About type of delivery there was no association with neonatal sepsis according to our data analysis which contrasted by many studies , A study by Peter A. et al . showed that CS delivery neonates at a high risk for neonatal sepsis.[32]

Regarding neonatal sex there are no association between gender and sepsis which is consistent with study of Caroline A. et al. that showed no relation between sepsis and gender. [31] Unlike the study of Martin K. which showed that male neonates are prone to neonatal sepsis than female neonates. This is mainly due to male sex hormones, i.e., androgens, have been shown to be suppressive on cell-mediated immune responses. In contrast, female sex hormones exhibit protective effects which may contribute to the natural advantages of females under septic conditions.[35]



## **Conclusion**

- The findings of this research show a significant association between maternal UTI and neonatal sepsis.
- The study suggests that infants born to mothers with UTI during pregnancy especially during third trimester of having an increased risk of developing sepsis in the neonatal period.
- This highlights the importance of timely diagnosis and treatment of UTIs in pregnant women to prevent adverse outcomes in newborns.

## **Limitations of the Study**

- This study is limited due to small size of population because it was conducted in one hospital.
- And it is not unique because participant memory and self-report nature of determinant factors are potential limitations that could cause bias.

## **Recommendation**

Based on the confirmed association between maternal UTI and neonatal sepsis, here are some recommendations for both doctors and mothers.

### **For Doctors:**

1. Antenatal screening: Implement routine screening for urinary tract infections (UTIs) during pregnancy to identify and treat maternal UTIs promptly. This can help reduce the risk of neonatal sepsis.
2. Timely treatment: Promptly diagnose and treat maternal UTIs to minimize the risk of transmission to the newborn. Prescribe appropriate antibiotics based on the sensitivity of the causative bacteria.
3. Education and awareness: Educate healthcare providers about the association between maternal UTI and neonatal sepsis to increase awareness and promote early detection and intervention.

### **Recommendations for Mothers:**

1. Attend prenatal care visits: Regularly attend prenatal check-ups to allow healthcare providers to monitor your health and detect any signs of urinary tract infections.
2. Hygiene practices: Practice good hygiene, including proper wiping techniques after using the toilet and maintaining clean genital areas, to minimize the risk of UTIs during pregnancy.
3. Stay hydrated: Drink an adequate amount of water to promote urinary tract health and flush out bacteria that could potentially cause UTIs.
4. Report symptoms promptly: If you experience any symptoms of a urinary tract infection such as frequent urination, pain or burning during urination, or lower abdominal pain, inform your healthcare provider immediately.

Further studies are needed to explore the underlying mechanisms of this association and to identify strategies for the prevention and management of neonatal sepsis in this vulnerable population

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