

ORIGINAL ARTICLE

Maternal knowledge about reproductive tract infections: enhancing outcomes for pregnancy and neonatal health

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ABSTRACT

Background: Reproductive tract infections (RTIs) are major contributors to maternal morbidity and adverse pregnancy outcomes. Data on pregnant women's knowledge and awareness of RTIs in Saudi Arabia remain limited. We assessed awareness and knowledge of RTIs among pregnant women attending antenatal clinics at King Abdulaziz University Hospital, Jeddah.

Methods: In this cross-sectional study conducted between April and June 2025, we included 329 pregnant women attending antenatal care clinics. Data were collected using a structured questionnaire assessing sociodemographic characteristics, knowledge of RTI symptoms, transmission, prevention, and treatment. Data were analyzed using IBM SPSS Statistics (version 21.0; IBM Corp., Armonk, NY, USA). The chi-square test and logistic regression analysis were used to assess associations between knowledge levels and participant characteristics.

Results: Most participants were Saudi nationals (90%), with a median age of 33 years. Overall, 65% of participants scored above the mean knowledge score; however, substantial gaps remained regarding prevention and transmission. Only 31% identified sexual contact as a transmission route, and 2.4% recognized condom use as a preventive measure. Education level and employment status were significantly associated with higher knowledge; employed women were more than twice as likely to demonstrate higher knowledge compared to unemployed women (adjusted odds ratio = 2.54; 95% confidence interval: 1.23-5.60; $p < 0.05$).

Conclusion: Integration of structured, evidence-based health education into routine antenatal care may improve knowledge, reduce infection risk, and enhance maternal and neonatal outcomes.

Keywords: RTI, pregnant women, antenatal care, health empowerment.

Introduction

Infectious diseases, caused by pathogens or their toxic byproducts, are transmitted by contact with infected persons, animals, or contaminated objects [1]. They account for >15 million deaths annually, representing a major global health concern [2]. Reproductive tract infections (RTIs), affecting male and female genital tracts, are among the most prevalent health problems experienced by females, particularly in developing countries [3]. The most common causative agents include *Neisseria gonorrhoeae*, *Chlamydia trachomatis*, *Gardnerella vaginalis*, human papillomavirus (HPV), and herpes simplex virus [4].

Symptoms in females may include abnormal vaginal discharge, genital discomfort, itching, or dysuria; however, many patients remain asymptomatic, posing challenges

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for effective disease control [5]. Biological differences, social inequalities, and restrictive cultural practices further increase women's vulnerability, often leading to more severe outcomes than in men [2]. Pregnancy-related physiological and immunological adaptations include changes in the vaginal microenvironment and heightened susceptibility to opportunistic RTIs. Many infections remain asymptomatic; untreated infections can result in serious pregnancy-related complications [6–8].

RTIs during pregnancy are linked to adverse outcomes including stillbirth, neonatal death, and congenital malformations. Short-term neonatal complications include intraventricular hemorrhage, respiratory distress syndrome, and necrotizing enterocolitis, while long-term effects include cerebral palsy and intellectual disability [8–10]. Third-trimester infections are further associated with preterm delivery, fetal growth restriction, ectopic pregnancy, low birth weight, and lower verbal intelligence quotient [8–10].

Despite global efforts to reduce the burden of RTIs, awareness and knowledge among pregnant women in Saudi Arabia remain unclear [11]. This study therefore aimed to assess the awareness and knowledge of RTIs among pregnant women attending antenatal clinics at King Abdulaziz University Hospital (KAUH), Jeddah, Saudi Arabia.

Material and Methods

Study design and setting

This prospective cross-sectional study was conducted at the Obstetrics and Gynecology outpatient clinic of KAUH between April and June 2025. We recruited pregnant women aged ≥ 18 years, residing in Jeddah, and attending antenatal care clinics during the study period.

Sample size and participants

The minimum required sample size was calculated using an online tool assuming a 95% confidence level and 5% margin of error, yielding 377 participants. Convenience sampling was used to recruit eligible participants during their clinic visits.

We excluded women aged < 18 years, healthcare providers, or women with a prior diagnosis of an infectious disease evaluated in the study [including human immunodeficiency virus (HIV), hepatitis B, rubella, toxoplasmosis, or other chronic infectious diseases]. These exclusions minimized bias from prior counseling or professional knowledge.

Overall, 371 pregnant women completed the questionnaire. After exclusion, 329 participants were included in the final analysis. Verbal informed consent was obtained from all participants prior to data collection.

Study instrument and data collection

Data were collected using a structured, pre-designed questionnaire adapted from an Arabic questionnaire by Albanghali and Othman [12], originally designed to assess RTI knowledge among young adults. Its content

was modified for pregnant women and antenatal care, with minor modifications made to enhance clarity and contextual relevance for our participants, while maintaining the original knowledge domains. The final questionnaire comprised two sections:

1. Sociodemographic and obstetric characteristics:

Age, nationality, education level, employment status, parity, number of living children, and gestational age.

2. Knowledge assessment: Awareness of infectious diseases in pregnancy, including common infections, symptoms, transmission routes, maternal/fetal complications, prevention, treatment, healthcare-seeking practices, and the relationship between RTIs and HIV infection.

The questionnaire was administered via face-to-face interviews during antenatal visits and completed electronically using Google Forms under the supervision of trained research team members. To minimize interviewer bias, all data collectors received standardized administration instructions prior to study commencement.

Laboratory results for toxoplasmosis, rubella, hepatitis B surface antigen, and HIV were retrieved from the VIDA electronic medical record system for descriptive purposes only; they were not included in knowledge scores.

Statistical analysis

Data were analyzed using IBM SPSS Statistics version 21.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize participant characteristics and responses. Categorical variables are presented as frequencies and percentages, and continuous variables as medians and interquartile ranges (IQRs) because age was non-normally distributed.

Knowledge scores were calculated by assigning 1 point for each correct response and 0 points for incorrect or "I do not know" responses. Total knowledge scores were summed, with the population mean serving as the threshold. Knowledge scores $\geq$ the mean were classified as "high knowledge," and those below the mean as "low knowledge."

Associations between categorical variables and knowledge levels were assessed using the chi-square test. The Wilcoxon rank-sum test was used to assess continuous variables. Univariable logistic regression analysis was performed to evaluate bivariate associations with high knowledge levels; clinically relevant and significant variables were entered into the multivariable logistic regression model to identify independent predictors. Results are reported as odds ratios (ORs), adjusted odds ratios (AORs), and 95% confidence intervals (CIs). A two-sided p -value < 0.05 was considered significant.

Research ethics

This study was approved by the Research Ethics Committee of King Abdulaziz University Hospital (Reference No. 374-24). Participation was voluntary, and verbal informed consent was obtained from all participants prior to enrollment. All data were kept strictly confidential and used solely for research purposes.

Results

Participant characteristics

Overall, 329 pregnant women attending antenatal clinics at KAUH participated in the study. The median age of the participants was 33 years (range, 29-37 years) (Table 1).

Knowledge domains analysis

Awareness of specific RTIs was low: Hepatitis B was the most recognized infection (39.0%), followed by HIV/acquired immunodeficiency syndrome (AIDS) (15.0%) and HPV (8.5%) (Table 2). Only 33.0% of participants correctly recognized that pregnant women may be asymptomatic or symptomatic, whereas 47.0% were completely unaware of potential symptoms. Dysuria was the most recognized symptom (39.0%), followed by foul-smelling vaginal discharge (15.0%), genital ulcers (6.1%), and genital itching (3.3%). Regarding transmission routes, 50.0% identified blood transfusion, 31.0% acknowledged direct sexual contact, and 16.0% were uncertain meanwhile 56.0% identified premarital screening. Only 2.4% recognized consistent condom use as an effective preventive measure.

Knowledge domain

Knowledge scoring

Overall knowledge scores were divided into low and high levels using the population mean score as a cutoff point. Overall, 215 participants (65.0%) demonstrated high knowledge, while 114 (35.0%) had low knowledge (Table 3).

Factors associated with high RTI knowledge

Chi-square and Wilcoxon tests were conducted to identify factors associated with higher knowledge scores. Educational level and employment status were significantly associated with knowledge. Participants with a bachelor's or master's degree had higher knowledge ($p < 0.001$), whereas those with diplomas, middle school, or elementary education had significantly lower knowledge (Table 4). Employment was also significant ($p = 0.007$); employed women showed higher awareness than unemployed participants. No significant differences in nationality, age, or parity ($p > 0.05$) were observed.

Regression

Univariable logistic regression analysis

The univariable logistic regression analysis (Table 5) confirmed the findings of the bivariate analysis. Employment was associated with higher odds of having high RTI knowledge (OR = 2.54, 95% CI: 1.36-5.08; $p = 0.005$). Compared with participants holding a bachelor's degree, those with a diploma (OR = 0.15, 95% CI: 0.05-0.40; $p < 0.001$) and middle school education (OR = 0.08, 95% CI: 0.00-0.52; $p = 0.023$) had significantly lower

Table 1. Sociodemographic and obstetric characteristics of participants (N = 329).

Characteristic	N = 329 ^a
Pregnancy status	
Yes	329 (100%)
Healthcare Provider Status	
No	329 (100%)
Age of participant	33.0 (29.0, 37.0)
Nationality of participant	
Saudi	297 (90%)
Non-Saudi	32 (9.7%)
Education level	
Bachelor	218 (66%)
Master	24 (7.3%)
diploma	19 (5.8%)
High school	57 (17%)
Elementary school	4 (1.2%)
Middle school	6 (1.8%)
PhD	1 (0.3%)
Employment Status	
Not employed	263 (80%)
Employed	66 (20%)
Number of Times Given Birth	
One birth	68 (21%)
2-5 births	187 (57%)
More than 5 births	14 (4.0%)
I have never given birth before	60 (18%)

^an (%); Median (IQR)

IQR, interquartile range.

odds of high knowledge. No significant associations were observed for nationality, age, or parity.

Multivariable logistic regression analysis: factors associated with high knowledge

Table 5 presents the results of the multivariate logistic regression analysis identifying factors associated with higher knowledge of reproductive tract infections among pregnant women. After adjusting for potential confounders, employment status and educational level were significantly associated with knowledge level. Employed participants were more than twice as likely to have a high level of knowledge as those who were unemployed (AOR = 2.54; 95% CI: 1.23-5.60; $p = 0.011$).

Participants with lower educational levels, particularly those with a diploma (AOR = 0.14; 95% CI: 0.04-0.39), middle school education (AOR = 0.09; 95% CI: 0.00-0.63), or elementary school education (AOR = 0.12; 95% CI: 0.01-1.02) had markedly lower odds of high knowledge compared with those holding a bachelor's degree ($p < 0.001$).

Discussion

While participants demonstrated relatively high general knowledge, critical gaps regarding specific RTI

Table 2. Knowledge of specific reproductive tract infections, symptoms, transmission, prevention, and treatment (N = 329).

Knowledge domain	Characteristic	Response	n (%)
RTI Knowledge	RTI's mentioned	Hepatitis B	128 (39.0)
		Chlamydia	10 (3.0)
		Trichomoniasis	14 (4.3)
		Human papillomavirus (HPV)	28 (8.5)
		HIV/AIDS	49 (15.0)
		Gonorrhea	8 (2.4)
		Herpes	26 (7.9)
		Syphilis	7 (2.1)
		I don't know	59 (18.0)
	Awareness of RTI symptoms during pregnancy	I don't know	154 (47.0)
		A pregnant woman never has symptoms	13 (4.0)
		A pregnant woman sometimes has symptoms	107 (33.0)
		A pregnant woman always has symptoms	55 (17.0)
	Symptoms indicating RTIs during pregnancy	I don't know	99 (30.0)
		Painful/burning urination	127 (39.0)
		Genital itching	11 (3.3)
		Foul-smelling vaginal discharge	49 (15.0)
		Pain during intercourse	23 (7.0)
		Genital ulcer	20 (6.1)
Knowledge of transmission	Modes of RTI transmission	Blood transfusion	163 (50.0)
		Direct sexual contact	102 (31.0)
		Hugging	10 (3.0)
		I don't know	54 (16.0)
Knowledge of prevention	Methods to prevent RTIs	RTI treatment before marriage/pregnancy	184 (56.0)
		Be faithful to one partner	60 (18.0)
		Abstinence	26 (7.9)
		Consistent condom use	8 (2.4)
		I don't know	51 (16.0)
Knowledge of consequences	Consequences of untreated RTIs	Adverse pregnancy outcomes	170 (52.0)
		Transmission to the fetus	53 (16.0)
		Infertility	19 (5.8)
		I don't know	87 (26.0)
Belief that RTIs increase HIV risk		Yes	136 (41.0)
		No	45 (14.0)
		I don't know	148 (45.0)
Knowledge of Treatment	Perception that RTIs are treatable	Some RTIs can be treated	182 (55.0)
		Yes	61 (19.0)
		No	16 (4.9)
		I don't know	70 (21.0)
Knowledge of treatment services	Where to obtain RTI treatment	Hospital	293 (89.0)
		Pharmacy without a doctor	1 (0.3)
		I don't know	35 (11.0)

AIDS, acquired immunodeficiency syndrome; HIV, human immunodeficiency virus; HPV, Human papillomavirus; RTI, reproductive tract diseases.

diagnoses, transmission routes, clinical symptoms, and preventive strategies were evident. Such misconceptions may adversely affect health-seeking behaviors and preventive practices.

Compared with earlier regional findings, our cohort demonstrated higher general knowledge. AlNujaidi et al. [13] reported that only 25.6% of Saudi women possessed adequate RTI knowledge, whereas 65.0%

scored above average in the present study. This higher awareness may reflect the tertiary care setting of our study, where routine antenatal visits provide opportunities for clinical interaction and counseling. Additionally, the majority of our participants held higher education degrees, contributing to higher health literacy. Nonetheless, knowledge of gonorrhea, syphilis, trichomoniasis, chlamydia, and HPV was low, consistent

Table 3. Summary of domain correctness and total knowledge score categorization (N = 329).

Characteristics	N = 329 ^a
Knows about RTI symptoms during pregnancy (1 = Correct)	107 (33%)
Knows about RTI transmission modes (0-3)	265 (81%)
Knows about the consequences of untreated RTIs (0-3)	242 (74%)
Knows about methods to prevent RTIs (0-4)	278 (84%)
Knows that RTIs can be treated (1 = Correct)	243 (74%)
Knows that having an RTI increases HIV risk (1 = Correct)	136 (41%)
Knows names of specific RTIs (0-8)	270 (82%)
Total knowledge score (Sum of all domains)	
0	17 (5.2%)
1	10 (3.0%)
2	14 (4.3%)
3	28 (8.5%)
4	45 (14%)
5	90 (27%)
6	86 (26%)
7	39 (12%)
Knowledge level	
Low knowledge	114 (35%)
High knowledge	215 (65%)

^an (%)

RTI, Reproductive tract infections.

with prior studies indicating that public awareness centers in Saudi Arabia heavily rely on widely publicized condition-specific campaigns rather than comprehensive reproductive health education [14,15].

Prominent misconceptions regarding clinical features and transmission dynamics were also identified. Approximately one-third of participants believed that RTIs are always symptomatic, and over a third believed RTIs could be transmitted through casual contact. Similar misconceptions have been reported both nationally and internationally [15,16]. These gaps may pose clinical risks, as asymptomatic infections during pregnancy may delay healthcare-seeking and prolong infection transmission [7,8].

Knowledge gaps regarding prevention were also pronounced. While premarital screening was widely recognized - likely due to the established national Saudi Premarital Screening Program [17] - few participants recognized consistent condom use or mutual fidelity as primary modes of prevention. Awareness of screening programs does not equate to a comprehensive understanding of disease transmission. Antenatal education should emphasize barrier methods, partner screening, and early intervention [8,18].

Table 4. Chi-square and Wilcoxon test.

Characteristics	Overall, N = 329 ^a	Low knowledge, N = 114 ^a	High knowledge, N = 215 ^a	p-value ^b
Pregnancy Status				
Yes	329 (100%)	114 (100%)	215 (100%)	
Healthcare provider status				
No	329 (100%)	114 (100%)	215 (100%)	
Age of participant				0.995
Median (IQR)	33.0 (29.0, 37.0)	33.0 (29.0, 37.0)	33.0 (29.0, 36.0)	
Nationality of participant				0.581
Saudi	297 (90%)	101 (89%)	196 (91%)	
Non-Saudi	32 (9.7%)	13 (11%)	19 (8.8%)	
Education level				<0.001
Bachelor	218 (66%)	63 (55%)	155 (72%)	
Master	24 (7.3%)	5 (4.4%)	19 (8.8%)	
diploma	19 (5.8%)	14 (12%)	5 (2.3%)	
High school	57 (17%)	24 (21%)	33 (15%)	
Elementary school	4 (1.2%)	3 (2.6%)	1 (0.5%)	
Middle school	6 (1.8%)	5 (4.4%)	1 (0.5%)	
PhD	1 (0.3%)	0 (0%)	1 (0.5%)	
Employment Status				0.007
Not employed	263 (80%)	101 (89%)	162 (75%)	
Employed	66 (20%)	13 (11%)	53 (25%)	
Number of Times Given Birth				0.200
One birth	68 (21%)	24 (21%)	44 (20%)	
More than one birth	141 (43%)	43 (38%)	98 (46%)	
I have never given birth before	60 (18%)	28 (25%)	32 (15%)	
More than five births	14 (4.3%)	3 (2.6%)	11 (5.1%)	
2-5 births	46 (14%)	16 (14%)	30 (14%)	

^an (%).

^bWilcoxon rank sum test; Pearson's chi-squared test.

IQR, interquartile range; RTI, reproductive tract infection.

Table 5. Univariable and multivariable logistic regression analyses of factors associated with high STI knowledge (N = 329).

Characteristics	N	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age (per 5 years)	329	1.04 (0.84-1.28)	0.700	0.81 (0.62-1.06)	0.130
Nationality					>0.900
Saudi	297				-
Non-Saudi	32	0.75 (0.36-1.62)	0.500	0.99 (0.43-2.37)	-
Education level					<0.001
Bachelor	218		-		-
Master	24	1.54 (0.59-4.82)	0.400	1.38 (0.48-4.59)	-
Diploma	19	0.15 (0.05-0.40)	<0.001	0.14 (0.04-0.39)	-
High school	57	0.56 (0.31-1.03)	0.058	0.65 (0.34-1.26)	-
Elementary school	4	0.14 (0.01-1.08)	0.086	0.12 (0.01-1.02)	-
Middle school	6	0.08 (0.00-0.52)	0.023	0.09 (0.00-0.63)	-
PhD	1	NA	-	NA	-
Employment status					0.011
Not employed	263		-		-
Employed	66	2.54 (1.36-5.08)	0.005	2.54 (1.23-5.60)	-
Number of times given birth					0.110
One birth	68		-		-
More than one birth	141	1.24 (0.67-2.29)	0.500	1.56 (0.77-3.12)	-
Never given birth	60	0.62 (0.30-1.27)	0.200	0.67 (0.31-1.43)	-
More than five births	14	2.00 (0.56-9.47)	0.300	3.39 (0.79-19.50)	-
2-5 births	46	1.02 (0.47-2.26)	>0.900	1.61 (0.66-4.02)	-

A 95% CIs were calculated using the Wald method. Bold value indicated statistical significance at $p < 0.05$. OR, odd ratio; AOR, adjusted odds ratio; CI, confidence interval; RTI, reproductive tract infection; NA, unstable estimate.

NA: OR and AOR were not reported because the estimates were unstable and not reliably interpretable.

Encouragingly, most respondents identified hospitals as appropriate treatment facilities, and over half recognized that many RTIs are treatable. However, nearly one-fifth remained uncertain about treatment availability, underscoring the need for education on healthcare utilization [18].

Chi-square and Wilcoxon analyses showed that both education level and employment status were significantly associated with knowledge about reproductive tract infections. These results suggest that education and occupation play vital roles in determining the awareness of RTIs among pregnant women.

Multivariable logistic regression confirmed these associations: employed women were more than twice as likely to have high knowledge. Women with a bachelor's or master's degree had the highest knowledge levels, while those with a diploma, middle school, or elementary school education had markedly lower knowledge. These findings align with prior Saudi and international studies in which educational level was also a significant determinant of women's knowledge of RTIs. Females with less than a bachelor's degree were less knowledgeable than those with higher education [13,19]. Another study in Saudi Arabia reported a strong association between higher educational levels and better RTI knowledge, where college-educated participants scored higher than those with only secondary or elementary education ($p < 0.0001$) [13]. Furthermore, the findings align with an Iranian study on pregnant women, which showed that knowledge

and attitude toward HIV/AIDS were significantly related to educational levels ($p = 0.000$), while age showed no association [20]. Our study showed that age, nationality, and parity were not significantly associated ($p > 0.05$). Overall, higher education and employment emerged as the strongest predictors of RTI awareness.

The identified knowledge gaps highlight the need for antenatal education addressing common transmission routes of RTIs, the possibility of asymptomatic infection during pregnancy, effective preventive methods such as antenatal screening and condom use, and the consequences of untreated infections for mothers and infants. Integrating these issues into routine antenatal visits may enhance maternal awareness, promote early health-seeking behavior, and support early detection and management of infections.

Limitations of the study

Despite its strengths, this study has some limitations. The cross-sectional design prevents causal inferences. Data collection from a single tertiary care facility in Jeddah may limit generalizability to other regions or non-tertiary primary care settings in Saudi Arabia. Furthermore, self-reported data collected within clinical settings may introduce social desirability bias, particularly given the sensitive nature of reproductive health topics. Finally, excluding women with prior infectious disease diagnoses removed a potentially knowledgeable subset of participants. Although the calculated minimum required sample size

was 377 participants, only 329 participants were included due to exclusion criteria in the final analysis, which should be considered when interpreting the findings.

Conclusion

The results revealed that, while general awareness was average, there were significant gaps regarding symptoms, transmission routes, and prevention measures for RTIs. Higher education and employment status emerged as strong predictors of better awareness. These findings indicate the urgent need to embed focused, evidence-based educational modules into routine antenatal care to improve maternal knowledge of the prevention of infection and its early detection. At the community level, awareness and educational efforts should be conducted through public health initiatives to reduce infection-related morbidity and improve maternal and neonatal outcomes in Saudi Arabia.

List of Abbreviations

AIDS	Acquired immunodeficiency syndrome
AOR	Adjusted odds ratio
HIV	Human immunodeficiency virus
HPV	Human papillomavirus
RTI	Reproductive tract infection
OR	Odds ratio

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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Consent to participate

Written informed consent was obtained from all the participants upon admission to the hospital

Ethical approval

Ethical approval was granted by the Research Ethics Committee of King Abdulaziz University (Reference No. 374-24) on 21 November 2024.

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Supplementary content (if any) is available online.

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