Contents lists available at ScienceDirect

Clinical Epidemiology and Global Health

Original article

Knowledge, attitudes and practices of pregnant women regarding urinary tract infections living in peripheral areas of Pakistan: A questionnaire-based cross-sectional study

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ARTICLE INFO

ABSTRACT

Background: Urinary tract infections (UTIs) are some of the most common infections affecting women during pregnancy, which – if left untreated – may lead to severe consequences for both mother and infant health. Low socio-economic status and educational attainment levels, inappropriate personal hygiene practices – especially in rural women – may lead to an increased risk of developing UTIs. The present study aims to assess the knowledge, attitudes and practices of pregnant women – who are living in peripheral areas of the Chakwal district, Punjab, Pakistan – regarding UTIs, according to the Health Belief Model (HBM).
Methods: A descriptive, cross-sectional study was carried out using a 91-item questionnaire, including six HBM domains. Data collection was performed with convenience sampling among pregnant women in hospitals between July and September 2021. Statistical analyses (descriptive statistics, χ^2-tests) were carried out using IBM SPSS 25.0.
Results: 98.4% (n = 243) of the respondents were married, 77.7% (n = 192) were housewives, 41.7% (n = 103) attended up to an intermediate college education, while 43.7% (n = 108) were in their first trimester. Majority of women (81.8%) had positive attitudes towards UTI-related knowledge-acquisition, and most of them (94.7%) had good hygiene practices; on the other hand, only around half of the participants (55.5%) had acceptable knowledge levels. Advanced age (p = 0.005) and higher educational attainment levels (p = 0.025) were associated with better attitudes, while higher income levels were associated with better knowledge (p < 0.001). In the HBM domains, major obstacles noted by the respondents' were finding it difficult to go for a urine/laboratory test and feelings of hesitation to refuse intimacy with their husband while having a UTI; on the other hand, good hygiene practices were not denoted as a barrier to prevent UTI occurrence. Participant age and the responses in the perceived benefits domain showed significant associations (p < 0.05).
Conclusion: As attitudes towards learning were overwhelmingly positive, our results suggest that educational interventions may enhance rural women's knowledge regarding UTIs, which may helpful in the prevention of recurrent infections and the associated health risks for the mother and fetus.

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1. Introduction

Urinary tract infections (UTIs) are some of the most common infectious syndromes, affecting a sizeable patient population (~150 million cases annually), thus constituting an important factor of disease burden, morbidity and mortality worldwide.[1,2] UTIs may be classified as asymptomatic to symptomatic, based on their disease presentation, and uncomplicated or complicated based on their severity[3]; asymptomatic bacteriuria may be defined as the presence of bacteriuria in the absence of genitourinary signs and symptoms, while symptomatic infections concur with dysuria, suprapubic pain or tenderness, low grade fever, urinary frequency, or urgency in females.[4] Over 80% of women experience an uncomplicated UTI during their lifetime, corresponding to ten million general practitioner (GP) visits and 1.5 million emergency room visits, in addition to 300,000 hospital admissions in the United States alone.[5,6] UTIs are the most common infections affecting women during pregnancy, which – if left untreated – may lead to severe consequences for both mother and infant health, such as intrauterine growth restiction and low birth weight, cesarean delivery, preterm delivery, bacteremia, toxic septicemia or neonatal deaths (stillbirths), pre-eclampsia, amnionitis, hypertension and pyelonephritis.[6–9] For example, an epidemiological study by McGrady et al. suggested that infant mortality rate was 2.4-times higher in pregnancies affected by a UTI.[10] On the other hand, asymptomatic bacteriuria – which has a prevalence of 13–20% in pregnancy – has also been associated with adverse birth outcomes[11]; 25–40% of women with untreated asymptomatic bacteriuria during pregnancy may develop acute pyelonephritis, which may lead to pre-delivery hospitalization, and is a risk factor for perinatal and neonatal morbidity.[12,13]

The most common causative agents for UTIs include Gram-negative bacteria from the gut – with uropathogenic *Escherichia coli* (UPEC) accounting for 80–90% of cases – while other Gram-negative bacteria, such as *Klebsiella* spp., *Enterobacter* spp., *Proteus mirabilis*, and Gram-positive bacteria, such as *Staphylococuss saprophyticus* and *Enterococcus* spp. may also be relevant.[14,15] Besides the innate anatomical characteristics of the female urinary tract, there are many well-known risk factors for UTIs – especially in rural women – including advanced age, low socio-economic status and educational attainment levels, inappropriate personal hygiene practices, number of intercourses per week, lack of disease awareness, anatomical abnormalities, past history of developing a UTI, and various chronic conditions (e.g., sickle cell anaemia, diabetes mellitus) or immunodeficiency.[16,17] In addition to these, several physiological changes during pregnancy predispose women to a higher chance of developing UTIs, including obstruction of the urinary tract due to the uterus size (which adds presure on the ureter), hormonal changes (progesterone has an effect of relaxing the smooth muscles and decreasing peristalsis, while increased levels of urinary progestin and estrogen hinder resistance against bacterial pathogens), increased vesico-urethral reflux, and a physiological increase in plasma volume (leading to a decrease in urine concentration and glycosuria).[18–20] In fact, the chance of developing UTIs increases in multipara women.[21]

Previous studies conducted in rural regions around the world suggest that there are considerable disparities in UTI prevalence, in addition to certain risk factors playing a disproportionate role in the development of UTIs in pregnant women.[22,23] Rural women need special attention during pregnancy, especially in case of having limited resources or information to preserve and to promote their health. Considering the higher risk of developing UTIs during pregnancy, and the associated health risks for the health of the mothers and infants, the aim of the present study was to assess the knowledge, attitudes and practices of pregnant women – who are living in peripheral areas of Pakistan – regarding UTIs, in a questionnaire-based study according to the Health Belief Model (HBM).

2. Materials and methods

2.1. Study design, duration

A descriptive, cross-sectional, questionnaire-based study design was used to determine the perceptions, attitudes and practices of pregnant women living in rural regions of Pakistan regarding UTIs using the HBM.[24] During the study, a convenience sampling approach was applied, based on the proximity and ease of availability of participants for inclusion. Data collection was performed between July and September 2021.

2.2. Study setting

Data collection was carried out in hospitals from four tehsils (a local unit of administrative division) in the Chakwal district, Punjab, Pakistan (population ~ 1.500.000 inhabitants, area: 6524 km^2).[25] The following organizations were selected for data collection: District Head Quarter (DHQ) Hospital Chakwal, Tehsil Head Quarter (THQ) Hospital Kallar Kahar, THQ Hospital Talagang, THQ Hospital Choasaidan Shah (government hospitals), and a non-profit organization hospital Begum Noor Memorial Hospital (Bhubhar, Chakwal).

2.3. Study population, inclusion and exclusion criteria

The study population included *i)* pregnant women with current UTI complaints, *ii)* pregnant women with previous UTI experience attending check-ups at the Gynecology Departments at the organizations involved, *iii)* pregnant women with previous UTI experience who wished to participate, attending other departments at the organizations involved, residing in the rural areas of the Chakwal District. Patients who could communicate in English, Urdu, and Punjabi (the native language of the region) were included the study, while pregnant women were included regardless of their age, gestationage, parity and gravidity. Non-pregnant women, individuals who did not have a previous experience with a UTI, those who were unable to understand any of the languages used, and people who did not wish to participate were excluded from the study.

2.4. Study instrument

The survey instrument used for data collection was adapted to use from a previous study conducted in the rural population of the Philippines', with the permission of the authors.[26] The 91-item instrument consisted of the following parts: *i)* socio-demographic information (10-items, age, marital status, education, family income, pregnancy status, gravidity, parity), *ii)* knowledge and perceptions about UTIs (12-items, with 4 selection options), *iii)* attitudes towards UTIs (4-items, with responses of a 4-point Likert-scale, ranging from "strongly agree", "agree", "do not agree", "disagree", which were scored as 4–1, respectively), *iv)* practices to prevent UTIs (20-items, with responses „yes" (and then a selection of additional answers) and "no"), *v)* HBM constructs associated with UTIs. A HBM uses behavioral theory to design and evaluate educational and behavioral interventions in the field of behavioral sciences.[26,27] The HBM constructs includes[28]: a) perceived sensitivity: the belief of a person about their chances to contract the disease or infection due to associated risk factor or their behavior and practices (4-items), b) perceived severity: the belief regarding the harmful damage in the latter stages of infection or disease affecting their health status (10-items), c) perceived benefits: the belief in the benefits of a suggested good healthcare practice to prevent the disease or infection and to prevent the high risk or intensity of disease (10-items),[29] d) perceived barriers: obstacles considered by the person in adopting new practices or previously known good practices (10-items), e) cues to action: the power of person that drives them to feel compelled to act (5-items), f) self-efficacy: self-assurance of person in their follow up actions (6-items). Each statement in the HBM section had

responses of a 4-point Likert-scale, ranging from "strongly agree", "agree", "do not agree", "disagree", which were scored as 4–1, respectively.

Before participation, the participants filled out a written informed consent form for their voluntary contribution to the study. The consent form included the protection of privacy rights and agreement of voluntarily participation. After the data collectors informed the participants regarding the study's goals, advantages, and risks, they were provided with the self-administered questionnaire. However, due to low literacy levels, the questionnaire was administered to a minority of rural women by the data collectors.[30] The confidentiality and anonymity of the participants were protected throughout the study.

2.5. Evaluation of knowledge-attitude-practices (KAP) scores

In the knowledge domain, each correct answer was scored as 1, while each incorrect response is scored as 0; therefore, the score range for this domain was 0–24. The cut-off value for appropriate knowledge was set at ≥12, while <12 was defined as poor knowledge. In the attitude domain, using the responses ranging from „strongly agree" to „strongly disagree", scores ranging from 4 to 1 were given for each response; thus, the score range for this domain was 4–16. The cut-off values for positive attitude was set at ≥10, while <10 was considered as negative attitude. For the health practices, responses of „Yes", „No" and „Sometimes" were assigned scores of 3, 1, 2, respectively; the score range for this domain was 8–24. The cut-off values for satisfactory health practices was set at ≥16, while <16 was considered as inadequate.

2.6. Sample size

During the study, n = 350 questionnaires were distributed at the data collection sites, out of which, n = 247 completely filled-out questionnaires were returned, yielding a response rate of 70.5%. The response rate was affected by the unwillingness of pregnant women to participate, the relatively short data collection period, which also overlapped with restrictions in healthcare facilities associate with the coronavirus disease 2019 (COVID-19) pandemic.

2.7. Statistical analysis

Statistical analysis was carried out using Statistical Package for the Social Sciences (SPSS) version 25 (SPSS Inc., Chicago, IL, USA); all continuous variables were expressed as means and standard deviations (SD), whereas categorical variables were expressed as frequencies (n) and percentages (%). To determine the internal consistency of the instrument, Cronbach's α was calculated: the calculated α was over 0.6 (α = 0.662), which denotes acceptable internal consistency.[31] To determine association with various socio-demographic variables with a.) the respondents' UTI-related knowledge, attitude and practices and b.) the results from the HBM constructs, the χ^2-square tests were performed (with Cramér's V, when significant results were observed). During analyses, p values < 0.05 were considered statistically significant.

2.8. Ethical considerations

The study was conducted in accordance with the Declaration of Helsinki and national and institutional ethical standards. Ethical approval for this study was obtained from the Institutional Review Board of University of Sargodha (Reference no. 21BNM/HR/146). The written permission letter was approved by the Chief Operating Officer (COO) of Begum Noor Memorial Hospital, and administration of respective Government Hospitals (DHQ Chakwal, THQ Kallar Kahar, THQ Choasaidan Shah, THQ Talagang) to conduct this research.

3. Results

3.1. Socio-demographic characteristics

The socio-demographic characteristics of the n = 247 (100%) pregnant women from Chakwal, Punjab, Pakistan are summarized in Table 1. Most of the participating women (n = 243, 98.4%) were married, between 24 and 35 years of age (n = 184, 74.5%), and had attended college for their intermediate education. The bulk of our respondents (n = 192, 77.7%) were housewives. The majority of pregnant women were in their first trimester (n = 108, 43.7%), and two-thirds were multiparous (n = 163, 66.0%). The vast majority of responders (n = 222, 89.9%) did not have diabetes or any history of a chronic kidney condition (n = 226, 91.5%). Almost half of the participants' families (n = 123, 49.8%) were living on a monthly income between 26,000 and 50000 RS (~91–182 USD). In the subsequent analyses (χ^2-square tests), the following subcategories were compared: age (18–23, 24–29, 30–35 and 36–41 years), highest level of education (elementary, high school, college and did not complete any education), family income levels (<25,000 RS, 26,000–50000 RS, 51,000–100000 RS and over 100,000 RS), trimester (1st, 2nd or 3rd trimester), number of pregnancies (first, second-third, fourth or more), parity (0, 1 more than 1); due to the low number of individuals in the subcategories, civil status was excluded from subsequent analysis.

Table 1
Socio-demographic characteristics of the participants (n = 247).

Socio-demographic parameter		Frequency % (n =)
Age	**18–23**	14.6% (36)
	24–29	35.2% (87)
	30–35	39.3% (97)
	36–41	10.9% (27)
Civil status	**Single**	0.4% (1)
	Married	98.4% (243)
	Separated/Divorced	1.2% (3)
Highest level of education	**Elementary**	17.8% (44)
	High School	34.0% (84)
	College	41.7% (103)
	Did not complete any	6.5% (16)
Current occupation	**Employee/business woman**	22.3% (55)
	Housewife	77.7% (192)
Family's total income per month	**<25,000 RS (< ~90 USD)**	20.6% (51)
	26,000–50000 RS (~91–182 USD)	49.8% (123)
	51,000–100000 RS (~183–364 USD)	28.3% (70)
	>100,000 RS (>~364 USD)	1.2% (3)
Pregnancies	**First**	32.8% (81)
	Second or third	36.4% (90)
	Fourth or more	30.8% (76)
Period of pregnancy	**1st trimester**	43.7% (108)
	2nd trimester	36.8% (91)
	3rd trimester	19.4% (48)
Parity	**0**	8.1% (20)
	1	25.9% (64)
	More than 1	66.0% (163)
History of kidney disease	**Yes**	8.5% (21)
	No	91.5% (226)
Diabetes	**Yes**	10.1% (25)
	No	89.9% (222)

RS: Pakistani Rupees; **USD:** United States dollar.

3.2. Knowledge and perceptions of pregnant women related to UTIs

Participants' responses to the knowledge-based questions are summarized in Table 2. During the study, multiple responses for the knowledge section were analyzed on the basis of percent responses and frequencies. As a result of the study, overall satisfactory knowledge was observed regarding UTIs. About 90% (n = 224) of rural women were familiar with the term/illness „urinary tract infection". Pregnant women are more susceptible to contracting a UTI, according to 98.8% (n = 244) of respondents and 81.0% (n = 200) of women related urinary

Table 2
Knowledge and perceptions of pregnant women related to UTIs (n = 247).

Statements	Frequency % (n =)	Percentage in total % (for multiple choice)
1. Have you ever heard of a UTI or urinary tract infection?	–	
Yes	90.7% (224)	
No	9.3% (23)	
2. What gender experiences a UTI more often? (more than one answer may be selected)		
Women	61.1% (151)	
Men	0.4% (1)	
Just the same	38.5% (95)	
3. Which of the following groups of individuals is more likely to have a UTI? (more than one answer may be selected)		
About 20-30-year-old females	9.3% (23)	6.3%
People with diabetes	28.7% (71)	19.3%
Men	12.1% (30)	8.2%
Pregnant women	98% (244)	66.3%
4. Which of the following may be a cause or causes of having a UTI? (more than one answer may be selected)		
Urinary incontinence	80.9% (200)	31.1%
Bacteria which originate from dirt	65.2% (161)	25.0%
Not washing or urinating before or after sexual intercourse	69.2% (171)	26.6%
Washing the private parts of the body from back to front	44.9% (111)	17.3%
5. Which of the following is/are a/the symptom/s of a UTI? (more than one answer may be selected)		
Fever	62.3% (154)	28.9%
Drowsiness (frequent urination)	57.4% (142)	26.6%
Urine with blood	76.9% (190)	35.6%
No appetite	19.0% (47)	8.8%
6. What to do when feeling any symptoms of UTIs? (more than one answer may be selected)		
To drink plenty of water	80.9% (200)	40.5%
To take an antibiotic	79.3% (196)	39.7%
To exercise	24.7% (61)	12.3%
To take a break	7.5% (37)	7.5%
7. Which of the following can be a complication to the mother or pregnant woman when contracting a UTI? (more than one answer may be selected)		
Damage to the kidneys or bladder	80.6% (199)	49.9%
Hypertension	39.2% (97)	24.3%
Separation	0.4% (1)	0.3%
Anemia	41.2% (102)	25.6%
8. Which of the following can be a complication to the child when the mother had a UTI while she was still pregnant? (more than one answer may be selected)		
Birth of a premature baby	45.3% (112)	23.1%
Underweight baby	36.4% (90)	18.6%
Blood infections	41.7% (103)	21.3%
Abortion	72.4% (179)	37.0%
9. Why is it necessary to treat a UTI? (more than one answer may be selected)		
To reduce chest pain	12.9% (32)	7.9%
To prevent kidney damage	78.5% (194)	48.0%
To prevent blurring of the eyes	6.0% (15)	3.7%
To prevent recurrence of UTIs	65.9% (163)	40.3%
10. What is the easiest process to identify if someone has a UTI? (more than one answer may be selected)		
Blood test (Complete blood count)	46.9% (116)	30.1%
Urinalysis	54.4% (210)	54.4%
Testing for bacteria in urine (Urine Culture)	19.4% (48)	12.4%
Fecalysis	4.8% (12)	3.1%

continence as a major cause of UTIs. The majority of respondents (76.9%; n = 190) considered urine with blood as an important symptom of UTI. Drinking plenty of water was mentioned as the best way to prevent aUTI, according to 81.0% (n = 200) of respondents, however, taking antibiotics (79.3%; n = 196) was also a very common response. Over 80% (n = 199) of women were aware that UTIs may affect kidney health if persistent, and 78.5% (n = 194) considered it is necessary to treat urinary tract infection to prevent kidney damage. On the other hand, lower awareness was seen when it comes to the possible complications of UTIs related to pregnancy outcomes (Statement 8).

3.3. Attitudes and practices of pregnant women related to UTIs

Majority of respondents showed a positive attitude regarding the prevention of UTIs during pregnancy as shown in Table 3. Out of n = 247 women, 96.7% (n = 239) considered it necessary to take the doctor's advice if they felt the symptoms of UTIs; 98.3% (n = 243) was keen to have more information about the causes of UTIs, while 94.8% (n = 234) was interested in more information on how to prevent UTIs.

Results of the questions about personal hygienene practices and techniques used by pregnant women related to UTIs are shown in Tables 4 and 5, respectively. Based on the participants' responses, positive attitudes were shown regarding female hygiene practices for preventing UTIs. 94.3% (n = 233) respondents stated to wash after urination, while 57.5% (n = 142) and 88.3% (n = 218) reported to who washed themselves before and after intercourse, respectively. On the other hand, almost half of the respondents (47.4%, n = 117) do not wear cotton panties. An appropriate washing practice (front to back) after urination was reported by 63.2% (n = 156), although over a half of the surveyed pregnant women (54.7%, n = 135) washes only with water. Interestingly, only 3.2% (n = 8) of women participating was found to use feminine washes for hygiene.

3.4. Knowledge-attitude-practice (KAP) analysis of pregnant women related to UTIs, and relationship with socio-demographic variables

Overall, the surveyed pregnant women from the rural areas of Chakwal showed excellent hygiene practices (as seen in Table 4.; good practices: 94.7% (n = 234); inappropriate practices: 5.3% (n = 13)), appropriate attitudes (positive attitudes: 81.8% (n = 202); negative attitudes: 18.2% (n = 45)), while knowledge related to UTIs may be considered only satisfactory (good knowledge: 55.5% (n = 137), insufficient knowledge: 44.5% (n = 110)). Table 5 shows the results of the statistical analysis in relation to appropriate vs. inappropriate knowledge, attitude and practices and socio-demographic characteristics of the participants: significant differences were seen in association with age (p = 0.005) and educational attainment levels (p = 0.025) in the context of attitudes of the respondents (higher educational levels and more advanced age showed better attitudes). In addition, family income

Table 3
Attitudes of pregnant women related to the prevention of UTIs (n = 247).

Statements	Strongly Agree % (n =)	Agree % (n =)	Disagree % (n =)	Strongly Disagree % (n =)
1. I want to know the causes of UTIs.	45.7% (113)	52.6% (130)	1.6% (4)	0% (0)
2. I want to know about techniques to avoid UTIs.	38.5% (95)	56.3% (139)	5.3% (13)	0% (0)
3. Urine should be checked even if no symptoms are felt.	19.8% (49)	42.1% (104)	34.0% (84)	4.0% (10)
4. A doctor should be consulted when symptoms of UTI are felt.	59.9% (148)	36.8% (91)	3.2% (8)	0% (0)

Table 4
Personal hygienee practices of pregnant women related to UTIs (n = 247).

Statements	Yes % (n =)	No % (n =)	Sometimes % (n =)
1. I wash after urination.	94.3% (233)	1.6% (4)	4.0% (10)
2. I urinate or wash before having sex.	57.5% (142)	32.0% (79)	10.5% (26)
3. I urinate or wash after sex.	88.3% (218)	8.5% (21)	3.2% (8)
4. I urinate whenever I feel like it.	82.6% (204)	9.3% (23)	8.1% (20)
5. I completely expel my urine into my bladder when I urinate.	78.5% (194)	16.6% (41)	4.9% (12)
6. I am wearing cotton panties.	38.% (95)	47.4% (117)	14.2% (35)

Table 5
Association between socio-demographic variables and knowledge, attitude and practices regarding UTIs during pregnancy.

Variables	*Statistical analysis p*-values (degrees of freedom [df], Cramér's V[a])		
	Knowledge (appropriate vs. poor)	Attitude (positive vs negative)	Practices (satisfactory vs. inadequate)
Age groups	0.088 (df = 3; -)	**0.005 (df = 3; 0.499)**	0.670 (df = 3; -)
Education levels	0.098 (df = 3; -)	**0.025 (df = 3; 0.563)**	0.624 (df = 3; -)
Family income levels	**<0.001 (df = 3; 0.663)**	0.136 (df = 3; -)	0.484 (df = 3; -)
Trimester of pregnancy	0.285 (df = 2; -)	0.472 (df = 2; -)	0.883 (df = 2; -)
Number of pregnancies	0.857 (df = 2; -)	0.248 (df = 2; -)	0.687 (df = 2; -)
Parity	0.575 (df = 2; -)	0.387 (df = 2; -)	0.234 (df = 2; -)

[a] Calculated in case of a significant result in the χ^2-test; *p*-values <0.05 are denoted in **boldface**.

levels also showed an association with the knowledge-level of the respondents (p < 0.001; higher financial status corresponded to higher knowledge).

3.5. Constructs and domains of the HBM in pregnant women related to UTIs

The responses to the six constructs of perceptions – namely perceived sensitivity, perceived severity, perceived benefits, perceived barriers, cues to action and self-efficacy are presented in Table 6, including their weighted arithmetic mean score and their statistical relationship with the socio-demographic characteristics of the participants. For perceived susceptibility, pregnant women believed that they are prone to UTIs and that they had a high likelihood of having the disease because of their present condition, with the highest weighted mean of 3.25; on the other hand, the mean score for „I am often concerned that I may have UTI" statement was the lowest (2.99). No significant associations were seen among the responses in the sensitivity domain and tested socio-demongraphic characteristics (i.e. age, education levels and trimester of pregnancy). With the highest weighted mean (3.43) in perceived severity, the majority of respondents believe that having a UTI is terrible (which showed an association with the current trimester of pregnancy; p = 0.043), while high blood pressure due to a UTI had the lowest perceived severity (2.52; which showed an association with the age of the respondents, p = 0.023).

In the section of percieved benefits, the weighted means show that majority of the respondents perceived that they can avoid having UTI by prenatal checkups (3.39), drinking 2–3 L of water (3.49), washing the sexual organ before (3.43) and after (3.51) intercourse and by eating

fruits rich in Vitamin C, they can recover quickly from having UTI (3.47). In many cases, the age of the participants and the responses in the perceived benefits domain showed significant relationships (p < 0.05; see Statements 1–7).

Based on the responses in the perceived barriers domain, the majority of pregnant women did not consider the presented statements are barriers to UTI prevention: overall, the lowest weighted mean of 2.23 was noted for to observing good personal hygiene before and after intercourse, while the highest value (2.79) was related to the refusal of a husband to have sexual intercousrse, even if currently pregnant and suffering from a UTI. Significant association was seen with higher education level and suggesting a partner to observe appropriate intimate hygiene (p = 0.015).

In the responses to the cues to action domain, respondents firmly agreed that they were most willing to do all required efforts to prevent UTI, based on the responses to Statement 1 (weighted mean: 3.16), while majority of pregnant women did not agree in attending a mother class (2.31). Respondents of older age were significantly more willing to attend regular check-ups (Statement 2; p = 0.047). For the self-efficacy domain responses, the respondents felt confident in their ability to practice healthy behaviors for a healthy pregnancy and a healthy baby (3.26). The lowest weighed mean (2.98) was shown for the statment „I am not afraid in case I get a UTI because I know the things that need to be done for me to be cured", but comparatively, this is still a high value, compared to responses in some other domains. Younger women less commonly thought that they will not have a UTI (p = 0.024), in addition, older women (p = 0.032), women with higher education levels (p = 0.032) and in more advanced stages of pregnancy (p = 0.019) at the time of the survey were more prone to agree with the statment „I know what to do if I get a UTI."

4. Discussion

UTIs are a common concern among women during their pregnancy, therefore focused preventive measures and increased awareness are critical for healthy and safe childbearing in the affected population.[32] Women living in rural areas may need special care and attention, due to them being disproportionally affected by certain illnesses, due to the fact that in many cases, they have poor health-related knowledge, as a consequence of to poor literacy rate and minimal resources available associated with healthcare and prevention-related information.[33] Considering pregnancy leads to several physiological changes that predispose women to higher risk for UTIs, the present study aimed to analyze the knowledge, attitude and practices of pregnant women – living in peripheral areas – about UTIs, in addition to assess their disease-related befiefs according to six domains of the Health Belief Model using a questionnaire-based design. Our study mainly focused on socio-demographic factors, data regaring the reproductive history of the participants, diabetes and kidney disease as potential risk factor contributing to UTIs, and as potential covariates which could have an effect on UTI KAP and disease-related beliefs. To the best our knowledge, this is the first such study to measure the KAP and health beliefs of pregnant women reagrding UTIs in the present study area.

More than half of the responding pregnant women in the study were housewives, which showed similarity with participants of the original study conducted in the Filipino community.[26] In agreement with a similar study conducted in North West Ethiopia,[34] the majority of women with UTIs were multiparous (n = 163). A study conducted on the prevalence of asymptomatic bacteriuria and associated risk factors in pregnant women considered multiparity as a risk factor for the development of UTIs.[35] The link between multiparity and UTI is owing to extensive changes affecting the whole urinary system during pregnancy, which have a considerable influence on the natural history of UTIs during pregnancy. These alterations differ from patient to patient, and are more likely to develop in women who have several pregnancies in a short period of time.[36] In our study, a considerable number (n = 108) of

Table 6

HBM related to UTIs in rural pregnant women.

PERCEIVED SENSITIVITY

Statements	Strongly agree % (n =)	Agree % (n =)	Does not agree % (n =)	Strongly disagree % (n =)	Mean score	*Statistical analysis p-values (degrees of freedom [df], Cramér's V[a])*		
						Age groups	Education levels	Trimester of pregnancy
1. My pregnancy was a big factor in having UTI.	32.4% (80)	60.1% (49)	6.9% (17)	0.4% (1)	3.25	0.674 (df = 9; -)	0.253 (df = 9; -)	0.460 (df = 6; -)
2. I am often concerned that I may have UTI.	27.5% (68)	45.3% (112)	25.9% (64)	1.2% (3)	2.99	0.401 (df = 9; -)	0.393 (df = 9; -)	0.082 (df = 6; -)
PERCEIVED SEVERITY								
1. Having a UTI is horrible.	51.0% (126)	40.9% (101)	8.1% (20)	0% (0)	3.43	0.912 (df = 9; -)	0.069 (df = 9; -)	**0.043 (df = 6; 0.368)**
2. I may have high blood pressure due to a UTI.	10.9% (27)	31.2% (77)	57.1% (141)	0.8% (2)	2.52	**0.023 (df = 9; 0.512)**	0.951 (df = 9; -)	0.960 (df = 6; -)
3. My daily routine will be affected due to a UTI.	39.3% (97)	52.2% (129)	8.1% (20)	0.4% (1)	3.3	0.104 (df = 9; -)	0.752 (df = 9; -)	0.520 (df = 6; -)
PERCEIVED BENEFITS								
1. Regular pre-natal check-ups will help me avoid UTIs and their complications.	45.7% (113)	48.6% (120)	4.9% (12)	0.8% (2)	3.39	**0.011 (df = 9; 0.455)**	0.593 (df = 9; -)	0.190 (df = 6; -)
2. Regular urine tests (urinalysis) will help me avoid UTIs and their complications.	30.4% (75)	46.2% (114)	19.4% (48)	4.0% (10)	3.03	**0.022 (df = 9; 0.320)**	0.299 (df = 9; -)	0.453 (df = 6; -)
3. Drinking 2–3 L of water per day is a way to avoid UTIs.	52.2% (129)	44.9% (111)	2.4% (6)	0.4% (1)	3.49	**0.010 (df = 9; 0.304)**	0.200 (df = 9; -)	0.636 (df = 6; -)
4. The right way to wipe (front to back) my sexual organ is a good way to prevent UTIs.	42.9% (106)	45.3% (112)	11.3% (28)	0.4% (1)	3.31	**0.032 (df = 9; 0.234)**	0.488 (df = 9; -)	0.400 (df = 6; -)
5. I can avoid UTIs if I urinate often.	40.9% (101)	51.0% (126)	7.7% (19)	0.4% (1)	3.32	**0.028 (df = 9; 0.239)**	0.144 (df = 9; -)	0.562 (df = 6; -)
6. Washing the sexual organ before intercourse is a way to prevent UTIs.	51.8% (128)	40.1% (99)	7.7% (19)	0.4% (1)	3.43	**0.048 (df = 9; 0.187)**	0.233 (df = 9; -)	**0.023 (df = 6; 0.398)**
7. Washing the sexual organ after intercourse is a way to prevent UTI.	56.7% (140)	38.5% (95)	4.0% (10)	0.8% (2)	3.51	**0.046 (df = 9; 0.202)**	**0.013 (df = 9; 0.399)**	0.37 (df = 6; -)
8. Drinking coffee hinders the recovery from a UTI.	14.2% (35)	30.8% (76)	46.6% (115)	8.5% (21)	2.51	0.691 (df = 9; -)	**0.011 (df = 9; 0.432)**	0.276 (df = 6; -)
9. Eating lots of fruits rich in Vitamin C is way to recover quickly from having UTI.	53.4% (132)	39.7% (98)	6.9% (17)	0% (0)	3.47	0.115 (df = 9; -)	0.773 (df = 9; -)	0.437 (df = 6; -)
PERCEIVED BARRIERS								
1. It is difficult to collect urine to be checked at a laboratory or health center.	8.5% (21)	26.7% (66)	61.9% (153)	2.8% (7)	2.41	0.625 (df = 9; -)	0.802 (df = 9; -)	0.356 (df = 6; -)
2. It's annoying to always go to the bathroom to urinate.	6.1% (15)	26.7% (66)	64.4% (159)	2.8% (7)	2.36	0.204 (df = 9; -)	0.777 (df = 9; -)	0.263 (df = 6; -)
3. Washing the sexual organ before and after intercourse is tiring.	4.0% (10)	17.0% (42)	76.5% (189)	2.4% (6)	2.23	0.095 (df = 9; -)	0.493 (df = 9; -)	0.288 (df = 6; -)
4. It's embarrassing to tell my partner that she should wash her sexual organ before and after we have sex.	10.9% (27)	42.5% (105)	45.3% (112)	1.2% (3)	2.63	0.693 (df = 9; -)	**0.015 (df = 9; 0.223)**	0.43 (df = 6; -)
5. It is difficult to refuse a husband if he wants to have sex even if he is currently pregnant and has UTI.	17.8% (44)	46.2% (114)	33.6% (83)	2.4% (6)	2.79	0.322 (df = 9; -)	0.674 (df = 9; -)	0.119 (df = 6; -)
CUES TO ACTION								
1. I always follow the doctor's advice so that I will be cured.	26.7% (6)	62.0% (155)	10.5% (26)	0% (0)	3.16	0.194 (df = 9; -)	0.391 (df = 9; -)	0.432 (df = 6; -)
2. I have regular check-ups at the health center.	12.6% (31)	51.8% (128)	34.4% (85)	1.2% (3)	2.76	**0.047 (df = 9; 0.219)**	0.400 (df = 9; -)	0.392 (df = 6; -)
3. I always attend the mother's class.	3.2% (8)	31.2% (77)	58.7% (145)	6.9% (17)	2.31	0.244 (df = 9; -)	0.286 (df = 9; -)	0.537 (df = 6; -)
4. I do everything for a healthy living.	10.9% (27)	59.5% (147)	27.1% (67)	2.4% (6)	2.79	0.117 (df = 9; -)	0.650 (df = 9; -)	0.779 (df = 6; -)
5. I make way to learn new information for good health.	12.1% (30)	67.2% (166)	19.4% (48)	1.2% (3)	2.9	0.864 (df = 9; -)	0.825 (df = 9; -)	0.653 (df = 6; -)
SELF-EFFICACY								
1. I will not have a UTI.	23.9% (59)	57.5% (142)	18.2% (45)	0.4% (1)	3.05	**0.024 (df = 9; 0.356)**	0.167 (df = 9; -)	0.539 (df = 6; -)
2. I know what to do if I get a UTI.	25.9% (64)	56.7% (140)	17.4% (43)	0% (0)	3.09	**0.032 (df = 9; 0.299)**	**0.032 (df = 9; 0.281)**	**0.019 (df = 6; 0.348)**
3. I am not afraid in case I get a UTI because I know the things that need to be done for me to be cured.	23.1% (57)	45.7% (113)	31.2% (77)	0% (0)	2.92	0.240 (df = 9; -)	0.383 (df = 9; -)	0.135 (df = 6; -)
4. I know my pregnancy would be healthy.	40.9% (101)	44.9% (111)	13.4% (33)	0.8% (2)	3.26	0.494 (df = 9; -)	0.623 (df = 9; -)	0.555 (df = 6; -)
5. I know my baby will be healthy at birth.	41.3% (102)	40.9% (101)	14.6% (36)	3.2% (8)	3.20	0.536 (df = 9; -)	0.300 (df = 9; -)	0.801 (df = 6; -)

[a] Calculated in case of a significant result in the χ^2-test; *p*-values <0.05 are denoted in **boldface**.

women were in their first trimester of pregnancy; a straightforward explanation for this is that women from rural areas usually only attend these prenatal check-ups. However, many studies have shown that the prevalence of UTIs to usually more frequent in the second or third trimesters.[34,37,38] Majority of respondents (n = 174) of this study belonged to the low-to-middle income bracket (≤50,000 RS/Month), which also shows similarity to the results of previously conducted studies at the Filippines and Ethiopia.[26,34] The majority of the rural women who participated in our study had positive attitude and satisfactory hygiene practices, however, the ratio of women with good knowledge levels about UTIs and preventive measures during pregnancy were considerably lower (55.5%). Our results were consistent with a similar study conducted in Behbahan, Iran, which showed women possessing moderate levels of knowledge with good attitudes and health behaviors towards the prevention of UTIs.[39] On the other hand, the study conducted in the Philippines revealed unsatisfactory knowledge paired with positive attitudes and good hygiene practices.[26] This low level of knowledge might be related to a lack of awareness-raising initiatives concerning UTIs and their effects on both the mother and the fetus, as well as a lack of professional advice from healthcare staff regarding UTIs during pregnancy. A significant association of knowledge with family income levels (p < 0.01), which was concurrent with the findings of the Ethiopian study reflected low-income level as a risk factor of UTI prevalence in women.[34] These results are in line with a study from Dehradun, India, where significant association of disease knowledge was shown in teenage girls with family income levels.[40] Association of knowledge with family income levels suggest that women belonging to families with low socio-economic situations may not be able to complete their studies.

The results of this study also revealed that rural women possessed a positive attitude towards acquiring knowledge regarding UTIs, their symtoms, causes, way of prevention and treatment options. Age and educational attainment levels were predictors of positive attitude in our sample. Positive attitudes towards additional knowledge to prevent UTIs was also found in the studies performed in Banha, Egypt,[41] Behbahan, Iran[39] and Ndola, Zambia.[42] Good hygiene and appropriate health-related practices of pregnant women – including their clothing manner ways of urination and washing techniques – were found as a result of this study. Appropriate hygiene practices were associated with lower frequency of UTIs in women according to a research conducted in a prenatal clinic of Babul, Iran.[43] Another study evaluated the impact of genital hygiene and sexual activity on UTI prevalence in pregnant women also emphasized good hygiene practices as crucial for prevention of these infections.[44] There was no significant relationship found between socio-demographic variables found regarding the hygiene practices of the women surveyed. Many other studies also came to the same conclusion, i.e. women possesed good hygiene practice regardless of their age, family income, educational attainment and pregnancy term.[26,34,45] In fact, the study from the Filippines also highlights that good hygiene practices were present despite of unsatisfactory knowledge levels of pregnant women.[26]

In addition to the evaluation of KAP regaring UTIs in pregnant women, we used the data collected from HBM constructs to evaluate participants' illness-related perceptions, which included six main domains.[46] The HBM showed that majority of women showed positive perceived sensitivity considering pregnancy as being a major risk factor leading to UTIs, and the severity of the disease to be terrible enough leading to kidney disease. Majority of women were of the opinion that drinking 2–3 L of water and regular pre-natal checkups may be beneficial for them to avoid this condition. They believed that washing their private parts before and after intercourse may also be helpful to avoid UTIs, in addition, the consumption of Vitamin C during pregnancy was also thought of as a preventive measure by maintaining immunity to avoid infection. The major obstacles noted were finding it difficult to go for a urine/laboratory test and the participants expressed feelings of hesitation to refuse intimacy with their husband while having a UTI. On the other hand – in accordance with our KAP results – they did not find

good hygiene practices to be a barrier to prevent the UTI occurrence. The HBM model showed that rural women – despite of their current condition and UTI experience – were hopeful to their pregnancy to be healthy and a positive attitude to follow the doctor's advice. Self-efficacy showed women to be adhered to carry a healthy pregnancy and hopeful to deliver a healthy baby. No significant association was found for perceived sensitivity with the socio-demographic factors included in the study, which was not the case in the Filipino study.[26] The level of severity presumed by the majority of participants is considering it horrible to have UTI, as it affects their daily routine activities both in housewives and working women and considered as they must avoid taking medications during their pregnancy due to fetal health concerns. They believed that having frequent UTIs may lead to kidney damage in the long term and may also affect the health of the fetus. In our sample, age and progression of pregnancy showed a significant relationship for perceived severity of disease. This concern to severity of disease suggests that if rural community is educated about the damage or health risks to both the mother and their baby, better outcomes regarding prevention of disease could be obtained. A study conducted in Tehran, Iran about the effect of educational intervention for UTI prevention showed that the presumption of UTI severity can make women more prone to learn methods to avoid the recurrency of UTIs.[47] The respondents agreed that regular pre-natal checkups, drinking enough water (plus good eating habits) may help to prevent and cure the UTIs. Socio-demographic factors (age, educational levels and pregnancy status) showed a significant association for perceived benefits, which was similar to the findings of a previous report.[34] Although majority of the respondents were aware of the benefits of regular prenatal check-ups, some of them explained that they couldn't afford regular check-ups, while others were concerned that some of the elders consider it unnecessary to regularly visit the gynecologists during pregnancy. They perceived benefits from consumption of fruits during pregnancy to avoid infection and increase their immunity and healthy fetus but with a concern of unaffordability due to poverty. A positive impact found during research work was that most of the women were aware of using cranberry sachets for healthy urinary tract and considered it a good alternative of medicine during pregnancy.[48] In the HBM cues to action domain, the pregnant women's willingness to follow the doctor's advice and their interest towards gathering health-related information was the most pronounced, which was influenced by the age of the individual. The possible reason behind the low score of attending a mother class was most of them were unaware of the concept of an educational mother class as in rural areas of Pakistan, no mother class is being conducted. A similar study based on HBM conducted in the Behbahan, Iran, revealed that educational interventions based on HBM have had a positive response and have led to improved knowledge about prevention of disease among participants.[39]

Patients with recurring bacteriuria may be treated with low doses of antibiotics to prevent future infection, however, in pregnancy, there may be concern both from the side of the mothers and the physicians to administer antimicrobial drugs.[49] Although antibiotics are necessary treat symptomatic UTIs, their overuse in many cases have also been described.[50] In addition, currently there is also the growing issue of antimicrobial resistance – which has become a global threat for health – as the prevalence of multidrug-resistant bacteria among urinary pathogens has reached concerning numbers.[51] A detailed review has provided five important measures to prevent UTI during pregnancy, which include appropriate hygiene behaviours, cranberry juice, immunization, consumption of ascorbic acid and herbal formulations including *Centaurium erythraea*, *Levisticum officinale* and *Rosmarinus officinalis*.[52] In addition, many studies suggest that some simple lifestyle changes, including good hygiene and self-care, 6–8 glasses of water, urinating in time and completely emptying the bladder are good practices to prevent infection.[53,54]

The current research had some limitations, like the cross-sectional nature, the study length (which was affected by restrictions in health-care facilities due to the pandemic) and convenience sampling design of

the study, which may increase the likelihood of bias, e.g., a self-selection bias. One of the limitations of the study is the unavailability of data on the prevalence of UTIs during pregnancy and the characteristics of patients in rural region. In addition, there was an unavailability of recorded data for the total number pregnant women in an area and those affected with specific infections; due to this, sample size calculations were not performed preceding the study. To increase the likelihood of generalizing the results of this study, a larger sample from different cities is recommended in the future.

To conclude, our study aimed to collect data on the knowledge, attitude and practices, and health beliefs of rural pregnant women regarding the risk and preventive measures of UTIs in the Chakwal district, Punjab, Pakistan. The presented research data provides a baseline to form educational interventions by clinicians and public health professionals to educate rural women about UTIs and their risk factors, ways to prevent the UTIs during pregnancy – and in general – with better attitudes and good hygiene practices. The current research concluded that rural women perceptions' regarding infection susceptibility and severity during pregnancy were found to be positive showing their concern regarding healthy life. Rural women perceive strong beliefs regarding benefits of hygiene practices and good diet to combat infections. Different barriers – including shyness and hesitation of rural women to talk about hygiene practice to their partners and feeling tired to go to hospital for check-ups – were identified, while hygiene practices were not a barrier for the prevention of disease. Rural women pose optimistic behavior in self-efficacy towards prevention of this disease during pregnancy, they reported a tendency to adhere to doctor's advice. A mother class should also be introduced in the area by the local government for educational interventions, as women living in periphery have a great difficulty in accessing health-related information. Healthcare providers at rural health facilities have a great responsibility in disseminating reliable health information regarding UTIs (including early signs and symptoms, causative agents, risk factors and complications), and in actively participating in health promotion. Finally, informative literature in the native languae of the women most at risk should be available at the healthcare centers on prevention, including topics like the use of feminine wash and hygiene practices, to prevent recurrent UTIs in pregnant women.

Ethics statement

Begum Noor Memorial Hospital has allowed to complete the Research Work and data collection to the topic "Knowledge, attitudes and practices of pregnant women regarding urinary tract infections living in peripheral areas of Pakistan: A questionnaire-based cross-sectional study".

Author contributions

S.A., B.C. and S.J. conceptualized and designed the study; A.S., M.G. and J.A, guided data analysis and interpretation; A.S. and B.C. wrote the initial draft of the manuscript; S.A, J.A., M.G. and S.J. critically reviewed the manuscript; S.A., J.A., and S.J. also supervised and administered the whole process of this research. All authors have read and agreed to the published version of the manuscript.

Funding

Data availability statement

All data generated during the study are presented in this paper and its supplementary materials.

Declaration of competing interest

The authors declare no conflict of interest, monetary or otherwise. The authors alone are responsible for the content and writing of this article.

Acknowledgements

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