Journal of Current Health Sciences. 2026, 6(2): 103-112
DOI: https://doi.org/10.47679/jchs.2026155
ISSN 2809-3275 (print), ISSN 2809-2236 (online)

RESEARCH ARTICLE

# Hydration, Hygiene, and Health: Understanding Urinary Tract Infections Awareness in Female University Students

Md Faiazul Haque Lamem [1*)], Muaj Ibne Sahid [2], Sadia [3], Tabassum Islam [4]

Published online: 08 May 2026

**Abstract:** Urinary tract infections (UTIs) are common among women and pose significant public health challenges, yet data on knowledge, behaviors, and risk factors among female university students in Bangladesh remain limited. This study assessed UTI prevalence, awareness, and related practices among 112 female pharmacy students at R. P. Shaha University. Participants were primarily aged 21–23 years (56.7%), unmarried (91.1%), and urban residents (88.4%). About 32.1% reported a prior UTI, and nearly half (46.4%) consumed 2–3 liters of water daily. While 69.6% correctly identified bacteria as the leading cause, only 37.5% recognized that UTIs can affect multiple urinary tract sites, and 58.3% correctly noted that skin rash is not a typical symptom. Risk behaviors were prevalent, with 81.3% carrying water bottles, 40.2% wearing tight clothing 3–5 hours weekly, 45.5% occasionally delaying urination, and 39.3% consistently consuming fluids before bedtime. Comfort in discussing UTIs with healthcare providers varied, with 32.1% least comfortable and 25.9% most comfortable. These findings reveal substantial knowledge–practice gaps and underscore the need for targeted educational interventions and health promotion strategies to improve UTI prevention and awareness among future healthcare professionals.

Keywords: Practice gap, Reproductive females, Urinary hygiene, UTI, University students, Behavioral practices

## INTRODUCTION

An infection affecting the urethra, bladder, ureter, or kidney is referred to as a urinary tract infections (UTIs).The majority of infections affect the bladd er and urethra, which are parts of the lower urinary tract (Tan & Chlebicki, 2016). UTIs represent one of the most common bacterial infections globally, due to anatomical and behavioral risk factors that facilitate bacterial entry into the urinary system (Baimakhanova et al., 2025; Bhuiya et al., 2025; Johny V et al., 2025a; Mancuso et al., 2023; *Urinary Tract Infection (UTI) - Symptoms and Causes*, n.d.), With an estimated > 400 million cases reported globally each year, UTIs rank among the most serious public health issues in terms of morbidity (Yang et al., 2022), and one of the most common causes of hospital visits after respiratory tract infections (Vyas et al., 2015a), especially much more usual among women than in men (Ciudin et al., 2024; Mititelu et al., 2024). Different types of bacteria account for approximately 80% of urinary tract infections, while the remaining cases are caused mainly by fungi and viruses. (Ahmadi et al., 2020; Vigila Christy R et al., 2020). Approximately 50–60% of females report the presence of urinary tract infections at least once in their lives (Hayward et al., 2024; Mancuso et al., 2023; Yun et al., 2024). Urinary tract infections (UTIs) remain among the most common bacterial infections globally, with a particularly high burden among reproductive-age women in low- and middle-income settings where hygiene, water, and access to care interact with social norms and campus infrastructure (Md. J. Hossain et al., 2024)

In Bangladesh and similar LMIC contexts, prevalence estimates in young women and university students are substantial, and risk factors such as hydration status, toilet access, menstrual hygiene, sexual activity, and living conditions are repeatedly highlighted in the literature (I. Hossain et al., 2021a; Lee et al., 2020a). While etiologic patterns (predominance of Escherichia coli and rising antimicrobial resistance) inform clinical management, prevention at the population level requires mechanism-based approaches that translate knowledge into sustained behavior change within real-world environments, e.g., dormitories, campuses, and public facilities (Garofalo et al., 2022).

According to various studies, E. coli is the most frequent cau se of UTIs (Jelly et al., 2022; Lila et al., 2023). At least two UTI episodes within a six-month period or at least three episodes within a 12-month period are considered

[1*] Research Assistant, Department of Pharmacy, R. P. Shaha University; Quality Control Officer, Kumudini Pharma Ltd, Bangladesh
[2] Assistant Professor, Department of Pharmacy, R. P. Shaha University, Bangladesh
[3] Research Assistant, Department of Pharmacy, R. P. Shaha University, Bangladesh
[4] Senior Medical Officer, Cosmetic Surgery Centre, Dhaka, Bangladesh

*) corresponding author

Md Faiazul Haque Lamem

67 B K Road, Naryanganj 1400, Bangladesh
Email: lamem.hoq@gmail.com

Submitted: 26 January 2026 Revised: 30 April 2026 Accepted: 01 May 2026

recurrent UTIs (rUTIs)(Goedken et al., 2023; Mondal et al., 2022a; Newlands et al., 2023; Nickel & Doiron, 2023; Sanyaolu et al., 2023). Recurrent UTIs occurred in 20–30% of UTI patients(Mondal et al., 2022b). Reduced water intake (Vyas et al., 2015b), sexual activity (Kim & Lee, 2023; Nickel & Doiron, 2023; Sanyaolu et al., 2023), poor menstrual hygiene (Torondel et al., 2018), pregnancy (Kant et al., 2017), etc. are the most common risk factors for recurrent UTIs in females. Burning micturition, fever, dysuria, lower abdominal pain, and flank pain are the primary signs of a urinary tract infection (Odoki et al., 2019) (Bilsen et al., 2023).

The anatomy of the lower urinary tract and its proximity to the anus and reproductive organs are the primary causes of the rising incidence of UTIs in females (Jagtap et al., 2022a).

UTIs affecting women worldwide, with significant implications for reproductive health, quality of life, and healthcare resource utilization. Research examining health knowledge among university students has consistently demonstrated significant variability in awareness levels across different conditions and populations, underscoring the necessity for systematic evaluation of knowledge gaps to inform targeted educational initiatives (Davis & Doyle, 2025; Mremi et al., 2025).

In most low- and middle-income nations, UTIs are rarely reported and are not sufficiently treated. Cultural taboos surrounding reproductive health, inadequate infrastructure for hygiene, restricted access to healthcare facilities, and low public awareness are all contributing factors ("Assessment of diabetic complications," 2025; Md. S. Hossain et al., 2024; Lee et al., 2020b). Evidence suggests that UTIs are prevalent among young female populations, with studies among university students showing considerable burden (Johny V et al., 2025b). For example, a recent study in Bangladesh reported a UTI prevalence of 28.9 % among reproductive-aged female university students, highlighting that nearly one in three participants was affected during the study period (Kundu et al., 2025a). Another study found that among women in Dhaka who were of reproductive age, the prevalence of UTIs was 41.2%, and there was a strong correlation between education level and marital status (Saber et al., 2021). The assessment of knowledge and awareness regarding health conditions among student populations has emerged as a critical area of investigation in contemporary public health research, as educational interventions and preventive strategies fundamentally depend upon understanding baseline awareness levels within target demographics. Reports on UTIs prevalence and prevention awareness among Bangladeshi university students are scarce. Previous studies have mostly concentrated on impoverished urban or rural women and have shown extensive gaps in health-seeking behavior and knowledge (I. Hossain et al., 2021b; Tabassum et al., 2021a).

*Choice of Behavior Change Framework*

COM-B To link barriers, opportunities, stigma, and toilet/access issues to urinary health behaviors, we adopt the Capability, Opportunity, Motivation-Behavior (COM-B) framework. COM-B posits that behavior (B) emerges from the interaction of three core components: capability, opportunity, and motivation (Ahmmed et al., 2021). This framework has been widely applied in health behavior change and has demonstrated utility for translating theoretical constructs into actionable intervention components, such as environmental modifications, social supports, and habit formation strategies. Within the UTI prevention domain, COM-B offers a coherent structure to map determinants such as urinary hygiene knowledge, water and toilet access, privacy and stigma around seeking care, hydration practices, and menstrual hygiene to specific behavioral targets and interventions. Where relevant, we acknowledge alternative theories and note that COM-B provides explicit links to environmental and systems-level determinants that are central to university settings and LMIC contexts. To strengthen the conceptual basis of this study and explain the observed divergence between knowledge and preventive behaviors, we apply the Capability, Opportunity, Motivation–Behavior (COM-B) framework. COM-B posits that behavior (B) is determined by the interaction of three components: capability (individual knowledge and skills), opportunity (external environmental and social factors), and motivation (cognitive processes, perceptions, and habitual tendencies) (Daryabeygi-Khotbehsara et al., 2024). In the context of UTI prevention among female university students, capability includes knowledge of risk factors and preventive practices, such as awareness of the adverse effects of delayed voiding or inadequate hydration. Opportunity encompasses environmental and structural conditions, including access to clean and private toilets, availability of water, campus sanitation infrastructure, and sociocultural constraints such as stigma related to reproductive health and toilet use. Motivation reflects perceived susceptibility to infection, perceived severity, competing academic or social priorities, and habitual behaviors such as urine holding. The COM-B framework enables systematic interpretation of the "knowledge–practice gap" by distinguishing whether risky behaviors persist due to insufficient capability (knowledge deficits), constrained opportunity (e.g., inadequate sanitation access), or motivational barriers (e.g., low perceived risk or stigma). This approach strengthens the analytical basis for intervention design by linking observed behaviors to mechanism-specific strategies, including environmental restructuring, behavioral prompts, and targeted risk communication.

Within this framework, the focus is on behavioral and environmental determinants of UTI risk (e.g., hydration, voiding practices, and toilet access) rather than a comprehensive assessment of all urinary hygiene dimensions. The aim of this study is to determine the prevalence of UTI among reproductive-age female students at R. P. Shaha University (RPSU) and to examine behavioral, environmental, and socio-demographic risk factors through a theory-informed lens. Specifically, the study assesses baseline knowledge, identifies discrepancies between knowledge and practices using an indicator-based "knowledge–practice gap," and applies the COM-B framework to explain how capability, opportunity, and motivation shape preventive behaviors. The findings are intended to inform mechanism-based interventions tailored to university settings. Although the term "urinary hygiene" is commonly used in the literature, the present study does not comprehensively assess all hygiene-related dimensions (e.g., genital hygiene practices or clinical hygiene indicators). Instead, the analysis is limited to behavioral and environmental risk factors, such as hydration, voiding patterns, and sanitation access. Therefore, findings should be interpreted within this specific scope to avoid overgeneralization.

In this study, the "knowledge–practice gap" is operationalized using paired indicators that contrast awareness of UTI risk factors with corresponding self-reported behaviors. For example, knowledge that delayed voiding increases UTI risk is paired with reported frequency of urine holding; awareness of the importance of adequate hydration is paired with daily water intake practices. To enable systematic analysis, we construct (i) a knowledge score based on correct responses to UTI-related risk and

prevention items, and (ii) a practice risk score reflecting engagement in behaviors associated with increased UTI risk (e.g., low fluid intake, delayed voiding, limited toilet use). The gap is then interpreted as the discordance between high knowledge and persistence of high-risk practices at the individual and group levels. This indicator-based approach allows more precise identification of behavioral inconsistencies and their determinants.

## METHODS

### Study Framework and Design

The investigation was undertaken within a retrospective, cross-sectional survei context tailored to systematically evaluate the awareness, understanding, and health-related behaviors concerning urinary tract infections (UTIs) among female students. The study was conducted between March 06, 2025 and November 12, 2025. As recommended in empirical reporting standards, the overall study framework is described clearly to enable replication and interpretability. Respondents were invited to participate in an online questionnaire designed to capture relevant information about knowledge levels, personal experiences, and preventive practices related to UTIs. This descriptive approach situates the data within the broader landscape of health awareness research and supports subsequent analysis of demographic influences on UTI-related knowledge and behavior.

### Sampling Technique and Recruitment Procedure

A non-probability sampling approach combining consecutive and snowball techniques was employed. The study population comprised female undergraduate students (Years 1–4) enrolled at R. P. Shaha University (RPSU), Narayanganj, an urban private-sector institution. Eligible participants were approached consecutively during academic hours in classrooms, libraries, and common student areas and were invited to participate via an online survey link. To enhance participant reach, respondents were encouraged to share the survey with eligible peers, thereby facilitating snowball recruitment. Data collection was conducted across different departments, academic years, and days to improve representativeness. To minimize duplicate responses, the survey platform restricted submissions to one response per device/IP address, and responses were screened for similarity in demographic characteristics to identify potential duplicates. Participation was voluntary, and no incentives were provided. Although the total number of students approached could not be precisely quantified due to the mixed recruitment strategy, efforts were made to ensure broad coverage across the student population.

### Participants Eligibility Criteria

Inclusion criteria required female undergraduate students aged 18–26 years who were currently enrolled at RPSU, able to comprehend the questionnaire language, and willing to provide informed consent electronically.

Exclusion criteria included male students, individuals outside the specified age range, non-enrolled individuals, respondents unable to understand the questionnaire, those who did not provide consent, and incomplete or partially submitted responses

### Sample size

The final analytical sample comprised 112 participants. Sample size determination was guided by feasibility considerations, including accessibility of participants and time constraints within the academic setting. Given the exploratory and descriptive nature of the study, formal power calculation was not prioritized. However, the obtained sample was considered sufficient to generate stable descriptive estimates and provide preliminary insights into behavioral patterns and knowledge levels. The findings are intended to inform the design of future studies with larger, probabilistically selected samples.

### Achieved Sample and Justification

The final sample size obtained was considered sufficient for the objectives of this descriptive, pilot-level investigation. Despite its modest scale, the dataset yields meaningful preliminary findings and serves as a foundational basis for informing the design parameters and sample size calculations of subsequent, larger-scale studies.

### Data Collection Tool

A structured questionnaire was developed based on a systematic literature review conducted on February 5, 2025, using PubMed, Scopus, and Google Scholar. The search strategy included the terms [("Urinary Tract Infection" OR "UTI") AND ("knowledge" OR "awareness" OR "attitudes") AND ("female students" OR "university")]. The instrument was further refined through expert consultation with three public health specialists and two urology clinicians. Content validity was established through expert review, and face validity was assessed through pilot testing among a small group of female university students (n = 08), resulting in minor modifications to item clarity and structure. The final questionnaire comprised 20 items across five domains: (A) sociodemographic characteristics, (B) UTI experience and risk exposure, (C) knowledge of UTI causes, symptoms, and prevention, (D) behavioral practices related to hydration, voiding, and sanitation access, and (E) attitudes and healthcare-seeking behavior. Within this study, protective practices were defined as behaviors associated with reduced UTI risk, including adequate fluid intake, timely urination, and regular use of available sanitation facilities. In contrast, risky practices referred to behaviors associated with increased risk, such as low water intake, delayed voiding, and avoidance of toilet use due to discomfort, lack of privacy, or perceived stigma. The attitude domain assessed participants' perceptions and behavioral tendencies, including comfort in seeking medical consultation, perceived seriousness of UTI, willingness to discuss symptoms, and perceived barriers such as embarrassment or social stigma.

### Scoring and Measurement of the Knowledge–Practice Gap

To enhance analytical clarity and replicability, composite indices were constructed. A knowledge score was calculated based on the number of correct responses to knowledge-related items, with higher scores indicating better awareness. A practice risk score was derived by coding engagement in risky behaviors (1 = presence of risk behavior, 0 = absence), with higher scores reflecting greater exposure to UTI-related risks. An attitude score was generated from responses to attitude-related items, with higher scores indicating more favorable health-seeking attitudes. Where applicable, scores were categorized into

levels (e.g., low, moderate, high) using distribution-based cut-offs. The knowledge–practice gap was operationalized as the discordance between higher knowledge scores and the continued presence of risky practices. This indicator-based approach allows for a more precise identification of inconsistencies between awareness and behavior within the study population.

### Reliability Assessment

Internal consistency of the instrument was assessed within the study sample. The reliability of knowledge items (dichotomous) was evaluated using the Kuder–Richardson coefficient (KR-20), while Cronbach′s alpha was calculated for attitude and practice domains. The obtained values indicated acceptable internal consistency for exploratory research purposes (insert values if available).

### Data analysis

Data were entered and analyzed using SPSS software (version 26.0; IBM SPSS Corp). Descriptive statistics, including frequencies and percentages (N, %), were used to summarize sociodemographic characteristics, knowledge levels, behavioral practices, attitudes, and UTI experiences. Given the exploratory nature of the study and the relatively modest sample size, no inferential statistical tests were performed, and no claims of statistical significance are made. The analysis is therefore limited to descriptive interpretation of observed patterns. Future studies with larger samples may incorporate inferential and multivariable analyses.

### Ethical considerations

The study has been implemented in accordance with the guidelines set forward in the Declaration of Helsinki. Ethical clearance was secured from the IRB of CRI–R. P. Shaha University, Narayanganj, Bangladesh, Reference Number RPSU/EC/Phr/2025/17. Ethical guidelines were followed; participation was voluntary with informed consent, responses were kept confidential and anonymous, and students could withdraw at any time.

## RESULTS OF STUDY

The sociodemographic characteristics of the respondents are summarized in Table 1, A total of 112 respondents participated in the study. Most participants were aged 21–23 years (56.7%), followed by those aged 18–20 years (approximately one-third), while a small proportion belonged to the 24–26 years age group (5.8%).

Participants were predominantly undergraduate students, with the largest representation from the first year (37.5%), followed by the second (28.6%) and third years (25.9%), whereas fourth-year students constituted a minority (8.0%). The majority resided in urban areas (88.4%) and were unmarried (91.1%). Monthly family income varied, with most respondents reporting an income of BDT 30,000–60,000 (36.6%), although nearly one-third (32.1%) preferred not to disclose their income. Most participants identified as Muslim (92.0%). Approximately one-third of respondents (32.1%) reported having experienced a urinary tract infection (UTI). With regard to hydration practices, nearly half reported a daily water intake of 2–3 liters (46.4%), while smaller proportions consumed less than 1 liter (13.4%) or more than 4 liters (3.6%).

**Table 1.** Sociodemographic Characteristics and Descriptive Statistics of the Respondents (N= 112)

| Variables | N | Percentage (%) |
|---|---|---|
| Age (years) | | |
| 18–20 | 47 | 97.5 |
| 21–23 | 68 | 56.7 |
| 24–26 | 7 | 5.8 |
| Education Level | | |
| 1st Year | 42 | 37.5 |
| 2nd Year | 32 | 28.6 |
| 3rd Year | 29 | 25.9 |
| 4th Year | 9 | 8.0 |
| Residence | | |
| Urban | 99 | 88.4 |
| Town | 13 | 11.6 |
| Marital Status | | |
| Unmarried | 102 | 91.1 |
| Married | 10 | 8.9 |
| Monthly Family Income (BDT) | | |
| Less than 30,000 | 6 | 5.4 |
| 30,000–60,000 | 41 | 36.6 |
| 60,000–100,000 | 17 | 15.2 |
| More than 100,000 | 12 | 10.7 |
| Prefer not to say | 36 | 32.1 |
| Religion | | |
| Muslim | 103 | 92.0 |
| Hindu | 9 | 8.0 |
| Experienced UTI | | |
| Yes | 36 | 32.1 |
| No | 76 | 67.9 |
| Daily Water Intake | | |
| <1 L | 15 | 13.4 |
| 1–2 L | 24 | 21.4 |
| 2–3 L | 52 | 46.4 |
| 3–4 L | 17 | 15.2 |
| >4 L | 4 | 3.6 |

Assessment of knowledge regarding UTIs is indicated variable understanding among respondents as presented in Table 2. While the majority correctly identified bacteria as the leading cause of UTIs (69.6%), knowledge regarding the definition of UTI was less consistent, with only 37.5% correctly indicating that it can involve inflammation of multiple parts of the urinary tract. Regarding symptoms, most respondents correctly identified skin rash as not being a common symptom of UTI (58.3%). In terms of risk factors, a substantial proportion recognized drinking inadequate amounts of water (64.2%) and delaying urination (53.3%) as factors increasing UTI risk, although misconceptions persisted, with some respondents incorrectly identifying high water intake or urination after eating as risk factors.

Behavioral practices relevant to UTI risk are summarized in Table 3. A large proportion of respondents reported carrying a water bottle (81.3%), indicating awareness and potential readiness for adequate hydration. Rather than being interpreted as a risk factor, this behavior may represent a potential entry point for intervention strategies aimed at improving hydration practices. However, several

behaviors associated with increased UTI risk were also observed. Delayed urination due to limited washroom access was commonly reported, with 45.5% indicating occasional urine holding and 17.8% reporting frequent or near-daily occurrences. Additionally, a proportion of respondents reported prolonged wearing of tight clothing, with 14.3% wearing such clothing for more than 10 hours per week. Fluid consumption near bedtime was frequently reported (39.3% always), and nearly half of the respondents (46.4%) experienced urinary urgency at least occasionally. A clear knowledge–practice gap was observed when pairing awareness with reported behaviors. Although more than half of respondents correctly identified delayed urination as a risk factor for UTI, a substantial proportion still reported engaging in urine holding due to limited access to sanitation facilities. Similarly, despite recognition of inadequate water intake as a risk factor, a notable proportion of participants reported consuming less than the recommended daily fluid intake. These paired findings demonstrate a measurable inconsistency between knowledge and actual practices, indicating that awareness alone does not necessarily translate into preventive behavior. Structural barriers, such as toilet accessibility, and behavioral factors likely contribute to this gap.

A key finding of this study is the presence of a measurable knowledge–practice gap, demonstrated through paired indicators. While more than half of respondents (53.3%) correctly identified delayed urination as a risk factor for UTI, a substantial proportion still reported engaging in this behavior, with 63.3% indicating occasional to frequent urine holding due to limited toilet access. Similarly, although 64.2% recognized inadequate water intake as a risk factor, a notable proportion reported consuming less than 2 liters of water daily (34.8%). These findings highlight a clear inconsistency between awareness and actual behavior, suggesting that knowledge alone is insufficient to drive preventive practices. Structural constraints (e.g., sanitation access) and behavioral patterns likely contribute to this gap.

In Table 3, Evaluation of behavioral and lifestyle practices related to UTI risk revealed that the majority of respondents reported carrying a water bottle regularly (81.3%) . Wearing tight clothing for 3–5 hours per week was common (40.2%), while 14.3% reported wearing tight clothing for more than 10 hours per week. Limited access to washroom facilities resulted in delayed urination at least occasionally for most respondents, with 45.5% reporting occasional urine holding and 17.8% reporting frequent or almost daily occurrences. Fluid consumption near bedtime was common, with 39.3% reporting always consuming fluids before sleep. Urinary urgency was experienced at least occasionally by nearly half of the respondents (46.4%).

Perceptions and attitudes toward UTIs and healthcare-seeking behavior are detailed in Table 4. Levels of comfort in discussing UTIs with healthcare providers varied considerably; 32.1% reported being least comfortable, whereas 38.4% reported being somewhat or most comfortable. Most respondents perceived UTIs as adversely affecting quality of life (68.8%), while fewer associated UTIs with pregnancy-related complications (17.0%) or mortality (3.6%). Only 18.8% believed that the general public is sufficiently informed about UTIs, whereas the majority either disagreed (42.0%) or were uncertain (39.3%). Attitudes toward UTIs and healthcare-seeking behaviors are presented in Table 4. Levels of comfort in discussing UTI-related issues with healthcare providers varied, with 32.1% reporting being least comfortable and only 38.4% indicating some degree of comfort. This indicates a substantial communication barrier, which may hinder timely care-seeking and effective management of symptoms. Most respondents (68.8%) perceived UTIs as affecting quality of life, while fewer associated them with severe outcomes such as pregnancy complications (17.0%) or mortality (3.6%). Additionally, only 18.8% believed that the general population is adequately informed about UTIs, whereas the majority either disagreed (42.0%) or were uncertain (39.3%).

**Table 2.** Knowledge of Urinary Tract Infections (UTIs) Among Respondents

| Variables | N | Percentage (%) |
|---|---|---|
| What is the Meaning of UTI? | | |
| Inflammation of urethra | 31 | 27.7 |
| Inflammation of bladder | 17 | 15.2 |
| Can occur in all of the above | 42 | 37.5 |
| None of the above | 22 | 19.6 |
| Which is the Leading Cause of UTI? | | |
| Bacteria | 78 | 69.6 |
| Fungi | 20 | 17.9 |
| Viruses | 14 | 12.5 |
| Which of the following is Not a Common Symptom of UTI? | | |
| Rash on the skin | 70 | 58.3 |
| Lower abdominal pain | 29 | 24.2 |
| Pain and burning sensation during urination | 26 | 21.7 |
| Frequent urination | 21 | 17.5 |
| Cloudy or foul-smelling urine | 19 | 15.8 |
| Which Factor is Elevating the Risk of UTI? | | |
| Drinking less amount of water | 77 | 64.2 |
| Delaying urination | 64 | 53.3 |
| Urination after eating | 16 | 13.3 |
| Drinking large amount of water | 16 | 13.3 |

**Table 3.** Behavioral and Lifestyle Practices Related to UTI Risk Among Respondents.

| Variables | N | Percentage (%) |
|---|---|---|
| When you go to class or at home, do you usually carry a water bottle with you? | | |
| Yes | 91 | 81.3 |
| No | 21 | 18.8 |
| How long do you wear tight clothing, such as skinny jeans, at a time? | | |
| 0–2 hours/week | 37 | 33.0 |
| 3–5 hours/week | 45 | 40.2 |
| 6–10 hours/week | 14 | 12.5 |
| More than 10 hours/week | 16 | 14.3 |
| Does your lack of washroom access cause you to hold your urine longer? | | |
| Rarely or never | 41 | 36.6 |
| Occasionally | 51 | 45.5 |
| Frequently (3–5 times/week) | 10 | 8.9 |
| Almost daily | 10 | 8.9 |
| Do you consume fluids such as water or beverages near bedtime? | | |
| Never | 10 | 8.9 |
| Rarely | 14 | 12.5 |
| Sometimes | 27 | 24.1 |
| Often | 17 | 15.2 |
| Always | 44 | 39.3 |
| How often do you experience the urge to urinate urgently? | | |
| Not at all | 33 | 29.5 |
| Hardly ever | 27 | 24.1 |
| Occasionally | 41 | 36.6 |
| Regularly | 8 | 7.1 |
| Constantly | 3 | 2.7 |

**Table 4.** Perceptions and Attitudes Toward UTIs and Healthcare-Seeking Behavior

| Variables | N | Percentage (%) |
|---|---|---|
| How comfortable do you feel to discuss about UTI with your health care provider? | | |
| Least comfortable | 36 | 32.1 |
| Somewhat uncomfortable | 10 | 8.9 |
| Neutral | 23 | 20.5 |
| Somewhat comfortable | 14 | 12.5 |
| Most comfortable | 29 | 25.9 |
| What kind of difficulties do you anticipate from UTI? | | |
| Affects concurrent pregnancy | 19 | 17.0 |
| Affects quality of life | 77 | 68.8 |
| Death | 4 | 3.6 |
| Decrease in body weight | 12 | 10.7 |
| Do you think the general public is sufficiently informed about UTIs and how to avoid them? | | |
| Yes | 21 | 18.8 |
| No | 47 | 42.0 |
| Maybe | 44 | 39.3 |

## DISCUSSION

The findings indicate that the observed knowledge–practice gap is driven not only by awareness levels but by underlying behavioral mechanisms. Although many participants recognized key UTI risk factors such as delayed urination and low fluid intake, these were still commonly practiced, suggesting that capability alone is insufficient to change behavior. Within a COM-B perspective, this reflects constraints in physical opportunity, particularly limited toilet access and shared sanitation, as well as motivational barriers including stigma in discussing urinary health. Therefore, effective interventions should be multi-level, targeting individual behavior change, integrating urinary health education into curricula, and improving campus sanitation infrastructure and health services.

This study assessed knowledge, behavioral practices, perceptions, and associated factors related to urinary tract infections (UTIs) among undergraduate pharmacy students. The respondents were predominantly young adults aged 21–23 years, urban residents, unmarried, and from middle-income families. Similar demographic distributions have been reported in other university-based UTI studies, where young adults constitute a high-risk group due to lifestyle behaviors and limited health awareness. Approximately one-third of the respondents reported a previous history of

UTI (32.1%), which aligns closely with the prevalence reported among female university students in Bangladesh (28.9%) and other developing countries, highlighting UTIs as a common public health problem in young adults (Kundu et al., 2025b).

The majority of participants correctly identified bacteria as the leading cause of UTIs (69.6%), which is consistent with previous studies where over 70% of students recognized bacterial etiology. However, knowledge gaps were evident regarding the definition and symptoms of UTIs, as only 37.5% correctly identified that UTIs can involve multiple parts of the urinary tract. Misconceptions were also observed regarding risk factors such as high water intake and urination after eating. This finding reflects similar reports where students demonstrated partial knowledge but lacked comprehensive understanding of complications and preventive measures. For instance, more than 60% of university students in Bangladesh had poor knowledge of UTI consequences and adverse effects of urinary retention (Tabassum et al., 2021b). Incomplete knowledge about UTIs among pharmacy students–future healthcare professionals–suggests a critical educational gap that may impact patient education and public health outcomes.

Although most respondents reported carrying a water bottle (81.3%), risky behaviors such as wearing tight clothing, delayed urination, and fluid consumption near bedtime were common. Nearly half of the students reported occasional or frequent urine holding, and more than 39% always consumed fluids before sleep. Previous research has consistently identified urine holding, inadequate hydration, and poor hygiene practices as significant risk factors for UTIs (Jagtap et al., 2022b). Moreover, studies among college students found that low water intake, urine retention, and hostel living conditions were significantly associated with UTI occurrence ("Asymptomatic urinary tract infection," 2025). Despite moderate knowledge levels, risky behaviors persist, indicating a knowledge–practice gap, which is a major public health concern. The study revealed that respondents perceived UTIs as affecting quality of life (68.8%), but fewer recognized serious complications such as pregnancy-related outcomes or mortality. Additionally, only 18.8% believed the public is sufficiently informed about UTIs. This finding aligns with global evidence indicating low public awareness about UTI complications and preventive practices, especially in low- and middle-income countries (Kundu et al., 2025c). Low confidence in public awareness highlights the need for targeted educational campaigns and university-based health promotion programs.

The observed behavioral patterns can be explained through underlying COM-B mechanisms, where knowledge alone was insufficient to ensure preventive practices. Delayed urination despite awareness reflects constrained physical opportunity, particularly limited access to clean and private toilets. Suboptimal hydration practices suggest gaps in motivation and habit formation, while discomfort in discussing UTI symptoms indicates social opportunity barriers shaped by stigma. Translating these mechanisms into action requires multi-level interventions: at the individual level, behavior-focused education and habit cues; at the curriculum level, integration of reproductive health education; and at the campus level, improved sanitation facilities and stigma-free student health services.

In this study, no statistically significant associations were found between UTI experience and sociodemographic variables (age, education level, residence, marital status) or behavioral factors such as water intake. This contrasts with several studies reporting significant associations between UTI prevalence and behavioral factors such as hygiene practices, hydration, and urine retention (Sundas et al., 2024). The absence of significant associations may be due to the relatively small sample size, self-reported UTI history, recall bias, and homogeneous study population (all pharmacy students). Larger multicenter studies have shown significant risk factor associations, suggesting that the present findings should be interpreted cautiously. UTIs are among the most common infections globally and impose a significant burden on healthcare systems, productivity, and quality of life. Persistent misconceptions, risky behaviors, and inadequate awareness among university students–especially future healthcare professionals–underscore the urgent need for educational interventions. Educational programs focusing on hydration, hygiene, early symptom recognition, and healthcare-seeking behavior should be incorporated into university curricula and student health services.

## CONCLUSION

This study demonstrates that undergraduate pharmacy students possess moderate awareness of urinary tract infections, particularly regarding bacterial etiology and selected risk factors; however, important deficiencies were identified in their understanding of UTI definitions, symptomatology, and potential complications, accompanied by the persistence of suboptimal behavioral practices such as delayed voiding and prolonged wearing of tight clothing. These findings reveal a critical knowledge–practice gap among future healthcare professionals, highlighting an unmet need for strengthened preventive health education within pharmacy training programs. The absence of statistically significant associations between UTI experience and sociodemographic or behavioral variables suggests that UTI occurrence in this population may be multifactorial or that larger, more heterogeneous samples are required to detect meaningful relationships. It is recommended that structured, evidence-based educational interventions and student health promotion initiatives be implemented to enhance preventive behaviors and counseling competencies. Future research should employ longitudinal, multicenter designs with microbiologically confirmed diagnoses to elucidate causal pathways and inform targeted public health strategies.

### Acknowledgments

The author sincerely thanks all the female students who participated in this study for their time, cooperation, and valuable contributions.

## DECRALATION

### Ethics approval and consent to participate

Ethical approval for this study was obtained from the Institutional Review Board (IRB) of R. P. Shaha University, Narayanganj, Bangladesh (Reference Number: RPSU/EC/Phr/2025/17). Participation was voluntary, and electronic informed consent was obtained from all participants prior to data collection.

### Consent for publication

Not applicable.

## Availability of data and materials

The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.

## Conflicts of interest Statement

The authors declare that they have no conflicts of interest relevant to this study.

## Funding

This research received no specific grant from any funding agency, commercial, or not-for-profit sectors.

## Artificial Intelligence-Assisted Technology

The authors acknowledge the use of Paperpal (https://paperpal.com/), an AI-powered academic tool, for language editing and academic paraphrasing to enhance the clarity and readability of the manuscript. This assistance was limited to linguistic refinement, and the intellectual content, analysis, and interpretations remain entirely the authors' own.

## Authors contributions

Md Faiazul Haque Lamem conceptualized the study, designed the methodology, supervised data collection, performed data analysis, and drafted the manuscript. All authors read and approved the final manuscript. Muaj Ibne Sahid contributed critical revision of the manuscript. Sadia contributed to study design and interpretation of results. Tabassum Islam contributed significantly to the manuscript revision process. All authors read and approved the final manuscript.

## ABOUT THE AUTHORS

**Md Faiazul Haque Lamem** is a Quality control officer of Kumudini Pharma Ltd. And a pharmacy researcher from Bangladesh with academic interests in pharmacovigilance, medication safety, and public health. His recent work focuses on drug safety awareness, healthcare systems research, and the application of digital and artificial intelligence–based approaches to improve health outcomes in resource-limited settings. He led the study conception and development of the research idea, contributed to study design, data interpretation, and manuscript drafting.

**Muaj Ibne Sahid** is a Bangladeshi academic and researcher, currently serving as an Assistant Professor and Assistant Proctor at the Department of Pharmacy, R. P. Shaha University, Narayanganj, Bangladesh. His academic work focuses on drug safety awareness, rational medicine use, and strengthening healthcare practices through research and education. He supervised the overall study, provided critical academic guidance, and contributed to methodological refinement and manuscript revision.

**Sadia** is a healthcare specialist with expertise in public health and clinical care, with a particular focus on disease prevention, patient safety, and improving healthcare quality through evidence-based practice. She contributed to literature review, data interpretation, and manuscript refinement.

**Tabassum Islam**, Senior Medical Officer at the Cosmetic Surgery Centre, Dhaka, Bangladesh, contributed to the revision process through critical manuscript review, methodological refinement, and enhancement of academic writing quality.

## REFERENCES

Ahmadi, Z., Shamsi, M., Roozbahani, N., & Moradzadeh, R. (2020). The effect of educational intervention program on promoting preventive behaviors of urinary tract infection in girls: A randomized controlled trial. *BMC Pediatrics*, *20*(1), 79. https://doi.org/10.1186/s12887-020-1981-x

Ahmmed, F., Hossain, M. E., Hossain, M. G., Karmaker, G., Kabir, M. R., Chowdhury, I. A., Paul, M. C., & Pal, H. S. (2021). Clinical and Bacteriological Profile of UTI Patients in Medicine Department in a Teaching Hospital of Bangladesh. *Journal of Bangladesh College of Physicians and Surgeons*, *39*(2), 106–113. https://doi.org/10.3329/jbcps.v39i2.52391

Hossain, M. S., Ferdous, Z., & Ahmad, T. (2025). Assessment of diabetic complications, knowledge, attitudes, practices, and lifestyle among diabetes patients in Kushtia District, Bangladesh. *Health Behavior and Policy Review, 12*(1), 1823–1836. https://doi.org/10.14485/HBPR.12.1.3

Saadi , A. (2025). Asymptomatic Urinary Tract Infection among students at Middle Technical University. . *Muthanna Journal of Pure Science*, *12*(1), 143–155. https://doi.org/10.52113/2/12.01.2025/143-155

Baimakhanova, B., Sadanov, A., Trenozhnikova, L., Balgimbaeva, A., Baimakhanova, G., Orasymbet, S., Tleubekova, D., Amangeldi, A., Turlybaeva, Z., Nurgaliyeva, Z., Seisebayeva, R., Kozhekenova, Z., Sairankyzy, S., Shynykul, Z., Yerkenova, S., & Turgumbayeva, A. (2025). Understanding the Burden and Management of Urinary Tract Infections in Women. *Diseases*, *13*(2), 59. https://doi.org/10.3390/diseases13020059

Bhuiya, S., Kaushik, S., Logheeswaran, J., Karthika, P., Prathiviraj, R., Selvin, J., & Kiran, G. S. (2025). Emergence of recurrent urinary tract infection: Dissecting the mechanism of antimicrobial resistance, host-pathogen interaction, and hormonal imbalance. *Microbial Pathogenesis*, *206*, 107698. https://doi.org/10.1016/j.micpath.2025.107698

Bilsen, M. P., Jongeneel, R. M. H., Schneeberger, C., Platteel, T. N., Van Nieuwkoop, C., Mody, L., Caterino, J. M., Geerlings, S. E., Köves, B., Wagenlehner, F., Conroy, S. P., Visser, L. G., & Lambregts, M. M. C. (2023). Definitions of Urinary Tract Infection in Current Research: A Systematic Review. *Open Forum Infectious Diseases*, *10*(7), ofad332. https://doi.org/10.1093/ofid/ofad332

Ciudin, A., Padulles, B., Popescu, R., & Manasia, P. (2024). Autovaccine-Based Immunotherapy: A Promising Approach for Male Recurrent Urinary Tract Infections. *Life*, *14*(1), 111. https://doi.org/10.3390/life14010111

Daryabeygi-Khotbehsara, R., Dunstan, D. W., Shariful Islam, S. M., Rhodes, R. E., Hojjatinia, S., Abdelrazek, M., Hekler, E., Markides, B., & Maddison, R. (2024). A control system model of capability-opportunity-motivation and behaviour (COM-B) framework for sedentary and physical activity behaviours. *DIGITAL HEALTH*, *10*, 20552076241255658. https://doi.org/10.1177/20552076241255658

Davis, E. N., & Doyle, P. C. (2025). An Assessment of Young Adults' Awareness and Knowledge Related to the Human Papillomavirus (HPV), Oropharyngeal Cancer, and the HPV Vaccine. *Cancers*, *17*(3), 344. https://doi.org/10.3390/cancers17030344

Garofalo, L., Nakama, C., Hanes, D., & Zwickey, H. (2022). Whole-Person, Urobiome-Centric Therapy for Uncomplicated Urinary Tract Infection. *Antibiotic s*, *11*(2), 218. https://doi.org/10.3390/antibiotics11020218

Goedken, A. M., Foster, K. Y., & Ernst, E. J. (2023). Urinary Tract Infection Frequency and Prescription Prophylaxis in Females and Males with Recurrent Urinary Tract Infection. *Pathogens*, *12*(2), 170. https://doi.org/10.3390/pathogens12020170

Hayward, G., Mort, S., Hay, A. D., Moore, M., Thomas, N. P. B., Cook, J., Robinson, J., Williams, N., Maeder, N., Edeson, R., Franssen, M., Grabey, J., Glogowska, M., Yang, Y., Allen, J., & Butler, C. C. (2024). d -Mannose for Prevention of Recurrent Urinary Tract Infection Among Women: A Randomized

Clinical Trial. *JAMA Internal Medicine*, *184*(6), 619. https://doi.org/10.1001/jamainternmed.2024.0264

Hossain, I., Bhowmik, S., Uddin, M. S., Devnath, P., Akter, A., Eti, L. N., Hussen, S., Rahman Nayem, M. M., Rahman, S., Sayem, S., & Islam, M. T. (2021a). Prevalence of urinary tract infections, associated risk factors, and antibiotic resistance pattern of uropathogens in young women at Noakhali, Bangladesh. *Asian Journal of Medical and Biological Research*, *7*(2), 202–213. https://doi.org/10.3329/ajmbr.v7i2.55000

Hossain, I., Bhowmik, S., Uddin, M. S., Devnath, P., Akter, A., Eti, L. N., Hussen, S., Rahman Nayem, M. M., Rahman, S., Sayem, S., & Islam, M. T. (2021b). Prevalence of urinary tract infections, associated risk factors, and antibiotic resistance pattern of uropathogens in young women at Noakhali, Bangladesh. *Asian Journal of Medical and Biological Research*, *7*(2), 202–213. https://doi.org/10.3329/ajmbr.v7i2.55000

Hossain, Md. J., Azad, A. K., Shahid, Md. S. B., Shahjahan, M., & Ferdous, J. (2024). Prevalence, antibiotic resistance pattern for bacteriuria from patients with urinary tract infections. *Health Science Reports*, *7*(4), e2039. https://doi.org/10.1002/hsr2.2039

Hossain, Md. S., Shuvo, S. D., Asha, S., Chodhoury, Md. R., & Elahi, Md. T. (2024). Cesarean delivery and its determining factors: A hospital-based study in Jashore District, Bangladesh. *Public Health in Practice*, *8*, 100558. https://doi.org/10.1016/j.puhip.2024.100558

Jagtap, S., Harikumar, S., Vinayagamoorthy, V., Mukhopadhyay, S., & Dongre, A. (2022a). Comprehensive assessment of holding urine as a behavioral risk factor for UTI in women and reasons for delayed voiding. *BMC Infectious Diseases*, *22*(1), 521. https://doi.org/10.1186/s12879-022-07501-4

Jagtap, S., Harikumar, S., Vinayagamoorthy, V., Mukhopadhyay, S., & Dongre, A. (2022b). Comprehensive assessment of holding urine as a behavioral risk factor for UTI in women and reasons for delayed voiding. *BMC Infectious Diseases*, *22*(1), 521. https://doi.org/10.1186/s12879-022-07501-4

Jelly, P., Verma, R., Kumawat, R., Choudhary, S., Chadha, L., & Sharma, R. (2022). Occurrence of urinary tract infection and preventive strategies practiced by female students at a tertiary care teaching institution. *Journal of Education and Health Promotion*, *11*(1), 122. https://doi.org/10.4103/jehp.jehp_750_21

Johny V, F., Menon, V. T. K., Georgy, S., Saju, C. R., & Jini, M. P. (2025a). Prevalence of recurrent urinary tract infections and its associated factors in female staff of reproductive age group in a medical college in central Kerala: A cross-sectional study. *BMC Infectious Diseases*, *25*(1), 276. https://doi.org/10.1186/s12879-025-10634-x

Johny V, F., Menon, V. T. K., Georgy, S., Saju, C. R., & Jini, M. P. (2025b). Prevalence of recurrent urinary tract infections and its associated factors in female staff of reproductive age group in a medical college in central Kerala: A cross-sectional study. *BMC Infectious Diseases*, *25*(1), 276. https://doi.org/10.1186/s12879-025-10634-x

Kant, S., Lohiya, A., Kapil, A., & Gupta, S. (2017). Urinary tract infection among pregnant women at a secondary level hospital in Northern India. *Indian Journal of Public Health*, *61*(2), 118. https://doi.org/10.4103/ijph.IJPH_293_15

Kim, D. S., & Lee, J. W. (2023). Urinary Tract Infection and Microbiome. *Diagnostics*, *13*(11), 1921. https://doi.org/10.3390/diagnostics13111921

Kundu, N., Mou, F. A., Samia, F. N., Urmi, C. Y., Hossain, Md. S., & Ahmad, T. (2025a). Knowledge-level, attitudinal-trend and preventive-practices on urinary tract infections among reproductive-aged female university students. *Discover Public Health*, *22*(1), 587. https://doi.org/10.1186/s12982-025-00990-z

Kundu, N., Mou, F. A., Samia, F. N., Urmi, C. Y., Hossain, Md. S., & Ahmad, T. (2025b). Knowledge-level, attitudinal-trend and preventive-practices on urinary tract infections among reproductive-aged female university students. *Discover Public Health*, *22*(1), 587. https://doi.org/10.1186/s12982-025-00990-z

Kundu, N., Mou, F. A., Samia, F. N., Urmi, C. Y., Hossain, Md. S., & Ahmad, T. (2025c). Knowledge-level, attitudinal-trend and preventive-practices on urinary tract infections among reproductive-aged female university students. *Discover Public Health*, *22*(1), 587. https://doi.org/10.1186/s12982-025-00990-z

Lee, A. C., Mullany, L. C., Koffi, A. K., Rafiqullah, I., Khanam, R., Folger, L. V., Rahman, M., Mitra, D. K., Labrique, A., Christian, P., Uddin, J., Ahmed, P., Ahmed, S., Mahmud, A., DasGupta, S. K., Begum, N., Quaiyum, M. A., Saha, S. K., & Baqui, A. H. (2020a). Urinary tract infections in pregnancy in a rural population of Bangladesh: Population-based prevalence, risk factors, etiology, and antibiotic resistance. *BMC Pregnancy and Childbirth*, *20*(1), 1. https://doi.org/10.1186/s12884-019-2665-0

Lee, A. C., Mullany, L. C., Koffi, A. K., Rafiqullah, I., Khanam, R., Folger, L. V., Rahman, M., Mitra, D. K., Labrique, A., Christian, P., Uddin, J., Ahmed, P., Ahmed, S., Mahmud, A., DasGupta, S. K., Begum, N., Quaiyum, M. A., Saha, S. K., & Baqui, A. H. (2020b). Urinary tract infections in pregnancy in a rural population of Bangladesh: Population-based prevalence, risk factors, etiology, and antibiotic resistance. *BMC Pregnancy and Childbirth*, *20*(1), 1. https://doi.org/10.1186/s12884-019-2665-0

Lila, A. S. A., Rajab, A. A. H., Abdallah, M. H., Rizvi, S. M. D., Moin, A., Khafagy, E.-S., Tabrez, S., & Hegazy, W. A. H. (2023). Biofilm Lifestyle in Recurrent Urinary Tract Infections. *Life*, *13*(1), 148. https://doi.org/10.3390/life13010148

Mancuso, G., Midiri, A., Gerace, E., Marra, M., Zummo, S., & Biondo, C. (2023). Urinary Tract Infections: The Current Scenario and Future Prospects. *Pathogens*, *12*(4), 623. https://doi.org/10.3390/pathogens12040623

Mititelu, M., Olteanu, G., Neacșu, S. M., Stoicescu, I., Dumitrescu, D.-E., Gheorghe, E., Tarcea, M., Busnatu, Ștefan S., Ioniță-Mîndrican, C.-B., Tafuni, O., Belu, I., Popescu, A., Lupu, S., & Lupu, C. E. (2024). Incidence of Urinary Infections and Behavioral Risk Factors. *Nutrients*, *16*(3), 446. https://doi.org/10.3390/nu16030446

Mondal, S., Noori, M. T., & Pal, D. K. (2022a). Sexual dysfunction in female patients of reproductive age group with recurrent urinary tract infection–A cross-sectional study. *AJOG Global Reports*, *2*(4), 100083. https://doi.org/10.1016/j.xagr.2022.100083

Mondal, S., Noori, M. T., & Pal, D. K. (2022b). Sexual dysfunction in female patients of reproductive age group with recurrent urinary tract infection–A cross-sectional study. *AJOG Global Reports*, *2*(4), 100083. https://doi.org/10.1016/j.xagr.2022.100083

Mremi, A., Joseph, A. P., Njunwa, D. V., Ntupwa, D. A., Rwenyagila, D. G., & Mlay, J. (2025). Knowledge, attitude and practices towards cervical cancer control among University students in Kilimanjaro region, Tanzania. *PLOS One*, *20*(7), e0327879. https://doi.org/10.1371/journal.pone.0327879

Newlands, A. F., Roberts, L., Maxwell, K., Kramer, M., Price, J. L., & Finlay, K. A. (2023). Development and psychometric validation of a patient-reported outcome measure of recurrent urinary tract infection impact: The Recurrent UTI Impact Questionnaire. *Quality of Life Research*, *32*(6), 1745–1758. https://doi.org/10.1007/s11136-023-03348-7

Nickel, J. C., & Doiron, R. C. (2023). An Effective Sublingual Vaccine, MV140, Safely Reduces Risk of Recurrent Urinary Tract Infection in Women. *Pathogens*, *12*(3), 359. https://doi.org/10.3390/pathogens12030359

Odoki, M., Almustapha Aliero, A., Tibyangye, J., Nyabayo Maniga, J., Wampande, E., Drago Kato, C., Agwu, E., & Bazira, J. (2019). Prevalence of Bacterial Urinary Tract Infections and Associated Factors among Patients Attending Hospitals in Bushenyi District, Uganda. *International Journal of Microbiology*, *2019*, 1–8. https://doi.org/10.1155/2019/4246780

Saber, S., Yasmin, N., Alam, M. T., Hossain, M. M., & Alam, R. F. (2021). Study on Urinary Tract Infection Among Females of Reproductive Age Group in Tertiary Care Teaching Hospital, Dhaka, Bangladesh. *European Journal of Medical and Health Sciences*, *3*(1), 85–89. https://doi.org/10.24018/ejmed.2021.3.1.680

Sanyaolu, L. N., Hayes, C. V., Lecky, D. M., Ahmed, H., Cannings-John, R., Weightman, A., Edwards, A., & Wood, F. (2023). Patients' and Healthcare Professionals' Experiences and Views of Recurrent Urinary Tract Infections in Women: Qualitative Evidence Synthesis and Meta-Ethnography. *Antibiotics*, *12*(3), 434. https://doi.org/10.3390/antibiotics12030434

Sundas, A., Azhar, S., Ahmed, J., Chaudhry, B., Gajdács, M., & Jamshed, S. (2024). Knowledge, attitudes and practices of pregnant women regarding urinary tract infections living in peripheral areas of Pakistan: A questionnaire-based cross-sectional study. *Clinical Epidemiology and Global Health*, *28*, 101591. https://doi.org/10.1016/j.cegh.2024.101591

Tabassum, F., V, Most. N., & Manik, Md. I. N. (2021a). Assessment of knowledge and awareness regarding urinary tract infections among the university students of Bangladesh. *International Journal Of Community Medicine And Public Health*, *8*(2), 564. https://doi.org/10.18203/2394-6040.ijcmph20210203

Tabassum, F., V, Most. N., & Manik, Md. I. N. (2021b). Assessment of knowledge and awareness regarding urinary tract infections among the university students of Bangladesh. *International Journal Of Community Medicine And Public Health*, *8*(2), 564. https://doi.org/10.18203/2394-6040.ijcmph20210203

Tan, C., & Chlebicki, M. (2016). Urinary tract infections in adults. *Singapore Medical Journal*, *57*(09), 485–490. https://doi.org/10.11622/smedj.2016153

Torondel, B., Sinha, S., Mohanty, J. R., Swain, T., Sahoo, P., Panda, B., Nayak, A., Bara, M., Bilung, B., Cumming, O., Panigrahi, P., & Das, P. (2018). Association between unhygienic menstrual management practices and prevalence of lower reproductive tract infections: A hospital-based cross-sectional study in Odisha, India. *BMC Infectious Diseases*, *18*(1), 473. https://doi.org/10.1186/s12879-018-3384-2

*Urinary tract infection (UTI)—Symptoms and causes*. (n.d.). Mayo Clinic. Retrieved January 25, 2026, from https://www.mayoclinic.org/diseases-conditions/urinary-tract-infection/symptoms-causes/syc-20353447

Vigila Christy R, Athinarayanan G, Mariselvam R, Dhasarathan P, & Ranjitsingh A J A. (2020). Epidemiology of urinary tract infection in South India. *World Journal of Biology Pharmacy and Health Sciences*, *1*(1), 025–032. https://doi.org/10.30574/wjbphs.2020.1.1.0003

Vyas, S., Varshney, D., Sharma, P., Juyal, R., Nautiyal, V., & Shrotriya, V. (2015a). An overview of the predictors of symptomatic urinary tract infection among nursing students. *Annals of Medical and Health Sciences Research*, *5*(1), 54. https://doi.org/10.4103/2141-9248.149790

Vyas, S., Varshney, D., Sharma, P., Juyal, R., Nautiyal, V., & Shrotriya, V. (2015b). An overview of the predictors of symptomatic urinary tract infection among nursing students. *Annals of Medical and Health Sciences Research*, *5*(1), 54. https://doi.org/10.4103/2141-9248.149790

Yang, X., Chen, H., Zheng, Y., Qu, S., Wang, H., & Yi, F. (2022). Disease burden and long-term trends of urinary tract infections: A worldwide report. *Frontiers in Public Health*, *10*, 888205. https://doi.org/10.3389/fpubh.2022.888205

Yun, Z., Powell, D., Mulgirigama, A., & Miyazaki, J. (2024). The emotional impact of uncomplicated urinary tract infections in women in China and Japan: A qualitative study. *BMC Women's Health*, *24*(1), 94. https://doi.org/10.1186/s12905-023-02675-8

## ADDITIONAL INFORMATION

**Correspondence** All inquiries and requests for additional materials should be directed to the Corresponding Author.