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Research Article

A Qualitative Study on Urinary Tract Infections Among Adult Patients in Bost University Hospital, Helmand

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Abstract:

Urinary tract infections (UTIs) are the leading cause of hospital visits worldwide, significantly impacting patients with underlying illnesses. To effectively manage UTIs, it is essential to understand the causes of these conditions. This study aimed to determine the prevalence of UTIs and identify the contributing factors among adult patients attending Bost University Hospital (BUH). A cross-sectional study involved 1768 patients from the internal medicine department at BUH. Among these patients, 125 (7.07% of total visitors) were diagnosed with UTIs, 108 of whom were interviewed.

The findings revealed that 57 of 108 patients (52.7%) experienced recurrent UTIs. Most diagnosed UTI patients were female (77.7%), and 92 of the 108 participants were married. The participants reported various signs and symptoms, including burning, dysuria, fever, frequency, abdominal pain, cloudy urine, urgency, chills, dribbling, and blood in urine.

The outcomes of this study will provide valuable insights for researchers, policymakers, and public health organizations seeking to address the factors contributing to UTIs. However, it is essential to acknowledge the study's limitations, such as the relatively small sample size and the fact that it was conducted exclusively among patients visiting the outpatient department of BUH's internal medicine department. Although these findings may not represent the general population, they are a starting point for further research.

Key words: Urinary Tract Infections, UTI Prevalence, Bost University Hospital, Helmand

Introduction

Urinary tract infections (UTIs) are prevalent bacterial infections that affect individuals worldwide and continue to be a significant public health concern (Foxman, 2014). They can occur at any age and are more frequently observed in females than males (Nicolle, 2014). UTIs arise when bacteria enter the urinary tract, leading to infections in various body parts, such as the urethra, bladder, ureters, or kidneys (Hooton, 2012). Escherichia coli (E. coli), a bacterium of the intestinal tract, is the primary cause of UTIs, resulting in a range of symptoms including frequent and painful urination, cloudy or bloody urine, and lower abdominal pain (Flores-Mireles et al., 2015).

Globally, UTIs account for millions of medical visits and substantial annual healthcare costs, significantly burdening healthcare systems (Flores-Mireles et al., 2015). The incidence of UTIs varies across countries and regions (Kline et al., 2018). For example, higher rates of antibiotic use in developed countries have led to a higher prevalence of UTIs and the emergence of multidrug-resistant bacteria (Flores-Mireles et al., 2015).

Numerous factors contribute to the prevalence of UTIs in lower-income Asian countries. Researchers have highlighted poor sanitation conditions, overcrowding, and limited access to clean water and hygiene facilities as significant factors leading to a high burden of UTIs in Asian countries (Chen et al., 2019). Cultural practices and dietary habits unique to Asia may further contribute to the development of UTIs (Devi et al., 2016).

Although research on UTIs in Afghanistan is limited, existing studies have shed light on the incidence of UTIs in countries with similar demographics. A high prevalence of UTIs has been reported in Afghanistan, particularly among women (Iqbal et al., 2016), and it emphasizes the urgent need for improved awareness, preventive measures, and access to appropriate healthcare services to address the burden of UTIs in the female population in Afghanistan. In addition, managing and treating UTIs has become more challenging considering the impact of conflict and instability in Afghanistan (Bartoloni et al., 2020). However, research focusing on UTIs in Afghanistan is crucial to understanding and addressing these challenges.

A retrospective study by Rasekh et al. (2022) conducted at Bost Provincial Hospital in Helmand, Afghanistan, included 90 hospitalized patients with UTIs. The study data showed that the incidence of UTIs was high in patients aged 14-45 (62.5%), with adults over 45 years at 28.4%. According to the results of this study, the incidence of UTIs decreased in the age group below 14 years by 4.5%. The study concluded that UTIs

constituted 1.2% of hospitalized patients at the target hospital in 2019 (Rasekh et al., 2022).

Significant progress has been made in understanding the epidemiology, risk factors, and treatment strategies for UTIs in different populations through extensive research studies (Hooton et al., 2019). These studies have contributed to our understanding of regional variations in the incidence, risk factors, and management approaches for UTIs (Bonkat et al., 2019). Specific focus is needed to identify risk factors for populations in lower or developing countries to improve treatment options and reduce incidence. Our review focused on populations in Asian countries such as Afghanistan and seeks to provide information on incidence, treatment options, and reduction of the risk factors for the target demographic.

We conducted a health-facility-based cross-sectional study to investigate the prevalence of UTIs in the Helmand Province region in rural Afghanistan. This region lacks adequate healthcare services, contributing to a high burden of infectious diseases, including UTIs. This study provides crucial data to assist policymakers and researchers in implementing preventive measures and treatment strategies to address the incidence of UTIs among populations in rural Afghanistan.

Literature review

Global Prevalence and Risk Factors

Urinary tract infections (UTIs) are a global health concern affecting people of all ages and genders worldwide. Recent global estimates show that UTIs account for approximately 150 million cases annually (Kline et al., 2018). Several risk factors have been associated with UTIs, including gender, sexual activity, catheterization, urinary tract abnormalities, and compromised immune function (Wullt et al., 2019). Various diagnostic methods to address symptoms and improve outcomes come with the global prevalence of UTIs.

Diagnostics

Prompt and accurate diagnosis is crucial for effective management of UTIs. Traditional culture-based methods such as routine urine cultures, anaerobic bacterial urine cultures, fungal urine cultures, and mycobacterial urine cultures are the gold standard for diagnosis despite being time-consuming (Najar et al., 2014). These methods aim to identify the causative pathogen in the urine via culturing the urine. The culture facilitates the bacteria growth to a detectable level, followed by serological and biochemical tests to determine the pathogen's sensitivity to antibiotics (Franco-Duarte et al., 2019). The turnaround time for these tests is typically 48-72 hours (Davenport et al., 2017).

However, the emergence of molecular diagnostic technologies such as polymerase chain reaction (PCR) has enabled faster and more specific identification of UTI-causing pathogens (Najar et al., 2014). The addition of testing for biomarkers of inflammation has provided an additional advantage in ascertaining the severity of UTI infections. One of these methods is C-reactive protein (CRP). Narayan Swamy et al. (2022) indicated that a remarkable increase in CRP can assist in differentiating upper urinary tract infection from lower urinary tract infection to initiate effective management. The study results suggested that an increased CRP of more than 100mg/dl can indicate upper urinary tract infections (Narayan Swamy et al., 2022).

Another marker that can assist in the diagnosis of UTI is procalcitonin. Procalcitonin is an essential biomarker for early detection of systemic bacterial infection (Cleland & Eranki, 2023). Other biomarkers, such as CRP, have less specificity than procalcitonin to distinguish bacterial and non-bacterial infection accurately (Riedel et al., 2011). Other biomarkers, such as CRP, have less specificity than procalcitonin to distinguish bacterial from non-bacterial infection accurately (Riedel et al., 2011). In a cross-sectional study, Darogha et al. (2021) indicated that the procalcitonin level significantly increases ($p<0.0001$) in patient populations with UTI. According to Schuetz et al. (2019), it is critical to use procalcitonin in the context of clinical presentations for the patient population when making clinical decisions. Moreover, applying biomarkers such as CRP and procalcitonin has shown promise for distinguishing between uncomplicated and complicated UTIs (Yim et al., 2019).

Treatment Strategies

Empirical antimicrobial therapy is commonly initiated for uncomplicated UTIs based on the prevalent pathogens and resistance patterns in a particular region. The incidence of antibiotic resistance in developing countries accounts for 55.5-85.5% of the primary etiological pathogen of UTIs, *Escherichia coli*, to fluoroquinolones (Kot, 2019). In lower and middle-income countries, antibiotic resistance might increase without appropriate surveillance and improper use of antibiotics (Shaifali et al.,2012).

Additionally, the increasing global burden of antibiotic resistance has led to the development of alternative treatments. These include probiotics, vaccines, and novel antimicrobial agents (Flores-Mireles et al., 2015). Moreover, non-pharmacological preventive measures such as adequate fluid intake and hygiene practices are vital in reducing the risk of recurrent UTIs (Koenig et al., 2020). Addressing these preventative measures is needed through detailed and consistent patient education programs.

Patient Education

Patients' level of health literacy is critical to improving disease outcomes (Shiri-Mohammadabad & Afshani, 2022). Appropriate health literacy can help patients with UTIs seek timely care, communicate with clinicians, and decide on follow-up treatment (Nawabi et al., 2021). However, only 43% of people in Afghanistan were deemed literate in 2019 (United et al. Organization,2020). In a qualitative study, Khan et al. (2023) indicated that patients with hypertension had lower health literacy levels with suboptimal medication adherence and follow-up with their primary care providers in a hospital-based study in Kabul City, Afghanistan.

Multiple study results have highlighted that health literacy is a critical component of self-efficacy behavior in preventive care

(Korasani et al., 2021; Sorensen et al., 2012). Eslami et al. (2023), in a cross-sectional study, found that health literacy can enhance UTI-preventive behavior in pregnant women, and they suggested that women with adequate levels of health literacy might comprehend health information and actively participate in care, resulting in improved outcomes. Identifying the incidence of UTIs in Afghanistan to focus our review further and identify the specific challenges for patients seeking treatment is essential.

UTIs in Afghanistan

Lower-income Asian countries, like Afghanistan, face significant challenges in controlling UTIs owing to their dense population, inadequate sanitation facilities, and limited access to healthcare services in rural areas (Yim et al., 2019). Various studies conducted in some Asian countries have reported UTI prevalence rates ranging from 20 to 50% (Yim et al., 2019). Pathogens commonly isolated in Asian countries include Escherichia coli and Klebsiella pneumonia (Kanamori et al., 2018). UTIs in developing countries also exhibit alarming levels of antibiotic resistance, particularly those infections containing extended-spectrum beta-lactamase (ESBL))-producing bacteria (Kanamori et al., 2018).

Afghanistan, an Asian country with a history of conflict and limited healthcare infrastructure, faces unique challenges in UTI management. There is limited epidemiological data on UTI prevalence and antimicrobial resistance in Afghanistan (Chowdhury et al., 2017). However, a study conducted in a tertiary care hospital in the capital city of Kabul in 2017 highlighted the predominance of multi-drug resistant E. coli strains in UTI cases seen at this hospital (Chowdhury et al., 2017). Unfortunately, this data is limited and may not apply widely to the population, resulting in challenges for both diagnosis and treatment. Along with these challenges comes the lack of access to medical care for a majority of the Afghani population in rural areas.

Access to medical care and pharmaceuticals

According to Vogel (2014), access to healthcare and medicine is limited in Afghanistan for various reasons, such as poor access to healthcare facilities and patient population financial issues. Medecins Sans Frontiers, a hospital-based survey, indicated that about 46% of patients delayed treatment for various reasons (Vogel, 2014). Moreover, the World Health Organization's minimum threshold for health professionals to provide healthcare services to 10,000 people is 22.8 skilled healthcare personnel (Safi et al., 2018).

However, available data in Afghanistan indicates that Afghanistan has 9.4 skilled healthcare personnel per 10,000 people, indicating severe shortages of available medical providers and significantly limiting access to needed medical care for the majority of the population (Safi et al., 2018). Our study highlights the issues and incidence of UTIs in a target population of patients treated at Bost Hospital in Helmand province, Afghanistan, between February and April 2022.

Study Design

This health facility-based, cross-sectional prospective study was conducted at Bost University Hospital (BUH) in Lashkargah City, Afghanistan, to investigate urinary tract infections (UTIs) among patients attending the outpatient department of internal medicine. BUH is a teaching hospital affiliated with Bost University. Of the 1768 patients who visited BUH between February 26 and April 6, 2022, 125 were diagnosed with UTIs. Of these, 108 agreed to participate in this study. Data collection methods included face-to-face interviews with patients diagnosed with UTIs. A structured questionnaire was used to collect demographic information (e.g., age, gender, occupation, and education level), UTI symptoms, medical history of UTIs, any other chronic diseases, and any risk factors for UTIs. The inclusion and exclusion criteria were as follows:

- Patients who agreed to participate in the interviews and complete the surveys
- Patients who were provisionally diagnosed with UTIs
- Patients aged between 18 and 60 years
- Patients who were seriously ill or refused to participate were excluded from this study.

Purpose

This study aims to determine the prevalence of UTIs in Helmand, Afghanistan, providing valuable information for healthcare professionals, policymakers, and researchers to develop targeted interventions and strategies for preventing and managing UTIs in these communities. The study also seeks to identify potential risk factors associated with UTIs in rural areas through a comprehensive demographic, socioeconomic, and behavioral analysis. Understanding these risk factors can aid in designing effective prevention and management strategies tailored to the unique needs of rural communities, improving overall health outcomes related to UTIs.

Methodology

A structured interview with 7 (see Table 1) questions was conducted in person and face-to-face by house officers at Bost University Hospital in Helman, Afghanistan. The questionnaire was created by a focus group of clinicians practicing in Helmand, Afghanistan. Before the interview, the patient completed the informed consent, and we provided information about the purpose of this study. Overall, the interview process was well-structured and designed to ensure the patient's needs were met while gathering the necessary information for medical and research purposes.

Table 1: Survey Questions

No	Questions
	When did urinary system symptoms occur? …….
	What symptoms do you get with a urine infection? Burning Dysuria Frequency Urgency Abdominal Pain Cloudy urine Dribbling/ dropping urine Blood in the urine Fever Chills Not listed above (please describe below)
	Have you used a urinary catheter? Yes / No
	From which source do you get your water? Bore hole Deep well Canal/ Stream Hand Pump Other
	Did you get UTI Previously? Yes, When? ……..... No
	Did you take any therapy for UTI? *Yes / No* Period of usage: ……. How many times did you take therapy? ……
	Which of the following do you use or have you used after urination for drops drying/ Cleaning? Water Tissue Paper Soil or Clod Other (What? ……)

Data analysis

The collected data were analyzed using Microsoft Excel and Microsoft Survey Forms. Descriptive statistics were used to calculate the total number of patients seen during the study period, the percentage of UTIs identified, gender, socioeconomic status, educational status, occupation, marital status, signs and symptoms of UTIs, frequency or incidence of UTIs in the past, hygiene methods, and any comorbidities in the target population.

Ethical considerations

Ethical approval for this study was obtained from the Research and Ethics Committee of Bost University in Lashkargah City, Afghanistan. Informed consent was obtained from each participant prior to the interviews. Participants were provided with information about the purpose of the study. Study participants were assured of maintaining privacy and confidentiality by not collecting their identifying information.

Results

The study spanned 40 days, comprising 35 business days. Five days of the 40 days were holidays, where no research was conducted. During this timeframe, 1768 patients sought treatment in the internal medicine department. Among them, only 125 patients met the specific criteria for our study by being diagnosed with a UTI. This proportion accounts for 7.07% of

the total patient population seen in the clinic during the study period; see Figure 2.

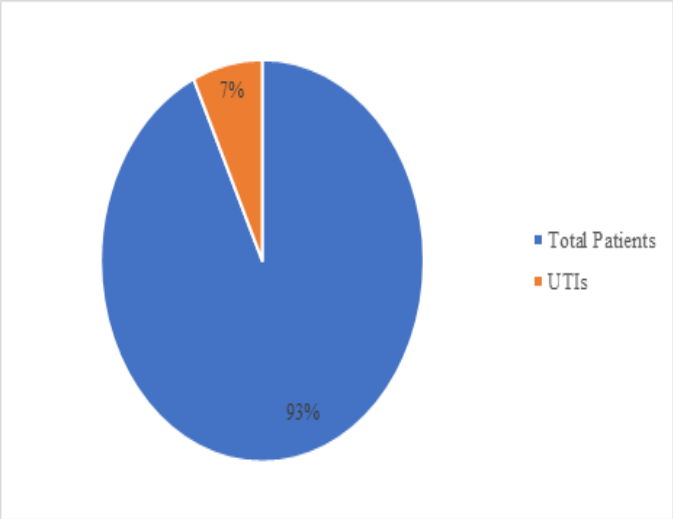

Figure 2: Percentage of Patients with UTI

Of the 125 patients with UTI, 108 agreed to participate in this study. Among the entire patient population (1768), 1215 were female (68.72%), and 553 were male (31.27%). Therefore, the gender distribution of our study participants mirrored that of the patient population, with 84 of 108 participants being female (77.7%) and 24 of 108 participants being male (22.3%).

Demographics

Around 74.7% of participants indicated that they have no education. Among participants with a lower literacy level, 73 were female, representing a high percentage (91.25 %). The majority of females stated their occupation as "housewife." Also, 92 participants reported marital status as married, and 16 were single. Participants reported their signs and symptoms of UTIs were as follows; see Figure 3.

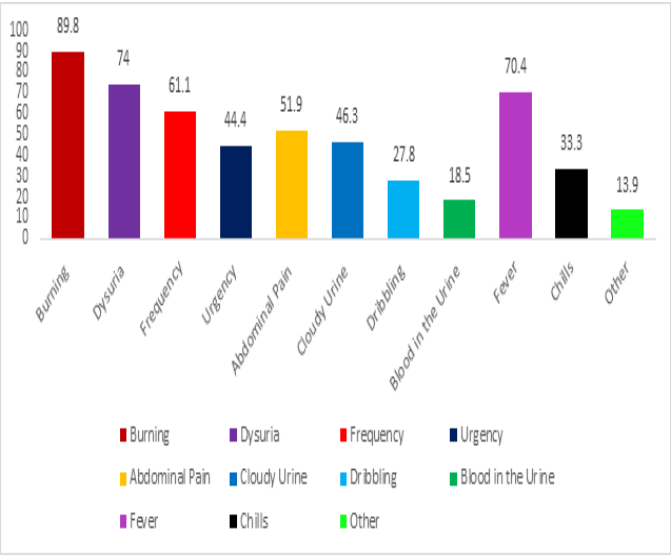

Figure 3: UTI Sign and Symptom Percentage

Recurrent UTIs were common among the participants, with 57 of 108 (52.7%) reporting that they had experienced UTIs at least once before seeking treatment for their current symptoms. Among the 57 patients with recurrent UTIs, 22 previously underwent five or more therapies to treat symptoms; see Figure 4.

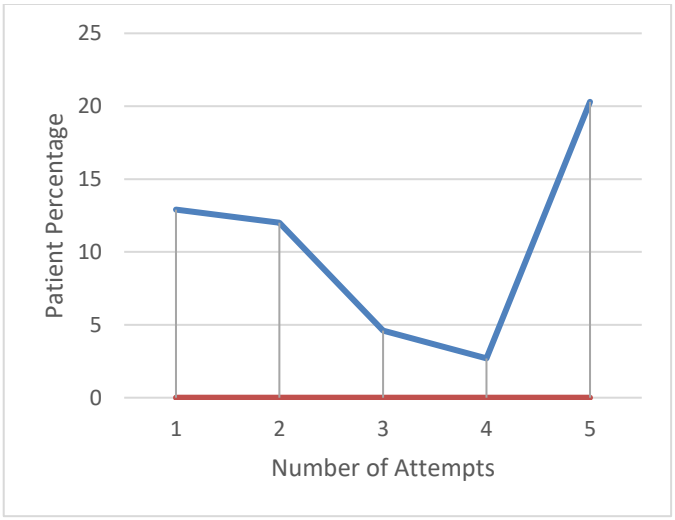

Figure 4: Number of Attempts to Treat UTI and Patient Percentage

Various methods were reported when the participants were asked about their drying or cleaning practice after urination. Participants commonly used water alone while others indicated other cleaning methods such as tissue paper, soil, clod, and others; see Figure 5.

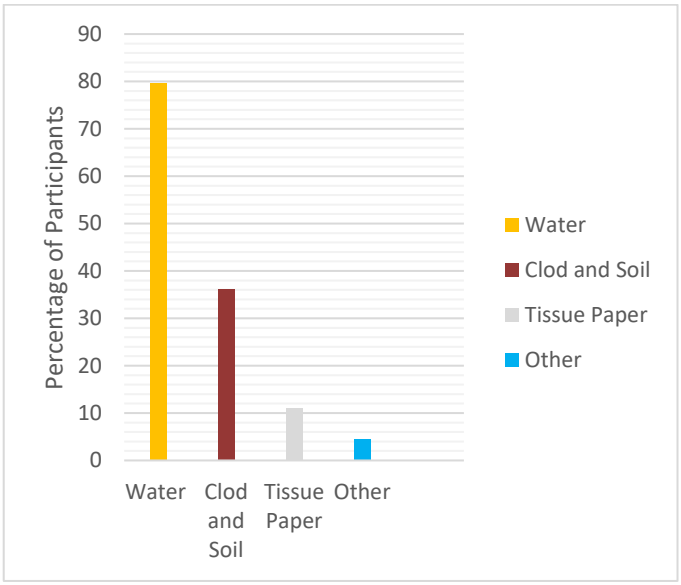

Figure 5: Material Used for Urination Cleaning

Based on patient interviews, this study identified that out of 1768 patients who visited the internal medicine department during the 40-day study period at Bost University Hospital, 125 (7.07%) were diagnosed with UTIs. Among the 108 UTI patients interviewed, 84 were female with the lowest level of health literacy and exhibited different signs and symptoms of UTIs than did the male patients. The most commonly identified symptoms included dysuria, burning, abdominal pain, fever, and chills. Recurrence was found to be common, with 57 of the participants in the sample (52.7%) experiencing repeated episodes, 22 of whom (20.4%) had sought treatment five or more times in the past.

Discussion

Urinary tract infections (UTI), a common cause of hospital visits, are a prevalent health issue worldwide, particularly in

lower-income countries such as Afghanistan (Miller et al., 2021). Common risk factors include a lack of awareness of hygiene and sanitation practices (Miller et al., 2021). Moreover, healthcare services are inadequate, especially in rural areas with limited access to primary healthcare due to provider shortages (Medina & Castillo-Pino, 2019). Consequently, the population suffers from various health problems, including UTIs.

In this study, the prevalence of UTIs among patients seen in Bost University's internal medicine ward was 7.07% for 1,768 patients seen during the study period. Recurrent UTIs were also observed in 57 of 108 (52.7%) patients (both male and female), suggesting that timely and accurate diagnosis and treatment are lacking or that access to essential healthcare services is limited. Of the total sample participants, 74.7% reported needing more education on the symptoms and treatment for UTIs, likely contributing to their lack of awareness of UTI prevention and hygiene practices. Notably, 77.7% of the interviewed UTI patients, 84 out of 108, were married females, indicating a significantly higher number of female UTI cases in the sample. This finding aligns with previous research demonstrating a correlation between the incidence of UTI and married female patients.

We found that 77.7% of participants were female, 74.7% indicated that they were illiterate, and 52.7% highlighted a recurrent history of UTI. Tegegne et al. (2023), in a systemic review and meta-analysis, suggested that the prevalence of UTI was significantly higher among illiterate ($P<0.01$), female ($P<0.01$), and patient populations with recurrent UTIs ($P<0.01$). Moreover, several study results suggested that a lower level of education, previous history of UTIs, marital status, and socioeconomic status can increase the risk of UTIs (Sharma et al., 2015; Singh et al., 2020; Wang et al., 2017).

Low literacy levels, specifically health literacy, can dramatically affect patients' ability to identify symptoms, seek treatment, and participate in follow-up with proper medication compliance (Khan et al., 2023). These findings are consistent with our patient population results, which show 52.7% recurrent UTIs. Approximately 36.1% of participants indicated using dirt clod and soil for perineal hygiene. In a cross-sectional study, Jelly et al. (2022) found that poor perineal hygiene was associated with UTIs. Also, Aggarwal and Lotfollahzadeh (2022) state that poor perineal hygiene can increase the risk of UTIs, which appears to be consistent with our study findings with 36.1% using methods other than water for cleansing after urination or defecation.

Conclusion

UTIs are a common global health issue impacting individuals and healthcare systems. Research studies, including those focused on Asia and Afghanistan, play a vital role in understanding the regional variations in UTI incidence, risk factors, and management strategies. By delving deeper into the latest research papers and studies, valuable insights can guide efforts toward preventing, diagnosing, and treating UTIs, ultimately improving the well-being of affected individuals worldwide.

Our study's findings revealed that 125 of 1768 individuals who sought care at the outpatient department of Bost University Hospital's Internal Medicine Department between February 26 and April 06, 2021, were diagnosed with urinary tract infections. Some were experiencing the recurrence of a UTI after undergoing treatment in the past. Some participants reported utilizing unhygienic materials such as clods and soil to cleanse urinary structure post-urination, contributing to the risk of exogenous-induced UTIs. We found that low literacy levels, specifically low health literacy, contributed to patients not seeking treatment, delaying treatment, or unsuccessfully treating prior UTIs. Most of these patients were women.

Therefore, conducting public health awareness campaigns and appropriate patient education is crucial as establishing new healthcare facilities for improved access to care. Campaigns and strategies prioritizing marginalized groups of women and girls are needed to provide them with adequate services geared toward their levels of health literacy. Further research regarding UTIs in Afghanistan is recommended to delve into the contributing factors, infectious diseases within the population, and sexual and reproductive health-related issues to gain a better understanding and develop targeted interventions.

Limitations

The study was limited by recall bias, as patients may not remember all the details of their medical history and risk factors. In addition, the study was not representative of the general population as it only included patients who had attended the hospital for 35 days. Furthermore, the sample size was relatively small (n=108), and the study was conducted exclusively among patients visiting the outpatient department of BUH's Internal Medicine. Therefore, our findings cannot be generalizable to the general population. This study serves as a starting point for further research in this area.

Data Availability

The dataset is available upon request.

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Conflict of interest

The authors declare that they have no conflicts of interest.

Reference

1. Aggarwal, N., & Lotfollahzadeh, S. (2022). Recurrent urinary tract infections. In *StatPearls [Internet]*. StatPearls Publishing.
2. Bonkat, G., Bartoletti, R., Bruyère, F., Wagenlehner, F. M., Mezei, T., Schubert, S., Pilatz, A., Ivanovski, O., Geerlings, S. E., Köves, B., Kulchavenya, E., Perepanova, T., & Spajic, D. (2019). EAU Guidelines on Urological Infections. *European Urology*, 76(5), 757-768. doi:10.1016/j.eururo.2019.09.035.
3. Bartoloni, A., Suardi, V., Bartalesi, F. (2020). Challenges and opportunities in current urogenital tuberculosis.

Journal of Chemotherapy, 32(01), 1-12. doi:10.1080/1120009X.2019.1703523

4. Chen, C. J., Wu, F. H., & Lei, W. Y. (2019). Knowledge, Attitudes, and Practice Survey on Urinary Tract Infection Prevention Among Women in Selected Asian Countries: A Systematic Review of the Literature. *Asia Pacific Journal of Public Health*, 31(5), 403-419. doi:10.1177/1010539519856426.
5. Darogha, S. N., Azeez, S. H., & Abdullah, Z. G. (2022). Evaluation of Procalcitonin and Interleukin-6 as a Marker of Bacterial Urinary Tract Infection. *Cellular and Molecular Biology (Noisy-le-Grand,France)*, *67*(4), 203–213. https://doi.org/10.14715/cmb/2021.67.4.23.
6. Davenport, M., Mach, K. E., Shortliffe, L. M. D., Banaei, N., Wang, T. H., & Liao, J. C. (2017). New and developing diagnostic technologies for urinary tract infections. *Nature Reviews Urology*, *14*(5), 296-310.
7. Devi, K., Borkakoty, B., & Mahanta, J. (2016). Urinary Tract Infection by Bacterial Pathogens: Current Scenario and Concerns. *Indian Journal of Medical Microbiology*, 34(1), 1-12. doi:10.4103/0255-0857.174123.
8. Eslami, V., Sany, S. B. T., Tehrani, H., Ghavami, V., & Peyman, N. (2023). Examining health literacy and self-efficacy levels and their association with preventive behaviors of urinary tract infection in Iranian pregnant women: across sectional study. *BMC Women's Health*, *23*(1), 258.
9. Franco-Duarte, R., Černáková, L., Kadam, S., Kaushik, K. S., Salehi, B., Bevilacqua, A., Corbo, M. R., Antolak, H., Dybka-Stępień, K., Leszczewicz, M., Relison Tintino, S., Alexandrino de Souza, V. C., Sharifi-Rad, J., Coutinho, H. D. M., Martins, N., & Rodrigues, C. F. (2019). Advances in Chemical and Biological Methods to Identify Microorganisms-From Past to Present. *Microorganisms*, *7*(5), 130. https://doi.org/10.3390/microorganisms7050130.
10. Flores-Mireles, A. L., Walker, J. N., Caparon, M., & Hultgren, S. J. (2015). Urinary Tract Infections: Epidemiology, Mechanisms of Infection and Treatment Options. *Nature Reviews Microbiology*, 13(5), 269-284. doi:10.1038/nrmicro3432
11. Foxman, B. (2014). Urinary Tract Infection Syndromes: Occurrence, Recurrence, Bacteriology, Risk Factors, and Disease Burden. *Infectious Disease Clinics of North America*, 28(1), 1-13. doi:10.1016/j.idc.2013.09.003
12. Hooton, T. M. (2012). Clinical Practice. Uncomplicated Urinary Tract Infection. *New England Journal of Medicine*, 366(11), 1028-1037. doi:10.1056/NEJMcp1104429
13. Hooton, T. M., Roberts, P. L., Cox, M. E., Stapleton, A. E., & Gupta, K. (2019). Within-patient and Between-patient Biological Variation in Nitrite and White Blood Cell Count As Markers of Urinary Tract Infection. *Clinical Infectious Diseases*, 68(5), 798-803. doi:10.1093/cid/ciy588
14. Iqbal, M., Amjad, N., Sadaf, R., Mirza, I. A., Bhutta, S., & Sabir, S. (2016). Urinary Tract Infection: Bacteriology and Antimicrobial Resistance Pattern of E. coli in Afghanistan. *Open Access Macedonian Journal of Medical Sciences*, 4(3), 428-431. doi:10.3889/oamjms.2016.089.
15. 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*, 122. https://doi.org/10.4103/jehp.jehp_750_21.
16. Khan, A., Tidman, M. M., Najib, H., & Darmal, I. (2023). A Qualitative Study on the Effects of Health Literacy in Population with Hypertension at Blossom Health Care Center, Kabul City, Afghanistan. Journal of Health and Medical Sciences, 6(3), 15-25.
17. Khorasani, E. C., Sany, S. B. T., Orooji, A., Ferns, G., & Peyman, N. (2020). Health literacy in Iranian women: a systematic review and meta-analysis. *Iranian Journal of Public Health*, *49*(5), 860.
18. Kline, K. A., Lewis, A. L., Nicolau, D. P., & Yates, D. M. (2018). Antibacterial Pharmacodynamics at Various Intracellular Concentrations of Antibiotics Against a Model of Staphylococcus Aureus Biofilm and Intracellular Macrophage Infection. *Journal of Antimicrobial Chemotherapy*, 73(6), 1593-1600. doi:10.1093/jac/dky054.
19. Kot, B. (2019). Antibiotic Resistance Among Uropathogenic *Escherichia coli*. *Polish Journal of Microbiology*, *68*(4), 403–415. https://doi.org/10.33073/pjm-2019-048.
20. Medina, M., & Castillo-Pino, E. (2019). An introduction to the epidemiology and burden of urinary tract infections. *Journal of Multidisciplinary Healthcare*, 12, 347–355. https://doi.org/10.2147/JMDH.S175165.
21. Miller, M., Lamb, M., Rivera, C., Montes, S. B., Jimenez-Zambrano, A., Bolanos, A., Asturias, E., Berman, S., & Harrison, M. S. (2021). Risk Factors and Referral Rates for Urinary Tract Infection in Pregnant Mothers of Southwest Guatemala. *Journal of Women's Health and Development*, *4*(4), 110–112.
22. Narayan Swamy, S. N., Jakanur, R. K., & Sangeetha, S. R. (2022). Significance of C-reactive Protein Levels in Categorizing Upper and Lower Urinary Tract Infection in Adult Patients. *Cureus*, *14*(6), e26432. https://doi.org/10.7759/cureus.26432
23. Nicolle, L. E. (2014). Urinary Tract Infections in Special Populations: Diabetes, Renal Transplantation, HIV Infection, and Spinal Cord Injury. *Infectious Disease Clinics of North America*, 28(1), 91-104. doi:10.1016/j.idc.2013.09.007
24. Rasekh, A., et al. (2022). Case study of urinary tract infection in Bost Hospital, Helmand province. *Bost Academic & Research National Journal*, 1(1), 2-8.
25. Chowdhury FR, Rokonuzzaman M, Sarmin MNR, Qadri F, Islam K, Nahar J, et al. (2017). Prevalence of extended-spectrum β-lactamase-positive and multidrug-resistant bacterial infections in patients with urinary tract infection: a tertiary-care hospital-based study from North-East India. *Indian Journal of Med Microbiology*, 35(2), 293-295.

26. Flores-Mireles AL, Walker JN, Caparon M, Hultgren SJ (2015). Urinary tract infections: epidemiology, mechanisms of infection and treatment options. *Nature Reviews Microbiology*, 13(5), 269-284.
27. Lucero-Prisno, D. E., 3rd, Essar, M. Y., Ahmadi, A., Lin, X., & Adebisi, Y. A. (2020). Conflict and COVID-19: a double burden for Afghanistan's healthcare system. *Conflict and Health*, *14*, 65. https://doi.org/10.1186/s13031-020-00312-x.
28. Kanamori H, Yano H, Hirakata Y, Endo S, Aoyagi T, Hatta M et al. (2018). High prevalence of extended-spectrum β-lactamases and an incidence of ertapenem resistance among clinical isolates of Escherichia coli causing healthcare-onset infections in Japan. *Journal of Antimicrobial Chemotherapy*, 73(4), 877-884.
29. Kline KA, Lewis AL (2018). Gram-Positive Uropathogens, Polymicrobial Urinary Tract Infection, and the Emerging Microbiota of the Urinary Tract. *Microbiology Spectrum*, 7(4), 1-19.
30. Koenig JF, Costa E, Hooton TM, Munoz-Price LS (2020). Management of Urinary Tract Infections in the Extended Care Setting. *Infectious Disease Clinics*, 34(3), 601-617.
31. Najar MS, Saldanha CL, Banday KA (2014). Approach to urinary tract infections. *Indian Journal of Nephrology*, 24(2), 79-86.
32. Nawabi, F., Krebs, F., Vennedey, V., Shukri, A., Lorenz, L., & Stock, S. (2021). Health literacy in pregnant women: a systematic review. *International Journal of Environmental Research and Public Health*, *18*(7), 3847.
33. Riedel, S., Melendez, J. H., An, A. T., Rosenbaum, J. E., & Zenilman, J. M. (2011). Procalcitonin as a marker for the detection of bacteremia and sepsis in the emergency department. *American Journal of Clinical Pathology*, *135*(2), 182–189. https://doi.org/10.1309/AJCP1MFYINQLECV2.
34. Safi, N., Naeem, A., Khalil, M., Anwari, P., & Gedi, G. (2018). Addressing health workforce shortages and maldistribution in Afghanistan. *Eastern Mediterranean Health Journal*, *24*(9).
35. Schuetz, P., Wirz, Y., Sager, R., Christ-Crain, M., Stolz, D., Tamm, M., Bouadma, L., Luyt, C. E., Wolff, M., Chastre, J., Tubach, F., Kristoffersen, K. B., Burkhardt, O., Welte, T., Schroeder, S., Nobre, V., Wei, L., Bucher, H. C., Bhatnagar, N., Annane, D., … Mueller, B. (2017). Procalcitonin to initiate or discontinue antibiotics in acute respiratory tract infections. *The Cochrane Database of Systematic Reviews*, *10*(10), CD007498. https://doi.org/10.1002/14651858.CD007498.pub3.
36. Shiri-Mohammadabad, H., & Afshani, S. A. (2022). Does Health Literacy cause better women's self-care performance? A Cross-Sectional Study in Iran. *Journal of Health Literacy*, *7*(1), 56-66.
37. Sharma, R., Negi, S., Kunj, D., & Sharma, V. (2015). Menstrual hygiene among adolescent girls. *Indian Journal of Community Health*, *27*(3), 376-380.
38. Shaifali, I., Gupta, U., Mahmood, S. E., & Ahmed, J. (2012). Antibiotic susceptibility patterns of urinary pathogens in female outpatients. *North American Journal of Medical Sciences*, *4*(4), 163–169. https://doi.org/10.4103/1947-2714.94940.
39. Singh, A., Gupta, V., Agrawal, D., Goyal, P., Singh, M., & Lukhmana, S. (2020). A cross-sectional study to investigate the impact of focused group discussion on menstrual hygiene among rural school girls of Southern Haryana, India. *Journal of Education and Health Promotion*, *9*, 260. https://doi.org/10.4103/jehp.jehp_475_20.
40. Sørensen, K., Van den Broucke, S., Fullam, J., Doyle, G., Pelikan, J., Slonska, Z., & Brand, H. (2012). Health literacy and public health: a systematic review and integration of definitions and models. *BMC Public Health*, *12*(1), 1-13.
41. Tegegne, K. D., Wagaw, G. B., Gebeyehu, N. A., Yirdaw, L. T., Shewangashaw, N. E., & Kassaw, M. W. (2023). Prevalence of urinary tract infections and risk factors among diabetic patients in Ethiopia, a systematic review and meta-analysis. *Plos One*, *18*(1), e0278028. https://doi.org/10.1371/journal.pone.0278028.
42. United Nations Educational, Scientific, and Cultural Organization (2020). Interview: Literacy rate in Afghanistan increased to 43 percent. https://uil.unesco.org/interview-literacy-rate-afghanistan-increased-43-cent.
43. Vogel, L. (2014). Afghan people risk their lives to obtain health care: MSF. *CMAJ : Canadian Medical Association Journal*, *186*(6), 411.https://doi.org/10.1503/cmaj.109-4751.
44. Wan, X., Wu, C., Xu, D., Huang, L., & Wang, K. (2017). Toileting behaviors and lower urinary tract symptoms among female nurses: A cross-sectional questionnaire survey. *International Journal of Nursing Studies*, *65*, 1–7. https://doi.org/10.1016/j.ijnurstu.2016.10.005.
45. Wullt B, Svanborg C (2019). Deliberate establishment of asymptomatic bacteriuria – a novel strategy to prevent recurrent UTI. Pathogens and Disease, 77(2), 1-11.
46. Yim J, Khanam F, Derakhshandeh R, Huh D, Salmah Ismail I, Elberry AA et al. (2019). Bacterial interference of urinary pathogens with Streptococcus anginosus as a urinary tract infection probiotic. *The Journal of Infectious Diseases*, 220(2), 187-198.