

Sanitation deficit: Evaluating the risk of urinary tract infections in populations

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Abstract

Poor sanitation and inadequate hygiene practices are strongly associated with an increased risk of urinary tract infections (UTIs) and their long-term complications, especially in women and communities with limited resources. This research sought to evaluate how sanitation shortcomings and hygiene habits affect urinary health in people aged 10 to 85 years. A prospective observational study involving 403 participants in Pathanamthitta district was carried out using a semi structured questionnaire to assess hygiene practices, access to sanitation and the incidence of UTIs. Findings indicated that 57.82 % maintained appropriate genital hygiene post -urination, whereas 50.12 % delayed urination because of unsanitary restrooms. Furthermore, 29.28 % often encountered UTIs linked to poor sanitation, and 28.54 % indicated infections occurring after utilizing public restrooms. These results emphasize the crucial impact of sanitation and hygiene practices on urinary health. Enhancing sanitation systems, promoting hygiene education and ensuring availability of clean facilities is crucial for decreasing UTI prevalence and advancing public health.

Keywords: Sanitation; Hygiene; UTI; Menopause; Public Toilets

1. Introduction

Hygiene refers to practices that maintain cleanliness and prevent disease, with the World Health Organization defines it as the conditions and actions that preserve health and prevent illness. Personal hygiene, especially hand washing, is one of the most effective ways to reduce infections. However, poor sanitation and hygiene greatly increase health risks among individuals. Lack of clean water, safe toilets, and proper waste management creates environments where bacteria, parasites, and fungi thrive, often spreading through contaminated food, water, soil, and hands. Among these, urinary tract infections (UTIs) represent a prevalent health issue that can be significantly affected by sanitation conditions and individual hygiene habits. In numerous communities, people are compelled to postpone urination or limit their fluid consumption because of insufficient clean and private sanitation options. These actions can promote bacterial proliferation in the urinary tract and aid in the onset of recurring UTIs. Women are especially susceptible because of anatomical characteristics and physiological states like menstruation, pregnancy, menopause and aging. Moreover, overcrowded and inadequately maintained public restrooms can act as possible sources of microbial contamination, thereby heightening the risk of infections. Even with advancements in public health systems, behaviors related to sanitation that impact urinary health are still not well examined in community groups. ^{[1][2][3][4]} Therefore, the hypothesis of the study is that poor sanitation condition and inadequate hygiene practices greatly contribute to the development of urinary tract infections and other urinary health issues. This research aimed to evaluate the effects of poor sanitation and hygienic practices on urinary health in individuals aged 10 to 85 years, as well as to analyze how sanitation habits affect the likelihood of urinary tract infections within the community. Understanding these factors is crucial for creating successful public health initiatives or programs, improving hygiene education, and encouraging better sanitation habits to decrease the incidence of urinary tract infections.

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Objective

This study helps to identify routine behaviors that harm the urinary system. It assesses inadequate sanitation impact on urinary health, evaluates hygienic practices, examines quality of life, and addresses water/sanitation inadequacies among general population of 10-85 years of age.

2. Materials and methodology

This prospective observational study was conducted over six months (December 2024–May 2025) among educational institutions and residents of Pathanamthitta district, with a total sample size of 403 participants, calculated using standard statistical formulas. Approval was obtained from the Institutional Review Board of Nazareth College of Pharmacy. Individuals aged 10–85 years who could read English or Malayalam and who were willing to participate were included, while those unwilling or unable to read/write were excluded. Data were collected through community surveys using validated semi-structured questionnaires and pre-designed forms, along with informed consent. Socio-demographic details such as age, gender, occupation, marital status, education, and residence were recorded. The collected data were analyzed in MS Excel and presented in tables as frequencies and percentages to assess the impact of poor sanitation on urinary health.

3. Results

3.1. Distribution of Age Group of Subjects

From the population of 403 people, 16.13% are of 10-15 years of age, 58.56% are of 16 - 35 years of age, 15.88% are of 36-55 years of age and 9.43 % are of 56-85 years of age.

3.2. Distribution of Post Pee Hygienic Practices

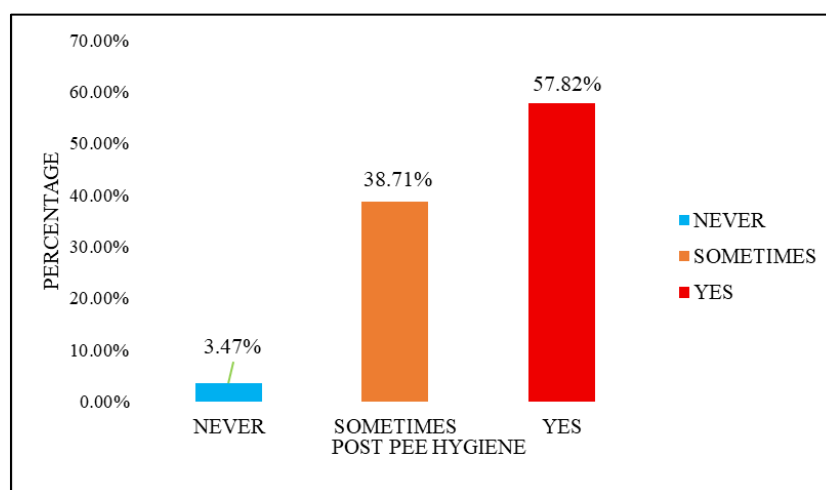


Figure 1 Distribution of Post Pee Hygienic Practices

The graph illustrates the prevalence of proper genital hygiene practices among participants after urination. From the study population of 403 people, 233 (57.82%) people followed proper genital area cleaning habits after urination and 156 (38.71%) people occasionally followed genital area cleaning habits after urination and 14 (3.47%) individuals didn't follow the practice of cleaning their private area after urination.

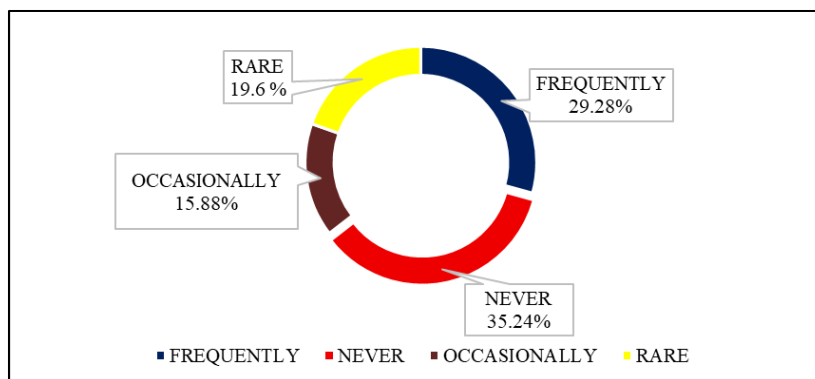
3.3. Distribution of Genital Hygiene Practices

The graph shows methods used by participants for cleaning their private area. From the study population of 403 people, 247 (61.29%) individuals cleaned their private area using water alone and 131 (32.51%) individuals cleaned their private area using soap and water and 25 (6.20%) individuals cleaned their private area using other liquids of the population.

Table 1 Distribution of Genital Hygiene Practices

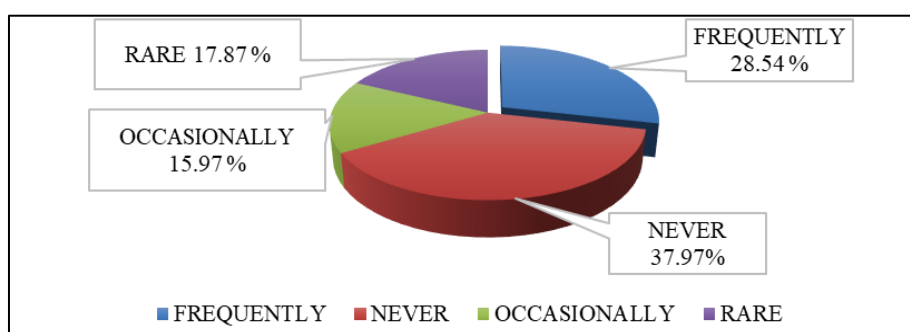
Si.no	Genital hygiene	Frequency	Percentage
1.	Only with water	247	61.29%
2.	Soap and water	131	32.51%
3.	With other liquids	25	6.20%
	Total	403	100.00%

3.4. Distribution of UTI Caused from Poor Sanitation

**Figure 2** Distribution of UTI Caused from Poor Sanitation

The graph illustrates the number of participants who developed urinary tract infections as a result of poor sanitation. Out of a total of 403 participants, 118 (29.28%) individuals reported experiencing urinary tract infections frequently, 64 (15.88%) participants had occasional infections, 79 (19.60%) experienced them rarely, while 142 (35.24%) participants reported never having had a urinary tract infection as a result of poor sanitation.

3.5. Distribution of UTI Incidence Linked to Public Toilet Use

**Figure 3** Distribution of UTI Incidence Linked to Public Toilet Use

The graph illustrates how frequently the participants developed urinary tract infections after using public toilets. Out of the group, 115 (28.54%) participants frequently suffered from urinary tract infections after using public toilets, 63 (15.97%) experienced them occasionally, 72 (17.87%) reported rare occurrences, and 153 (37.97%) participants stated they never experienced any infections after using public toilets.

3.6. Distribution of Delaying Urination Due to Dirty Toilets

The graph indicates the proportion of participants who hold back urination because of poor sanitation. Among 403 study population 202 (50.12%) participants held back urination because of poor sanitation. 164 (40.69%) participants sometimes restrain urination themselves and 37 (9.18%) never restrain urination themselves due to poor sanitation.

Table 2 Distribution of Delaying Urination Due to Dirty Toilets

Si.no	Delaying urination due to dirty toilets	Frequency	Percentage
1	Never	37	9.18%
2	Sometimes	164	40.69%
3	Yes	202	50.12%
	Total	403	100.00%

4. Discussion

In this study which involves a varied cohort of 403 individuals, primarily examining hygiene habits and their impact on urinary tract infections (UTIs), post-urination cleanliness behaviors revealed that a notable 57.82% (233 participants), consistently practiced adequate cleansing of the genital area right after urination, 38.71% (156) engaged in these practices irregularly or occasionally and merely 3.47% (14) entirely neglected this vital routine. These results demonstrate a strong positive correlation with the research by Tetsuya Akaishi (2024) titled *"Post-Toilet Wiping Style Is Associated With The Risk Of Urinary Tract Infection In women"*, which found that approximately 40-50% of women used an arm-reaching technique to wipe between their legs after using the restrooms, a post toilet wiping method suspected of increasing UTIs risk by possibly aiding bacterial transfer in women.^[5]

Expanding on this foundation, overall genital hygiene practices within the study group indicated that 61.29% (247) individuals preferred to cleanse their private area solely by water, 32.51% (131) used a mix of soap and water for more effective cleansing and a small 6.2% (25) opted for other liquids, trends that are in positive agreement with the research by Ilknur Demir et.al., (2020) in *Analyzing the relationship between genital hygiene behaviors in woman and urinary tract infections in any period of life* where a statistically significant relationship was found between improper genital cleaning techniques specifically washing from back to front- and the occurrence of UTIs at any stage throughout a woman's life.^[6]

Further examination of contributing factors revealed that inadequate sanitation practices were linked to urinary tract infections (UTIs) in 29.28% (118) of individuals who frequently experienced infections, 15.88% (64) occasionally, 19.60% (79) rarely, and 35.24% (142) never, closely aligning with the findings of Rama Kawade et.al., (2019) in their study titled *"Access to sanitation and risk of developing urinary tract infections among women from low socio economic settings"*. This research indicated an overall UTI prevalence of 19.6% which increased to 23.2% for women under 30 attributing higher risks to coping strategies in the absence of private restrooms such as delaying urination (21.3% prevalence) altering meal schedules to limit nighttime bathroom trips (26.6%) and intentionally decreasing fluid intake (10.7%) all of which were significantly associated with UTI occurrence.^[7]

Moreover the use of public toilets was associated with frequent UTIs in 28.54% (115 participants), occasional cases in 15.97% (63) rare events in 17.87% (72) and no issues in 37.97% (153) highlighting a significant connection with the bacteriological study conducted by Mukandayishimiye Julienne et.al., (2024) in *"Identification of bacteria from public toilet of modern market (Goico) in Musanze Town, Rwanda,"* which found that female restrooms had a higher contamination rate of 51.43% compared to 48.57% in male restrooms, thus increasing infection risks for users.^[8]

Similarly, urination restraint due to poor sanitation was reported by 50.12 % of participants, while 40.69 % occasionally restrained urination and 9.18 % reported that they never restrained urination, indicating that inadequate sanitation facilities significantly influence voiding behavior among the study population. This finding is consistent with the study conducted by S. Jagtap et.al., (2022) titled *"Comprehensive Assessment of Holding Urine as a Behavioral Risk Factor for UTI in women and Reasons for Delayed Voiding"*. This study highlighted that prolonged urine retention is an important behavioral risk factor for urinary tract infections, with poor sanitation and inadequate public toilet hygiene being among the most common reasons for delayed voiding, thereby increasing the likelihood of self-reported UTIs among individuals who frequently practice urine retention.^[9]

Abbreviations

UTI: Urinary Tract Infections

5. Conclusion

Poor hygiene and insufficient have a significant negative impact on the urinary system, primarily by increasing the likelihood of urinary tract infections (UTIs). The absence of clean private restrooms leads individuals to retain urine for extended periods, which puts pressure on the bladder, disrupts muscle functionality, and promotes bacterial growth. Environments such as schools and hostels exacerbate this issue. Inadequate, crowded facilities compromise privacy and hygiene, making it difficult for students – particularly adolescent girls dealing with menstruation – to maintain proper routines. Without access to sanitary pads, clean water and private spaces, they often neglect personal hygiene, thus increasing the risk of infections. Unsanitary toilet seats and rundown public restrooms heighten the spread of pathogens, resulting in frequent UTIs, incontinence and possible kidney complications. Alarming, our research revealed that a majority of participants were unaware of these risks, viewing them merely as minor inconveniences. We took actions by providing education on the importance of urinating promptly thorough handwashing, proper wiping techniques, staying hydrated and managing menstruation effectively.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

The authors certify that they have obtained consent from the participants in this study and their details will be concealed with due effort.

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