Original Article

Investigating WASH (Water, Sanitation, and Hygiene) Practices and Related Health Risks Among Women in Communities of Dharavi, Mumbai

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Abstract

Access to sufficient water, sanitation, and hygiene (WASH) remains a persistent challenge in urban slum settlements thus, affecting women's health and well-being. This pilot study investigates WASH practices among women aged 15–45 in Dharavi, Mumbai—one of Asia's largest informal settlements—with a keen focus on menstrual hygiene management and the associated risk of Urinary Tract Infections (UTIs). A cross-sectional survey was conducted among 50 women aged 15–45 years using structured questionnaires. Data were analysed using descriptive statistics, Chi-square, and Fisher's Exact Test to evaluate associations between menstrual hygiene practices and UTI symptoms. Most women (78%) are still dependent on overcrowded community toilets, which lack basic facilities such as water and soap. Disposable sanitary pads were used by 74% of respondents, while 26% still relied on cloth. A significant association was observed between frequency of changing menstrual products and UTI symptoms ($\chi^2 = 14.3$, $p = 0.027$; Fisher's $p = 0.011$). Avoiding eating to reduce toilet visits was also associated with UTI symptoms ($\chi^2 = 4.37$, $p = 0.037$). Choice of menstrual product was linked to age ($p = 0.022$) and education level ($p = 0.006$) of the women. However, reduced water intake showed no significant association ($p = 0.155$). The study highlights the urgent need for raising awareness programs in managing reproductive infections in Dharavi. Affordable sanitary products, safe disposal facilities, and gender-sensitive sanitation policies are critical to reducing health risks and promoting dignity in menstrual hygiene management. Comparative analysis with previous slum-based studies further revealed that women in Dharavi exhibit higher adoption of sanitary pads across all education levels and age groups but problems such as sanitation insecurity, behavioural restrictions, and unsafe disposal practices still persist which highlights incompetent WASH conditions in low-resource urban environments.

Keywords: Menstrual Hygiene, WASH Practices, UTI, Dharavi, Women's Health.

Introduction

The World Health Organization (WHO) has placed water, sanitation, and hygiene (WASH) practices to be the most basic needs for universal development. One of the 2030 agendas called the "WASH initiative" and Goal 6 of the Sustainable Developmental Goals (SDGs), was framed with the aim "to ensure availability and sustainable management of water

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and sanitation for all" by 2030[1,2]. Slum settlements have become an inevitable feature in urban areas, often seen as residence with inadequate housing, overcrowding, and a lack of basic amenities such as clean water, sanitation, and secure living conditions[3]. Inadequate and poor quality sanitation infrastructure is the major concern for developing country such as India[4]. Data related to individual characteristics of women, housing condition, access to sanitation facilities, behaviors adopted by the women that could lead to UTI and an episode of symptomatic UTI in the previous one month were recorded through structured questionnaire. Logistic regression analysis was performed to find out risk factors for UTI among women.Results: The prevalence of UTI was found to be 19.6%. The prevalence was higher among young women aged upto 30 years (23.2%). The gap in access to safe WASH services in Indian slums is expected to expand as the rate of growth in urban population is 2–3% per year, whereas the slum populations are increasing at an alarming rate (6–8% per year)[5]. In the slums of Mumbai, around 81 to 243 people share one toilet. This is the world's highest number, and India ranks among the first 12 countries practising open defecation which is a major public health concern[6].

Women are especially vulnerable as the lack of adequate and safe WASH affects their overall livelihood[5]. Besides privacy, women need to spend more time in the toilet because they must always sit or squat[7,8]. Women need to be physically safe when they use outside or in public toilets; be it at school, marketplace, or workplace. If WASH facilities in schools, workplaces, market spaces, and public areas are poorly maintained, dirty, and unsafe, it will have a cascading effect on women's health. Health risks of women and adolescent girls exacerbate especially when they menstruate if there are no facilities for changing and disposing sanitary materials safely. The issue of toilets is more serious in urban slum areas as compared to the rural slum because spaces are cramped and open space is deficient. A study conducted by Srivastava et al.[9] in slums of Lucknow aimed to examine the health and sanitation practices among women living in these settlements. Poor menstrual hygiene practices placed them at an increased risk of infections, including urinary tract infections and sexually transmitted diseases.

An astonishing 355 million women and girls are still waiting for a toilet. Unavailability of either an individual or shared toilet forces them to use poorly maintained and overcrowded community toilet blocks or practice open defecation[10]. Often, in densely populated areas of urban slums it is a challenge for women to find privacy. This can lead them to avoid urinating and defecating for many hours which may cause urinary tract infections (UTI) in them[11]. Such behaviour causes persistent constipation, diarrhoea, increased rates of maternal mortality, and worsened menstrual and pregnancy symptoms[12]. UTI is the most common non-intestinal infection among women worldwide. More than half of all women experience at least one urinary tract infection (UTI) during their lifetime.[13]. This study aims to examine the water, sanitation, and hygiene practices of women living in Mumbai's slums, particularly in Dharavi, and assess the health risks linked to inadequate sanitation and hygiene. The pilot study conducted through this research might aid in providing various factors that might provide new link to UTI and poor sanitation practices and would also bridge the gap for further research.

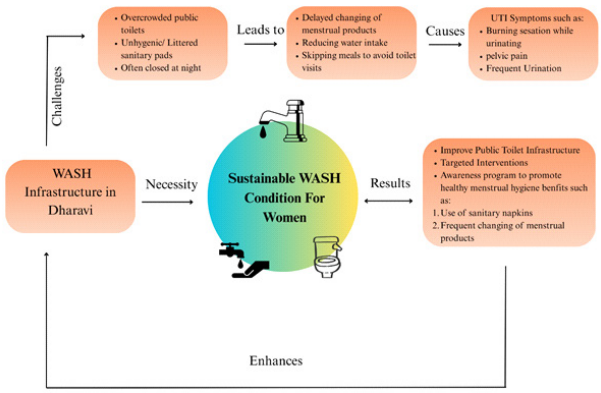


Figure 1: Infographic depicting factors affecting WASH Infrastructure access and required improvements

Methodology

Study Design and Area

This study is a cross-sectional pilot survey conducted to explore the association between WASH (Water, Sanitation, and Hygiene) practices and related health risks among women residing in the slum areas of Dharavi, Mumbai.

Study Population

The target population for this study included women between the ages of 15 and 45 years, who are residents of slum localities within the Dharavi region. This age group was selected to specifically understand menstrual hygiene management practices and the occurrence of urinary tract infections (UTIs) among women in their reproductive years.

Sample Size and Sampling Technique

The total sample size for this pilot study was 50 respondents. The sample size of 50 was based on the availability and willingness of respondents during the study period. Participants were selected through purposive and convenient sampling techniques. This approach was adopted due to the limitations in time and accessibility to participants, which restricted the ability to conduct random sampling.

Data Collection Tool and Procedure

Data were collected through interviews based on a self-constructed, structured questionnaire designed to gather information on sanitation practices, usage of community toilets, hygiene strategies, challenges during menstruation, and symptoms related to UTIs. Offline collection was carried via direct one-on-one interaction.

Variables Selected

The following variables were assessed through the questionnaire:

Section 1: Demographic Information

Section 2: Sanitation and Toilet Usage

Section 3: Water Access & Usage

Section 4: Menstrual Hygiene Practices (For menstruating women)

Section 5: Coping strategies and health seeking behaviour

Results:

1. **Demographic Information**

Table 1.1 Age of the respondents

Age Group	Number of Respondents	Percentage
15–25	20	40%
26–35	12	24%
36–45	18	36%

Table 1.2. Education Level of the respondents

Education Level	Number of Respondents	Percentage
No Formal Education	12	24%
Primary	13	26%
Secondary	11	22%
Higher Secondary	8	16%
Graduation	6	12%

Table 1.3. Occupation of the respondents

Occupation	Number of Respondents	Percentage
Housewife	25	50%
Unemployed	9	18%
Daily Wage Worker	6	12%
Private Job	5	10%
Student	5	10%

Table 1.4. Type of Residence

Type of House	Number of Respondents	Percentage
Semi-Pucca	36	72%
Pucca	14	28%

The above section depicts the age of the respondents, where 40% of the sample was of age 15-25, which was majority of the population, and the education level depicted that most of the women (26%) had received education till primary level. However, 50% of the women were housewives and majority of the population (72%) resided in semi – pucca houses in Dharavi region.

2. **Sanitation and Toilet Usage**

Table 2.1 Type of Toilet Used

Type	Number of Respondents	Percentage
Community	39	78.0%
Household	11	22.0%

Table 2.2. Frequency of using household/community toilet

Frequency	Number of Respondents	Percentage
1–2 times	26	52.0%
3–4 times	20	40.0%
More than 4 times	4	8.0%

Table 2.3. Waiting time to use the community/ household toilet

Waiting Time	Number of Respondents	Percentage
Less than 5 mins	33	66.0%
5–10 minutes	13	26.0%
More than 10 mins	4	8.0%

Table 2.4. Availability if water in household/ community toilet

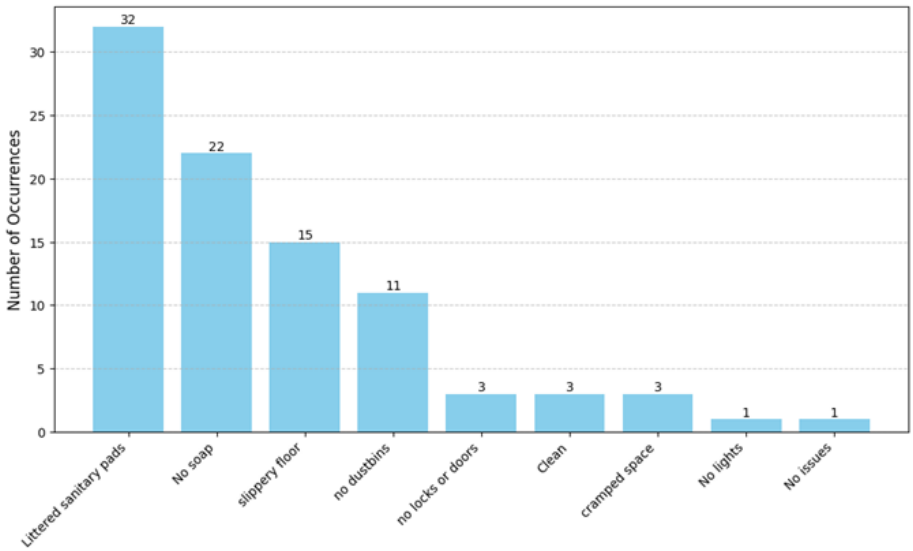
Availability	Number of Respondents	Percentage
Always available	36	72.0%
Sometimes available	14	28.0%

Table 2.5. Condition of the community toilet

Condition	Number of Respondents	Percentage
Clean and well-maintained	10	20.0%
Partially clean	24	48.0%
Dirty and unhygienic	14	28.0%
Not applicable	2	4.0%

Table 2.6. Handwashing practices after using the toilet:

Practice	Number of Respondents	Percentage
With soap and water	37	74.0%
Just water	10	20.0%
With water only (sink not used)	1	2.0%
No handwashing sink	1	2.0%
No handwashing	1	2.0%



Graph 2.7. Toilet infrastructure issue faced:

(78%) of women use community toilet and (50%) of women use them at least 1-2 times daily, thus maintaining them is crucial. 68% women have to at least wait for 5 minutes to use these community toilets. 40% of

women claimed that while the community toilets were partially clean, many (26%) also complained that there were used sanitation pads thrown on the ground or stuck in between the windows of the toilets that caused odor and flies in the toilet, making them uncomfortable and hesitant to use them. No soap, no dustbins and slippery floors were other major issues that women faced while using community toilets.

3. **Water Access & Usage**

Table 3.1. Access to safe drinking water at home

Source	Number of Respondents	Percentage
Piped water	50	100.0%

Table 3.2. Daily water intake (glasses per day)

Intake Level	Number of Respondents	Percentage
Less than 3	11	22.0%
3–5	22	44.0%
More than 5	17	34.0%

Table 3.3. Difficulty in accessing water daily

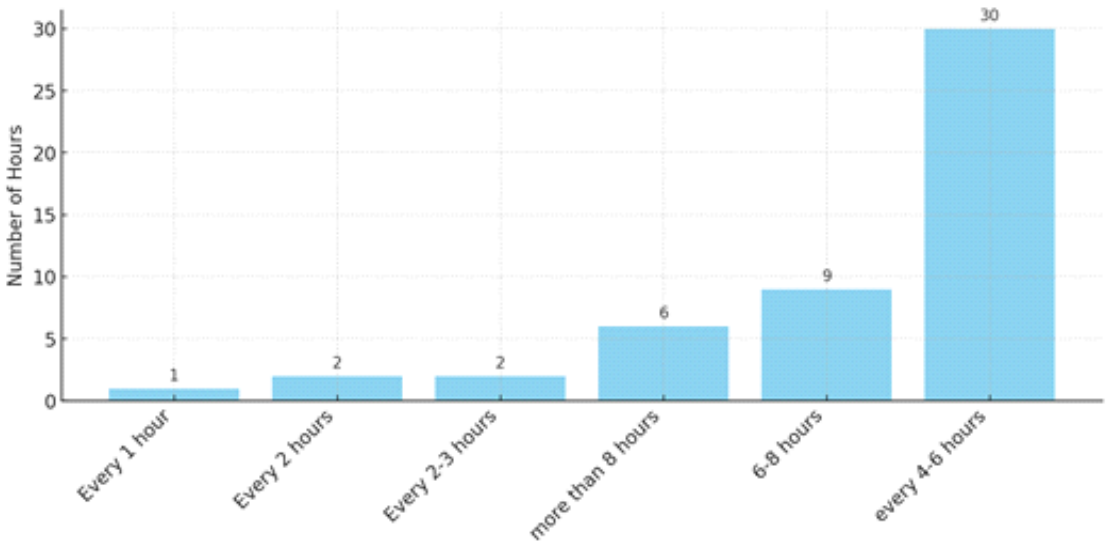
Response	Number of Respondents	Percentage
Yes	10	20.0%
Sometimes	8	16.0%
No	32	64.0%

Everyone in the region received piped water on a daily basis. This is a positive indication on water facility in the colonies of Dharavi. However, varied results were obtained for water intake, where 44% of the women only consumed 3-5 glasses of water daily. For healthy individuals, the average daily water for men is about 15.5 cups and for women about 11.5 cups. That might mean that at least four to six cups of plain water, is mandatory when depending on other fluid sources such as coffee, tea, juice, fruits, and vegetables. While majority of women had no issues in accessing water daily, rest 80% women did face some issues that could potentially limit their water intake as well.

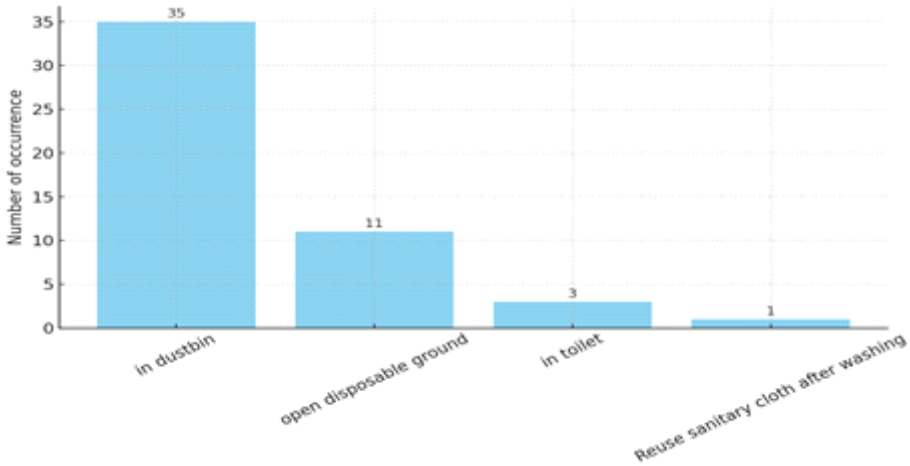
4. **Menstrual Hygiene Practices (For menstruating women)**

Table 4.1. Type of menstrual product used:

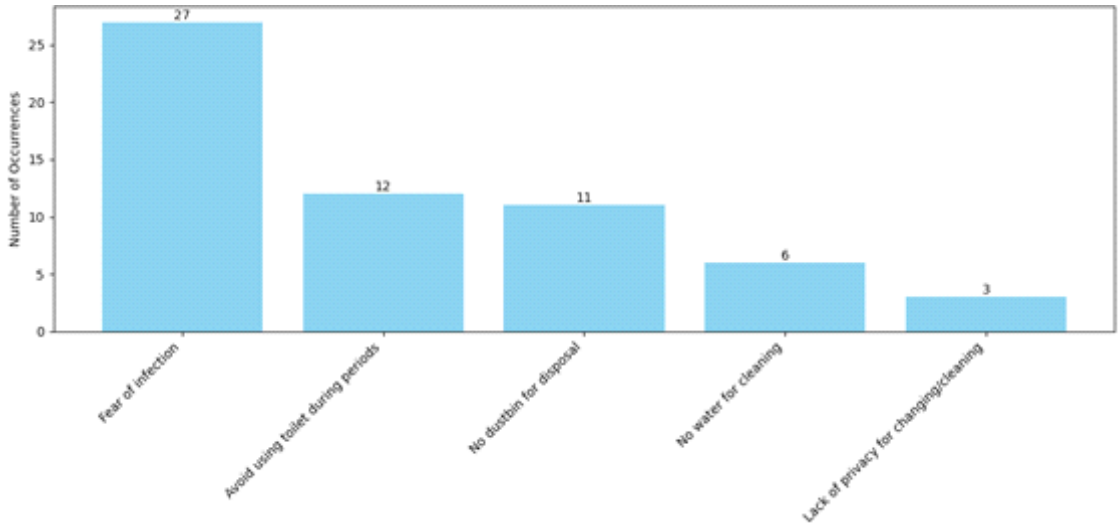
Menstrual Product	Percentage	Number of Respondents
Disposable sanitary pads	74.0%	37
Cloth	26.0%	13



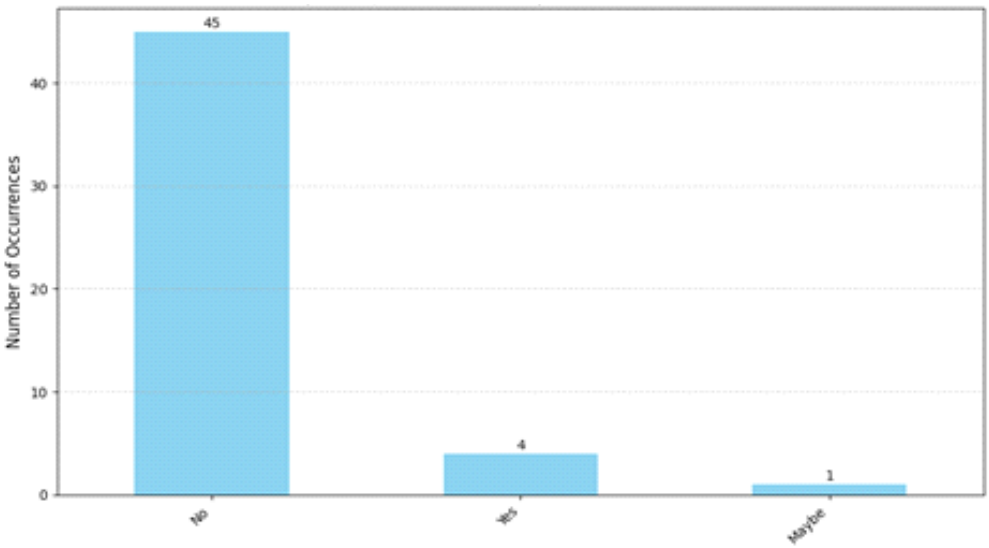
Graph 4.2. Frequency of changing menstrual product:



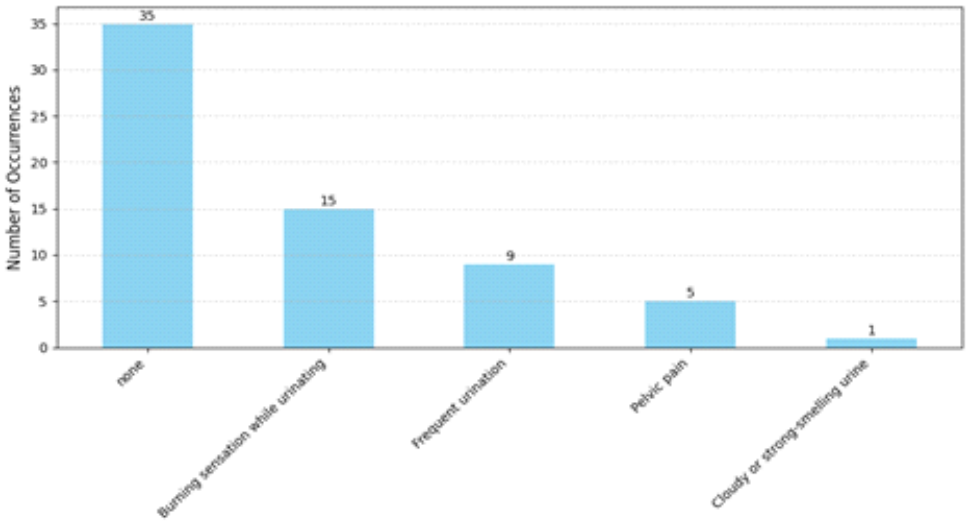
Graph 4.3. Disposal Method of Used Menstrual Product:



Graph 4.4. Challenges Faced During Menstruation While Using Community Toilets:



Graph 4.5. Have you experienced Urinary Tract Infections (UTIs)?



Graph 4.6. Have you experienced following symptoms of UTI?

Around 74% of women use disposable sanitary pads, and most women tend to change their menstrual product in every 4-6 hours and thus maintaining a healthy menstrual hygiene.26% of the respondents rely on using cloth, and many tend to reuse them after washing.Additionally, a significant amount of women disposed their used menstrual product in open disposable ground due to lack of a dustbin nearby. Fear of getting infection, avoiding using community toilets during menstruation, lack of disposable bins were few key challenges faced by majority of the women interviewed. Although (90%) of women claimed that they don't have UTI, large percentage of women did experience the symptoms of UTI, such as burning sensation while urinating, pelvic pain and frequent urination. This is particulary concerning as it suggests that many women lack the knowledge of whether they suffer from UTI thus making diagnosis of the infection even more diffiult.

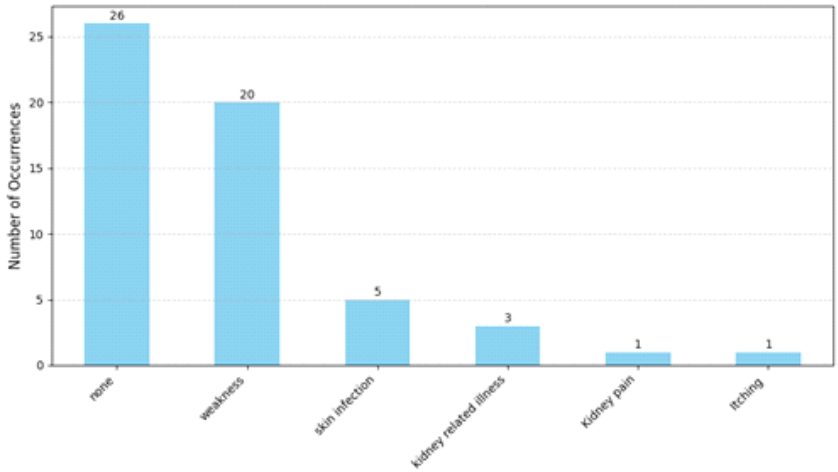
5. **Coping strategies and health seeking behaviour**

Table 5.1 Have you ever reduced water intake to avoid using community toilets?

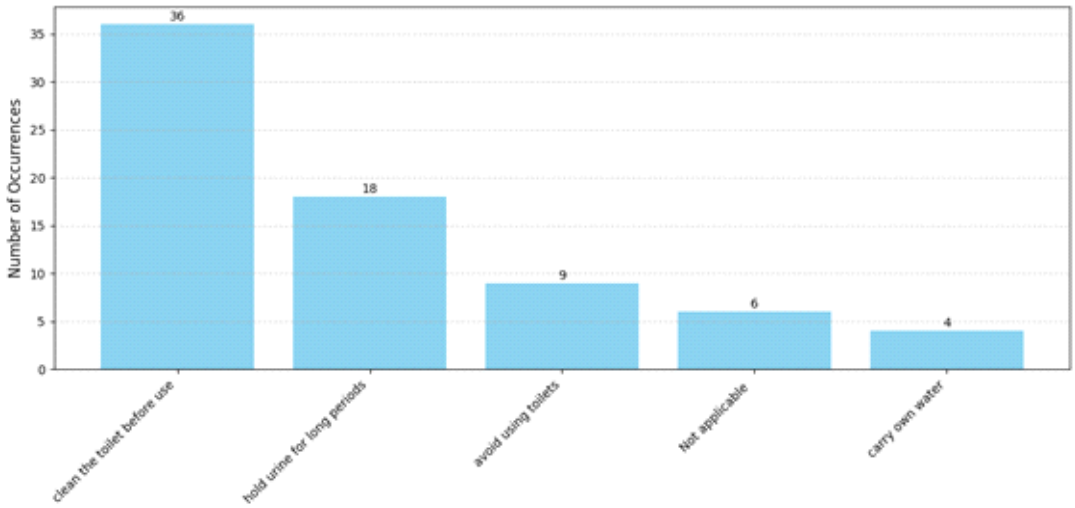
Response	Number of Respondents	Percentage
No	34	68.0%
Sometimes	15	30.0%
Yes, regularly	1	2.0%

Table 5.2 Have you ever avoided eating to reduce toilet visits?

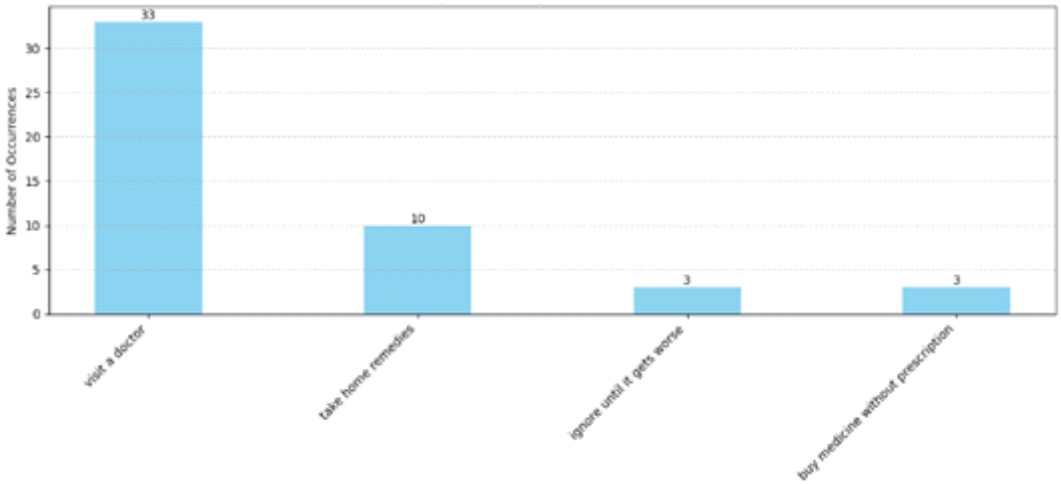
Response	Number of Respondents	Percentage
No	44	88.0%
Yes	6	12.0%



Graph 5.3. Have You Experienced Any of the Following Due to Poor WASH Conditions?



Graph 5.4. What Strategies Do You Use to Manage Hygiene in Poor Toilet Conditions?



Graph 5.5. What do you do when you have health problems:

While not observed commonly, a few women might tend to avoid eating or drinking to minimise toilet visits when the community toilets were closed, especially during the night. Weakness, and skin infections were observed in women who were interviewed. Poor hygiene conditions and avoidance towards hygiene of toilets could potentially cause these conditions.

STATISTICAL ANALYSIS

CHI SQUARE TESTAND FISCHER'S EXACT TEST BETWEEN FREQUENCY OF CHANGING MENSTRUAL PRODUCT AND UTI OCCURENCE

Null Hypothesis (H_0):

There is no association between the frequency of changing menstrual products and the occurrence of UTI symptoms.

Alternative Hypothesis (H_1):

There is a significant association between the frequency of changing menstrual products and the occurrence of UTI symptoms.

	Experienced Any UTI Symptoms (True/False)		
frequency of changing menstrual product	**False**	**True**	**Total**
5-10 hours	1	0	1
6-8 hours	4	4	8
Every 1 hour	1	0	1
Every 2 hours	0	2	2
Every 2-3 hours	0	2	2
every 4-6 hours	25	5	30
more than 8 hours	4	2	6

	Experienced Any UTI Symptoms (True/False)		
frequency of changing menstrual product	**False**	**True**	**Total**
Total	35	15	50

χ^2 Tests			
	Value	**df**	**p**
χ^2	14.3	6	0.027
Fisher's exact test			0.011
N	50		

Since the **p-value (0.027)< 0.05**, we reject the null hypothesis.

Thus, there is a **statistically significant association** between the frequency of changing menstrual products and the occurrence of UTI symptoms.

CHI SQUARE TEST AND FISCHER'S EXACT TEST BETWEEN AVOIDING EATING TO REDUCE TOILET VISITS AND UTI OCCURENCE

Null Hypothesis (H_0):

There is no association between avoiding eating to reduce toilet visits and the occurrence of UTI symptoms.

Alternative Hypothesis (H_1):

There is a significant association between avoiding eating to reduce toilet visits and the occurrence of UTI symptoms.

	Experienced Any UTI Symptoms (True/False)		
Have You Ever Avoided Eating to Reduce Toilet Visits?	**False**	**True**	**Total**
no	33	11	44
yes	2	4	6
Total	35	15	50

χ^2 Tests			
	Value	**df**	**p**
χ^2	4.37	1	0.037
Fisher's exact test			0.058
N	50		

Since the **p-value (0.037) < 0.05**, we reject the null hypothesis.

Thus, there is a **statistically significant association** between avoiding eating to reduce toilet visits and the occurrence of UTI symptoms.

CHI SQUARE TEST AND FISCHER'S EXACT TEST BETWEEN REDUCING WATER INTAKE TO AVOID USING COMMUNITY TOILET AND UTI OCCURENCE

Null Hypothesis (H_0):

There is no association between reducing water intake to avoid using community toilets and the occurrence of UTI symptoms.

Alternative Hypothesis (H_1):

There is a significant association between reducing water intake to avoid using community toilets and the occurrence of UTI symptoms

	Have You Ever Reduced Water Intake to Avoid Using Community Toilets?			
Experienced Any UTI Symptoms (True/False)	**no**	**sometimes**	**yes, regularly**	**Total**
False	26	9	0	35
True	8	6	1	15
Total	34	15	1	50

χ^2 Tests			
	Value	**df**	**p**
χ^2	3.73	2	0.155
Fisher's exact test			0.122
N	50		

Since the **p-value (0.155) >0.05**, we fail to reject the null hypothesis.

Thus, there is no **statistically significant association** between reducing water intake to avoid using community toilets and the occurrence of UTI symptoms.

CHI SQUARE TEST AND FISCHER'S EXACT TEST BETWEEN THE TYPE OF MENSTRUAL PRODUCT USED AND THE AGE OF THE RESPONDENTS

Null Hypothesis (H_0):

There is no association between the type of menstrual product used and the age of the respondents

Alternative Hypothesis (H_1):

There is a significant association between the type of menstrual product used and the age of the respondents

Contingency Tables			
	type of menstrual product used		
Age	cloth	disposable sanitary pads	Total
15-25	1	19	20
26-35	5	7	12
36-45	7	11	18
Total	13	37	50

χ^2 Tests			
	Value	df	p
χ^2	7.67	2	0.022
Fisher's exact test			0.012
N	50		

Since the **p-value (0.022) < 0.05**, we reject the null hypothesis.

Thus, there is a **statistically significant association** between the type of menstrual product used and the age of the respondents

CHI SQUARE TEST AND FISCHER'S EXACT TEST BETWEEN THE TYPE OF MENSTRUAL PRODUCT USED AND THE EDUCATION LEVEL OF THE RESPONDENTS

Contingency Tables			
	type of menstrual product used		
Education level	cloth	disposable sanitary pads	Total
Graduation	0	6	6
Higher Secondary	1	7	8
No formal education	8	4	12
Primary	2	11	13
Secondary	2	9	11
Total	13	37	50

χ^2 Tests			
	Value	df	p
χ^2	14.3	4	0.006
Fisher's exact test			0.010
N	50		

Since the **p-value (0.006) < 0.05**, we reject the null hypothesis.

Thus, there is a **statistically significant association** between the type of menstrual product used and the education level of the respondents.

Discussion

This exploratory study sheds light on WASH-related challenges faced by women in Dharavi and their association with urinary tract infections (UTIs). In comparison to the study by Kawade et al.[4] and our present studies indicate heavy dependence on shared sanitation facilities where, 78% of women in Dharavi relied on community toilets compared to complete absence of individual toilets in Kawade et al.'s[4] sample, though 93.2% of their respondents had access to a semi-private bathroom structure for urination. In contrast, only 22% of women in Dharavi reported household toilet access, reflecting continued infrastructural inadequacy in Mumbai's largest slum.

Our current data reflects that 32% women reported deliberately reducing or delaying fluid intake to avoid community toilet which is comparatively higher than the 12.15% as reported by the findings of Devane et al.(2024)[14] and merely 12% of the current participants in our study avoided eating to reduce toilet visits as compared with 24.9% in Devane et al.(2024)[14] study, suggesting lack of sanitation security within the Dharavi community. With respect to these behavioural patterns, the prevalence of UTI symptoms in our study has been reported at 34% which was nearly threefold higher than in

the pre-intervention phase of studies undertaken by Devane et al. (2024)[14] (12.8%). Together, these comparisons reinforce that limited access to safe sanitation facilities drives unhealthy behavioural adaptations particularly, reduced food and water intake that increases susceptibility to urinary-tract symptoms (UTIs).

Additionally, our current study's finding states that approximately 30% of women who delayed changing menstrual products beyond 4–6 hours exhibited a statistically significant association with UTI symptoms ($\chi^2 = 14.3$, $p = 0.027$; Fisher's $p = 0.011$) which closely aligns with the results of Torondel B. et al.(2018)[15], who reported that 30.1% of women changing menstrual absorbents once daily had a higher prevalence of Bacterial Vaginosis ($p = 0.001$). Both studies reflects that infrequent absorbent changing pattern is a consistent behavioural determinant of urogenital infections such as UTI, BV (Bacterial Vaginosis) in low-resource settings.

Compared with the study conducted by Kejriwal et al. (2021)[16], the present study showed consistently higher adoption of sanitary pads across all education levels with 74 % overall usage versus 58.4 %. Among women with no formal education, 40 % of women in our study used pads compared with 28 % in theirs, and among graduates, the difference was particularly striking (90 % versus 7.4 %). These results suggest better awareness and accessibility initiatives in community of Dharavi despite similar socio-economic constraints, while education remains a strong determinant of product choice in both populations. When age-wise patterns were compared, both, our present study and Kejriwal et al. (2021)[16] studies revealed that younger women were more likely to use sanitary pads, while older age groups still relied on cloth. The sanitary pad usage in our current study was 90% among women aged 15–20 years which gradually declined to 50 % among those aged 41–45 years, whereas Kejriwal et al. (2021)[16] reported 78.3% and 32.1%, respectively, for the same age groups. Despite substantial disposable pad use in our study, unsafe disposal practices such as open dumping of used pads (22%) and in toilets itself (6%), shows an inevitable gap between product usage and safe disposal infrastructure.

Conclusion

This study helps to understand how inadequate WASH infrastructure in Dharavi significantly compromises women's health, particularly by increasing vulnerability to urinary tract infections (UTIs). Key findings demonstrate that delaying the change of menstrual products beyond recommended intervals and behavioural adaptations such as skipping meals to avoid unsafe toilets were significantly associated with UTI symptoms. Younger and more educated women were more likely to use disposable sanitary pads compared to older or less-educated counterparts.

The contribution of this study lies in linking specific coping behaviours—such as avoiding food intake due to unsafe sanitation facilities—to UTI occurrence, a rarely documented pathway in slum health research. These findings are consistent with previous studies on poor menstrual hygiene practices but expand understanding by showing how women's strategies to overcome use of unsafe toilets themselves become health risks.

However, being a pilot study with a modest sample size and purposive sampling method, generalizability is limited. Larger-scale studies are needed to explore larger sample size that will provide a comprehensive data and thus evaluatetargeted interventions. Despite these limitations, the implications are clear: policymakers, community medicine professionals, and social workers must prioritize gender-sensitive WASH infrastructure, affordable sanitary products, safe disposal mechanisms, and awareness campaigns. Addressing these gaps is not only a matter of infection prevention but also a question of equity, dignity, and empowerment for women living in urban slums.

Funding Sources: This research did not require any grant from any funding agency.

Statement of Ethics: This study involved primary data collection only through voluntary participation. Informed verbal and written consent were obtained from all participants prior to their inclusion in the study. The research by no means involved any sensitive medical records, clinical procedures, or interventions. No human trials were conducted, and no personally identifiable information was collected that could compromise participant privacy. As the

study was observational in nature and did not pose any physical, psychological, or social risk to the participants, it did not require ethical clearance from an Institutional Ethics Committee.

Declaration of conflicts of interest: The authors declare that there are no conflicts of interest related to this study.

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