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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

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Abstract

Aim To study the prevalence of recurrent urinary tract infections (UTIs) and its associated factors in female staff of reproductive age group in a medical college in central Kerala.

Introduction Recurrent UTIs can be defined as ≥ 3 episodes of UTIs within a period of 12 months. Females with recurrent UTIs have lower health-related quality of life compared to the general population; the incidence of UTI in women of reproductive age group is very common. This study focused on female employees of reproductive age group in a private medical college.

Methods A cross-sectional study was done among female staff of reproductive age group in a private medical college in central Kerala, with a sample size of 417. All female staff (18–49 years) were given a questionnaire and asked to fill it out. All those who filled out the questionnaire were included in the study according to both inclusion and exclusion criteria. Data entry and analysis were performed via Microsoft Excel 2019 and SPSS version 22.0.

Result Our study of 417 participants revealed a prevalence of recurrent UTIs of 22.30% (95% CI = 18.3- 26.3%). Recurrent UTI was significantly associated with daily water intake, urination frequency, holding urine, foul-smelling vaginal discharge, constipation, pre-coital urination, and pre- and post-intercourse vaginal hygiene. Also, occupation was found to be significantly associated with recurrent UTI, with cleaning staff having higher odds.

Conclusion Our study found the prevalence of recurrent UTI in 417 population as 22.30%. Prevention of recurrent UTI requires a daily intake of > 2 L of water and personal & sexual hygiene. Reducing recurrent UTIs enhances quality of life. Educating female staff is crucial.

Keywords Recurrent UTIs, Reproductive age group, Quality of life, Female staff

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Introduction

A urinary tract infection (UTI) is an infection in any part of the urinary system, including the urethra, bladder, ureter, and kidney. Most infections involve the lower urinary tract—the urethra and bladder [1].

UTI is one of the major public health problems in terms of morbidity, with an estimated > 400 million cases annually reported worldwide [2] and one of the most common causes of hospital visits after respiratory tract infections [3]. Urinary tract infections are significantly more common in females than in males [4–11]. Around 50–60% of females report urinary tract infections at least once in their lives [12–16]. Approximately 80% of urinary tract infections are caused by different types of bacteria; the rest are caused mainly by fungi and viruses [17, 18].

The main reasons for the increasing prevalence of UTI in females are their lower urinary tract anatomy and its location, which is proximal to the anus and reproductive organs [15, 19, 20]. The different studies said that the most common causative agent for UTI is E. coli [21–31].

Recurrent UTI (rUTI) can be defined as at least two episodes of UTI occurring within six months or at least three episodes within a 12-month period [32–36]. About 20 to 30% of patients with UTIs went on to have recurring UTIs [32]. The most common risk factors for recurrent UTI in females are decreased water intake [3, 23], sexual intercourse [34–35, 37], poor menstrual hygiene [21, 34, 38], personal hygiene [21, 34], diabetes mellitus [21], pregnancy [39], etc. The main symptoms of UTI are burning micturition, fever, dysuria, lower abdominal pain, and flank pain [21, 40, 41].

Many Indian women wash and reuse cotton clothing instead of using sanitary pads when they are menstruating. One of the main factors contributing to rUTI in females in the reproductive age group is this kind of unsanitary menstruation practise [42]. One of the other main causes of UTI in women is sexual activity, and postcoital UTIs account for the majority of rUTI in the reproductive age range. This is common in the initial period of marriage, and so it is called honey moon cystitis [18, 32]. A higher risk of UTI may result from retaining urine for different reasons or restricting use of the washroom at work [43].

Urinary tract infections are more common in those with type 2 diabetes mellitus. The symptoms of urinary tract infections (UTIs) in diabetics can range from asymptomatic bacteriuria to cystitis, pyelitis, pyelonephritis, and urosepsis, and in severe and uncommon cases, emphysematous pyelonephritis and cystitis, renal abscess, and renal papillary necrosis [44]. Increased incidence of UTI may also be associated to high urine glucose levels [45].

Antibiotic therapy and patient education about good personal and household hygiene and increasing water consumption are the mainstays of UTI treatment. Despite the availability and use of antimicrobial medications, trends for UTI caused by bacteria have been on an increase [46]. The main factor driving these trends is the rapid rise in antibiotic resistance [11]. Untreated and undetected urinary tract infections (UTIs) can occasionally result in problems such permanent renal damage that can cause hypertension, end-stage renal disease, incontinence, and sexual dysfunction [25, 32, 47].

Females with recurrent UTI have lower health-related quality of life compared to the general population [28, 34–36]; moreover, the incidence of UTI in women of reproductive age groups is increasing day by day. Women experience the highest prevalence; up to 50% of females will experience at least one urinary tract infection (UTI) episode in their lifetime.

Moreover, when considering the data from the staff clinic of our medical college, it showed that most of the patients suffering from recurrent UTIs were females, and recurrent UTIs are one of the most common causes of sick leave among female employees. So, we decided to do a study to find out the prevalence of recurrent UTI in women of reproductive age and its associated factors.

Materials and methods

A cross-sectional study was done on female staff of reproductive age group in a private medical college in central Kerala. Since we needed to evaluate the current status of rUTI in our hospital, we selected our hospital purposively. All the female staff (18–49 years) were informed about the study. Since the study focused on working women, participants were limited to those aged 18 or above. So, all who provided informed written consent were given a questionnaire in English and Malayalam (the local language) and asked to fill it out. The study was conducted from 1st October 2023 to 31st March 2024. To assess feasibility, a pilot study was conducted with 123 participants (30% of the planned sample size), including Auxiliary Nurse Midwives (ANMs), postgraduate medical students, and gardening staff. The study evaluated questionnaire feasibility, respondent engagement, and completion time. The pilot study subjects and results were not included in the main study.

Patient and public involvement statement

The staff were involved in the development of research question through staff outpatient clinic. And study protocol was modified according to feedback from them to prioritise their concerns. After circulating the questionnaire in both English and in local language (Malayalam), we refined the Malayalam version based on participant feedback during pilot study. This prioritized their concerns and complex medical terms were simplified. The questionnaire initially took an average of 15 min to complete,

which was modified to decrease the time of completion to 10 min.

The questionnaire was distributed to all the female staff working in the tertiary care centre in central Kerala, India who gave consent to participate in the study. Study population comprised doctors, nurses, lab/ radiology technician, pharmacy staff, office staff, wheelchair handlers, canteen staff, cleaning staff Medical Record Department (MRD) staff, Nutritionist, Social workers, Security staff, Attenders, Receptionist. The questionnaire was filled by themselves. The data was collected anonymously and confidentiality of information was assured. The data was collected under following headings.

1. Sociodemographic variables: age, religion, place of residence, marital status, occupation
2. Details on water intake, toileting behaviour and vaginal hygiene - Daily water intake, urinary frequency per day, History of (H/o) holding urine, H/o foul smelling vaginal discharge, H/o vaginal itching, H/o washing genital area after urination, public toilet utilization, type of toilet, H/o washing toilet seat before use, H/o constipation.
3. Details on menstrual history – Type menstrual cycle, type of sanitary products, types of vaginal wash during menstruation, frequency of vaginal wash during menstruation per day.
4. Details based on sexual activity, vaginal hygiene practices, pre- and post-coital urination - Sexually active, urinate before sexual intercourse, vaginal wash before sexual intercourse, urinate after sexual intercourse, vaginal wash after sexual intercourse.

At the end of the study a newsletter was sent to all the participants detailing the results of the study. Details on common causes, symptoms, and complications of rUTI, as well as the significance of drinking plenty of water, practicing good toileting habits such as refraining from holding urine, cleaning toilet seat before use, washing genital area after urination, maintaining excellent vaginal and sexual hygiene for preventing rUTI and importance of getting prompt diagnosis and treatment with onset of symptoms were mentioned in the newsletter.

Sample size calculation

The proportion of recurrent UTI in female patients of reproductive age group was estimated to be 20.5% (p) in previous study [32].

Using the formula.

$$\text{Sample size(N)} = \frac{Z^2_{1-\propto/2} p(1-p)}{d^2}$$

With a significance level(α) at 5%, 95% confidence interval, prevalence of Recurrent urinary tract infection(p) as 20.5%, relative precision(d) as 20% of p and with 10% of non-response rate, minimum sample size to be obtained was 410.

Inclusion criteria

1. All female staff aged between 18 and 49 years who consented to be part of the study.

Exclusion criteria

1. Female staff who were employed for less than one year in the medical college.
2. Pregnant women, women on maternity leave, sick leave and annual leave during the study period.
3. Women experiencing menopause.

Operational definitions

- Recurrent UTI: Recurrent urinary tract infections can be defined as ≥ 3 episodes of urinary tract infections within last 12 months [32–36].

Study tools

A questionnaire containing socio-demographic details, pretested questionnaire to assess social and medical problems (Supplementary material-1).

Data analysis and statistics

The data obtained was coded, entered into a Microsoft Excel sheet, and analysed using the statistical software Statistical Package for Social Sciences (SPSS Version 23). Results of continuous measurements were expressed in terms of mean +/- sd. The results of categorical measurement were presented as a percentage. Significance is assessed at the 5% level. The association between factors and the prevalence of recurrent UTIs in female staff were analysed by the Chi square test. To analyse how the factors influenced outcomes, logistic regression was done to estimate crude odds ratio (OR) and 95% confidence intervals (CI).

Results

Sociodemographic characteristics

Out of 420 participants who gave consent for the study, 3 had incomplete responses despite three follow-up attempts and were therefore excluded. Ultimately, 417 participants were included in the study. We surveyed over a 6-month period and all data have been aggregated. The majority of participants were in the age group of 18–30 years (218(52.28%)) and 31–40 years (144(34.53%)), with a mean age of 31 ± 7.8 years (SD). Regarding religious

affiliation, majority belonged to Christian community (260 (62.35%)), and Hindu community (144 (34.53%)). With in the participants, 286 (68.59%) resided in rural areas and 131 (31.41%) in urban areas. Among them, 287 (68.82%) were currently married, 118 (28.30%) were single, and 12 (2.88%) were widowed or divorced. Of the participants, 113 (27.10%) were nurses, 63 (15.11%) were pharmacy staff, 59 (14.15%) were doctors, 45 (10.8%) were laboratory/radiology technicians, and 32.84% corresponded to other occupations such as office workers, wheelchair handlers, canteen staff, and cleaning staff (Table 1).

Prevalence of recurrent UTI

The overall prevalence of recurrent UTIs was 22.30% (95% CI of 18.3- 26.3%) which accounts to 93 study subjects (Fig. 1).

Daily water intake, toileting habits, and vaginal health

When participants were asked about their daily water intake, toileting habits, and vaginal health (Table 2), more than one-third of participants (185 (44.36%)) drank only one litre or less of water per day. More than half of the study subjects reported urinating 4–8 times (209 (50.12%)) daily.

In the participant pool, more than two-third (302(72.42%)) have occasionally held their urine, and 31 (7.43%) have regularly held their urine. The reasons given for holding urine were: 167 (40.05%) due to busy work schedules, 99 (23.74%) hesitated to use unclean public restrooms, 47 (11.27%) lacked access to a toilet while traveling, and 20 (4.8%) attributed it to laziness.

A history of foul-smelling vaginal discharge was reported by 71(17.02%) individuals and 158(37.89%) participants had a history of vaginal itching since the last year. Only less than one- fourth of the participants (51(12.23%)) never washed toilet seats before use. Our study revealed that nearly one-fourth (73(17.5%)) participants suffered from constipation.

Menstrual history

As displayed in Table 3, majority of the participants (334(80.1%)) had a regular menstrual cycle. More than three-fourth of the participants (341(81.77%)) used sanitary pads and half of the participants (210(50.36%)) used simple water to wash their vagina. During menstruation, most of the women (269(64.5%)) washed their vagina more than three times per day.

Sexual history

The participant's sexual history is detailed in Table 3. Majority of the participants (265(63.55%)) were sexually active. The data collected from sexually active participants revealed that, the proportion of pre- and post -coitus voiding was 77.36% and 81.51% respectively. Additionally, 223(84.15%) participants washed their vagina before and 226 (85.28%) washed just after the sexual activity.

Table 1 Socio-demographic details of study participants

Variable	Category	Recurrent UTI		Total	*P* value (Chi-Square)
		Yes (%)	No (%)		
Age (In years)	18–30	49(22.48%)	169(77.52%)	218	0.182*
	31–40	27(18.75%)	117(81.25%)	144	
	41–49	17(30.90%)	38(69.10%)	55	
Religion	Christian	55(21.15%)	205(78.85%)	260	0.554*
	Hindu	36(25%)	108(75%)	144	
	Muslim	2(15.38%)	11(84.62%)	13	
Place of residence	Rural	63(22.03%)	223(77.97%)	286	0.842
	Urban	30(22.90%)	101(77.10%)	131	
Marital status	Currently married	69(24.04%)	218(75.96%)	287	0.432*
	Unmarried	22(18.64%)	96(81.36%)	118	
	Widow/ Divorce	2(16.67%)	10(83.33%)	12	
Occupation	Doctor	15(25.42%)	44(74.58%)	59	0.044*
	Nurse	23(20.35%)	90(79.65%)	113	
	Lab/ Radiology technician	10(22.22%)	35(77.78%)	45	
	Pharmacy staff	8(12.70%)	55(87.30%)	63	
	Office staff	3(10%)	27(90%)	30	
	Wheel chair handlers	7(26.92%)	19(73.08%)	26	
	Canteen staff	4(28.57%)	10(71.43%)	14	
	Cleaning staff	19(40.43%)	28(59.57%)	47	
	Others	4(20%)	16(80%)	20	

*Fisher's exact test

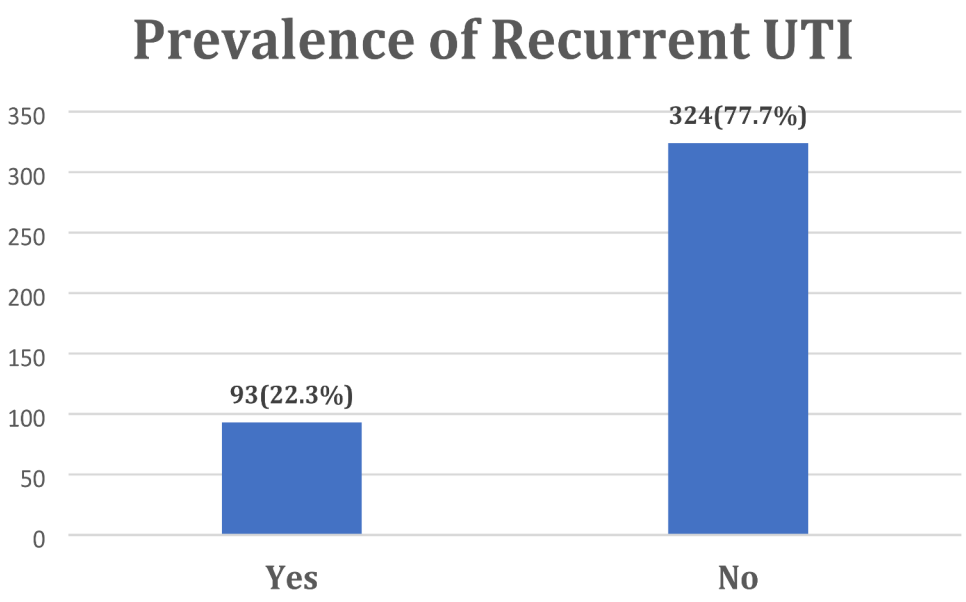

Fig. 1 Prevalence of recurrent UTI. The overall prevalence of recurrent UTIs in the study participants accounted to 22.30% with a 95% CI of 18.3–26.3%. The graph shows the presence or absence of recurrent UTI in x axis and number of study participants in y axis

Table 2 Distribution of study participants based on water intake, toileting behaviour and vaginal hygiene

Variable	Category	Recurrent UTI		Total	*P* value (Chi-Square)
		Yes (%)	No (%)		
Daily water intake (In litre)	≤ 1	79(42.70%)	106(57.30%)	185	0.001
	1–2	10(6.29%)	149(93.71%)	159	
	> 2	4(5.48%)	69(94.52%)	73	
Urinary frequency per day	1–3 times	68(36.76%)	117(63.24%)	185	0.001
	4–8 times	24(11.48%)	185(88.52%)	209	
	> 8 times	1(4.35%)	22(95.65%)	23	
H/o holding urine	Never	9(10.71%)	75(89.29%)	84	0.001
	Occasionally	69(22.85%)	233(77.15%)	302	
	Usually	15(48.39%)	16(51.61%)	31	
H/o foul smelling vaginal discharge	Yes	32(45.07%)	39(54.93%)	71	0.001
	No	61(17.63%)	285(82.37%)	346	
H/o vaginal itching	Yes	55(34.81%)	103(65.19%)	158	0.001
	No	38(14.67%)	221(85.33%)	259	
H/o washing genital area after urination	Never	5(50%)	5(50%)	10	0.148*
	Occasionally	18(22.5%)	62(77.5%)	80	
	Usually	70(21.41%)	257(78.59%)	327	
Public toilet utilization	Never	9(16.98%)	44(83.02%)	53	0.541
	Occasionally	64(23.70%)	206(76.30%)	270	
	Usually	20(21.28%)	74(78.72%)	94	
Type of Toilet	Usually Western	70(20.59%)	270(79.41%)	340	0.077
	Usually Indian	23(29.87%)	54(70.13%)	77	
H/o washing toilet seat before use	Never	16(31.37%)	35(68.63%)	51	0.007
	Occasionally	46(27.38%)	122(72.62%)	168	
	Usually	31(15.66%)	167(84.34%)	198	
H/o constipation	Yes	28(38.36%)	45(61.64%)	73	0.001
	No	65(18.90%)	279(81.10%)	344	

*Fisher's exact test

Table 3 Distribution of study participants based on menstrual history, sexual activity, Vaginal Hygiene practices, and pre- and post-coital urination

Variable	Category	Recurrent UTI		Total	*P* value (Chi-Square)
		Yes (%)	No (%)		
Menstrual cycle	Regular	72(21.56%)	262(78.44%)	334	0.464
	Irregular	21(25.30%)	62((74.70%)	83	
Type of sanitary products	Cloth	2(9.52%)	19(90.48%)	21	0.281*
	Menstrual cup	12(21.82%)	43(78.18%)	55	
	Sanitary pad	79(23.17%)	262(76.83%)	341	
Types of vaginal wash during menstruation	With plain water	45(21.43%)	165(78.57%)	210	0.225*
	Using soap and water	43(21.94%)	153(78.06%)	196	
	Using products other than soap	5(45.45%)	6(54.55%)	11	
Frequency of vaginal wash during menstruation per day	Once daily	1(20%)	4(80%)	5	0.870*
	2–3 times	34(23.78%)	109(76.22%)	143	
	> 3 times	58(21.56%)	211(78.44%)	269	
Sexually active (*n* = 417)	Active	69(26.04%)	196(73.96%)	265#	0.016
	Not active	24(15.79%)	128(84.21%)	152	
Urinate before sexual intercourse (*n* = 265)	Yes	44(21.46%)	161(78.54%)	205	0.001
	No	28(46.67%)	32(53.33%)	60	
Vaginal wash before sexual intercourse (*n* = 265)	Yes	52(23.32%)	171(76.68%)	223	0.001
	No	20(47.62%)	22(52.38%)	42	
Urinate after sexual intercourse (*n* = 265)	Yes	53(24.54%)	163(75.46%)	216	0.034
	No	19(38.78%)	30(61.22%)	49	
Vaginal wash after sexual intercourse (*n* = 265)	Yes	49(21.68%)	177(78.32%)	226	0.001
	No	23(58.97%)	16(41.03%)	39	

*Fisher's exact test

Table 4 Distribution of study participants based on Medical and Surgical History (*n* = 417)

Medical and Surgical history	Frequency	Percentage
Previous history of a caesarean section	95	22.7%
Previous history of urinary catheterization	20	4.8%
History of renal stones	15	3.6%
History of diabetes mellitus	14	3.3%
History of chronic cough	5	1.2%
History of hypertension	4	1%
History of obstructive uropathy	4	1%
History of pelvic surgery	4	1%
History of prolapsed uterus	2	0.5%

History of urinary tract infection

In this study 93 (22.3%) had a history of recurrent UTIs, and 132 (39.63%) had at least one UTI in the last year. And out of them, 70 (53%) suffered from dysuria, 69 (52.3%) had lower abdominal pain, 57 (43.18%) had increased frequency of urination, 41 (31.1%) had lower back pain, 35 (26.5%) had fever, 20 (15.2%) had chills, 11 (8.3%) had history of vomiting, 10 (7.6%) had burning micturition, and 9 (6.8%) had episodes of haematuria during the period of urinary tract infections. Less than one- fifth of participants (20 (15.15%)) with UTI were admitted in hospital for treatment.

Out of 417 participants, 331 (79.37%) thought that the signs and symptoms of UTIs are serious enough to consult a doctor and take medication. The medical and surgical histories of the participants (Table 4), shows that 95 (22.7%) had a previous history of a caesarean section, 20 (4.8%) had a previous history of urinary catheterization, 15 (3.6%) had renal stones, 14 (3.3%) had a history of diabetes mellitus, 5 (1.2%) had a chronic cough, 4 (1%) had hypertension, 4 (1%) had a history of pelvic surgery, and 2 (0.5%) had a history of prolapsed uterus.

Associated factors to recurrent UTIs

The potential risk factors associated through logistic regression for recurrent UTI are shown in the Table 5. Factors such as reduced water intake (less than 2 L) (OR = 6.4, 95%CI of 3.8–10.8), less frequent urination (≤ 3 times/day) (OR = 4.3, 95%CI of 2.6 to 7) holding urine for a prolonged duration (OR = 2.7, 95% CI 1.6 to 4.6), having h/o vaginal discharge (OR = 3.3, 95% CI of 2.2 to 6.6) or itching (OR = 3.1, 95%CI of 1.9 to 4.9), not washing toilet seat before use (OR = 1.6, 95% CI of 1.1 to 2.2), constipation (OR = 2.6, with 95% CI 1.5 to 4.5), being sexually active(OR = 1.8, with 95% CI of 1.1 to 3.1), not cleaning vaginal area before (OR = 2.5, with 95%CI 1.2 to 5.2) and/or after sexual intercourse (OR = 4.5, with 95% CI of 2.1 to 9.4) were found to be risk factors of recurrent UTI.

Whereas urinating before the act of vaginal sex was found to be protective against recurrent UTI with odds ratio of 0.3(95% CI of 0.18–0.63). Also as shown in Table 5, being a cleaning staff was found to have 2.7 times

Table 5 Logistic regression analysis for determinants of recurrent UTI

Variables	Odds ratio	95% C.I. for Odds ratio		*P* value
		Lower	Upper	
Religion	0.788	0.509	1.220	0.286
Place of residence	0.951	0.580	1.559	0.842
Marital status	1.181	0.903	1.544	0.224
Daily water intake of < 2 L	6.448	3.841	10.824	0.0001
Reduced average frequency of urination per day	4.321	2.657	7.026	0.0001
H/o Holding urine	2.795	1.689	4.625	0.0001
Foul smelling vaginal discharge	3.384	2.227	6.599	0.0001
Vaginal itching Since the last year	3.106	1.931	4.994	0.0001
Wash the genital area after each urination	1.376	0.877	2.160	0.165
Public toilet utilisation	1.078	0.727	1.598	0.709
Type of Toilet	0.609	0.350	1.060	0.079
Not Washing, toilet seat before use	1.654	1.191	2.297	0.003
Constipation	2.671	1.551	4.599	0.0001
Menstrual cycle	1.233	0.704	2.156	0.464
Type of sanitary products	0.732	0.448	1.196	0.213
Types of vaginal wash during menstruation	0.984	0.779	1.243	0.893
Frequency of vaginal washing during menstruation per day	1.105	0.704	1.735	0.663
Sexually active	1.878	1.122	3.143	0.017
Urinate just before sexual intercourse	0.343	0.185	0.638	0.001
Not washing vaginal area before sexual intercourse	2.571	1.271	5.205	0.009
Urinate just after sexual intercourse	1.860	0.947	3.653	0.072
Not washing vaginal area after sexual intercourse	4.541	2.189	9.418	0.0001
Occupation				
Doctor	1.224	0.647	2.315	0.535
Nurse	0.854	0.503	1.452	0.560
Lab/Radiology technician	0.995	0.473	2.093	0.989
Pharmacy staff	0.460	0.211	1.005	0.051
Office staff	0.367	0.109	1.237	0.106
Others	0.865	0.282	2.654	0.800
Wheelchair handlers	1.307	0.532	3.211	0.560
Canteen staff	1.411	0.432	4.607	0.568
Cleaning staff	2.714	1.437	5.126	0.002

higher odds (95% CI of 1.4 to 5.1) for getting recurrent UTI compared to doctors.

Discussion

Recurrent UTI is a major health issue in women of reproductive age group, which impacts their productivity and quality of life [4, 7, 34–36]. Despite this, there are only few studies that looked into recurrent UTI in working women of reproductive age group. Hence the current study focussed on finding the prevalence and associated factors in female staff of reproductive age group working in a tertiary healthcare centre.

Our study found that proportion of participants with recurrent UTIs is 22.30% (95% CI = 18.3- 26.3%). This finding was consistent with that of a study done by Mondal et al. (prevalence of 20.5%) in women of reproductive age group attending an OPD clinic in a tertiary care centre [32]. But the prevalence of recurrent UTI in similar age group was found to be much higher (36%) in a study in Babylon by Al-Musawi et al. [48].

Reduced water intake less than 2 litters emerged as a major risk factor of rUTI in our study with an odds ratio of 6.4(CI = 3.8–10.8). This result corroborates the findings of many previous studies such as that conducted by, Vyas S. et al. in Bareilly [3], and Prasuna Jelly et al. in north India, where the participants were female students (MBBS and Nursing) in a tertiary care teaching institution [23]. In the study conducted by Vyas S. et al. in Bareilly showed that taking less than one litter water per day had a twelve times risk of getting UTI. Also, our results agree with that of the study by Hailay A et al. in adult patients in Northern Ethiopia with twice the risk of getting UTI when taking two litter of water [45].

Another Major risk factor of rUTI in our study is reduced frequency of voiding, i.e., less than 4 times per day with 4 times risk compared to those voiding more than 4 times. And this is congruent with the results from Hailay A et al. study which showed odds ratio of 2.32 for those voiding less than five times per day. Urine

stasis and a proliferation of bacteria in the bladder, which causes UTIs, explains this association [45].

In the current study, we could bring out that holding urine proved to have almost thrice the risk for rUTI in women. This result is in line with the study by Jagtap S et al. in women of reproductive age groups in 8 different lady's hostels at Pondicherry University which shows that holding urine is one of the major risk factors (with OR = 2) for the repeated occurrence of UTIs [20]. Common reasons for holding urine were long travels with unavailability of rest room and lack of clean public toilet. But in our study busy work schedule is major reason for holding urine. Prolonged retention of urine causes bacterial pathogen to ascend and cause infection. Also, periureteral colonisation increases the risk of recurrent UTI [20].

The study identified foul-smelling vaginal discharge and vaginal itching as strong associated factors with almost three times risk of getting rUTI. Similar association were also seen in a cross-sectional study done by Ahmed SM et al. among adolescent girls in rural Karimnagar district [10]. While rUTI primarily involves urinary system these symptoms may indicate coexisting vaginal infection or other underlining conditions. Hence presence of such symptoms with urinary symptoms should indicate further evaluation.

Another observation in our study was that not washing toilet seat prior to using them doubles the risk of recurrent UTI. Similar results were seen in study done by Vyas S. et al.in unmarried nursing students aged 18–30 years studying in the SRMSIMS, Nursing College Bareilly with odds ratio of 2.3(1.01–5.27) [3].

Another insight from our study was association between constipation and recurrent UTI. Constipation almost triples the risk of recurrent UTI. Similar association was found in study by Mondal S et al. in female patients with UTI who had attended a urology outdoor patient department of a tertiary-care hospital in eastern India [32]. Faecal impaction due to constipation can lead to increase pressure on bladder and urethra, this can lead to retention of urine. This provides a conducive environment for bacterial growth [49].

Another interesting finding in the study was strong significant association of being sexually active to rUTI. It was seen that women who are sexually active have almost 2 times more risk of developing rUTI compared to women who are not are sexually active. It is a known fact that sexual intercourse is the most significant risk factor in rUTI [50] In a study by Jhang et al., the odds ratio of rUTI was as high as 10.3 in young women with intercourse more than 9 times in the past one month [51] and a higher frequency of sexual intercourse (more than two times per week) triples the risk of rUTI [51, 52]. Our study emphasised on other behavioural factors such as pre-and post coital vaginal hygiene and pre- and post coital urination. Following initial bivariate analysis using chi-square test, all these factors were found to be significantly associated with rUTI. Sexual intercourse makes easier to Bacteria stick urethra and latter enter into urinary tract due to its proximity to vagina. Hence urinating before and after urination can be recommended to help flush out bacteria from the urinary tract [53]. However, another study by Foxman B.et al. failed to show increase of UTI after sexual intercourse in a group of 316 women aged 40–65 years [54].

Both the hospital-based cross-sectional study by Torondel B et al. on non-pregnant women of reproductive age groups in Odisha [38] and the hospital-based case-control study by Padma Das et al. on 486 women in Odisha, India [42] demonstrated a substantial correlation between the prevalence of UTIs and menstrual practices. But our study could not bring out this finding, since the most of the study participants are medical and paramedical professionals, their high levels of knowledge and excellent menstrual hygiene might be the reason for this disparity.

The study also identified that compared to doctors, the cleaning staff had triple the risk contracting rUTI. This indicates the importance of providing health awareness and proper personal hygiene practices to the cleaning staff of the hospital.

Study limitations

This study has many limitations. First, results of our study cannot be generalised to the entire population of working women as the study was done on women who were employed at a private medical college. Second, the use of self-reported data and cross-sectional study design, may have contributed to some recall bias. Future studies using a longitudinal study design, microbiological confirmation, and a more diverse population could strengthen the external validity of our findings.

Conclusion

Our study among the female staff of reproductive age group revealed a very high prevalence of recurrent UTIs and this represents interaction of multiple factors such as anatomical, physiological, behavioural and sexual activity. Our study has brought out the emphasis on the sexual factors and behavioural factors such as reduced water intake, infrequent urination, holding urine, poor toileting habits, and poor vaginal hygiene. Conditions like foul-smelling vaginal discharge, vaginal itching and constipation were found to be significant. Therefore, in order to lower the frequency of recurring UTIs and thereby improve the quality of work and life, we would like to provide the following recommendations:

Education and awareness Proper awareness on common causes, symptoms, complications, when to seek medical care and preventive methods of UTI to all the staff.

Behavioural interventions Preventive methods include daily 2–3 L water intake, good toileting habits, good vaginal hygiene, and sexual hygiene.

Prompt diagnosis and proper treatment Early diagnosis and completion treatment course of UTI and other associated conditions like constipation and vaginitis are also very important. Collaboration among health care providers including Urologists, Gynaecologists and General practitioners essential for proper management of recurrent UTIs.

Future research should focus on implementing sustainable preventive strategies such as vaccines and non-antibiotic medications.

Supplementary Information

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Supplementary Material 1

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Author contributions
Franco Johny.V, V.T Krishnadas Menon and C.R Saju conceived and designed the study. Franco Johny V collected and screened the data. Franco Johny V, Sneha Georgy and Jini M P acquired, analysed, or interpreted the data. SG, FJV and VTK drafted the manuscript. All authors critically revised the manuscript for important intellectual content. JMP and FJV did the statistical analysis. CRS and VTK supervised the study. FJV and SG had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. FJV is the guarantor. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

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Data availability
All data relevant to the study are included in the article. The survey used for this study is available upon reasonable request.

Declarations

Ethics approval and consent to participate
This study involves human participants and was approved by Institutional ethics committee of Amala Institute of Medical Sciences, Thrissur, India (Ref.No: 18/EC/23/AIMS-04). Participants gave informed written consent to participate in the study before taking part. Authors followed all standard protocols needed to conduct this study. All methods were performed in accordance with the relevant guidelines and regulations, including the Declaration of Helsinki.

Competing interests
The authors declare no competing interests.

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