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Comparative study of causative agents of UTI among indoor, outdoor, children and adult patients of Pakistani Population

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ABSTRACT

Urinary tract infection (UTI) is the most common serious bacterial infection in developing countries causing illness in persons of all age groups, in nosocomial infection it is the second most important contributors of morbidity and mortality. This cross sectional study was done to found out the overall prevalence of UTI in the indoor and outdoor patients, 21.2% incidence is found out in Pakistan Institute of Medical Sciences, Islamabad under all age groups, represented many areas of Pakistan. Adults were more prone to infection (49.5%) as compared to children and elderly population. Females were more susceptible for UTI with 60.5% prevalence, in comparison 39.5% for males. Gram negative bacteria were responsible for 80.28% of UTIs and *Escherichia Coli* was the most predominant uropathogen (43.2%) in this study. The most effective drug was Levofloxacin and Polymixin for Gram negative bacteria, and Vancomycin for Gram positive. Since the hospital environment is a sort of collection agency for many pathogenic microorganisms by virtue of the many seriously ill patients who passes through it, therefore, it is extremely important for the hospital managements to do everything possible to minimize the spread of these organisms to other patients. Proper cleanliness should be followed so that the organism can't enter the body by means of contamination. Measures should be taken at the level of each person to minimize the incidence of UTI till its lower possible level.

Key Words: UTIs, uropathogen, Gram negative bacteria, *Escherichia Coli*, Levofloxacin

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INTRODUCTION

Urinary tract infection (UTI) is the most common serious bacterial infection ranging from asymptomatic presence of bacteria in the urine to severe infection of the kidney with resultant sepsis in developing countries causing illness in persons of all age groups [1] in nosocomial infection it is the second most important contributors of morbidity and mortality [2].

The common age group for females is 21-30 years, for males are 31-40 years [8], whereas in neonates and infants, the reported prevalence is 0.1 to 1% and 14% respectively. Infants younger than 3 months have higher urinary tract infection with prevalence of 7.5% in girls and 8.7% in boys[1]. Most of urinary tract infections (90%) are caused by gram-negative bacteria like *Escherichia coli*, *Klebsiella* species, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Acinetobacter*, and *Serratia. Escherichia coli* are the most common gram-negative bacteria responsible for community acquired and nosocomial UTI [2, 4, 5].

E. coli, the predominant cause of UTI, showed the highest percentage of resistance to Ampicillin (93.1%) and the lowest resistance to Amikacin (2.2%).[14, 6]. The second commonest organism (after *E.coli*), i.e., *S. aureus* (23%) was most sensitive to cephalosporin (88.8%) of second generation, followed by nitrofurantoin (77.7%), Amikacin (80.6%) and Norfloxacin (65.5%). The third common organism, *Klebsiella* (9.71%) was most sensitive to Norfloxacin (75%) and nitrofurantoin (75%). *Pseudomonas aeruginosa* was significantly resistant to most of the antibiotics except Amikacin, ESBL- producing bacteria are resistant to Aminoglycosides, Tetracycline, Chloramphenicol, Trimethoprim, sulfonamides and Quinolones [4-6].

ESBLs-producing strains of Entero bacteriaceae have emerged as a major problem in hospitalized as well as community based patients. Frequency of ESBL-producers in the community is usually 0.2% - 0.6%, but in some reports on UTIs they reached up to 14%. In indoor patients, ESBLs-producing *E. coli* was found to be most prevalent organism (51%) followed by *Klebsiella pneumoniae* (40%) and *Pseudomonas aeruginosa* (5.8%). While in case of outdoor patients, *Klebsiella pneumoniae* (47.1%) was the most prevalent ESBLs-producing organism, followed by *Escherichia coli* (38.1%) and *Pseudomonas aeruginosa* (9.52%) [6]. ESBL are also detected in the isolates of *E. coli* [7, 8].

Age is an important factor in the occurrence of UTI and it is more common at the extremes of life; highest incidence during the first year of life and reaches again to its peak during adolescence. The common age group for females is 21-30 years, whereas for males is 31-40 years and common in neonates and infants, with a reported prevalence of 0.1 to 1% in neonates, increasing to 14% and 5.3% in febrile neonates and infants, respectively. Sexually active women aged 20 to 40 years and postmenopausal women older than 60 years are the two populations at greatest risk for UTI [7, 9].

The objective of this research was to compare the prevalence of causative agents of UTI in Children and adults, Males and females. Community and nosocomial UTI by taking samples of indoor and outdoor patients and to explore the antibiotic susceptibility pattern of the identified microorganisms to certain antibiotics was determined.

MATERIALS AND METHODS

Hospital based cross sectional study was carried out in the Microbiology Department of Pakistan Institute of Medical Sciences (PIMS) Islamabad. This study was designed to measure the prevalence of UTI among children and adults for the duration of six months. **Inclusion criteria:** Urine samples of indoor or outdoor patients that were received in lab for culture and sensitivity were included in this study. Urine samples of patients of all age groups were included in this study N=1363. **Exclusion criteria:** All those urine samples that were received in the laboratory for the routine examination and microscopy and Patients taking antibiotics at the time of taking samples were excluded. **Demographic Characteristics** Demographic characteristics of the respective patients attending the laboratory were also recorded as according to the age of the patients, specimens were grouped as: Day 01-20 years, 21 years-50 years, and 51-above. **Sample collection:** The urine sample was tested immediately and after 24 hours of collection which were refrigerated with boric acid. Urine was first examined microscopically as a wet preparation. In case, if bacteria and white cells found out, gram staining was also performed. The samples received in the laboratory were directly stained by using gram staining technique and inoculated on culture media and identified on the bases of morphological, cultural and biochemical characteristics. **Cultural Identification:** All samples were inoculated on CLED agar plates were incubated aerobically for 24-48 hours at 37°C and after 24 hours the plates were examined for number of colonies and identification of colony. [10] **Colonial morphology of different microorganisms:** *Escherichia coli* are a lactose fermenting bacteria so they gave yellow colored colonies, which were opaque and slightly deeper colored center was found. *Klebsiella* species gave large mucoid yellow or yellow-white colonies. *Proteus* gave translucent blue-grey appearance [11]. **Biochemical Identification:** Gram-negative bacteria were identified by oxidase test and all other tests of API 20 E and API NE. Gram-positive microorganisms were identified with the corresponding laboratory tests as catalase coagulase, CAMP test (for *Streptococcus agalactiae*), and esculin agar (for enterococci) [12].**Antimicrobial Susceptibility Testing:** Antimicrobial susceptibility of isolates was tested by the Modified Kirby-Bauer disc diffusion technique Mueller Hinton medium, using antibiotic discs of Oxoid (UK) with the minimum inhibitory concentration (MIC). The susceptibility criteria were applied according to CLSI 2010 guidelines [12, 13]. **Interpretation of results:** Using the interpretative Chart, the zone sizes of each anti-microbial were interpreted, reporting the organisms as resistant, intermediate/moderately sensitive and sensitive [11, 13]. **Quality Control:** Appropriate quality control was performed in the laboratory by using *Enterococcus faecalis* ATCC 29212, *Escherichia coli* ATCC 25922, *Pseudomonas aeruginosa* ATCC 27853, *Staphylococcus aureus* ATCC 29213, K*. pneumonia* ATCC 700603 and *Streptococcus pneumonia* ATCC 49619 [13].

Statistical Methods: The statistical analysis was performed with the Statistical Package for Social Sciences version 17 for Windows (SPSS Inc.; Chicago, IL, USA) software and Microsoft Excel 2010. Descriptive analysis was done by calculating frequencies and percentages. The significance of results was calculated at 95% confidence level (P<0.05).

RESULTS

It was a cross sectional hospital based study conducted in Microbiology Department of Pakistan Institute of Medical Sciences, Islamabad. In this study one thousand, three hundred sixty three patients' urine samples received for culture and sensitivity during the period of six months were included.The samples of

patients from wards with complicated UTI as well as from OPD with uncomplicated UTI were processed to evaluate the prevalence of causative agents of UTI.

Out of total 1363 urine samples which were processed for screening of Urinary Tract Infections; 289(21.2%) samples were found positive for UTI.

Prevalence of Causative Agents of UTI; Gender and Age wise Correlation

In order to identify the causative agents for UTI, all the samples were inoculated on CLED agar for the detection of microorganism; six microorganisms *viz. Escherichia Coli, Klebsiella pneumonia, Pseudomonas aeruginosa, Proteus sp., Staphylococcus sp. and Candida* were isolated from the samples. Majority of the causative agents were gram negative organisms 232 (80.3%) and the rest organisms were gram positive 17 (5.9%) and *Candida sp.* 11 (5%) According to our results UTI was found in age groups ranging from two month infant to hundred years old elder person and most prevalent in age groups of 21- 50 years (Table I).

Table I: Prevalence of causative agents of UTI and Age wise correlation

Table 1 Frequency of different organisms in different age groups				
	Age			Total
	day 1- 20 years	21-50 years	51- above	
Escherichia coli	20	56	49	125
	16.0%	44.8%	39.2%	43.2%
Klebsiella pneumoniae	7	19	10	36
	19.4%	52.8%	27.8%	12.4%
Proteus vulgaris	5	6	4	15
	33.3%	40.0%	26.7%	5.1%
Staphylococcus saprophyticus	5	5	1	11
	45.5%	45.5%	9.1%	3.8%
Pseudomonas aeruginosa	9	23	13	45
	20.0%	51.1%	28.9%	15.5%
Staphylococcus aureus	1	2	2	5
	20.0%	40.0%	40.0%	0.17%
MRSA	0	1	0	1
	.0%	100.0%	.0%	0.34%
Proteus Spp	0	2	1	3
	.0%	66.7%	33.3%	1.03%
Proteus mirabilis	0	5	3	8
	.0%	62.5%	37.5%	2.7%
Candida albicans	9	24	7	40
	22.5%	60.0%	17.5%	1.38%
Total	56	143	90	289
	19.4%	49.5%	31.1%	100.0%

Prevalence of *Escherichia coli*; Gender and Age wise Correlation

The *E. coli* was found in 125/289 (43.2%) samples (Table I). Out of these 125 samples 20(16%) samples of children of age 0-20 years, 56 (44.8%) samples of adults age 21-50 years and 49(39.2%) samples of population having age 51-above were found positive for *E. coli.* The age group 21-50 years was found most susceptible to *E. coli* (Table I). The *E. coli* was found most prevalent in females 62 (52.2%) as compared to males 59(47.2% (Table II).

Prevalence of *Pseudomonas aeruginosa*; Gender and Age wise Correlation

The*Pseudomonas aeruginosa* was found in 46/289 (15.9%) samples (Table I). Out of these 46 samples 9(20%) samples of children of age 0-20 years, 23 (51.1%) samples of adults age 21-50 years and 13(28.9%) samples of population having age 51-above were found positive for *Pseudomonas aeruginosa.* The age group 21-50 years was found most susceptible to *Pseudomonas aeruginosa* (Table I). The *Pseudomonas aeruginosa* was found most prevalent in females 23 (56%) as compared to males 18 (43.9% (Table II).

Prevalence of *Klebsiella pneumoniae*; Gender and Age wise Correlation

The *Klebsiella pneumoniae* was found in 36/289 (12.4 %) samples (Table.1). Out of these 36 samples 7 (19.4%) samples of children of age 0-20 years, 19 (52.8%) samples of adults age 21-50 years and 10 (27.8%) samples of population having age 51-above were found positive for *Klebsiella pneumoniae.* The age group 21-50 years was found most susceptible to *Klebsiella pneumoniae* (Table I) The *Klebsiella pneumoniae* was found most prevalent in females 27 (75%) as compared to males 9 (25%) (Table II).

Prevalence of *Proteus vulgaris*; Gender and Age wise Correlation

The*Proteus vulgaris* was found in 15/289 (5.1%) samples (Table II). Out of these 15 samples 6 (33.3% samples of children of age 0-20 years, 5 (40) samples of adults age 21-50 years and 4 (26.6%) samples of population having age 51-above were found positive for *Proteus vulgaris.* The age group 21-50 years was found most susceptible to *Proteus vulgaris* (Table I) The *Proteus vulgaris* was found most prevalent in females 10 (55.5%) as compared to males 8 (44.4%) (Table II)

Prevalence of *Proteus mirabilis*; Gender and Age wise Correlation

The *Proteus mirabilis* was found in 8/289 (2.7%) samples (Table I). Out of these 7 samples none of the samples of children of age 0-20 years was found positive, 5 (62.5% 45.4) samples of adults age 21-50 years and 3(37.5%) samples of population having age 51-above were found positive for *Proteus mirabilis.* The age group 21-50 years was found most susceptible to *Proteus mirabilis* (Table I). The *Proteus mirabilis* was found most prevalent in females 2 (40%) as compared to males 3 (60%) (Table II).

Prevalence of *Staphylococcus saprophyticus*; Gender and Age wise Correlation

The *Staphylococcus saprophyticus* was found in 11/289(3.8%) samples (Table.1). Out of these 15 samples 5(45.5%) samples of children of age 0-20 years, 5 (45.4) samples of adults age 21-50 years and 1(9%) samples of population having age 51-above were found positive for *Staphylococcus saprophyticus.* The age group 21-50 years was found most susceptible to *Staphylococcus saprophyticus* (Table I) The *Staphylococcus saprophyticus* was found most prevalent in females 7 (63.3%) as compared to males 4 (36.3%) (Table II)

Prevalence of *Staphylococcus aureus* and *MRSA*; Gender and Age wise Correlation

The *Staphylococcus aureus* was found in 5/289(0.17%) samples (Table. I). Out of these 5 samples 1 (20%) samples of children of age 0-20 years, 2(20%) samples of adults age 21-50 years and 2 (20%) samples of population having age 51-above were found positive for *Staphylococcus aureus.* The age group 21-50 and above years was found most susceptible to *Staphylococcus aureus*(Table.1). The *Staphylococcus aureus* was found most prevalent in females 3 (75%) as compared to males 1 (25%) (Table II)

Prevalence of *Candida albicans*; Gender and Age wise Correlation

The *Candida* was found in 40/289 (1.38%) samples (Table.1). Out of these 40 samples 24 (60%) samples of children of age 0-20 years, 9 (22.5%) samples of adults age 21-50 years and 7(17.5%) samples of population having age 51-above were found positive for *Candida.* The age group 0-20 and above years was found most susceptible to *Candida* (Table I). The *Candida* was found most prevalent in females 28 (70%) as compared to males 12 (30%) (Table II).

Table II: Prevalence of causative agents of UTI and Gender wise correlation

Organisms	Male	Female	
Escherichia coli	59	66	125
	47.2%	52.2%	100.0%
Klebsiella pneumoniae	9	27	36
	25%	75%	100.0%
Proteus vulgaris	8	10	18
	44.4%	55.5%	100.0%
Staphylococcus saprophyticus	4	7	11
	36.3%	63.3%	100.0%
Pseudomonas aeruginosa	23	18	41
	56%	43.9%	100.0%
Staphylococcus aureus	1	3	4
	25%	75%	100.0%
MRSA	1	0	1
	100%	0%	100.0%
Proteus Spp	1	2	3
	33.3%	66.6%	100.0%
Proteus mirabilis	3	2	5
	60%	40%	100.0%
Candida albicans	12	28	40
	30%	70%	100.0%
	19.4%	49.5%	100.0%

ANTIBIOTIC SUSCEPTIBILITY PATTERNS OF UTI CAUSING AGENTS:

Antibiotic Susceptibility pattern of Gram Negative Organisms in UTI

The isolated strains of gram negative organisms were subjected to the standard disc diffusion Kirby-Bauer antibiotic susceptibility test. The antibiotic susceptibility of these strains was studied against Nitrofurantoin, Piperamidic acid, Amoxicillin+clavulanic acid, Cefetrixone, Ceftazidime, Cefetrixone, Cefoperazone+sulbactam, Cefoperazone+sulbactam, Tobramycin, Amikacin, Imipenem, Polymixin and Levofloxacin.

Antibiotic Susceptibility Patterns of *Escherichia coli*

The *E. coli* isolated from urine samples of UTI patient were mostly susceptibility to these antibiotics. A total of 98 strains susceptible to Nitrofurantoin; 51 to Piperamidic acid; 45 to Amoxicillin clavulanic acid; 41 to Ceftriaxone; 41 to Ceftazidime; 99 to Cefoperazone+ sulbactam; 91 to Cefoperazone+ sulbactam; 75 to Tobramycin; 95 to Amikacin; 107 to Imipenem; 110 to Polymixin and 72 to Levofloxacin (Table III).

Antibiotic Susceptibility Patterns of *Klebsiella pneumonia*

The *Klebsiella pneumonia* isolated from urine samples of UTI patient were mostly susceptibility to these antibiotics. A total of 21 strains susceptible to Nitrofurantoin; 13 to Piperamidic acid ; 11 to Amoxicillin+clavulanic acid; 9 to Ceftriaxone; 12 to Ceftazidime; 29 to Cefoperazone+sulbactam; 22 to Cefoperazone+sulbactam; 17 to Tobramycin; 25 to Amikacin; 30 to Imipenem 30 to Polymixin and 20 to Levofloxacin (Table III).

Antibiotic Susceptibility Patterns of *Pseudomonas aeruginosa*

The *Pseudomonas aeruginosa* isolated from urine samples of UTI patient were mostly susceptibility to these antibiotics. A total of 22 strains susceptible to Nitrofurantoin; 35 to Piperamidic acid ; 34 to Amoxicillin+clavulanic acid; 28 to Ceftriaxone; 31 to Ceftazidime; 10 to Cefoperazone+sulbactam; 19 to Cefoperazone+sulbactam; 28 to Tobramycin; 15 to Amikacin; 10 to Imipenem; 6 to Polymixin; 29 to Levofloxacin and 21 to PRL(Table III).

Antibiotic Susceptibility Patterns of *Proteus vulgaris, Proteus mirabilis and other Proteus species*

The *Proteus* isolated from urine samples of UTI patient were mostly susceptibility to these antibiotics. A total of 16 strains susceptible to Nitrofurantoin; 8 to Piperamidic acid; 11 to Amoxicillin+clavulanic acid; 20 to Ceftriaxone; 12 to Ceftazidime; 21 to Cefoperazone+sulbactam; 17 to Cefoperazone+sulbactam; 13 to Tobramycin; 22 to Amikacin; 19 to Imipenem; 19 to Polymixin and 21 to Levofloxacin (Table III).

Table III: Antibiotic Susceptibility pattern of Gram Negative Organisms in UTI

Antibiotics	*Escherichia coli*		*Klebsiella pneumonia*		*Proteus mirabilis*		*Proteus species*		*Proteus vulgaris*		*Pseudomonas aeruginosa*	
	S	**R**	**S**	**R**	**S**	**R**	**S**	**R**	**S**	**R**	**S**	**R**
F	98	25	21	15	3	2	3	0	10	8	23	22
PIP	51	73	13	23	1	4	2	1	5	13	10	35
AMC	45	80	11	25	3	2	1	2	7	11	11	34
CRO	41	84	9	26	3	2	1	2	16	12	17	28
CAZ	41	84	12	24	4	1	1	2	7	11	14	31
SCF	99	26	29	7	5	0	2	1	14	4	35	10
TZP	91	34	22	14	5	0	2	1	10	8	26	19
TOB	**75**	**48**	17	19	4	1	1	2	8	10	17	28
AK	95	28	25	11	5	0	2	1	14	4	30	15
IPM	107	16	**30**	**4**	4	1	2	1	13	5	35	10
PB	110	15	30	4	5	0	1	2	13	5	39	6
LEV	72	48	20	16	4	1	1	2	16	2	16	29
PRL	-	-	-	-	-	-	-	-	-	-	24	21

Antibiotic Susceptibility pattern of Gram Positive Organisms in UTI

The isolated strains of gram negative organisms were subjected to the standard disc diffusion Kirby-Bauer antibiotic susceptibility test. The antibiotic susceptibility of these strains was studied against Nitrofurantoin, Piperamidic acid, Penicillin, Chloramphenicol, Co-trimoxazole, Linezolid, Vancomycin, Fusidic acid, Erythromycin and Levofloxacin.

Antibiotic Susceptibility Patterns of *Staphylococcus aureus:*

The *Staphylococcus aureus*isolated from urine samples of UTI patient were mostly susceptibility to these antibiotics. A total of 4 strains susceptible to Nitrofurantoin; 3 to Piperamidic acid; 4 to Chloramphenicol; 1 to Co-trimoxazole; 3 to Linezolid; 5 to Vancomycin; 3 to Erythromycin; 3 to Fusidic acid and 3 to Levofloxacin (Table IV).

Antibiotic Susceptibility Patterns of *Staphylococcus saprophyticus:*

The *Staphylococcus saprophyticus* isolated from urine samples of UTI patient were mostly susceptibility to these antibiotics. A total of 8 strains susceptible to Nitrofurantoin; 7 to Piperamidic acid; 1 to Chloramphenicol,; 1 to Penicillin; 9 to Co-trimoxazole; 10 to Linezolid; 1 to Vancomycin;7 to Erythromycin; 9 to Fusidic acid and 8 to Levofloxacin (Table IV).

Table IV: Antibiotic Susceptibility pattern of Gram Positive Organisms in UTI

Antibiotics	*Staphylococcus aureus*		*Staphylococcus saprophyticus*	
	S	R	S	R
F	4	0	8	3
PIP	3	0	7	4
P	0	5	1	10
C	4	1	1	10
SXT	1	4	9	2
LZD	3	2	10	1
VA	5	0	1	10
E	3	2	7	4
FA	3	2	9	2
LEV	3	2	8	3

DISCUSSION

It was a cross sectional hospital based study. For the present study all patients' urine samples received during the six months for culture and sensitivity in the Microbiology Lab of PIMS were included in the study. This constituted an overall one thousand, three hundred and sixty three urine samples that were processed to evaluate the prevalence of causative agents of UTI.

The prevalence of UTI in this studied population was 21.2%; this high incidence may be attributed to the fact that this data was collected from the OPD as well as from the wards patients of different departments who might have been previously infected with UTI at any stage during hospitalization, catheterization or any other chronic disease. This high prevalence also reflects the low socio-economic status and so the poor living style of the majority of the population in Pakistan. Similar findings were seen in Nigeria 22% by Mbata (2007) who recorded 21.9% among Prison inmates in Nigeria. The high prevalence of UTI was also recorded 25.6% by Nedolisa (1998), 38.6% recorded by Akinyemi *et al*. (1997) and 35.5% recorded by Ebie *et al.,* (2001) [15-18].

In the present study most of the patients infected were from 21- 50 years old mostly in female whereas, the incidence of UTI was higher in males from 51 – 80 years. The reason for this can be due to the fact that during this age females are sexually active. Our results were similar with the findings of Tena D (2009) who also showed that UTI is less common in young men below 50 and who did not undergo any genitourinary procedure. Infection tends to rise after the age of 50 in men. Similarly Akram *et al*., (2007) also observed that high frequency of UTIs in elderly patients (51.04 %) [19, 20].

Gender Wise Trends of UTI

In the present study the data was further analyzed according to gender and age group to study the impact on the development of UTI. In this study, the prevalence of UTI in females was 60.5% which was more than males 39.5%. This might be due to the close proximity of female urethral meatus to the anus, shorter urethra and urothelial mucosa adherence to the muco-polysaccharide lining. Pregnancy itself is the major predisposing factor to UTI, especially in the first and third trimester. In the present study high incidence of UTI in females of age group 21-50 years may be due to the high risk of recurrence in them. This is in agreement with other reports which stress that UTI was more frequent in females than in males, during youth and adulthood [15, 21].

Prevalence of Causative Agents of UTI:

The most common organism isolated in these patients were *E. coli* (43.2%), *P. aeruginosa* (15.5%), *Klebsiella pneumoniae* (12.4%), *Proteus vulgaris* (5.1%) and *Staphylococcus saprophyticus* (3.8%). Similar findings were also reported; which indicate that a gram negative bacterium, particularly *E. coli,* was the commonest pathogen isolated from UTI patients. [15, 18] In the present study the other isolates include *Proteus mirabilis (2.7%), Candida albicans* (1.38%), *Proteus Spp* (1.03%), *Staphylococcus aureus* (0.17%) and *MRSA* (0.34%) and the most prone age group was 21-51 years (adults) as compared to children and elderly population. *Proteus spp* is the major causative agent in this group, followed by *E.coli*.

Antibiotic Susceptibility Patterns of UTI Causing Agents

The most useful antibiotics proved in the present study were Levofloxacin, Polymixin and Imipenem for gram negative organisms, and Vancomycin prove to be useful for gram positive bacteria. This is similar to other reported susceptibility pattern to these drugs [15, 18]. In the present study Nitrofurantoin, Ampicillin and Co-trimoxazole (septrin) which are commonly used antibiotics were poorly effective against majority of the organisms isolated in this study [15, 22].

The findings have no doubt highlighted the need for constant monitoring of susceptibility of specific pathogens in different populations to commonly used anti-microbial agents. These data may be used to determine trends in antimicrobial susceptibilities, to formulate local antibiotic policies, to compare local with national data and overall to assist clinicians in the rational choice of antibiotic therapy to prevent misuse. Also, the results from this study revealed that the important infecting organisms were found to be the commensals of perianal and vaginal regions. This calls for increase in personal hygiene.

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COMPETING INTERESTS

The authors declare no competing interests.

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None

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