

TRENDS OF UTI (URINARY TRACT INFECTION IN INDIA)

Deepali A. Gohel, Dr. Anju Dhar*, Soni D. Gupta, Raksha Patel, Rupesh D. Dingankar

General Diagnostics International (P) Ltd., Plot 6, Sector 24, Turbhe, Navi Mumbai, Maharashtra, Pin: -400705.

*Corresponding Author: Dr. Anju Dhar

General Diagnostics International (P) Ltd., Plot 6, Sector 24, Turbhe, Navi Mumbai, Maharashtra, Pin: -400705.

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ABSTRACT

A urinary tract infection (UTI) is a very common type of infection and it can occur in any part of the urinary system which includes the kidneys, ureters, bladder and urethra. Most infections involve the lower urinary tract — the bladder and the urethra. Symptoms typically include needing to urinate often, having pain in lower back of side or burning micturition while urinating. Most of the UTI get treated with Antibiotics. Urinary tract infection is one of the infectious diseases affecting both genders. Women are at greater risk of developing a UTI than are men. Women get UTI up to 30 times more often than men do. Also, as many as 4 in 10 women who get UTI will get at least one more within 6 months.^[1] With this background the UTI cases from all over India were studied. In a period of 1 year (2021-2022), a total of 8072 samples were processed and analysed for the prevalence of UTI in India. The present study shows the gender-wise distribution of UTI, among them 35.56% were males and 64.44% were females. In this study the percentage of UTI is common in women in the reproductive age and post-menopausal stage. This study also shows age-wise distribution of UTI as children (55.48%), adults (49.63%) and elderly (53.41%). An analysis of UTI positive culture showed the presence of *Escherichia coli*, *Klebsiella* spp, *Enterobacter* spp, *Citrobacter* spp, *Proteus* spp, *Pseudomonas* spp, *Acinetobacter* spp, *Staphylococcus aureus*, *Enterococcus* spp. This study also provides the seasonal trend of UTI in India. According to the graph plotted for seasonal trend in UTI, it is found that there is a decrease in percentage positivity of almost all above mentioned organisms in winter season except for organisms *Klebsiella* spp. and *Citrobacter* spp. whose percentage increases in the winter season and then decreases in the summer season.

INTRODUCTION

In the urino-genital system, the output from kidneys is eliminated and wastes are filtered in urinary tracts. The urinary tract has an upper and lower part. This filter tube of human system often gets affected by bacterial, fungal and viral infections.^[2]

UTI can affect any age group. It is also known as one of the most common and potential serious bacterial infection of childhood. Common risk factors in children includes Vesicoureteral reflux, Bladder Bowel Dysfunction and older non continent children (eg developmental delay.)

Amongst children, girls and uncircumcised boys are more affected understandable given bacterial skin flora concentration under the nappy in infancy, shorter female urethral distance and foreskin area in uncircumcised male during toilet training can lead to volitional holding and bladder stasis. All above factors promotes UTI in children.^[3]

Urinary tract infection (UTI) is a contagion among men and women but the incidence is found high among women due to their biological conditions.^[4] Women get UTI more often because a women urethra is shorter than

a men. It is reported that UTI is affecting both genders but women in the age group 15-44 are more prone to this infection.^[5] Of the different types of urinary tract infection, cystitis (lower urinary tract infection) and pyelonephritis (upper urinary tract infection) are the major problems. For lower urinary tract infection, the common symptoms include inflammation and irritation in the lining of urethra and bladder, burning sensation or pain while urinating. More frequent urination and often with only a small amount of urine, sensation of having to urinate urgently, cloudy, bad smelling, or bloody urine, lower abdominal pain and mild fever. For upper urinary tract infections, the frequent symptoms include, high fever, nausea and vomiting, shaking chills, pain in back or one side of waist. In the children fever, vomiting, loss of bladder control sleeping mode are common symptoms. In the elderly fatigue is common due to UTI.^[6]

UTI may occur in any season but the risk of UTI increases in winters due to less consumption of water as well as due to cold induced diuresis which is your body's way of preventing hypothermia by decreasing blood flow to the skin and concentrating it around the organs to keep them warm. Cold weather can not only cause UTI but also exacerbate underlying lower urinary tract problems

like residual urine, urge incontinence and excessive night-time urination.

METHOD AND MATERIALS

For the study, data of 8072 samples received in the laboratory, was collected. Samples were received in a leak-proof universal sterile container. Once the sample received, it was processed immediately. If there is delay in sample processing, the samples were kept in the refrigerator at 2°C- 8°C temperature for not more than 4 hours. Then the samples were processed.

Materials required for sample processing^[7]

1. Microscope
2. Glass slide
3. Cover slips
4. Sterile loops (0.1µL volume)
5. Centrifuge
6. Sterile Blood Agar plate
7. Sterile MacConkey's Agar plate
8. Sabouraud's dextrose Agar plate
9. Sterile Mueller Hinton Agar plate
10. Sterile Antibiotic discs
11. Forceps
12. Sterile cotton swab

Once the samples were received, they were identified and a lab number was assigned. Then the samples were taken for processing.

1. Gross examination

- Once the samples were received, physical examination was done- Quantity, Colour, turbidity and pH.

2. Microscopy

- Urine sample were then centrifuged at 2500rpm for 10 minutes, and then wet mount is prepared using a glass slide, cover slip and dropper.^[8]
- The wet mount prepared is then observed microscopically for identification of presence of host cells (Pus cells, epithelial cells), bacteria, yeast cells.
- A smear is prepared for gram staining to identify host cells, gram positive and gram negative organisms.
- Results were recorded.

3. Isolation of bacteria

- Urine sample is then inoculated using sterile loop (1µL) on media- Blood agar, MacConkey agar and Sabouraud's agar^[9].
- Sample is inoculated on Blood agar for colony count of the bacteria to determine significant and insignificant Bacteriuria.
- Isolation is obtained using pentagonal streaking method.
- With a 1µL loop, one hundred colonies equals 10⁵ cfu/ml.
- After inoculation, the plates are incubated in the incubator at 37°C for 24 hours.

4. Interpretation of Result

- After 24 hours of incubation, the plates are observed for growth.
- If there is no growth, sample is reported as sterile.
- If growth is observed, colony characteristics are noted and then it is further processed for identification of the bacteria and AST is performed.
- Colony count of the bacteria is calculated to determine the significance of the infection.

Bacterial colony count/ ml	Remarks
Less than 10 ³ CFU/ml	Insignificant Bacteriuria.
10 ³ -10 ⁵ CFU/ml	Doubtful significance special situations like pediatric patients, patient on diuretics and antibiotics, etc.
more than 10 ⁵ CFU/ml	Significant Bacteriuria.
Percutaneous Nephrostomy (PCN) specimen, Ureterostomy, Suprapubic catheterisation (SPC)	No colony count.

- IMViC test, TSI, Motility, Urea hydrolysis are performed to identify the bacteria.
- The identification of Gram positive organisms was performed using Vitek 2 compact system.
- AST is performed by making a suspension and comparing its turbidity with the 0.5 McFarland standards.
- If candida is grown, Germ-tube test is performed and reported accordingly.

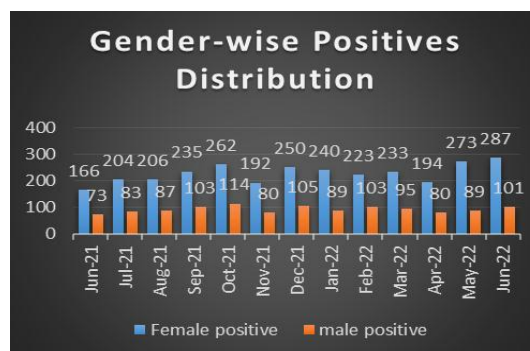
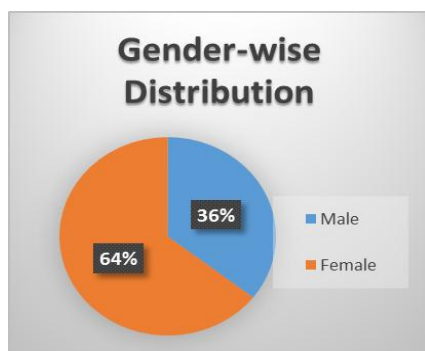
RESULTS

In this study a 13 months data (June-2021 to June-2022) was analysed to interpret the various trends of UTI

across India. A total of 8072 samples were analysed by Urine Culture and sensitivity technique, and 4167 samples (51.62%) were found to be positive.

Gender-wise prevalence of UTI

The gender-wise distribution of the total male and female samples was compared with the male-female positive samples and it was found that the prevalence of UTI in females is more than that in males by 49%.



Age-wise prevalence of UTI

In this study the patients were divided into 3 age groups as follows:

1. <16 years
2. 16-60 years and
3. >60 years

For age group <16, the percentage positivity was found to be 10%.

For age group <16 the difference between male and female positives was found to be approximately 3%.

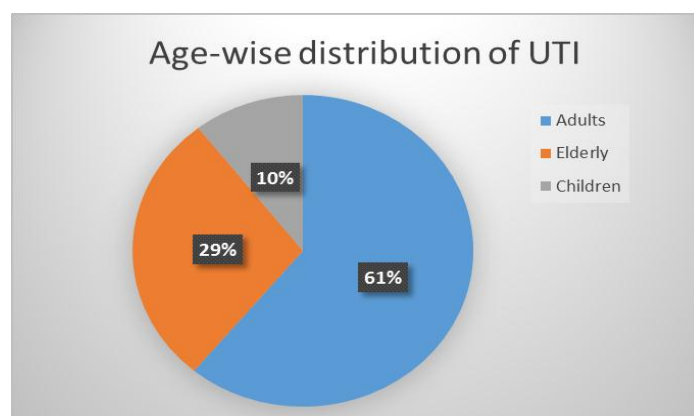
For age group 16-60, the percentage positivity was found to be 61%.

Maximum patients (61%) were from age group 16-60 and also the positivity rate was higher (58.8%) in this age category especially females which contributed a total of 46.3%.

For age group >60, the percentage positivity was found to be 29%.

For age group >60 the difference between male and female positives was found to be approximately 5%.

For all the age groups studied, the percentage of female patients as well as female positives was greater than that compared to the males.

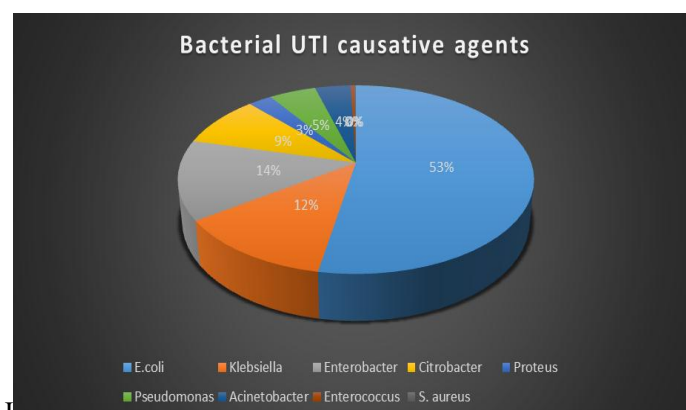


Prevalence of different organisms in causing UTI

In this study it was found that the UTI was caused by various organisms such as Gram negative bacteria including Enterobacteriaceae family (*Escherichia coli*, *Klebsiella* spp., *Enterobacter* spp., *Citrobacter* spp., *Proteus* spp.), *Pseudomonas* spp. and *Acinetobacter*

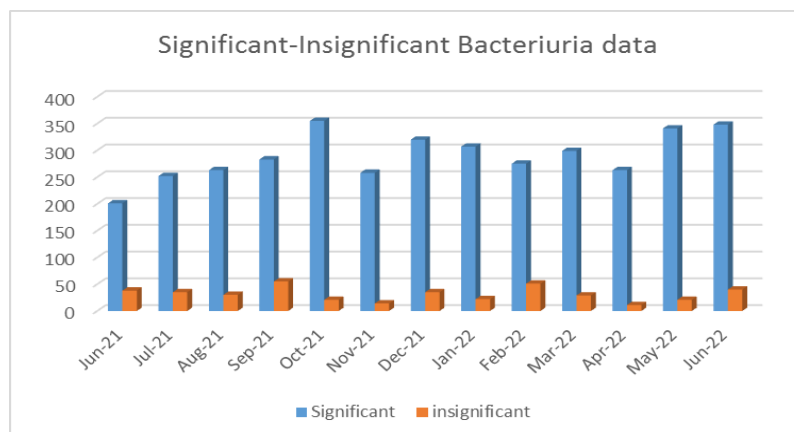
spp., and Gram positive bacteria including *Enterococcus* spp. and *Staphylococcus aureus*.

It was found that 53% of the UTI were caused by *Escherichia coli* contributing as the causative agent for more than half of the UTI's.



Significant-insignificant Bacteriuria

Out of a total of 4167 positive samples, 90.35% were cases of significant Bacteriuria i.e; with a cfu of $\geq 10^5$ /ml.



Seasonal trend of UTI

In the monsoon season the percentage of samples positive for *Escherichia coli* was found to be 52.9% which was reduced to 49.2% in the winter season and in the summer season was again increased to 54.7%.

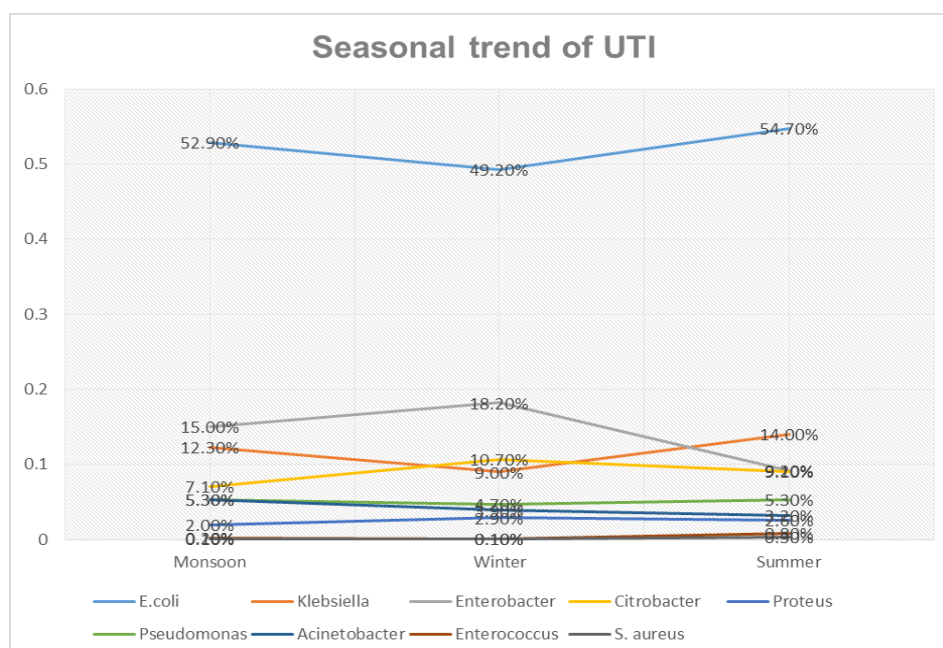
In the monsoon season the percentage of samples positive for *Klebsiella* spp. was found to be 12.3% which dropped to 9% in winter season and again a rise to 14% was observed in the summer season.

It was also observed that the percentage of samples positive for *Enterobacter* spp. was greater than that of *Klebsiella* spp. in monsoon (15%) as well as winter season (18.2%). A maximum of *Enterobacter* spp. (18.2%) were isolated and identified in winter season. In summer season, however there was a reduction in positive samples for *Enterobacter* spp. (9.2%) as compared to other seasons and also in comparison of *Klebsiella* spp.

The percentage of *Citrobacter* spp. in monsoon season was found to be 7.1%, which increased to 10.7% in the winter season and was found to be 9.2% in summer season.

The trend for other organisms isolated such from family Enterobacteriaceae as *Proteus* spp., *Pseudomonas* spp., and *Acinetobacter* spp. and also Gram positive organisms such as *Enterococcus* spp. and *Staphylococcus aureus* was more or less the same for all the seasons compared.

According to the graph plotted for seasonal trend in UTI, it is found that there is a decrease in percentage positivity of almost all above mentioned organisms in winter season except for organisms *Klebsiella* spp. and *Citrobacter* spp. whose percentage increases in the winter season and then decreases in the summer season.



DISCUSSION

Over the years, the factors affecting the occurrence of UTI among patients have significantly changed. This study helps in the evaluation of the changing risk factors and etiological agents in the occurrence of UTI among the people of India. A 13 month cross sectional study was done under the Microbiology department of General Diagnostics International Private Limited, Navi Mumbai. Among 8072 samples received by the laboratory for urine culture, 4167 were found to be positive.

In the present study, 64.44 % of the patients were female whereas 35.56% were male among the total samples received. This was consistent to a study by Momoh *et al.*^[10] (2011) who reported UTIs in 60.2% of the females and 39.8% of males. Among the total positive cases found, 71.15% cases were female whereas 28.85 cases were male with a female to male ratio of 2.47:1. This was also similar to the study done by VR Christy.^[11] (2019) who reported 56.91% positive cases for female and 43.09% for male in their study of Epidemiology of urinary tract infection in south India.

The occurrence of UTI commonly increases with age. In this study, the age range of the patients was 2 years - 92 years. The patients age were classified as children (below 16 years), adults (17-65 years) and elderly (66 years and above). The maximum affected age range was adults (4924 patients) which comprised of 61% of the patients affected with UTI. Amongst the UTI positive cases, 28.50% were elderly and 10.50% were children. These results were consistent with a study done by M. Eshwarappa.^[12] (2021) in his research of clinico-microbiological profile of urinary tract infection in south India.

UTI can be caused when bacteria from an external source enter the urethra. A wide range of pathogenic organisms are responsible for its occurrence. In this study we found that the most common causative agent is *Escherichia coli* which was responsible for 52.48% of the positive cases. The other causative agents were *Klebsiella* spp. (12.35%), *Enterobacter* spp. (13.60%), *Citrobacter* spp (8.93%), *Proteus* spp. (2.56%), *Pseudomonas* spp. (5%), *Acinetobacter* spp. (3.83%), *Enterococcus* spp. (0.40%) and *Staphylococcus* spp. (0.16%). Another common source of UTI was *Candida* spp. which was found in 6.50% of the total positive cases. The results showed slight resemblance with a study by Ana L. Flores-Mireles.^[13] (2015)

According to the Indian seasons of the year, the number of positive cases in the winter season (October to January) were slightly more as compared to the summer (February to May) and monsoon (June to September) season. Considering the total positive cases throughout the year, 35.24% of the positive cases were during the winter season whereas there were 30.61% positive cases during monsoon and 34.13% positive cases during summer. This was contrasting to a study by Hsu, Po-

Cheng.^[14] (2019) where he concluded that UTI occurrence rate varied from 7% to 18%, and it was highest in the summer (13.0% \pm 2.6%) and lowest in the winter (10.2% \pm 1.9%).

Overall this study highlights the risk, gender and age factors, seasonal variations among causative organisms and etiological agents associated with the patients suffering from UTI in India. It shows that *E. coli* is the principal pathogen of UTIs and the occurrence of UTI is more common in females and adults.

CONCLUSION

The present study shows that adults (61%) are most likely to have the occurrence of UTI. Gender wise distribution shows that females (71.15%) have shown occurrence of UTI. Thus we can conclude as shown that adult females in India are the most likely to be affected by UTI. Faryabi *et al.*^[15] reported that UTI was most prevalent among geriatric population in both genders and a similar report was made by Prakasam *et al.*^[16]. However, the present study showed an opposite condition and females are more prone to UTI when compared to males. The various types of bacterial and fungal pathogens responsible for the occurrence of UTI among the affected patients were *Escherichia coli* (52.48%), *Klebsiella* spp. (12.35%), *Enterobacter* spp. (13.60%), *Citrobacter* spp (8.93%), *Proteus* spp. (2.56%), *Pseudomonas* spp. (5%), *Acinetobacter* spp. (3.83%), *Enterococcus* spp. (0.40%), *Staphylococcus* spp. (0.16%) and *Candida* spp (6.50%). According to the seasons of India, the positivity rate of UTI among the total samples received by the laboratory were slightly less in monsoon (30.61%) as compared to the winters (35.24%) and summers (34.13%). This concludes that climatic conditions may not have a huge influence on the prevalence of UTI among the Indian population. Among the total positive cases detected, 90.35% samples had significant bacteriuria count whereas 9.65% had insignificant bacteriuria count. Antibiotic administration before conducting the test, asymptomatic UTI and the onset of UTI could be the probable reasons for insignificant bacterial counts.

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