

## ORIGINAL ARTICLE

# DISTRIBUTION OF URINARY TRACT INFECTIONS BY SEX, AGE GROUP AND TYPE OF BACTERIA IN POPULATION OF ISLAMABAD, PAKISTAN

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## ABSTRACT

**Background:** Urinary tract infections (UTIs) are common bacterial infections leading to significant morbidity, hospital admissions and cost. Our objectives were to determine the distribution of urinary tract infections by sex, age group and type of bacteria in population of Islamabad, Pakistan.

**Materials & Methods:** This cross-sectional study was conducted in Department of Nephrology, Khan Research laboratories Teaching Hospital, Islamabad, Pakistan from June 2018 to May 2020. A sample of 182 UTIs cases was selected from population at risk consecutively. Sex, age groups and type of bacteria were variables. All variables were nominal except age group which was ordinal. Distribution was analyzed by count, percentage and confidence intervals for proportion at 95%CL for population.

**Results:** Out of 182 patients with UTIs, 90 (49.45%) were men and 92 (50.55%) women, 19 (10.44%) were in age group 18-40 years, 75 (41.21%) in age group 41-60 years and 88 (48.35%) in age group of >60 years. Most common bacteria was *Escherichia coli* 116 (63.74%), followed by *Klebsiella pneumonia* 20 (10.99%), *Pseudomonas aeruginosa* 15 (8.24%), *Enterococcus faecalis* 15 (8.24%), *Staphylococcus aureus* 7 (3.85%), *Proteus mirabilis* 4 (2.20%), *Acinetobacter* 2 (1.10%), *Enterobacter* 2 (1.10%) and *Staphylococcus epidermidis* 1 (0.54%).

**Conclusion:** In our population, the prevalence of UTIs was similar in men and women, while it was higher in age group >60 years, followed by 41-60 years and 18-40 years. The most common bacteria were *E.coli*, followed by *K.pneumonia*, *Paeruginosa*, *E.faecalis*, *S.aureus*, *P.mirabilis*, *Acinetobacter*, *Enterobacter* and *S.epidermidis*.

**KEY WORDS:** Urinary Tract Infections; Distribution; Sex; Age groups; Population; Bacteria; *Escherichia Coli*; *Klebsiella Pneumonia*; *Pseudomonas Aeruginosa*; *Enterococcus Faecalis*.

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## 1. INTRODUCTION

**1.1 Background:** Urinary tract infections (UTIs) are common bacterial infections leading to significant morbidity, hospital admissions and cost. About 150 million people are infected with UTIs annually globally, with more than six billion US dollars cost.<sup>1</sup> UTIs are more frequent in women than men with highest prevalence in younger age groups.<sup>2</sup> Around 40-50% women get UTI once in their lifespan.<sup>3</sup> Women are more susceptible to UTIs because of too short ure-

thra and close proximity of urethral opening to the anus and vagina.<sup>4</sup>

Dash, et al.<sup>5</sup> from Odisha, India from January 2010 to July 2012 (n=577) distributed urinary tract infections as 122 (21.14%) men and 455 (78.86%) women, and 275 (47.66%) in age group 18-37 years, 216 (37.44%) in 38-67 & 86 (14.90%) in ≥68 years. Most common bacteria were *Escherichia coli* (*E.coli*) 397 (68.8%), followed by *Enterococcus* 56 (9.7%), coagulase negative staphylococcus 36 (6.2%), *Staphylococcus aureus* (*S.aureus*) 28 (4.9%), *Klebsiella pneumonia* (*K.pneumonia*) 17 (2.9%), *Citrobacter* 13 (2.3%), *Pseudomonas aeruginosa* (*Paeruginosa*) 9 (1.6%), *Proteus mirabilis* (*P.mirabilis*) 8 (1.4%), *Enterobacter* 7 (1.20%) and *Candida* 6 (1%).

Pondei, et al.<sup>6</sup> from Bayelsa state of Nigeria from May 2010 to July 2011 (n=237) distributed UTIs as 62 (26.16%) men and 175 (73.84%) women. Most common bacteria were *E.coli* 102 (43.0%), followed

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by *K.pneumonia* 51 (21.5%), *S.aureus* 42 (17.7%), Coliform 25 (10.5%), *P.mirabilis* 9 (3.8%) and *Paeruginosa* 8 (3.4%). Linhares, et al.<sup>7</sup> from Aveiro, Portugal during 2000-2009 (n=18,797) reported UTIs as 4,043 (21.51%) men and 14,754 (78.49%) women. Most common bacteria were *E.coli* 64.5%, followed by *S.aureus* 6.0%, *P.mirabilis* 4.7%, *K.pneumonia* 4.3%, *Enterococcus faecalis* (*E.faecalis*) 3.6%, *Proteus vulgaris* (*P.vulgaris*) 2.7%, *Paeruginosa* 2.4%, *Enterobacter* 1.9%, *Staphylococcus epidermidis* (*S.epidermidis*) 1.8% and *Providencia* 1.7%.

Sohail, et al.<sup>8</sup> from Lahore, Pakistan from December 2012-January 2014 (n=392) distributed UTIs as 129 (32.91%) men and 263 (67.09%) women. Most common bacteria were *E.coli* 244 (62.25%), followed by *E.faecalis* 58 (14.80%), *Candida* 56 (14.29%), *Paeruginosa* 23 (5.87%), *K.pneumonia* 5 (1.28%), *P.mirabilis* 3 (0.77%) and *S.aureus* 3 (0.77%). Sabir, et al.<sup>9</sup> from Lahore, Pakistan in 2014 (n=402) distributed UTIs as 321 (79.85%) caused by *E.coli*, 38 (9.45%) by *S.aureus*, 22 (5.47%) by *P.mirabilis* and 21 (5.22%) by *Paeruginosa*. Jan, et al.<sup>10</sup> from Peshawar, Pakistan from January 2016-December 2017 distributed 762 UTIs as 221 (29%) men and 541 (71%) women, and 213 (27.95%) in age group 16-35 years, 248 (32.55%) in 36-55 & 301 (39.50%) in 55-90 years. Most common bacteria were *E.coli* 586 (76.90%), followed by *Citrobacter* 54 (7.09%), *Morganella morganii* (*M.morganii*) 37 (4.86%), *Enterobacter* 35 (4.59%), *S.aureus* 27 (3.54%), *Paeruginosa* 19 (2.49%), *K.pneumonia* 3 (0.39%) and *P.mirabilis* 1 (0.13%).

Khan, et al.<sup>2</sup> from D.I.Khan, Pakistan from February 2012 to January 2013 (n=44) distributed UTIs as 10 (22.8%) in men, 34 (77.2%) in women, and 9 (20.45%) in age group 1-20 years, 17 (38.63%) in 21-40, 10 (22.72%) in 41-60 & 8 (18.20%) in >60 years. Most common bacteria were *E.coli* 25 (56.82%), followed by *K.pneumonia* 7 (15.90%), *Paeruginosa* 3 (6.82%), *S.aureus* 3 (6.82%), *Enterococcus* 2 (4.55%), *Candida* 2 (4.55%), *Enterobacter* 1 (2.27%) and *Streptococcus* 1 (2.27%).

Khan, et al.<sup>11</sup> from Rawalpindi, Pakistan during January to December 2012 distributed 440 UTIs as 133 (30.23%) men and 307 (69.77%) women. Most common bacteria were *E.coli* 270 (61.36%), followed by *Paeruginosa* 52 (11.82%), *K.pneumonia* 42 (9.55%), *E.faecalis* 26 (5.91%), *Enterococcus clocae* (*E.clocae*) 14 (3.18%), *P.mirabilis* 10 (2.27%), *Acinetobacter baumannii* (*A.baumannii*) 10 (2.27%), *Citrobacter* 8 (1.81%), *Serratia* 2 (0.45%), *M.morganii* 2 (0.45%), *Burkholderia cepacia* (*B.cepacia*) 2 (0.45%) and *Stenotrophomonas maltophilia* (*S.maltophilia*) 2 (0.45%). Malik, et al.<sup>12</sup> from Rawalpindi, Pakistan published in May 2020, distributed 440 UTIs as 144 (32.73%) men and 296 (67.27%) women. Most common bacteria were *E.coli* 330 (75%), followed by *K.pneumonia* 45 (10.23%), *Enterococcus* 24 (5.45%), *S.aureus* 17

(3.86%), *Paeruginosa* 12 (2.73%), *Acinetobacter* 6 (1.36%), *Enterobacter* 5 (1.14%) and *P.mirabilis* 1 (0.23%).

## 1.2 Research Problems (RPs), Knowledge Gaps (KGs), Research Questions (RQs) & Rationale:

Our RPs were unawareness of epidemiological knowledge relating to the distribution of UTIs by sex, age group & type of bacteria in population of Islamabad, Pakistan. Unavailability of pertinent facts & figures relating to these RPs in different online sources were our three KGs. Our three RQs were; "What would be the distributions of UTIs by sex, age group & type of bacteria in population of Islamabad, Pakistan". Finding answers to these RQs would be justification of our project.

## 1.3 Research Objectives (ROs)

**RO 1-3:** To discover the distribution of urinary tract infections by sex, age group and type of bacteria in population of Islamabad, Pakistan.

## 2. MATERIALS AND METHODS

**2.1 Study Design, Settings & Duration:** This cross-sectional study was done at the Department of Nephrology, Khan Research Laboratories Teaching Hospital, Islamabad, Pakistan from June 2018 to May 2020. The data was collected from the Nephrology, Medical, and Gynecology outdoors and indoors. Project was started after taking approval from the Hospital Ethical Review Committee & consent from patients.

**2.2 Population, Sample Size & Technique and Sample Selection:** Islamabad is the capital city of Pakistan and is administered by the Pakistan Federal Government as part of the Islamabad capital territory. KRL Teaching Hospital provides services to the population of twin cities; Islamabad & Rawalpindi which have population of about 4.1 million people in 2017 Census. Age  $\geq 18$  years was presumed to contribute its 50%; hence 2.05 million count. With presuming prevalence of 5% of UTI for this age group,<sup>13</sup> margin of error 3.17% and 95%CL, sample size was computed as 182<sup>14</sup> through consecutive approach. All adult ( $\geq 18$  years) patients with UTI were eligible.

**2.3 Conduct of Procedure:** After history and examination, relevant investigations were performed. Single sample of  $\geq 1$  ml clean-catch mid-stream urine were taken under strict aseptic conditions for urine analysis and culture & sensitivity. Supervision by a microbiologist, isolated organisms were identified by characteristics of colonies, gram-staining and biochemical analysis.

**2.4 Data Collection Plan:** Sex (men/ women), age groups (18-40, 41-60 and >60 years) and type of bacteria were variables. All variables were measured on categorical scale.

**2.5 Data Analysis Plan:** The distribution was analyzed by count and percentage for the sample with

confidence intervals for proportion at 95%CL using normal distribution approximation method.<sup>15</sup>

### 3. RESULTS

**3.1 Distribution of urinary tract infections by sex and age group:** Out of 182 patients with UTI, 90 (49.45%) were men and 92 (50.55%) women, and 19 (10.44%) were in age group 18-40 years, 75 (41.21%) in 41-60 years and 88 (48.35%) in >60 years.

The prevalence was similar in men and women, while it was higher in age group of >60 years, followed by 41-60 years and 18-40 years. (Table 3.1)

**3.2 Distribution of urinary tract infections by type of bacteria:** Most common bacteria were *E.coli* 116 (63.74%), followed by *K.pneumonia* 20 (10.99%), *Paeruginosa* 15 (8.24%), *E.faecalis* 15 (8.24%), *S.aureus* 7 (3.85%), *P.mirabilis* 4 (2.20%), *Acinetobacter* 2 (1.10%), *Enterobacter* 2 (1.10%) and *S.epidermidis* 1 (0.54%). (Table 3.2)

### 4. DISCUSSION

#### 4.1 Distribution of urinary tract infections by sex:

Our study showed similar prevalence of UTIs in men 49.45% (95% CI 42.27-56.65) and women 50.55% (95% CI 43.35-57.73). Contrary to our findings, all the following studies showed higher prevalence for women than men.

Khan, et al.<sup>11</sup> from Rawalpindi, Pakistan showed higher prevalence for women 69.77% (307/440) than men 30.23% (133/440). Malik, et al.<sup>12</sup> from Rawalpindi, Pakistan reported higher prevalence for women 67.27% (296/440) than men 32.73% (144/440). Khan, et al.<sup>2</sup> from D.I.Khan, Pakistan described higher prevalence for women 77.2% (34/44) than men 22.8% (10/34). Jan, et al.<sup>10</sup> from Peshawar, Pakistan proved higher prevalence for women 71% (541/762) than men 29% (221/762). Sohail, et al.<sup>8</sup> from Lahore, Pakistan demonstrated higher prevalence for women 67.09% (263/392) than men 32.91% (129/392).

**Table 3.1: Distribution of urinary tract infections by sex and age group in population of Islamabad, Pakistan (n=182)**

| Variables  | Groups      | Sample statistics |                  | 95% CI for proportion |       |
|------------|-------------|-------------------|------------------|-----------------------|-------|
|            |             | Count             | Percentage       | Lower                 | Upper |
| Sex        | Men         | 90                | 90*100/182=49.45 | 42.27                 | 56.65 |
|            | Women       | 92                | 92*100/182=50.55 | 43.35                 | 57.73 |
| Age groups | 18-40 years | 19                | 19*100/182=10.44 | 6.786                 | 15.73 |
|            | 41-60 years | 75                | 75*100/182=41.21 | 34.31                 | 48.47 |
|            | >60 years   | 88                | 88*100/182=48.35 | 41.20                 | 55.57 |
| Total      |             | 182               | 100%             | Population parameters |       |

**Table 3.2: Distribution of urinary tract infections by type of bacteria in population of Islamabad, Pakistan (n=182)**

| Variables        | Attributes                    | Sample statistics |                   | 95% CI for proportion |       |
|------------------|-------------------------------|-------------------|-------------------|-----------------------|-------|
|                  |                               | Count             | Percentage        | Lower                 | Upper |
| Type of bacteria | <i>Escherichia coli</i>       | 116               | 116*100/182=63.74 | 56.54                 | 70.37 |
|                  | <i>Klebsiella pneumonia</i>   | 20                | 20*100/182=10.99  | 7.22                  | 16.36 |
|                  | <i>Pseudomonas aeruginosa</i> | 15                | 15*100/182=8.24   | 5.05                  | 13.15 |
|                  | <i>Enterococcus faecalis</i>  | 15                | 15*100/182=8.24   | 5.05                  | 13.15 |
|                  | <i>Staphylococcus aureus</i>  | 7                 | 7*100/182=3.85    | 1.87                  | 7.73  |
|                  | <i>Proteus mirabilis</i>      | 4                 | 4*100/182=2.20    | 0.85                  | 5.51  |
|                  | <i>Acinetobacter</i>          | 2                 | 2*100/182=1.10    | 0.30                  | 3.91  |
|                  | <i>Enterobacter</i>           | 2                 | 2*100/182=1.10    | 0.30                  | 3.91  |
|                  | <i>Staph. epidermidis</i>     | 1                 | 1*100/182=0.54    | 0.09                  | 3.03  |
| Total            |                               | 182               | 100%              | Population parameters |       |

Dash, et al.<sup>5</sup> from Odisha, India highlighted higher prevalence for women 78.86% (455/577) than men 21.14% (122/577). Pondei, et al.<sup>6</sup> from Bayelsa state of Nigeria stated higher prevalence for women 73.84% (175/237) than men 26.16% (62/237). Linhares, et al.<sup>7</sup> from Aveiro, Portugal revealed higher prevalence for women 78.49% (14,754/18,797) than men 21.51% (4,043/18,797).

No studies were available which showed similar or higher prevalence in men than women.

**4.2 Distribution of urinary tract infections by age groups:** In our results, the prevalence of UTIs was higher in age group >60 years 48.35% (95%CI 41.20-55.57), followed by 41-60 years 41.21% (95% CI 34.31-48.47) and 18-40 years 10.44% (95% CI 6.786-15.73). (Table 3.1)

Jan, et al.<sup>10</sup> reported higher prevalence of UTIs in age group 55-90 years 39.50% (301/762), followed by 36-55 years 32.55% (248/762) and 16-35 years 27.95% (213/762). Khan, et al.<sup>2</sup> found higher prevalence in age group 21-40 years 38.63% (17/44), followed by 41-60 years 22.72% (10/44), 1-20 years 20.45% (9/44) and >60 years 18.20% (8/44). Dash, et al.<sup>5</sup> reported higher prevalence of UTIs in age group 18-37 years 47.66% (275/577), followed by 38-67 years 37.44% (216/577) and ≥68 years 14.90% (86/577).

**4.3 Distribution of urinary tract infections by type of bacteria:** In our results, most common bacteria were *E.coli* 116 (63.74%), followed by *K.pneumonia* 20 (10.99%), *Paeruginosa* 15 (8.24%), *E.faecalis* 15 (8.24%), *S.aureus* 7 (3.85%), *P.mirabilis* 4 (2.20%), *Acinetobacter* 2 (1.10%), *Enterobacter* 2 (1.10%) and *S.epidermidis* 1 (0.54%). (Table 3.2)

Malik, et al.<sup>12</sup> reported most common bacteria as *E.coli* 330 (75%), followed by *K.pneumonia* 45 (10.23%), *Enterococcus* 24 (5.45%), *S.aureus* 17 (3.86%), *Paeruginosa* 12 (2.73%), *Acinetobacter* 6 (1.36%), *Enterobacter* 5 (1.14%) and *P.mirabilis* 1 (0.23%).

Khan, et al.<sup>11</sup> reported most common bacteria as *E.coli* 270 (61.36%), followed by *Paeruginosa* 52 (11.82%), *K.pneumonia* 42 (9.55%), *E.faecalis* 26 (5.91%), *E.clocae* 14 (3.18%), *P.mirabilis* 10 (2.27%), *A.baumannii* 10 (2.27%), *Citrobacter* 8 (1.81%), *Serratia* 2 (0.45%), *M.morganii* 2 (0.45%), *B.cepacia* 2 (0.45%) and *S.maltophilia* 2 (0.45%).

Khan, et al.<sup>2</sup> from D.I.Khan, Pakistan reported most common bacteria as *E.coli* 25 (56.82%) followed by *K.pneumonia* 7 (15.90%), *Paeruginosa* 3 (6.82%), *S.aureus* 3 (6.82%), *Enterococcus* 2 (4.55%), *Candida* 2 (4.55%), *Enterobacter* 1 (2.27%) and *Streptococcus* 1 (2.27%).

Jan, et al.<sup>10</sup> reported most common bacteria as *E.coli* 586 (76.90%), followed by *Citrobacter* 54 (7.09%), *M.morganii* 37 (4.86%), *Enterobacter* 35 (4.59%), *S.aureus* 27 (3.54%), *Paeruginosa* 19 (2.49%),

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Sohail, et al.<sup>8</sup> reported most common bacteria as *E.coli* 244 (62.25%), followed by *E.faecalis* 58 (14.80%), *Candida* 56 (14.29%), *Paeruginosa* 23 (5.87%), *K.pneumonia* 5 (1.28%), *P.mirabilis* 3 (0.77%) and *S.aureus* 3 (0.77%).

Linhares, et al.<sup>7</sup> reported most common bacteria as *E.coli* 64.5%, followed by *S.aureus* 6.0%, *P.mirabilis* 4.7%, *K.pneumonia* 4.3%, *E.faecalis* 3.6%, *P.vulgaris* 2.7%, *Paeruginosa* 2.4%, *Enterobacter* 1.9%, *S.epidermidis* 1.8% and *Providencia* 1.7%.

Pondei, et al.<sup>6</sup> reported most common bacteria as *E.coli* 102 (43.0%), followed by *K.pneumonia* 51 (21.5%), *S.aureus* 42 (17.7%), *Coliform* 25 (10.5%), *P.mirabilis* 9 (3.8%) and *Paeruginosa* 8 (3.4%).

Dash, et al.<sup>5</sup> reported most common bacteria as *E.coli* 397 (68.8%), followed by *Enterococcus* 56 (9.7%), coagulase negative staphylococcus 36 (6.2%), *S.aureus* 28 (4.9%), *K.pneumonia* 17 (2.9%), *Citrobacter* 13 (2.3%), *Paeruginosa* 9 (1.6%), *P.mirabilis* 8 (1.4%), *Enterobacter* 7 (1.20%) and *Candida* 6 (1%).

## 5. CONCLUSIONS

In our population, the prevalence of UTIs was similar in men and women, while it was higher in age group >60 years, followed by 41-60 years and 18-40 years. The most common bacteria were *E.coli*, followed by *K.pneumonia*, *Paeruginosa*, *E.faecalis*, *S.aureus*, *P.mirabilis*, *Acinetobacter*, *Enterobacter* and *S.epidermidis*.

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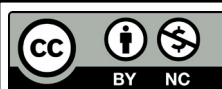
**CONFLICT OF INTEREST**  
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#### AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

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|--|---------------------|
| Conception or Design:                            | ZUZ, UU, IU         |
| Acquisition, Analysis or Interpretation of Data: | ZUZ, UU, IU, KJ, SA |
| Manuscript Writing & Approval:                   | ZUZ, UU, IU, KJ, SA |

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.



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