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, 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.

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. UTIs are more frequent in women than men with highest prevalence in younger age groups. Around 40-50% women get UTI once in their lifespan. Women are more susceptible to UTIs because of too short urethra and close proximity of urethral opening to the anus and vagina.

Dash, et al. 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. from Bayelsa state of Nigeria from May 2010 to July 2011 (n=237) distributed urinary tract infections as 62 (26.16%) men and 175 (73.84%) women. Most common bacteria were 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
Pseudomonas 8 (3.4%). Linhares, et al.7 from Aveiro, Por-
gugal 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%, Pmirabilis 4.7%, K.pneumonia 4.3%,
Enterococcus faecalis (E.faecalis) 3.6%, Prote-

cus vulgaris (P.vulgaris) 2.7%, Pseudomonas 2.4%,
Enterobacter 1.9%, Staphylococcus epidermidis
(S.epidermidis) 1.8% and Provedencia 1.7%.
Sohail, et al.8 from Lahore, Pakistan from Decem-
ber 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%), Pseudomonas 23 (5.87%), K.pneumonia 5
(1.28%), Pmirabilis 3 (0.77%) and S.aureus 3 (0.77%).
Sabir, et al.9 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 PMirabilis
and 21 (5.22%) by Pseudomonas. Jan, et al.10 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 (35.5%) 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%), En-
terobacter 35 (4.59%), S.aureus27 (3.54%), Pseud-
onas 37 (4.86%), Enterococcus 3 (0.39%) and
Pmirabilis1 0 (0.13%).
Khan, et al.11 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
(40.45%) 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%), Pseudomonas
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.12 from Rawalpindi, Pakistan during Jan-
uary 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
Pseudomonas 52 (11.82%), K.pneumonia 42 (9.55%)
E.faecalis 26 (5.91%), Enterococcus cloaceae (E.clo-
ca) 14 (3.18%), PMirabilis 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 Ste-
rnotrophomonas maltophilia (S.maltophilia) 2 (0.45%).
Malik, et al.13 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 PMirabilis 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 &
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 pop-
ulation of twin cities;Islamabad & Rawalpindi which
have population of about 4.1 million people in 2017
Census. Age ≥18 years was presumed to contribute its
50%; hence 2.05 million count. With presuming
prevalence of 5% of UTI for this age group,13 margin of
error 3.17% and 95%CL, sample size was comput-
ed as 18214 through consecutive approach. All adult
(≥18 years) patients with UTI were eligible.
2.3 Conduct of Procedure: After history and ex-
amination, relevant investigations were performed.
Single sample of ≥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 ana-
lyzed by count and percentage for the sample with
confidence intervals for proportion at 95%CL using normal distribution approximation method.\textsuperscript{15}

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 *Escherichia coli* 116 (63.74\%), followed by *Klebsiella pneumonia* 20 (10.99\%), *Pseudomonas aeruginosa* 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)

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

<table>
<thead>
<tr>
<th>Variables</th>
<th>Groups</th>
<th>Sample statistics</th>
<th>95% CI for proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Count</td>
<td>Percentage</td>
<td>Lower</td>
</tr>
<tr>
<td>Sex</td>
<td>Men</td>
<td>90</td>
<td>90*100/182=49.45</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>92</td>
<td>92*100/182=50.55</td>
</tr>
<tr>
<td>Age groups</td>
<td>18-40 years</td>
<td>19</td>
<td>19*100/182=10.44</td>
</tr>
<tr>
<td></td>
<td>41-60 years</td>
<td>75</td>
<td>75*100/182=41.21</td>
</tr>
<tr>
<td></td>
<td>&gt;60 years</td>
<td>88</td>
<td>88*100/182=48.35</td>
</tr>
<tr>
<td>Total</td>
<td>182</td>
<td>100%</td>
<td>Population parameters</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Variables</th>
<th>Attributes</th>
<th>Sample statistics</th>
<th>95% CI for proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Count</td>
<td>Percentage</td>
<td>Lower</td>
</tr>
<tr>
<td>Type of bacteria</td>
<td><em>Escherichia coli</em></td>
<td>116</td>
<td>116*100/182=63.74</td>
</tr>
<tr>
<td></td>
<td><em>Klebsiella pneumonia</em></td>
<td>20</td>
<td>20*100/182=10.99</td>
</tr>
<tr>
<td></td>
<td><em>Pseudomonas aeruginosa</em></td>
<td>15</td>
<td>15*100/182=8.24</td>
</tr>
<tr>
<td></td>
<td><em>Enterococcus faecalis</em></td>
<td>15</td>
<td>15*100/182=8.24</td>
</tr>
<tr>
<td></td>
<td><em>Staphylococcus aureus</em></td>
<td>7</td>
<td>7*100/182=3.85</td>
</tr>
<tr>
<td></td>
<td><em>Proteus mirabilis</em></td>
<td>4</td>
<td>4*100/182=2.20</td>
</tr>
<tr>
<td></td>
<td>Acinetobacter</td>
<td>2</td>
<td>2*100/182=1.10</td>
</tr>
<tr>
<td></td>
<td>Enterobacter</td>
<td>2</td>
<td>2*100/182=1.10</td>
</tr>
<tr>
<td></td>
<td><em>Staph. epidermidis</em></td>
<td>1</td>
<td>1*100/182=0.54</td>
</tr>
<tr>
<td>Total</td>
<td>182</td>
<td>100%</td>
<td>Population parameters</td>
</tr>
</tbody>
</table>
Dash, et al.\textsuperscript{5} from Odisha, India highlighted higher prevalence for women 78.86% (455/577) than men 21.14% (122/577). Pondei, et al.\textsuperscript{6} from Bayelsa state of Nigeria stated higher prevalence for women 73.84% (175/237) than men 26.16% (62/237). Linhares, et al.\textsuperscript{7} 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.\textsuperscript{10} 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.\textsuperscript{11} reported most common bacteria as E. coli 370 (63.74%), followed by P. aeruginosa 37 (6.36%), K. pneumonia 330 (58.60%), followed by Enterococcus 244 (42.25%), and S. aureus 224 (38.45%). In our results, the prevalence of UTIs was similar in men and women, while it 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.\textsuperscript{10} reported higher prevalence of UTIs in age group 21-40 years 38.63% (17/44), 1-20 years 13.54% (6/44) and 21-50 years 21.51% (4,043/18,797). Malik, et al.\textsuperscript{12} reported most common bacteria as E. coli 116 (63.74%), followed by K. pneumonia 20 (10.99%), P. aeruginosa 15 (8.24%), S. aureus 7 (3.85%), Enterococcus 2 (1.10%), Acinetobacter 2 (1.10%) and S. epidermidis 1 (0.54%). (Table 3.2)

Malik, et al.\textsuperscript{12} 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%), P. aeruginosa 12 (2.73%), Acinetobacter 6 (1.36%), Enterobacter 5 (1.14%) and P. mirabilis 1 (0.23%).

Khan, et al.\textsuperscript{11} reported most common bacteria as E. coli 270 (61.36%), followed by P. aeruginosa 52 (11.82%), K. pneumonia 42 (9.55%), E. faecalis 26 (5.91%), E. cloacae 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.\textsuperscript{2} from D.I.Khan, Pakistan reported most common bacteria as E. coli 25 (56.82%) followed by K. pneumonia 7 (15.90%), P. aeruginosa 3 (6.82%), S. aureus 3 (6.82%), Enterococcus 2 (4.55%), Candida 2 (4.55%), Enterobacter 1 (2.27%) and Strep-tococcus 1 (2.27%).

Jan, et al.\textsuperscript{10} 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%), P. aeruginosa 19 (2.49%), K. pneumonia 3 (0.39%) and P. mirabilis 1 (0.13%).

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Linhares, et al.\textsuperscript{7} 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%, P. aeruginosa 2.4%, Enterobacter 1.9%, S. epidermidis 1.8% and Provedencia 1.7%.

Pondei, et al.\textsuperscript{6} 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 P. aeruginosa 8 (3.4%).

Dash, et al.\textsuperscript{2} 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%), P. aeruginosa 9 (1.6%), P. mirabilis 8 (1.4%), Enterobacter 7 (1.2%) 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, P. aeruginosa, E. faecalis, S. aureus, P. mirabilis, Acinetobacter, Enterobacter and S. epidermidis.

REFERENCES


CONFLICT OF INTEREST

Authors declare no conflict of interest.

GRANT SUPPORT AND FINANCIAL DISCLOSURE
None declared.

AUTHORS’ CONTRIBUTION

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

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.