Prevalence and risk factors for urinary tract infections among pregnant women

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Urinary Tract Infections (UTIs) during pregnancy are among the most common health problems worldwide afflicting many women in their reproductive years especially in developing countries. Due to several anatomical and hormonal changes, pregnant women are more susceptible to develop UTIs. UTIs have several adverse outcomes both on the woman and the fetus. This study aimed to determine the prevalence of UTIs during pregnancy and the factors associated with UTIs. Data collection involved physical assessments; urinalysis and urine culture was done on a midstream urine sample. Two hundred and sixty (260) pregnant women attending the clinic for the current pregnancy were systematically sampled from the Ante-Natal Care (ANC) clinic. Data analyses included both simple univariate cross-tabulations as well as binary logistic regression models using SPSS version 15. The prevalence of UTIs among pregnant women was (14.2%) regardless of the women's age, parity and gestational age. Of the urogenital hygiene risk factors assessed, only the type of undergarment material was found to be strongly (OR= 10.64) significantly (P= 0.000) contributing to the occurrence of UTI among the pregnant women. The lifestyle factors associated with UTI occurrence were not significant in contributing to the occurrence. Of the sexual practices surveyed, which are; multiple sexual partners, frequency of sexual intercourse, bath post coitus, vaginal douching and family planning method were not significantly associated with the UTI occurrence.

Key words: Prevalence, risk factors, urinary tract, infection.

INTRODUCTION

Background and research gap
Urinary tract infections represent the most common bacterial infection in pregnancy (Harvey, 2009). Pregnant women are at an increased risk for UTIs, beginning in week 6 and peaking during weeks 22 to 24 (Agersew et al., 2012; Delzell and Lefevre, 2000) due to a number of anatomical and physiological factors with the incidence of infection of the kidney increasing in the third trimester of pregnancy. The prevalence of UTIs in pregnancy globally ranges from 13%-33% with asymptomatic bacteriuria occurring in 2–10% during pregnancies while symptomatic has been found to account for 1-18% during pregnancies (Samad, 2007; Agersew et al., 2012). The prevalence has remained constant and most of the recent observational studies, including those from developing countries, report similar rates (Schnarr and Smaill, 2008). In studies that have been done regionally, the prevalence of UTIs among pregnant women was found to be 14 % in Sudan (Hamdan et al., 2011), 15.5% in Tanzania (Masinde et al., 2009) and 13.3% in Uganda (Andabati and Byomugisha, 2010). If UTI goes, Ante-partum UTI has been implicated as a risk factor for poor perinatal outcomes and adverse obstetric complications.

In studies that have been done regionally, the prevalence of UTIs among pregnant women was found to be 14 % in Sudan (Hamdan et al., 2011), 15.5% in Tanzania (Masinde et al., 2009) and 13.3% in Uganda (Andabati and Byomugisha, 2010). Screening for and treatment of UTI in pregnancy has become a standard of obstetric care and most antenatal guidelines include
routine screening for asymptomatic bacteriuria (Nicolle et al., 2005; MOH, 2007). Urinary Tract Infections during pregnancy are among the commonest health problems worldwide, especially in developing countries (Delzell and Lefevre, 2000). The economic burden of UTI in adult women is significant. The health care direct and indirect costs associated with UTIs in terms of bed occupation, staff and supply are also large and include substantial out-of-pocket expenses for the patients (Griebling, 2011).

Although pregnancy does not increase the rates of asymptomatic bacteriuria, it does increase the risk that it will progress to a full-blown kidney infection, which can cause early labor and other serious pregnancy complications. Pregnant women are at an increased risk for UTIs, beginning in week 6 and peaking during weeks 22 to 24 (Delzell and Lefevre, 2000) with the incidence of infection of the kidney increasing in the third trimester of pregnancy (Dafnis and Sabatini, 1992).

The renal pelvis and ureters begin to dilate as early as the eighth week of pregnancy opening up the route for bacteria to move up; (Jeyabalan and Lain, 2007) and the bladder itself is displaced superiorly and anteriorly. Mechanical compression from the enlarging uterus affects the bladder volume as well as blockage of the free drainage of urine. Smooth muscle relaxation due to progesterone results in decreased peristalsis of the ureters and decreased bladder tone increases urinary stasis that is associated with the infection (Masinde et al., 2009; Jeyabalan and Lain, 2007). It’s also more difficult for a pregnant woman to expel urine as quickly and easily as she does normally (Dafnis and Sabatini, 2006).

Hormonal effects especially during pregnancy and post-menopausal period increases the risk for UTI due to lack of estrogen. Estrogen loss thins the walls of the urinary tract and reduces its ability to resist bacteria. It also reduces certain immune factors in the vagina that help block E. coli from adhering to vaginal cells (Harvey, 2009). Estrogen is essential to maintain the normal acidity of vaginal fluid. This acidity is critical to permit the growth of Lactobacillus in the normal vaginal flora, which acts as a natural host defense mechanism against symptomatic UTI (Griebling, 2011). Differences in urine pH and osmolality and pregnancy-induced glycosuria and aminoaciduria may facilitate bacterial growth (Jeyabalan and Lain, 2007; Schnarr and Smaill, 2008). During pregnancy, due to the abdominal distension, women find it difficult to clean their genitalia well and this may highly contribute to the occurrence of UTIs in pregnancy.

**METHODOLOGY**

The study was carried out at Thika level-5 hospital, a government institution that serves Thika municipality and its environs between December 2012 and March 2013. The municipality constituted of a cosmopolitan affluent, middle class and slum based population. The target population included all pregnant women attending outpatient antenatal clinic at Thika level five hospitals. The study population included all pregnant women who were seeking antenatal services at the hospital at any gestational stage of the pregnancy who consented or assented to participate in the study. The mothers below 18 years of age whom we could obtain assent were included because of significant data that can be missed in this age group pertaining to UTIs.

The sample size calculation for the antenatal mothers to participate in this study was based on Fisher’s formula for estimating the minimum sample size for prevalence studies (Fishers et al., 1998).

\[
\begin{align*}
   n & = z^2 \left( \frac{1}{2} \right) \left( \frac{p(1-p)}{d^2} \right) \\
   & = 1.96^2 \times 0.133 \times 0.867 \\
   & = 0.05^2 \\
   & = 177.2 + \left( \frac{10}{100} \times 177.2 \right) \\
   & = 195 \\
   & = 210
\end{align*}
\]

The study population included all pregnant women who were seeking antenatal services at the hospital who consented to participate. Systematic and Stratified sampling methods were employed in selecting respondents until the expected number was reached. To avoid over representation from one trimester the sample size was stratified to the three trimesters with an aim of getting 70 pregnant women from trimester 1, 2 and 3 respectively participating in the study. Demographic and risk factors details were obtained through a structured questionnaire interviews. To obtain the prevalence, Midstream urine specimen was collected aseptically and cultured. A diagnosis of UTI was done when at least 105 colony forming units (CFU/L) were.

Cleaning, Coding and verification of the data was done before data was analyzed. Analysis was done using SPSS version 15. Chi-square test (2x2) or Fishers Exact Test where applicable were applied for P-value derivation for socio-demographic and risk factors to identify variables associated with UTIs. Binary logistic regression analysis was carried out to generate the adjusted odds ratio with 95% confidence interval for the associations between variables and UTIs. An alpha of less than 0.05 (P<0.05) was considered statistically significant. The study was approved by the Kenya Medical Research Institute Scientific and Ethical review.
committees and the University Board of Postgraduates. Permission was sought from the Hospital administration and formal consent obtained from each client before collection of patient information and urine specimen. All data collected was handled in confidence and anonymity of the source respondent.

RESULTS AND FINDINGS

Socio-demographic characteristics

A total of 260 pregnant women were recruited and participated fully in this study. The prevalence of UTI among this study sample was 14.2%. The mean age of the women was 24.62 (SD=4.9) years with 78.1% of the mothers aged between 20 to 30 years (Table 1). Sixty nine mothers (26.5%) were symptomatic while 191(73.5%) were asymptomatic. Prevalence of symptomatic and asymptomatic bacteriuria among those who had UTI was 4.2% (2.24-7.23) and 10% (6.78-14.11) respectively.

As per the findings, mothers who were unemployed had a strong and statistically significant association to occurrence of UTI (OR 3.56; P>0.05). Being in third trimester was found to be 2.14 times more likely to develop UTI as compared to mothers in first and second trimester (P=0.03). Mothers in second trimester were 34% less likely (P=0.021; OR= 0.34) to develop UTI (Table 4-7) compared to their counterparts in 1<sup>st</sup> and 3<sup>rd</sup> trimester. Mothers with a normal blood pressure were 33% protective of UTI development while those high blood pressure were 3 times more likely to develop UTI (P=0.025).

Seven out of every ten women 175 (67.3%) reported that they knew the importance of urine testing during pregnancy. Almost half of the respondents 123(47.3%) started their ANC clinic attendance for the current pregnancy on or before the 16<sup>th</sup> gestational. None of the respondents reported to have smoked in the current pregnancy.

Urgency 113 (43.1%) was the most common reported symptom while hematuria 11 as the least common symptom (figure 1).

Risk Factors for Urinary Tract Infections among Pregnant Women

Two in every ten respondents 50 (19.2%) reported to have taken alcohol in the current pregnancy. Of the 260 respondents, 42.7% and 57.3% of them reported to have been using undergarments made of cotton and non-cotton materials respectively (table 2).

Seven out of ten respondents 180 (69.2) indicated that they were in a circle of multiple sexual partners either themselves involved or their spouses involved with only 80 (30.8%) of the spouses reporting not involving in multiple partner sex. Majority of the women reported to have sexual intercourse twice in a week 111 (42.7%) and they also had the highest prevalence rate at 16 (43.3%).

When respondents were asked to state where they thought women got UTI from. Seven out of every ten women (65.8%) had no idea where women get UTI from and 75% of them were found with UTI. The remaining proportion of the total respondents indicated that women get UTIs from sex (18.1%), contaminated dirty toilets (6.9%), poor hygiene (3.8%), hospitals (3.1%) and damp panties (2.3%). Only 6.1% of the women associated it to poor urogenital hygiene (damp panties and poor hygiene) none of which was found with UTI (Figure 2). None of the mothers whose options were damp panties and poor hygiene had UTIs.

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Table 1: Selected Socio-demographic Characteristics of respondents

<table>
<thead>
<tr>
<th>Variables</th>
<th>Response</th>
<th>with UTI</th>
<th></th>
<th>Without UTI</th>
<th>OR</th>
<th>95 % CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N (%)</td>
<td>N (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maternal age</td>
<td>&lt;20 years</td>
<td>37</td>
<td>14.2</td>
<td>7</td>
<td>0.92</td>
<td>0.3010 to 2.8018</td>
<td>0.8811</td>
</tr>
<tr>
<td></td>
<td>20-30 years</td>
<td>5</td>
<td>26</td>
<td>11.7</td>
<td>1.62</td>
<td>0.6427 to 4.0923</td>
<td>0.3058</td>
</tr>
<tr>
<td></td>
<td>&gt;30 years</td>
<td>1</td>
<td>12</td>
<td>2.7</td>
<td>0.21</td>
<td>0.0277 to 1.6004</td>
<td>0.1322</td>
</tr>
<tr>
<td>Education level</td>
<td>None</td>
<td>7</td>
<td>8.1</td>
<td>0</td>
<td>0.8714</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Primary</td>
<td>19</td>
<td>51.4</td>
<td>0</td>
<td>0.8478</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Secondary</td>
<td>13</td>
<td>35.1</td>
<td>0</td>
<td>0.8714</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tertiary</td>
<td>46</td>
<td>64.9</td>
<td>0</td>
<td>0.8478</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td>Married</td>
<td>34</td>
<td>91.9</td>
<td>2</td>
<td>0.994</td>
<td>0.2781 to 3.5613</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Single</td>
<td>3</td>
<td>8.1</td>
<td>0</td>
<td>0.994</td>
<td>0.2808 to 3.5963</td>
<td></td>
</tr>
<tr>
<td>Occupation</td>
<td>Un employed</td>
<td>18</td>
<td>48.6</td>
<td>0</td>
<td>0.0004</td>
<td>1.7714 to 7.5017</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Employed</td>
<td>15</td>
<td>51.4</td>
<td>0</td>
<td>0.0004</td>
<td>0.1333 to 0.5645</td>
<td></td>
</tr>
<tr>
<td>Parity</td>
<td>Nulliparous</td>
<td>1</td>
<td>26</td>
<td>8</td>
<td>1.05</td>
<td>0.5051 to 2.1731</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>Multiparous</td>
<td>24</td>
<td>64.9</td>
<td>0</td>
<td>0.9</td>
<td>0.4602 to 1.9797</td>
<td></td>
</tr>
<tr>
<td>Gestation</td>
<td>1st Trimester</td>
<td>11</td>
<td>29.7</td>
<td>0</td>
<td>0.854</td>
<td>0.5011 to 2.3042</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2nd Trimester</td>
<td>6</td>
<td>16.2</td>
<td>0</td>
<td>0.021</td>
<td>0.1358 to 0.8478</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3rd Trimester</td>
<td>39</td>
<td>54.1</td>
<td>0</td>
<td>0.033</td>
<td>1.0624 to 4.3288</td>
<td></td>
</tr>
<tr>
<td>Blood pressure</td>
<td>Normal(110/60-120/80mmHg)</td>
<td>30</td>
<td>81.1</td>
<td>0</td>
<td>0.025</td>
<td>0.1259 to 0.8714</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High(=&gt;130/90mmHg)</td>
<td>7</td>
<td>18.9</td>
<td>0</td>
<td>0.025</td>
<td>1.1475 to 7.9412</td>
<td></td>
</tr>
</tbody>
</table>
Figure 1: Frequency of Urologic symptoms among the study population

Figure 2: Awareness of sources of UTI among pregnant women

Table 2: Lifestyle risk factors associated with occurrence of UTIs

<table>
<thead>
<tr>
<th>Variables</th>
<th>Response</th>
<th>with UTI</th>
<th>Without UTI</th>
<th>OR</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>(%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>37</td>
<td>14.2</td>
<td>223</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material of undergarment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotton</td>
<td>14</td>
<td>37.8</td>
<td>97</td>
<td>43.5</td>
<td>0.79</td>
<td>0.3867 - 1.6166</td>
</tr>
<tr>
<td>Other than cotton</td>
<td>23</td>
<td>62.2</td>
<td>126</td>
<td>56.5</td>
<td>1.26</td>
<td>0.6186 - 2.5859</td>
</tr>
<tr>
<td>Frequency of changing undergarment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>once</td>
<td>3</td>
<td>8.2</td>
<td>10</td>
<td>4.5</td>
<td>1.88</td>
<td>0.4921 - 7.1779</td>
</tr>
<tr>
<td>twice</td>
<td>17</td>
<td>45.9</td>
<td>77</td>
<td>34.5</td>
<td>1.61</td>
<td>0.7979 - 3.2554</td>
</tr>
<tr>
<td>&gt; twice</td>
<td>17</td>
<td>45.9</td>
<td>136</td>
<td>61</td>
<td>0.54</td>
<td>0.2699 - 1.0953</td>
</tr>
<tr>
<td>Taking alcohol</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>8</td>
<td>21.6</td>
<td>42</td>
<td>18.8</td>
<td>1.19</td>
<td>0.5073 - 2.7861</td>
</tr>
<tr>
<td>No</td>
<td>29</td>
<td>78.4</td>
<td>181</td>
<td>81.2</td>
<td>0.84</td>
<td>0.3589 - 1.9713</td>
</tr>
<tr>
<td>Multiple sexual partners</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>25</td>
<td>13.9</td>
<td>155</td>
<td>69.5</td>
<td>0.91</td>
<td>0.4339 - 1.9253</td>
</tr>
<tr>
<td>No</td>
<td>12</td>
<td>15</td>
<td>68</td>
<td>30.5</td>
<td>1.09</td>
<td>0.5194 - 2.3048</td>
</tr>
</tbody>
</table>

Among the lifestyle, urogenital hygiene and sexual practices factors associated with UTI occurrence surveyed, none of them was found to be significantly contributing to the occurrence in this study population.
The P values were all greater than 0.05 and their Odds ratio showing weak to moderate associations (Table 2).

A multivariate analysis Logistic regression was carried out to establish a relationship between the risk factors and the occurrence of UTIs (table 3). By introducing all the variables into the logistic regression (Backward Stepwise method), the best model revealed that women who changed their undergarment twice or more times in a day, women who used undergarment materials made of cotton and those who did not consume alcohol were 3.6%, 8.7% and 11.6% less likely to develop UTI (P<0.05) compared to their counterparts. Women who changed their garments once/ day, those who used undergarments made of materials other than absorbent cotton and women who did not know what UTI are and only a few could associate it to urethral dilatation, decreased tone, decreased urine concentration and increased stasis, plus hormonal changes, all these factors contribute to the increased risk of UTI among the pregnant mothers (Table 3).

DISCUSSION
One of the main findings of this study was the prevalence of UTIs among pregnant women (14.2%) regardless of the women's age, parity and gestational age. This falls within the global prevalence range of 13%-33% [8] and is similar to the prevalence of UTI among pregnant women in neighboring countries reported in other studies: Sudan, Tanzania, Ethiopia and Uganda (Hamdan et al., 2011; Assesa et al., 2008; Andabati and Byomugisha, 2010). This was however lower than the prevalence range of 31.3%, 45% and 78.7% reported elsewhere (Shahira et al., 2007; Subedi et al., 2009; Amadi et al., 2007). Our findings were also higher than the findings of a study done in developed countries (Gilstarp and Ramin, 2001; Gayathree et al., 2010; Gulfareen, 2010). This variation could be attributed to environmental, economic and social habits in different parts of the world. The relatively high prevalence of UTI among the women in this study could be explained by the fact that majority of the mothers did not know what UTI are and only a few could associate it to poor urogenital hygiene which was found to be a strong associate of UTI development.

Majority of the mothers (86.5%), who were found with UTIs belonged to the age between 20-30 years though not statistically different from other age groups in UTI occurrence (OR=1.6; P=0.3). This age group is the peak reproductive period in most societies ours included. A similar trend was reported in Pakistan and Tanzania (Gulfareen, 2010 and Masinde et al., 2009). Among the socio demographic factors that were assessed, all were found not associated except employment status which had a strong association to occurrence of UTI among Pregnant women at Thika Level 5 Hospital (OR >3; p=0.0004) at bivariate level but was insignificant at multivariate level.

According to literature, the risk of UTIs in pregnancy begin in week 6 and peaking during weeks 22 to 24, due to urethral dilatation, decreased tone, decreased urine concentration and increased stasis, plus hormonal changes, all these factors contribute to the increased risk with increased pregnancy duration (Delzell and Lefevre, 2000). The findings in this study were discordant in that majority of the women who suffered from UTI were from the third trimester followed by those in first trimester. The high prevalence of UTI among mothers in the third trimester could be attributed to mothers starting there ANC clinic late as well urine stasis and ureteral dilatation and hence a single urine testing before 20 weeks gestation misses more than half of UTIs in pregnancy exposing them and their unborn babies to adverse effects. This results are however discordant with results reported elsewhere (Masinde et al., 2009, Shahira et al., 2007; Gayathree et al., 2010; Shnarr and Small, 2008). Gestational age was not significant factor in association with UTI occurrence similar to findings reported in Sudan (Hamdan et al., 2011). A study in Egypt however found discordant results with gestational age as significant
associates of UTI (Shahira et al., 2007). A high prevalence of UTI (54.1%) was recorded among women who had never heard (55%) of UTI as compared to those who had heard (45.9%).

High rate of bacteriuria was observed among women who used underwear made of non-cotton material and those who took bath either once or twice. In literature it’s indicated that simple hygiene habits, including voiding before and after sexual intercourse, absorbent cotton made under clothes and wiping from anterior to posterior, are often advocated to decrease the risk of UTI (Donald et al., 2008; Griebling, 2011). Front to back self-cleaning after defecation and frequent bathing were found to be protective against UTI occurrence among this study population. Review from recent studies however found no advantage to these behavioral techniques (Samad, 2007; Hamdan et al., 2011).

In this study, a significant association was found between material of undergarment and UTI occurrence. This could be attributed to the fact that most mothers used undergarments made of materials other than cotton which is absorbent hence more vulnerable. Most mothers bought attractive and affordable undergarments other than absorbent. A study in Egypt reported that unsatisfactory personal hygiene and those mothers who usually use underwear clothes other than cotton were significantly associated with UTI occurrence (Shahira et al., 2007). The remaining urogenital hygiene factors were not found to be associated with UTI occurrence.

Among the lifestyle factors associated with UTI occurrence, only alcohol consumption was found to be significantly contributing to the occurrence in this study population. In study done in Pakistan, sexual activity was highly associated with occurrence of UTIs (Gulfareen, 2010). In this study, none of the sexual practices activities surveyed was found significant in the occurrence of UTI. Similar findings in which sex was not significantly associated with UTI have been reported in most regional studies (Masinde et al., 2009; Andabati and Byomugisha, 2010).

Having multiple sexual partners and frequency of sexual intercourse (≥3 times /week) had a moderate relationship. Studies in Egypt (Shahira et al., 2007) and Nigeria (Amiri et al., 2009) also found frequency of sexual intercourse associates of UTI. This could be due to the mechanical sexual action which facilitates entry of E. Coli one of the UTI causing bacteria.

CONCLUSION AND RECOMMENDATION

This study demonstrated that UTI is prevalent among antenatal mothers in Thika level V hospital. UTIs are still a burden to the maternal and child health and it contributes vastly to the morbidity of pregnant mothers. Therefore urine examination should be an integral investigation of antenatal care services and should be included in all antenatal guidelines. Majority of the urinary tract symptoms were due to the pregnancy related changes and not existence of UTIs. Although lifestyle factors were not significant in UTI causation, personal and urogenital hygiene played a significant role in the occurrence of UTIs. Therefore, health education about personal hygiene should be emphasized by antenatal care professionals to all pregnant mothers as well as sensitizing all women of reproductive age to seek ANC services as soon as they conceive. Routine Screening for and treatment of UTIs in pregnancy is an vital measure in avoiding the pregnancy related complications both to mother and fetus as per the Kenyan guidelines (MOH, 2007) and not a single occasion screening between 12 to 16 weeks.

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