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Prevalence and Risk Factors of Urinary Tract Infection in Pregnant Women: Systematic Review and Meta-Analysis

Srija Voruganti[1], Saif Ali Khan[2]

[1,2]M. Pharm. Scholar, Department of Pharmacy Practice, National Institute of Pharmaceutical Education and Research (NIPER), S.A.S. Nagar

Abstract

Background: Urinary Tract Infections (UTIs) are the second-most frequent bacterial infections, with an overall incidence of 5-10%. This study aimed to investigate the prevalence and risk factors associated with UTI in pregnant women.

Method: A systematic search was conducted in the open domain, electronic databases such as PubMed and Google Scholar. Citation searching was also performed to identify all relevant studies. All the steps were carried out by two independent reviewers to avoid bias. Based on inclusion & exclusion criteria, followed by qualitative evaluation, the studies were included and analyzed by fixed or random effects model using CMA. A sub-group analysis was also performed for Asian and African countries for prevalence and for different categories of risk factors.

Results: Out of 45 studies, 41 studies were included for the prevalence of UTI in pregnant women and 19 studies were included to evaluate the risk factors. The pooled prevalence of UTI in African pregnant women was higher when compared to Asian pregnant women (28.6% vs. 20.7%). The risk factors statistically significantly associated with UTI were found to be undergarment texture (silk), history of catheterization, diabetes mellitus, past history of UTI and HIV.

Conclusion: UTIs are prevalent in pregnant women in Asian and African pregnant women. Hence, identification of risk factors and frequent screening of UTIs during pregnancy is recommended to avoid maternal-fetal complications.

Keywords: Urinary Tract Infections, Pregnant Women, Asia, Africa, Risk factors, Prevalence.

Introduction

The most typical infection among pregnant women is a Urinary Tract Infection (UTI), which has been associated with maternal and fetal complications. UTIs during pregnancy are known to cause preterm labor, preeclampsia, pyelonephritis, and low birth weight baby [1].

It is anticipated that 8-10% of pregnant women will experience a UTI during their pregnancy. The etiology of UTI during pregnancy is the change in level of hormones [2], higher amount of sugars and protein. Other causes include *Escherichia coli, Klebsiella pneumoniae*, *Proteus mirabilis*, sexual activity, and Group B *streptococcus* [3].

Various factors which make pregnant women more prone to developing UTIs include pregnancy lifestyle, obstruction of the bladder, sexual activity, hygiene, history of catheterization, past history of UTI, etc. [4].

The symptoms of UTI are a burning sensation during micturition, frequent urination, strong-smelling urine, haematuria, nausea and vomiting, and pain in the lower back and abdomen [5].
The microorganisms responsible for causing UTI are *Escherichia coli*, *Klebsiella pneumonia*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Streptococcus* species (*S. agalactiae*, *S. aureus, S. saprophyticus*, *S. haemolyticus*), *Ureaplasma urealyticum* [6].
In systematic reviews, aiming at every relevant document and combining it with other related documents gives a more comprehensive picture of the problem. The pooled evidence by meta-analysis increases the statistical significance of the study.
This study aimed to assess the prevalence and associated risk factors of UTI among pregnant women.

Methods

This study was conducted using resources available in the open domain. This study followed Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines [8]. The protocol was registered on PROSPERO with registration number – CRD42023425762.

Search Strategy

A comprehensive search was conducted in databases like PubMed/MEDLINE and Google Scholar to identify all published literature. In addition to this, cross-referencing (lists of already identified articles references) were also checked and potentially eligible articles were retrieved. Search strategy for electronic databases was performed using MeSH terms (Medical Subject Heading) and keywords. The following terms were used, “Urinary tract infection”, “Prevalence”, “Risk factors”, “Epidemiology”, “Population at risk”, “Pregnancy”, “Pregnant women”, and “Gestation”. The filters like journal articles, observational studies, humans, and the English language were used to narrow down the search. A brief search strategy of PubMed has been provided in supplementary file (S1).

Eligibility Criteria

The included studies met the following inclusion criteria: observational studies (cohort, cross-sectional studies) that include pregnant women with UTI, studies reporting the prevalence of UTI in Asian and African pregnant women, risk factors, all the information from Asian and African regions that is available in the open domain, studies in English language only, studies on human subjects only, and all the studies from the year 2000. The exclusion criteria were observational (Case-control) and experimental studies that include non-pregnant female subjects with UTI, studies reporting other than UTI, literature with incomplete or irrelevant data, studies conducted on animals, and studies other than the English language.

Study selection

After performing the search strategy, all the retrieved articles were imported to EndNote software version 10 and the duplicates were removed. Irrelevant articles were excluded based on inclusion and exclusion criteria. In primary screening, title and abstract of the included articles were assessed. In secondary screening, the full text of the included studies was reviewed.

Data Extraction

The data extraction was performed in a pre-designed Microsoft Excel template for all the included studies. The following data was extracted from the articles - general characteristics like name of the author, year

of publication, full title, country in which the study was performed, region, design of the study, settings and duration, details of the participants like total sample size, number of cases and controls, participants characteristics like age, ethnicity, details of prevalence, (sample size, and number of subjects with event), and details of risk factors (total sample in case and control, number of events in case and control group).

Quality assessment

The quality of the included observational studies was assessed using New Castle Ottawa Scale (NOS). The NOS consists of three domains: Selection, Comparability, and Outcome/Exposure. It assigns a maximum of five stars for selection, two stars for comparability, and three stars for the exposure category. Thus, eight or more stars indicate 'high' quality, 6-7 stars indicate 'medium' quality and 5 or fewer stars indicate 'low' quality.

Statistical Analysis

The meta-analysis of extracted data was performed using Comprehensive Meta-Analysis (CMA) version 2. Proportionate pooling for the prevalence was performed and represented using a forest plot.

The significant risk factors for UTI were determined using a quantitative pooled odd ratio (OR) with a 95% confidence interval (CI). The z value was used to establish the significance of pooled OR (a *p*-value of 0.05 or less was considered significant) [9]. Heterogeneity was assessed using the I^2 value. The fixed effect model was used if the I^2 value was found to be less than 50% (I^2<50%) and the random effects model was used if the I^2 value was found to be more than 50% (I^2>50%). The value of pooled odds ratio was used to assess the association between risk factors and the diseased population. Risk factors were represented visually using forest plots.

Further, publication bias analysis was also carried out by visually observing an asymmetrical funnel plot, as well as via Egger's test for statistical confirmation. A sub-group analysis was performed for Asian and African countries for prevalence and for different categories of risk factors.

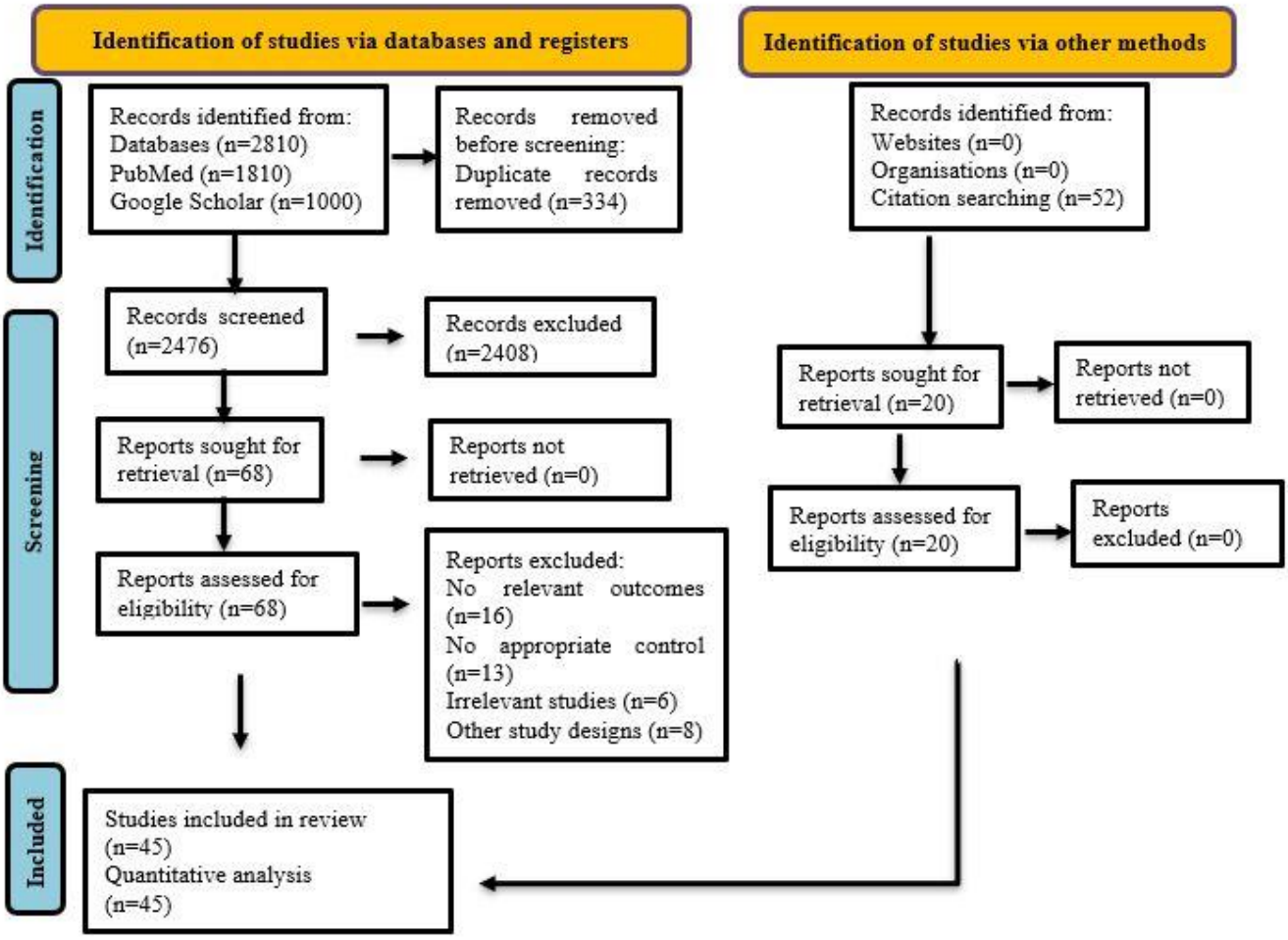
The complete review and analysis were performed by two independent reviewers (SV, SAK) to prevent analytical errors and discrepancies were cleared by discussing with a third party.

Results

Search results

A total of 2862 records were retrieved from PubMed/MEDLINE, Google Scholar, and other resources. From this, 334 duplicates were found and removed. The remaining 2528 records were screened by their title and abstract, full-text, methodological quality, and other reasons. Further, 2483 articles were excluded. Finally, a total of 45 studies met the inclusion criteria and were enrolled in the study (Figure 1).

Figure 1: PRISMA diagram



Study characteristics

A total of 45 studies with 16,691 pregnant women in the age range of 20-40 years from Asian and African countries were included in this systematic review and meta-analysis. Out of 45 studies, 41 studies reported the prevalence; and, 19 studies were extracted for risk factors that reported at least one risk factor. Other study characteristics are tabulated in Table 1.

Table 1: Characteristics of Included Studies

#	Study ID	Country	Sample size	Duration	Study design
1	Haddad, 2005 [10]	Yemen	137	6 months	Cross-sectional
2	Masinde, 2009 [11]	Tanzania	247	4 months	Cross-sectional
3	Kolawole, 2009 [12]	Nigeria	300	4 months	Cross-sectional
4	Moghadas, 2009 [13]	Iran	297	12 months	Cross-sectional
5	Haider, 2010 [14]	India	232	8 months	Cross-sectional
6	Kawser, 2011 [15]	Bangladesh	250	24 months	Cross-sectional
7	Hamdan, 2011 [16]	Sudan	235	6 months	Cross-sectional

8	Alijahan, 2012 [17]	Iran	2496	1 month	Cross-sectional
9	Demilie, 2012 [18]	Ethiopia	367	4 months	Cohort
10	Ashshi, 2012 [19]	Saudi Arabia	200	12 months	Cross-sectional
11	Emiru, 2013 [20]	Ethiopia	367	4 months	Cross-sectional
12	Faidah, 2013 [21]	Saudi Arabia	200	11 months	Cross-sectional
13	Tadesse, 2014 [22]	Ethiopia	244	7 months	Cross-sectional
14	Turay, 2014 [23]	Nigeria	200	NA	Cross-sectional
15	Onuoha, 2014 [24]	Nigeria	200	5 months	Cross-sectional
16	Oladeinde, 2015 [25]	Nigeria	220	6 months	Cross-sectional
17	Onuwuezobe, 2015 [26]	Nigeria	300	6 months	Cross-sectional
18	Anejo-Okopi, 2015 [27]	Nigeria	150	3 months	Cross-sectional
19	Ogba, 2015 [28]	Nigeria	120	NA	Cross-sectional
20	Shaheen, 2016 [29]	Egypt	250	3 months	Cross-sectional
21	Uddin, 2016 [30]	Bangladesh	247	5 months	Cross-sectional
22	Gessese, 2017 [31]	Ethiopia	300	10 months	Cross-sectional
23	Ranjan, 2017 [32]	India	120	6 months	Cross-sectional
24	Kant, 2017 [33]	India	1253	3 months	Cross-sectional
25	Taye, 2018 [34]	Ethiopia	169	4 months	Cross-sectional
26	Annaldasula, 2018 [35]	India	242	12 months	Cohort
27	Nwachukwu, 2018 [36]	Nigeria	200	NA	Cross-sectional
28	Ghaima, 2018 [37]	Iraq	1140	12 months	Cross-sectional
29	Onyango, 2018 [38]	Kenya	210	NA	Cross-sectional
30	Nguefack, 2019 [39]	Cameroon	354	4 months	Cross-sectional
31	Kashif, 2019 [40]	Saudi Arabia	303	6 months	Cross-sectional
32	Ali, 2019 [41]	Nigeria	145	6 months	Cross-sectional
33	Yonis, 2019 [42]	Libya	140	11 months	Cross-sectional
34	Aydin, 2020 [43]	Turkey	206	6 months	Cross-sectional
35	Belete, 2020 [44]	Ethiopia	323	4 months	Cross-sectional
36	Koffi, 2020 [45]	Côte D'Ivoire	987	12 months	Cross-sectional
37	Mahmoud, 2020 [46]	Egypt	440	NA	Cross-sectional
38	Tula, 2020 [47]	Ethiopia	296	4 months	Cross-sectional
39	Abate, 2020 [48]	Ethiopia	319	11 months	Cross-sectional

40	Ngong, 2021 [49]	Cameroon	287	4 months	Cross-sectional
41	Johnson, 2021 [50]	Uganda	400	4 months	Cross-sectional
42	Ezugwu, 2021 [51]	Nigeria	383	4 months	Cross-sectional
43	Abdullahi, 2021 [52]	Nigeria	110	4 months	Cross-sectional
44	Dube, 2022 [53]	UAE	682	12 months	Cross-sectional
45	Ali, 2022 [54]	Somaliland	422	6 months	Cross-sectional

Quality Assessment

The critical appraisal for individual included studies was done using New-castle Ottawa Scale (NOS) and 'Low', 'Moderate', and 'High' quality were assigned for each included study. The quality of the included studies ranged from 'moderate' to 'high'. None of the studies found was of 'low' quality.

Prevalence of UTI

A total of 41 studies were included in the meta-analysis for proportionate pooling of the prevalence of UTI in pregnant women. Out of which, 28 studies were included for African pregnant women, and 13 studies were included for Asian pregnant women.

Prevalence of UTI in African Pregnant Women

Of the total 8045 participants included, 2342 were cases. The countries that were included in the African region were Tanzania, Nigeria, Sudan, Ethiopia, Egypt, Kenya, Libya, Cote D'Ivoire, Uganda and Somaliland.

The overall pooled prevalence was 28.6% (95% CI: 21.2-37.4, $p<0.05$). The I^2 value was 98.15% confirming high heterogeneity; and hence, the random effects model was used to pool the result. $p>0.05$ reflected statistical insignificance and confirms the absence of publication bias (Supplementary file-S2).

Prevalence of UTI in Asian Pregnant Women

The total number of participants included were 6959; of these, 1235 were cases. The countries that were included from the Asian region were Yemen, Iran, India, Bangladesh, Iraq, Saudi Arabia, and Turkey.

The overall pooled prevalence was 20.7% (95% CI: 12.1-33.3, $p<0.05$). The I^2 value was 98.70% showing high heterogeneity and hence, the random effects model was used to pool the result. $p>0.05$ reflects the statistical insignificance and confirms the absence of publication bias (Supplementary file-S3).

Risk Factors for UTI in Pregnant Women

A total of 19 studies were included for risk factors of UTI in pregnant women with the total number of participants being 5223 (1536 as cases & 3687 as controls).

A total of 36 risk factors were identified; of these, 34 were dichotomous variables and only two were continuous variables (age, income). Only those risk factors, for which data was available for at least three studies were enrolled to perform meta-analysis (forest plots). Since there were two studies involving two risk factors, the data was not combined.

Out of the 32 risk factors (table 2), the following 12 risk factors were found to be statistically significant; history of catheterization [OR 4.02, 95%CI: 2.43-6.64, $p<0.05$], sexual activity over thrice/week [OR 1.75, 95%CI: 1.01-3.04, $p<0.05$], past history of UTI [OR 3.48, 95%CI: 2.21-5.48, $p<0.05$], education level

illiterate [OR 1.56, 95%CI: 1.02-2.39, p<0.05], read & write [OR 1.56, 95%CI: 1.12-2.17, p<0.05], primary school [OR 1.29, 95%CI: 1.03-1.62, p<0.05], higher education [OR 0.41, 95%CI: 0.17-0.98, p<0.05], diabetes mellitus [OR 3.69, 95%CI: 2.58-5.26, p<0.05], grand gravida [OR 1.78, 95%CI: 1.22-2.61, p<0.05], HIV [OR 1.86, 95%CI: 1.07-3.23, p<0.05], undergarment texture-cotton [OR 0.25, 95%CI: 0.10-0.62, p<0.05], silk [OR 6.69, 95%CI: 1.62-27.54, p<0.05].

The remaining risk factors that showed statistically insignificant results were; nulliparity [OR 0.91, 95%CI: 0.55-1.51, p>0.05], primiparity [OR 1.00, 95%CI: 0.77-1.29, p>0.05], multiparity [OR 1.16, 95%CI: 0.80-1.66, p>0.05], anemia [OR 1.92, 95%CI: 0.82-4.54, p>0.05], urban residency [OR 1.04, 95%CI: 0.28-3.89, p>0.05], rural residency [OR 0.96, 95%CI: 0.26-3.56, p>0.05], sexual activity under thrice/week [OR 0.52, 95%CI: 0.26-1.05, p>0.05], high school education level [OR 0.59, 95%CI: 0.31-1.15, p>0.05], university [OR 0.94, 95%CI: 0.74-1.19, p>0.05], 1st trimester [OR 0.84, 95%CI: 0.68-1.05, p>0.05], 2nd trimester [OR 0.97, 95%CI: 0.68-1.39, p>0.05], 3rd trimester [OR 1.03, 95%CI: 0.80-1.33, p>0.05], primigravida [OR 0.85, 95%CI: 0.71-1.03, p>0.05], multigravida [OR 0.93, 95%CI: 0.78-1.12, p>0.05], employed [OR 0.50, 95%CI: 0.21-1.20, p>0.05], unemployed [OR 1.40, 95%CI: 0.79-2.48, p>0.05], marital status – single [OR 0.96, 95%CI: 0.48-1.95, p>0.05], married [OR 0.77, 95%CI: 0.58-1.02, p>0.05], divorced [OR 0.56, 95%CI: 0.08-4.01, p>0.05].

Visual representation of forest plots and funnel plots are presented in supplementary file (S4).

Table 2: Risk Factors for UTI in Pregnant Women

#	Risk factor	Studies	Case	Control	Heterogeneity		Model	Effect Estimate, OR [95%CI]	z value	*p*-value	Egger's test
					p-value	I^2 (%)					*p-value*
1	Nullipara	6	406	1447	0.003	72.5	Random	0.91, (0.55, 1.51)	-0.34	0.727	0.735
2	Primipara	6	393	1348	0.204	30.8	Fixed	1.00, (0.77, 1.29)	-0.03	0.976	0.787
3	Multipara	9	525	1945	0.021	55.6	Random	1.16, (0.80, 1.66)	0.78	0.433	0.437
4	Anemia	6	430	1094	0.000	84.6	Random	1.92, (0.82, 4.54)	1.49	0.134	0.473
5	Urban	5	277	1163	0.000	91.1	Random	1.04, (0.28, 3.89)	0.06	0.947	0.092
6	Rural	5	277	1163	0.000	91.1	Random	0.96, (0.26, 3.56)	-0.06	0.947	0.092
7	Catheterization history	3	156	956	0.337	8.0	Fixed	4.02, (2.43, 6.64)	5.42	**0.000**	0.350
8	Sexual activity <3/week	5	204	1255	0.036	60.6	Random	0.52, (0.26, 1.05)	-1.82	0.068	0.536

9	Sexual activity ≥3/week	3	105	835	0.278	21.9	Fixed	1.75, (1.01, 3.06)	1.99	**0.046**	0.901
10	Past history of UTI	12	820	2712	0.000	80.0	Random	3.48, (2.21, 5.48)	5.39	**0.000**	0.576
11	Illiterate	13	1083	2852	0.001	64.3	Random	1.56, (1.02, 2.39)	2.04	**0.041**	0.111
12	Read & write	8	657	1714	0.227	19.2	Fixed	1.56, (1.12, 2.17)	2.61	**0.009**	0.615
13	Primary school	10	815	2308	0.167	30.2	Fixed	1.29, (1.03, 1.62)	2.19	**0.028**	0.890
14	High school	11	982	2281	0.000	90.4	Random	0.59, (0.31, 1.15)	-1.55	0.121	0.894
15	Higher education	11	878	2395	0.000	91.4	Random	0.41, (0.17, 0.98)	-2.01	**0.044**	0.189
16	University	6	558	1298	0.394	3.5	Fixed	0.94, (0.74, 1.19)	-0.52	0.599	0.018
17	1st trimester	14	1043	2664	0.454	0.0	Fixed	0.84, (0.68, 1.05)	-1.54	0.122	0.465
18	2nd trimester	15	1099	2908	0.000	78.1	Random	0.97, (0.68, 1.04)	-0.14	0.883	0.578
19	3rd trimester	15	1099	2908	0.005	55.4	Random	1.03, (0.80, 1.33)	0.24	0.809	0.351
20	Hypertension	6	472	895	0.598	0.0	Fixed	1.47, (0.98, 2.20)	1.85	0.063	0.264
21	Diabetes Mellitus	8	663	1430	0.108	40.6	Fixed	3.69, (2.58, 5.26)	7.19	**0.000**	0.012
22	Primigravida	9	828	1990	0.130	36.0	Fixed	0.85, (0.71, 1.03)	-1.64	0.099	0.384
23	Multigravida	8	818	1768	0.060	48.3	Fixed	0.93, (0.78, 1.12)	-0.73	0.461	0.961
24	Grandgravida	3	370	639	0.822	0.0	Fixed	1.78, (1.22, 2.61)	2.96	**0.003**	0.102
25	Employed	8	861	1666	0.000	93.1	Random	0.50, (0.21, 1.20)	-1.55	0.119	0.609
26	Unemployed	8	861	1666	0.000	83.3	Random	1.40, (0.79, 2.48)	1.14	0.252	0.145
27	Marital status – Single	5	489	1078	0.004	73.7	Random	0.96, (0.48, 1.95)	-0.09	0.921	0.383

28	Marital status – Married	6	558	1431	0.315	15.3	Fixed	0.77, (0.58, 1.02)	-1.80	0.071	0.891
29	Marital status – Divorced	4	434	905	0.000	89.6	Ran-dom	0.56, (0.08, 4.01)	-0.58	0.561	0.063
30	HIV	4	269	986	0.333	11.9	Fixed	1.86, (1.07, 3.23)	2.19	**0.028**	0.004
31	Undergar-ment - cot-ton	4	338	762	0.000	86.4	Ran-dom	0.25, (0.10, 0.62)	-2.99	**0.003**	0.769
32	Undergar-ment – silk	4	338	762	0.000	93.1	Ran-dom	6.69, (1.62, 27.54)	2.63	**0.008**	0.084

Discussion

To the best knowledge of the co-authors, there are no systematic reviews conducted on prevalence of UTI in Asian and African countries. However, only one pooled study was conducted on the prevalence of UTI in pregnant women in Iran and Ethiopia. The risk factors have not been studied intensively, so far. Hence, the results of this study not only bring forth the available evidence to understand the prevalence in Asian and African pregnant women but also make an objective evaluation of all the associated risk factors.

In the present study, 45 observational studies were included for meta-analysis that were carried out in Asian and African regions from the year 2000. Of these 45 studies, 43 were cross-sectional and two were cohort studies.

In this study, the overall pooled prevalence of UTI was 20.7% and 28.6% in pregnant Asian and African women, respectively. Azami *et.al.* [55] have reported the prevalence of UTI in pregnant Iranian women as only 9.8%. Results of Getaneh *et.al.* [56], in Ethiopian pregnant women, showed the prevalence as 15.3%; both of these are lower than the overall prevalence of the present systematic review and meta-analysis. The earlier studies included only one country from Asian and African regions.

Multiple factors influence the onset and development of UTI in pregnant women. To understand the risk factors comprehensively, age, parity, anemia, residency, history of catheterization, sexual activity, education status, past history of UTI, gestational age, hypertension, diabetes mellitus, gravidity, occupation, marital status, HIV, undergarment texture, BMI, socioeconomic status were included for the meta-analysis.

Several studies have demonstrated that history of catheterization causes damage to the urethral mucosa, increasing the risk of UTI in pregnant women. These findings were supported by the studies conducted in Ethiopia by Getaneh *et. al*. [56], and Abate *et.al*. [48].

Earlier studies have also shown the effect of poor levels of education on escalating the risk of UTI. Similarly, some studies [29, 34, 46, 54] reported a significant association between low education level (illiterate, read & write, primary school) and development of UTI. This is indeed related to pregnant women's insufficient awareness of uropathogens transmission and prevention. The result of this study confirmed a statistically significant association between better levels of education and the risk of UTI. This finding of the present study is in agreement with the result of Shaheen *et. al*. [29].

The present study showed a significant association between past history of UTI and pregnant women with UTI. This result showed consistency with studies conducted in Ethiopia [56, 20, 31] and India [14]. This may be proven by the fact that pregnant women with history of UTIs are more likely to develop resistant strains.

The other associated risk factor that proved to be strongly correlated with UTI was sexual activity. Women who had three or more sexual encounters a week were more likely to develop UTI than those who had fewer encounters. Sexual intercourse is known to increase the likelihood of urethra being contaminated with bacteria. This finding matches with previous results of Emiru *et. al.* [20], and Parveen *et. al.* [15].

Diabetes mellitus was found to be a significant risk factor in this study. Kashif *et. al.* [40], Ezugwu *et. al.* [51], and Emiru *et. al.* [20] demonstrated a significant association between diabetes mellitus and UTI in pregnancy. Bladder dysfunction, diminished immunity, and glycosuria are all associated with diabetes mellitus and are all thought to increase the risk of UTIs.

The results of the present study confirmed that grand gravidity increased the risk of UTI. The results were consistent with studies conducted by Taye *et. al.* [34], Mahmoud *et.al.* [46], and Johnson *et. al.* [50].

An extensive study conducted by Tessema *et. al.* [58], found a strong association between UTI in pregnant women and HIV and results are comparable with this study. Due to the reduction in immunity, individuals with HIV are more susceptible to acquire UTIs.

This present study reported that the use of silk undergarments increases the risk of UTI. Similar to earlier findings from Egypt [29], India [35], and Kenya [38], it was identified that the type of undergarment used significantly contributed to the development of UTI. It is very likely that the moisture contained in non-cotton undergarments encourages the growth of bacteria, increasing the risk of UTIs. This study also found a significant association between the use of cotton undergarments and the development of UTIs in pregnant women.

This present study reported a statistically insignificant association between various factors like parity, anemia, residency in urban and rural areas, gestational age, hypertension, occupation, marital status, and BMI. However, these factors were found to be statistically significant in a few studies [20, 29, 46, 57].

Before considering these findings to translate to practice, it is very important to take into account the limitations of the study. Only articles in the English language were included in this study. Only two databases were used, and continuous variables were eliminated. The studies that clearly report UTIs were included.

Conclusion

This meta-analysis has demonstrated that the prevalence of UTI was higher in African pregnant women compared to Asian pregnant women. History of catheterization, past history of UTI, level of education, diabetes mellitus, HIV, gravidity, and undergarment texture are the risk factors for developing UTI.

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