

The Prevalence of Urinary Tract Infections in Iranian Children: A Meta-Analysis and Systematic Review

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ABSTRACT

Introduction: Urinary Tract Infections (UTIs) are the most common infections in children worldwide, however, data from Iran is not very well studied.

Aim: The aim of the present study was to evaluate the prevalence of UTIs in Iranian children.

Materials and Methods: From the beginning of databases to November 2017, International {PubMed, Web of Science (WOS) and Google scholar} and National {Scientific Information Database (SID), Magiran} databases were searched for related observational studies that were conducted in Iran including only on Iranian children and published in English and Persian

languages. The quality of the articles was evaluated using the Hoy D tool.

Results: Out of 515 initial studies, 14 and 6 studies were included in systematic review and meta-analysis, respectively. The overall prevalence of UTI in 3926 children was 4.92% (95% CI:2.32, 7.52; I²=93.58%). The prevalence of UTI in male and female children was 2.59% and 4.78%, and the difference was non-significant.

Conclusion: Considering the prevalence of UTIs in Iranian children, it is recommended that studies should be conducted in the field of research at the national level to determine the precise incidence and risk factors for UTIs in children.

Keywords: Asymptomatic bacteriuria, Infectious disease, Paediatrics

INTRODUCTION

Globally, UTIs are the most common infectious disease in children [1]. In USA (2007) more than 10.5 million cases were diagnosed with symptoms of UTIs [2]. UTI is a term used for a wide range of clinical disorders of asymptomatic bacteriuria, infection of the kidneys, and sepsis [3]. UTIs are the most commonly reported infections in children [4-6]. Based on a meta-analysis study, the global incidence of UTIs in children is 7% [7]. In children, UTIs can have varying degrees of severity [8]. Symptoms like fever can also lead to chronic kidney failure as likelihood of scar formation in the kidney increases [9,10]. Therefore, early diagnosis of UTI is important, especially in children with special conditions of childhood, which does not allow the proper collection of urine samples, especially in developing countries where there is no access to appropriate primary care centres [11]. There is no precise and accurate prevalence of UTI in Iranian children except the Tola H et al., study which was conducted only on a specific population based on age (infants and specific disease) of infants with jaundice that the prevalence of UTI was 11% [12]. Policy makers can identify one of the most important health problems that can be reduced by correct screening. Conversely, if not identified, there would be an increased risk of developing chronic kidney disease which imposes a huge cost on healthcare system. This systematic review was conducted to determine the prevalence of UTIs in Iranian children.

MATERIALS AND METHODS

This systematic review adopted methods developed in accordance with the guidelines detailed on the PRISMA checklist [13].

Inclusion and exclusion criteria: Only observational studies were included however, letter to editors, reviews, articles without quality (based on hoy tool) and studies conducted on adult's participants were excluded. Only articles in English and Persian languages were included. The studies confirming with the UTI definition as "UTI is

defined as bacteriuria of more than 10⁵ CFU/mL in urine culture along with/without urinary symptoms" [14,15].

Sampling methods and sample size: All observational studies with any sampling and census designs were included in the present systematic review.

Search strategy: Two independent researchers conducted searches in International (PubMed, Google Scholar and WOS) and National databases (SID and Magiran) from the launching of the databases to November 2017, without time limitation in English and Persian languages. The references list of included articles are checked for finding more related articles. Specific search strategies were created by a Health Sciences Librarian with expertise in systematic review searching by using MESH terms and free terms according to the PRESS standard [16]. We used the MEDLINE search strategy for searching other databases. The keywords used in the search strategy were: Urinary tract infection, UTI, Paediatrics, Children and Iran which were combined with Boolean operators including AND, OR, and NOT.

Selection of studies and data extraction: By considering the eligibility criteria, two researchers independently screened the titles and abstracts. After removing duplicate studies, full texts of the studies were screened depending on the eligibility criteria and the required information were extracted. To resolve questions about eligibility, additional information was obtained from the authors of the study wherever necessary. General information (first author, province and year of publication), study characteristics (sampling method, study design, setting, sample size and risk of bias) and outcome measures (prevalence of UTI) were also collected.

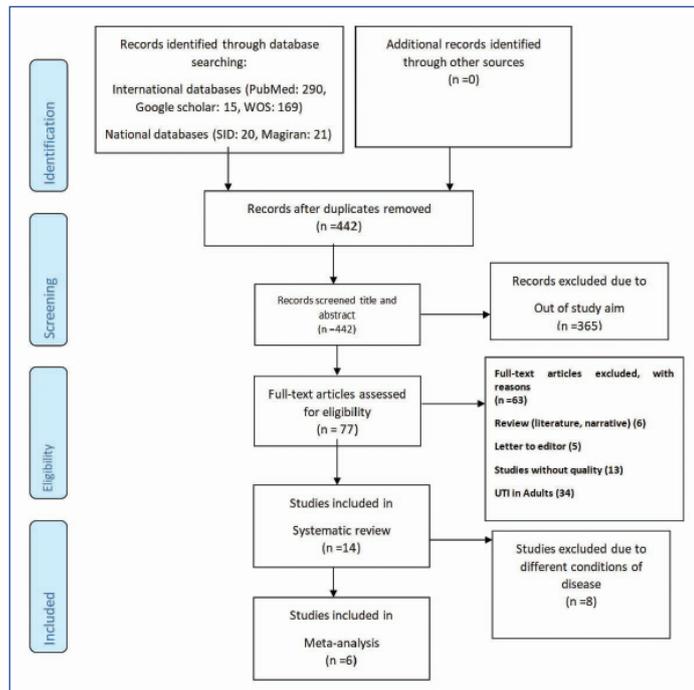
Quality assessment and abstraction: The Hoy D et al., tool was used to evaluate the methodological quality and risk of bias of each included observational study [17]. This 10-item tool was used to evaluate the quality of studies in two dimensions including external validity (items 1-4 assessed the target population, sampling frame, sampling method and non-response bias minimal) and internal

validity (items 5-9 assessed the data collection method, case definition, study instrument, mode of data collection while item 10 assessed bias related to data analysis). The higher score showed a lower risk of bias and the lower score showed a higher risk of bias. The risk of bias was independently evaluated by two researchers. The consensus method was used to resolve disagreements.

Data synthesis: Extracted data of final included studies combined by forest plot and prevalence of UTI assessed by random effect model using STAT 14.0 statistical software.

RESULTS

Study selection: A total of 515 articles were retrieved from the initial search in PubMed, Google scholar, SID, Magiran, and Web of science from inception to 1 November 2017. From a total of 442 non-duplicated studies in the title and abstracts screening process, 365 studies were excluded because their titles were unrelated. Of



[Table/Fig-1]: Flow diagram of study selection.

77 studies, 14 studies met the eligibility criteria. Of the 63 excluded studies, six studies were review, five studies were letter to editor, 34 studies examined UTI prevalence in adults, five studies did not have full text and 13 studies did not meet the least quality requirement for inclusion in the study [Table/Fig-1].

Study characteristics: These 14 studies were conducted on 6786 (male:3,339; female:3,447) Iranian children with age range between 2 to 12 years [18-31]. Out of the 14 included studies, 13 studies provided cross-sectional data, one study was a prospective study [19]. Out of the 14 studies, four studies were from Fars [21,23,24,29], two studies were from Ardabil [22,30] and Tehran [19,28] and one study was from East Azerbaijan [18], South Khorasan [25], Sistan and Baluchestan [31], Golestan [20], Hamadan [27] and a national study [26], respectively. The most common sampling method used was convenience (n=4). More than 85% of studies had a low risk of bias. The most common setting where studies were conducted was in the hospital (n=11). Of 14 studies only six studies were included in final meta-analysis, other eight studies excluded from final analysis due to different type of diseases that affected the UTI in children participants. Prevalence of UTI in children were between 5.8% to 38% in children with constipation (n=120) and nephrotic syndrome (n=124), respectively [Table/Fig-2].

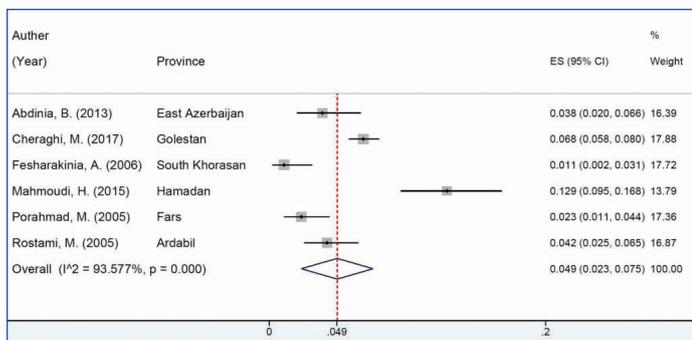
Prevalence of UTIs in children: Six studies that were conducted on 3926 children (male:1939/female:1987) were included in meta-analysis [18,20,25,27,29,30]. In asymptomatic children based on the results of the random effect method, the overall prevalence of UTI in 3926 children was 4.92% (95% CI: 2.32, 7.52; I²=93.58%) [Table/Fig-3]. Prevalence of UTI in male and female children were 2.59% (95% CI: 1.88, 3.29) and 4.78% (95% CI: 3.86, 5.71), respectively and this difference was also found in the study participant's subgroup [Table/Fig-4].

DISCUSSION

This systematic review was conducted to determine the prevalence of UTIs in Iranian children until November 2017. The overall prevalence of UTI among asymptomatic Iranian children was 4.92%, which is lower than the prevalence of UTI in children of India (15%) [32]. The probable cause of this variation is attributed to sample size, research methodology and the study setting in both researches.

First author	Year	Province	Sampling method	Design	Setting	Study population	Sample size	Overall Prevalence (%)	Risk of bias
Abdinia B et al., [18]	2013	East Azerbaijan	Random Cluster	Cross-Sectional	School	Asymptomatic	312	3.8	Moderate
Abedi A et al., [19]	2017	Tehran	Convenience	Prospective	Hospital	Cystic fibrosis	153	11.11	Low
Cheraghi M et al., [20]	2017	Golestan	Convenience	Cross-Sectional	Health center	Asymptomatic	2145	6.81	Low
Dehghani SM et al., [21]	2013	Fars	Purposive	Cross-Sectional	Hospital	Constipation	120	5.83	Low
Etehad G [22]	2000	Ardabil	Convenience	Cross-Sectional	Hospital	Multiple diseases	100	30	Low
Fallahzadeh MH and Ghane F [23]	2006	Fars	Consecutive	Cross-Sectional	Hospital	Kidney transplantation	120	6.67	Low
Fallahzadeh MK et al., [24]	2011	Fars	Census	Cross-Sectional	Hospital	Diarrhoea	138	17.39	moderate
Fesharakinia A et al., [25]	2006	South Khorasan	Multistage cluster	Cross-Sectional	Hospital	Asymptomatic	278	1.08	Low
Kalantar E et al., [26]	2008	National	Convenience	Cross-Sectional	Hospital	Multiple diseases	1669	26.20	moderate
Mahmoudi H et al., [27]	2015	Hamadan	Two stage cluster	Cross-Sectional	Hospital	Asymptomatic	350	12.86	Low
Panahi Y et al., [28]	2008	Tehran	Purposive	Cross-Sectional	Hospital	Febrile	433	9.01	Low
Porahmad M [29]	2005	Fars	Cluster	Cross-Sectional	School	Asymptomatic	387	2.33	Low
Rostami M et al., [30]	2005	Ardabil	Simple random	Cross-Sectional	School	Asymptomatic	454	4.19	Low
Salarzaei M et al., [31]	2017	Sistan and Baluchestan	Simple random	Cross-Sectional	Hospital	Nephrotic syndrome	124	37.90	Low

[Table/Fig-2]: Characteristics of final included studies about prevalence of UTI in Iranian children.



[Table/Fig-3]: Prevalence of children's UTI in health population studies and of pooled prevalence of UTI estimate in Iran.

First author	Male			Female		
	ES	95% CI for ES	% Weight	ES	95% CI for ES	% Weight
Abdinia B et al., [18]	0.71	0.13, 3.93	25.32	6.40	3.61, 11.09	6.35
Cheraghi M et al., [20]	4.66	3.57, 6.06	32.16	9.13	7.52, 11.04	27.45
Fesharakinia A et al., [25]	1.35	0.37, 4.79	14.24	0.77	0.14, 4.23	37.64
Mahmoudi H et al., [27]	7.69	4.23, 13.58	2.35	15.91	11.67, 21.32	3.63
Porahmad M [29]	1.58	0.54, 4.54	15.68	3.05	1.40, 6.48	14.74
Rostami M et al., [30]	2.78	1.28, 5.93	10.26	5.46	3.22, 9.12	10.19
Overall random pooled ES	2.59	1.88, 3.29	100	4.78	3.86, 5.71	100

[Table/Fig-4]: Prevalence of UTI in asymptomatic children by gender.

ES: Effect size

Also, according to individual studies in the United States (9%) [33], England (5.6%) [34], and Turkey (7.1%) [35], it was found that the UTI rate is lower compared to the figures published in Iran. This difference can be attributed to the methodological differences in studies as well as the existence of better screening programs for children in the above mentioned countries [36-38]. Also, the results of this study showed that the prevalence of UTI is higher in women than in men, in line with studies in the United States [39] and Turkey [35], which can be due to the shorter urine tract in women. One of the most important sub-factors in urinary tract infections is poor health behaviours, especially in developing countries. By increasing education in family and community level towards management of risk factors of UTI is crucial.

LIMITATION

The limitations of the present study were less number of studies related to the topic and heterogenous group of participants in studies. The lack of clarity of the causes of UTIs in most studies. In retrospect, the authors feel that if few more keywords like pyelonephritis, cystitis, urethritis, pyonephrosis, bacteriuria would have been included during literature search then it would have led to better results.

CONCLUSION

The results of the present study provide healthcare policymakers with precise prevalence rate of UTIs in children which enables them to make necessary plans according to their actual level.

Considering the prevalence of UTIs in Iranian children, it is recommended to perform studies in the field at national level to determine the precise incidence and risk factors for UTIs in children.

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