

## Prevalence of Urinary Tract Infection in Children with Febrile Convulsion: A Systematic Review and Meta-Analysis

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### Abstract

**Background:** Urinary tract infections (UTIs) are classified as upper or lower and can be asymptomatic or manifest fever, abdominal pain, sepsis, hematuria, and typical renal colic. Therefore, this study was to determine the prevalence of UTIs in patients with febrile seizure (FS).

**Method:** The studies published between 2010 and 2022 and indexed in Web of Science (ISI), Scopus, PubMed, EBSCO, SID, and Magiran databases were searched for the purpose of this meta-analysis and systematic review. The study checklist included the author's name, year of publication, location and prevalence of UTI. Prevalence of UTI was analyzed using the RANDOM model after entering the CMA3 software.

**Results:** Six articles, with the total sample size of 1480 people (778 boys and 702 girls), were selected for the final analysis. They were published between 2011 and 2018; the lowest prevalence rate (11.1%) was reported in a study by Akbar et al., in Golestan city, and the highest prevalence (15.2%) was related to a study by Mahyar et al., in the city of Qazvin. In general, the prevalence of UTI was found to be 3.7 (95% CI: 1.3-10.4), and in boys, 15 (95% CI: 12.2-18.2) in girls with FS; and the overall rate was equal to 9.8 (95% CI: 7.6-12.6).

**Conclusions:** Considering the overall prevalence of UTIs (9.8%) and its high rate in girls (15%), preventive interventions are suggested.

**Key Words:** Children, Febrile seizure, Meta-analysis, Pediatrics, Prevalence, Systematic review, Urinary Tract Infection.

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## 1- INTRODUCTION

Bacterial infections account for 25,000 deaths per year, and two-thirds of these infections are caused by gram-negative bacteria (1, 2). Urinary tract infections (UTIs) are one of the most common bacterial diseases that affect about 150 million people every year. The high prevalence of UTIs has imposed high costs on the patient and the health care system, and all these factors contribute to increasing health care costs (3-5). This infection can involve the urinary tract, kidneys or bladder. If the urinary infection spreads to the kidneys, it can cause dangerous complications in the patient (6, 7). The health UTI-related care costs are estimated at 3.5 billion dollars in the United States (8).

UTIs are classified as upper or lower. UTIs can be asymptomatic or manifest fever, abdominal pain, sepsis, hematuria, and typical renal colic (8). In lower UTIs, inflammation of the bladder, nocturnal urination, pain, urinary urgency, and smelly urine are observed. While upper UTIs are characterized by pelvic inflammation and kidney parenchyma, side pain and chills, which causes septic shock if the disease worsens (9, 10). Also, renal scarring and chronic abdominal pain are among the long-term complications of UTIs, which lead to hypertension and chronic kidney failure in the long term (9, 11). In a study, Salari et al. reported a UTI prevalence of 11.5% among 827,948 Iranian diabetic patients, which increased with an increase in the participants' age and the years of research (7). Similarly, in a study on 3773 patients, Tegegne et al. reported that the prevalence of UTIs was 15.97% and this rate was lower in women and illiterate people (12).

Many physical diseases such as cancer (13), trauma complications (14, 15), and infectious diseases (16) afflict children; and UTIs are one of these diseases (17). UTIs are one of the common infections

with a higher prevalence in girls than in boys. There are difficulties in diagnosing UTIs in children, since its prevalence and incidence depends on gender, age, race, etc. (18). In fact, the prevalence of UTIs is higher in infants and children, and its rate in children is estimated to be 5%, and its annual incidence is 3.1 in girls and 1.7 in boys per 1000 people (19, 20). Febrile seizure (FS) patients are one of the groups in which UTIs are observed (21, 22). FS is the most common seizure in children, which is accompanied with fever and without symptoms of central nervous system infection. FC mostly occurs in the age group of six months to six years, which peaks at the age of 18 months and disappears at the age of six years (22-24). Considering the importance of UTIs, this study aimed to determine the prevalence of UTIs in patients with FS.

## 2- MATERIALS AND METHODS

This study aimed to determine the prevalence of UTIs among Iranian patients with FC, through systematically reviewing and analyzing articles searched with the specific keywords of prevalence, urinary tract infection, febrile infection, febrile seizure and Febrile convulsion, Children, Febrile seizure, Pediatrics, from the beginning of 2010 to the end of the year 2022. The search was conducted by two experts (assistant Professors in neurology and pediatrics), in Web of Science (ISI), Scopus, PubMed, EBSCO, SID, Magiran, and Google Scholar databases. All the data was collected by the internal ward specialist present in the research.

The study checklist included the author's name, year of publication, location and prevalence of UTI. Data was analyzed using the RANDOM model after entering the CMA3 software.

## 3- RESULT

Six articles, with the total sample size of 1480 people (778 boys and 702 girls), were selected for the final analysis. The

studies were published between 2011 and 2018; the lowest prevalence rate (11.1%) was reported in a study by Akbar et al. (25), in Golestan city, and the highest

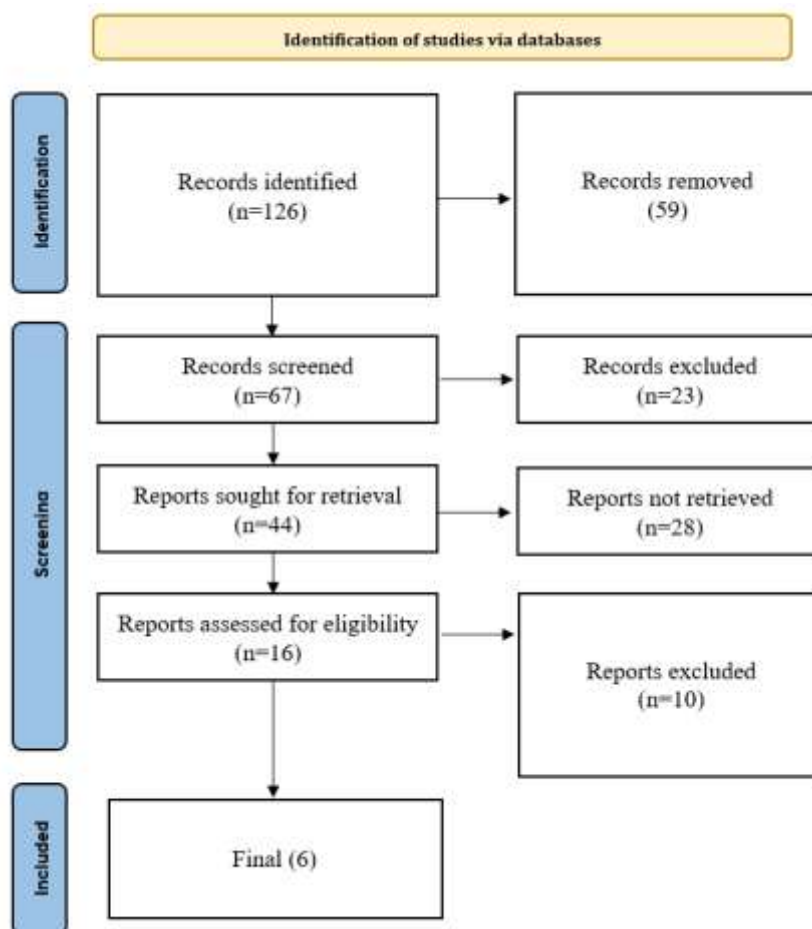
prevalence (15.2%) was related to a study by Mahyar et al. (26), in the city of Qazvin (**Table 1**).

**Table-1:** Specifications of the articles

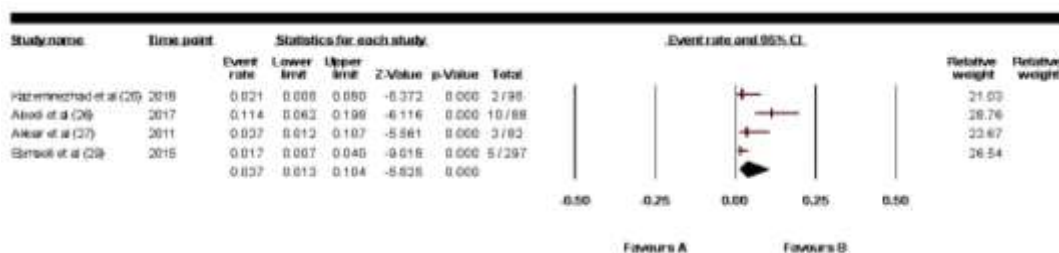
Author	Year	City	N (%)			UTI-N (%)		
			Male	Female	Total	Male	Female	Total
Kazeminezhad et al (27)	2018	Ilam	95 (39.9)	143 (60.1)	238	2	26	28(11.8)
Abedi et al (28)	2017	Tehran	88(57.5)	65(42.5)	153	10	7	17(11.1)
Akbar et al (25)	2011	Golestan	82(59.9)	55(40.1)	137	3	6	9(6.5)
Mahyar et al (26)	2018	Qazvin	97	68	165	-	-	25(15.2)
Esmaili et al (29)	2015	Mashhad	297(49.8)	299(50.2)	596	5	44	49(8.22)
Moghaddam et al (30)	2016	Rasht	119(62.3)	72(37.7)	191	-	-	13(6.8)

The results further revealed that the prevalence of UTI is equal to 3.7 (95% CI: 1.3-10.4) in boys, and 15 (95% CI: 12.2-

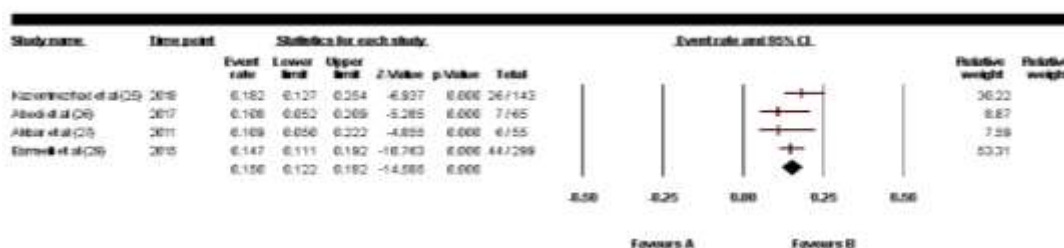
18.2) in girls with FS; and the overall rate is equal to 9.8 (95% CI: 7.6-12.6) (**Fig. 1-6** and **Table 2**).



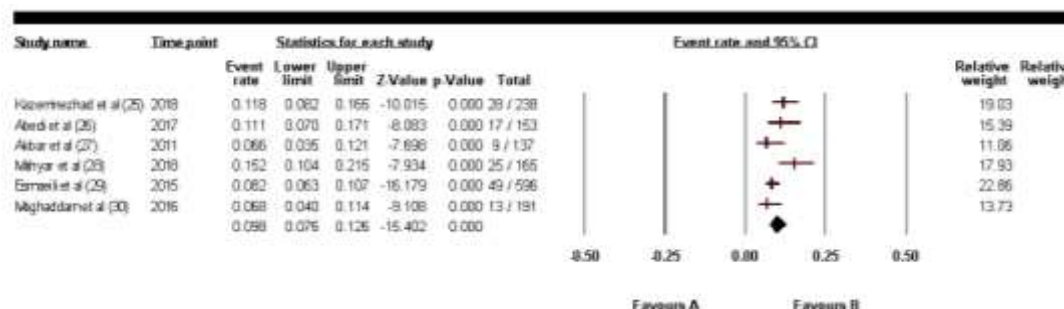
**Fig. 1:** Flowcharts for systematic review



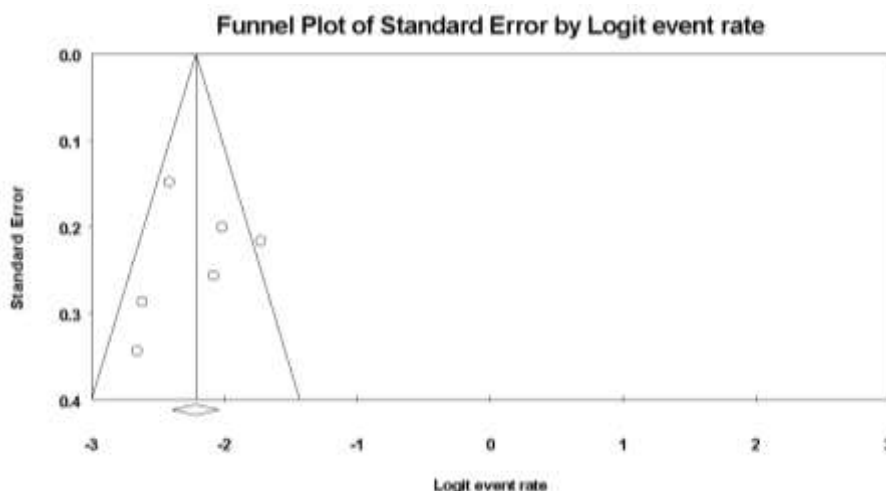
**Fig-2:** Prevalence of UTI in boys with FC (I-squared=80.125, Q-value=15.095 and T au Squared =0.971)



**Fig. 3:** Prevalence of UTI in girls with FC



**Fig.4:** Total prevalence of UTI in patients (I-squared=57.431, Q-value=11.746 and T au Squared =0.068)



**Fig. 5:** Publication Bias

**Table-2:** Statistical description of the data

FC patients	Prevalence	I-squared	Q-value	T au Squared	T au
boys	3.7 (95%CI:1.3-10.4)	80.125	15.095	0.971	0.985
girls	15 (95%CI:12.2-18.2)	0.000	2.76	0.000	0.000
total	9.8 (95%CI:7.6-12.6)	57.431	11.746	0.068	0.262

#### 4- DISCUSSION

UTIs are one of the most common infections seen in childhood and, if left untreated, lead to damage to the kidney parenchyma in the form of renal fibrosis or delayed kidney growth. Various pathogens have been effective in causing UTIs, of which *E. Coli* is one of the most common types. Due to the antibiotic's resistance, disease prevention is a priority (31). UTIs are a serious threat to children's health, and their prevalence is higher in women, and half of them experience UTIs during their lifetime (32, 33).

Results of the present study demonstrated that the prevalence of UTIs was 3.7% in boys with FS (95% CI: 1.3-10.4), and 15% in girls (95% CI: 12.2-18.2). Consistent with our results, other studies have also indicated that the prevalence of UTIs is higher in women than in men. For instance, Rostami et al. found that the prevalence of UTIs was 5.5% and 2.8% in girls and boys, respectively (34), Swerkersson et al. found the amount of *E. coli* in 96% of girls and 89% of boys (34). Similarly, Batavia et al. reported *E. coli* in 53% of girls and in 5% of boys (35).

Our results, in addition, revealed that the overall prevalence was 9.8% (95%CI: 7.6-12.6). A study by Kantamalee et al. also investigated the number of 335 children with FC (217 (64.78%) boys and 118 (35.22%) girls), during the years 2004 and 2013. They found that the prevalence of UTIs was equal to 12 (3.58%) (36). In another study, YAO et al. investigated two groups of FS children (n = 81) and non-FS ones (n = 100), reporting 40 types of pathogenic pathogens in the FC group; and

the results of WBC, CRP, PCT in the FC group were higher than those in the control group. (37). Yet another study on 1242 children with UTI, stated that the FC prevalence was equal to 25 cases (3.2%) (38).

Novelty and innovation are one of the strengths of the study, and the small number of studies, (n= 6 studies), is one of the weaknesses. Further studies in the field are supposed to confirm the results by future investigations.

#### 5-CONCLUSION

Considering the overall prevalence of UTIs (9.8%) and its high rate in girls (15%), preventive interventions are suggested. It is recommended that the FC treatment team including nurses and physicians as well as the related healthcare management team have essential considerations to UTIs in FC patients, attempting to reduce its prevalence, especially among girls. Also, it is necessary to train families for preventive measures.

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