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Prevalence of Urinary Tract Infections in Uganda: A Systematic Review and Meta-Analysis

Danladi Makeri[1], Priscilla Peter Dilli[2], Doreen Nyaketcho[3], Theophilus Pius[4]*

[1]Department of Microbiology and Immunology, Kampala International University Western Campus, Bushenyi, Uganda
[2]Department of Public Health, Kampala International University Western Campus, Bushenyi, Uganda
[3]School of Pharmacy, Kampala International University Teaching Hospital, Bushenyi, Uganda
[4]Department of Medical Laboratory Sciences, Kampala International University Teaching Hospital, Bushenyi, Uganda
Email: *piustheophillus@kiu.ac.ug

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Abstract

Urinary tract infections (UTIs) pose a significant burden on public health, affecting millions of individuals worldwide; on average, a typical Ugandan female will have an infection once a month. Understanding their epidemiology is crucial for targeted interventions. This systematic review and meta-analysis sought to synthesize existing literature on urinary tract infections in Uganda, providing a comprehensive overview of its prevalence. On June 24th, 2023 we searched two bibliographic databases PubMed and Scopus to identify studies conducted in Uganda that reported urinary tract infections. The main concepts related to this research, "urinary tract infections, "prevalence"; "Uganda" were expanded with their variations and combined using Boolean operators (AND, OR) to formulate the final search query. The selection and inclusion of studies followed the Preferred Reporting Items for Systematic Reviews and Meta-analysis. This study found the national pooled prevalence of urinary tract infection in Uganda to be 24.92% (95% CI: 23.407 - 26.479; I^2 = 98.85 [98.56% - 99.08%]) with Northern Uganda having the highest pooled prevalence 71.94% (63.70 - 79.23). The predominant isolates are *Staphylococcus aureus*, *Escherichia coli*, and *Klebsiella pneumoniae.* Gram-negative bacteria uropathogens were dominants across most studies except for Odongo *et al.*, 2013: 53.66% (95% CI: [42.30 - 64.75] I^2: 93.3% [89.9 - 95.4]) and Calzada *et al.*, 2022: 76.4% (95% CI: [66.22 - 85.76] I^2: 93.3% [89.9 - 95.4]) which had Gram-positive bacteria as the dominant bacteria with more female more affected than men. This study found a high pool prevalence of UTIs in Uganda with Northern and Western Uganda having the highest prevalence. *Escherichia coli*, *Staphylococcus aureus*, and *Klebsiella* *pneumoniae* were the common bacteria while a recent study in 2022 reported Gram-positive bacteria as the predominant bacteria. More studies should be done in the Central and Eastern regions of Uganda. Further studies should recruit more males to ascertain the prevalence of UTIs among males as many studies had focused on and recruited more females than males.

Subject Areas

Clinical Medicine, Internal Medicine, Public Health, Urology

Keywords

Prevalence, Urinary Tract, Infections, Uropathogen, Systematic Review, Meta-Analysis, Uganda

1. Introduction

Infections of the urinary tract are inflammatory disorders that are caused by the abnormal growth of pathogens. Urinary tract infection (UTIs) causes' short-term morbidity accompanied by fever, burning sensations while urinating, LAP, itching, formation of blisters and ulcers in the genital area, genital and supra-pubic pain, and pyuria generally depending on the age of the person infected and the location of the urinary tract infected [1]. It may also lead to permanent damage to the kidney. Urinary tract infections (UTIs) are one of the major causes of comorbidities especially, in patients with underlying conditions, and account for major reasons for hospital visits globally [2].

Urinary tract infections can be categorized into two namely, community-acquired or nosocomial [2]. The community-acquired urinary tract infections (CA-UTIs) are infections of the urinary system that takes place in a person's life while in the community setting or the hospital environment within less than 48 hours of admission [2]. Community-acquired UTI is the second most common microbial infection in the community setting. The second category of UTIs is nosocomial urinary tract infections (N-UTIs) which occur after 48 hours of hospital admission, and the patient was not incubating at the time of admission or within 3 days after discharge [3]. Also, urinary tract infections may be asymptomatic, acute, chronic, and complicated or uncomplicated, and the clinical manifestations of UTIs depend on the portion of the urinary tract involved, the etiologic organisms, the severity of the infection, and the patient's ability to mount an immune response to it. Both asymptomatic and symptomatic UTIs pose a serious threat to public health care, therefore reducing the quality of life and leading to work absenteeism [4].

On the other hand, uncomplicated UTIs typically affect immunocompetent individuals who have no structural or neurological urinary tract abnormalities; these infections are distinguished into lower UTIs (Cystitis) and upper UTIs (pyelonephritis) [5]. Many risk factors are linked to cystitis, including female gender, a prior UTI, sexual activity, vaginal infection, diabetes, obesity, and genetic susceptibility. Furthermore, complicated UTIs are associated with factors that compromise the urinary tract or host defense, including urinary obstruction, urinary retention caused by neurological disease, immunosuppression, renal failure, renal transplantation, pregnancy, and the presence of foreign bodies such as calculi, indwelling catheters or other drainage devices [6]. Acute pyelonephritis with community onset is an ascending UTI that involved the kidneys and may be associated with bacteremia. Though pyelonephritis is less common than cystitis, it causes short-term morbidity and can lead to severe and sometimes fatal complications. The occurrence is highest among young women, followed by infants and the elderly. Likewise cystitis, the most common pathogen is *E. coli* followed by other *Enterobacteriaceae*, with a wide range of variation. Acute pyelonephritis may be treated with oral antibiotics that cover the same spectrum of pathogens as cystitis, but it calls for adequate antibiotic concentrations in the upper urinary tract and bloodstream [7].

There are many risk factors for UTIs especially in women and these include frequent sexual intercourse, history of recurrent urinary tract infections, not urinating after intercourse, use of spermicide, and use of a diaphragm. Though the long-term adverse effects associated with uncomplicated urinary tract infections appear to be insignificant, if it is not treated, they can interfere with daily living [8].

About 80% of uncomplicated urinary tract infections are caused by *Escherichia coli*, followed by *Staphylococcus saprophyticus* in as many as 5% to 15% of cases. *Enterococci*, *Klebsiella* species, and *Proteus mirabilis* account for a small percentage of overall infections. Cystitis caused by bacteria begins with the colonization of the peri-urethral skin and the anterior urethra before getting into the bladder [9]. Uropathogenic *E. coli* demonstrates specific virulence factors, which allow them to adhere to vaginal and uroepithelial cells, repel bactericidal activity of human serum, prevent phagocytosis by leucocytes, and production of specific cytotoxins for tissue invasion [10]. Such virulence factors and uropathogenicity are not confined to *E. coli* and have been shown with *Proteus mirabilis* and *Klebsiella* spp [11]. Enterobacteriaceae are the organisms most commonly responsible for both community-acquired and healthcare-associated urinary tract infections; they are found in 70% - 80% of such infections [1]. *Escherichia coli* (*E coli*) is the commonest organism causing UTIs [7]. Other causes are *Klebsiella, Staphylococcus aureus, Staphylococcus saprophyticus, Proteus, Streptococcus faecalis, Streptococcus pyogenes, Candida*was also observed to produce UTI in diabetic and immunocompromised patients. A study also reported various organisms isolated as most prevalent which includes *Escherichia coli, Klebsiella* sp. *Pseudomonas aeruginosa*, *Staphylococcus aureus, Proteus sp.* and *Serratia marcences*. These organisms were isolated from urinary tract infections of patient populations [12]. The most frequent organisms isolated were *Escherichia coli* (*E. coli*), *Enterococcus*, *Klebsiella, Enterobacter* species, and *Pseudomonas*. Another study found *Escherichia coli*, *Staphylococcus* spp., and *Pseudomonas* spp. as the most prevalent bacteria. Others isolated *Klebsiella* spp., *Proteus* spp., *Staphylococcus epidermidis*, *Staphylococcus saprophyticus*, *Streptococcus* spp, *Enterococcus* spp., and *Citrobacter* spp. in their study [2]. This systematic review and met-analysis is to intend to ascertain the burden of UTIs prevalence in Uganda which is a public health concern due to its reoccurrence especially among the females. It is important to note that UTI not only causes acute morbidity but also is associated with renal scarring, hypertension, and chronic kidney disease in the long run, if not treated at an appropriate time with the right antimicrobial agent [12].

2. Methods

2.1. Search Strategy

We searched two bibliographic databases, PubMed and Scopus, for studies conducted in Uganda and among Ugandans which reported investigating the prevalence, incidence, or epidemiology of urinary tract infection. We formulated our search query by combining key concepts including "urinary tract infections", "UTI", "bacterial isolate," and "Uganda" with their variations using the Boolean operators (AND, OR) as presented in **Table 1**. We did not register a protocol for this study.

2.2. Study Selection Criteria

We included studies that met the inclusion criteria which included: (i) studies must be conducted in Uganda (ii) evidence of bacterial isolation from urine samples (iii) studies must have recruited at least 10 participants. We excluded studies that did not meet the inclusion criteria were excluded; the exclusion criteria included:(i) studies lacking evidence of primary isolation of bacteria, (ii) meta-analysis, (iii) review articles, (iv) case reports with less than 10 respondents, and (iv) studies without accessible full texts. The selection and reporting of this review followed the Preferred Reporting Items for Systematic Reviews and Meta-analysis [13].

Table 1. Search Query.

Database	Search query
Scopus	TITLE-ABS-KEY ("prevalence" OR "epidemiology" OR "incidence") AND ("urinary tract infections" OR "UTI" OR "bacterial infections") AND ("Uganda" OR "East Africa") AND ("demographic factors" OR "risk factors" OR "symptoms" OR "diagnosis" OR "treatment")
PubMed	("prevalence" OR "epidemiology" OR "incidence") AND ("urinary tract infections" OR "UTI" OR "bacterial infections") AND ("Uganda" OR "East Africa") AND ("demographic factors" OR "risk factors" OR "symptoms" OR "diagnosis" OR "treatment")

2.3. Data Extraction and Critical Appraisal

Data extraction, de-duplication, and title and abstract screening were performed independently by two authors (DM and TP). For all studies that met the inclusion criteria, authors (DM and PPD) accessed the full text and screened them for eligibility for inclusion criteria. We created a standardized Microsoft Excel (2019) spreadsheet into which, we extracted and added relevant data from included studies into columns labeled as follows: author name, year of publication, Study region, sample size (number of people recruited into the study), the total number of bacteria isolated, number of respondents with UTI, period of study, sample specimen, isolation method, and study design. Critical appraisal to assess the quality and risk of bias of included studies was achieved using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for studies reporting prevalence. We assessed publication bias using funnel plots. Two authors (MD and TP) independently performed the appraisals; whenever there was a discrepancy, it was resolved by consensus.

2.4. Statistical Analysis

Using the random effect analysis model, we computed the pooled prevalence of urinary tract infectionwith 95% confidence intervals. We used the I^2 statistic to assess study heterogeneity at 95%CI and interpreted as low, moderate, or high the values (≤ 25%), (25% - 75%), and (≥ 75%), respectively [14]. All meta-analyses were performed using MedCalc® Statistical Software version 22.007 (MedCalc Software Ltd, Ostend, Belgium; https://www.medcalc.org; 2023).

3. Results

A systematic search of PubMed and Scopus databases retrieved 130 studies; four (4) other studies not indexed in the databases we searched were retrieved from Google search making a total of 135 studies. Twenty-five (25) duplicates were removed, and one hundred and five (105) studies were subjected to title and abstract screening. Eighty-two (82) titles and abstracts were excluded for not meeting the inclusion criteria. The remaining twenty-three (23), which passed title and abstract screening, were further screened for all components of the inclusion criteria. At this stage, one (1) review article and fifteen (15) studies lacking relevant data were excluded. **Figure 1** shows the study selection process. Critical appraisal of the eligibles studies observed discrepancies in reporting, especially in studies that used multiple specimens from individual respondents yet presented combined frequencies of various specie isolates; however, this was not considered a ground for exclusion.

Eleven (11) studies with a total of 3110 participants made the inclusion criteria (Mwaka *et al*., 2011; Johnson *et al*., 2021; Calzada *et al*., 2022; Nteziyaremye *et al*., 2020; Andabati *et al*., 2010; Deus *et al*., 2017; Odoki *et al*., 2020; Ocokoru *et al*., 2015; Gerald 2021; Abongomera *et al*., 2021 and Odongo *et al*., 2013). Two studies representing 18.2% of the eligible studies did not report the study design

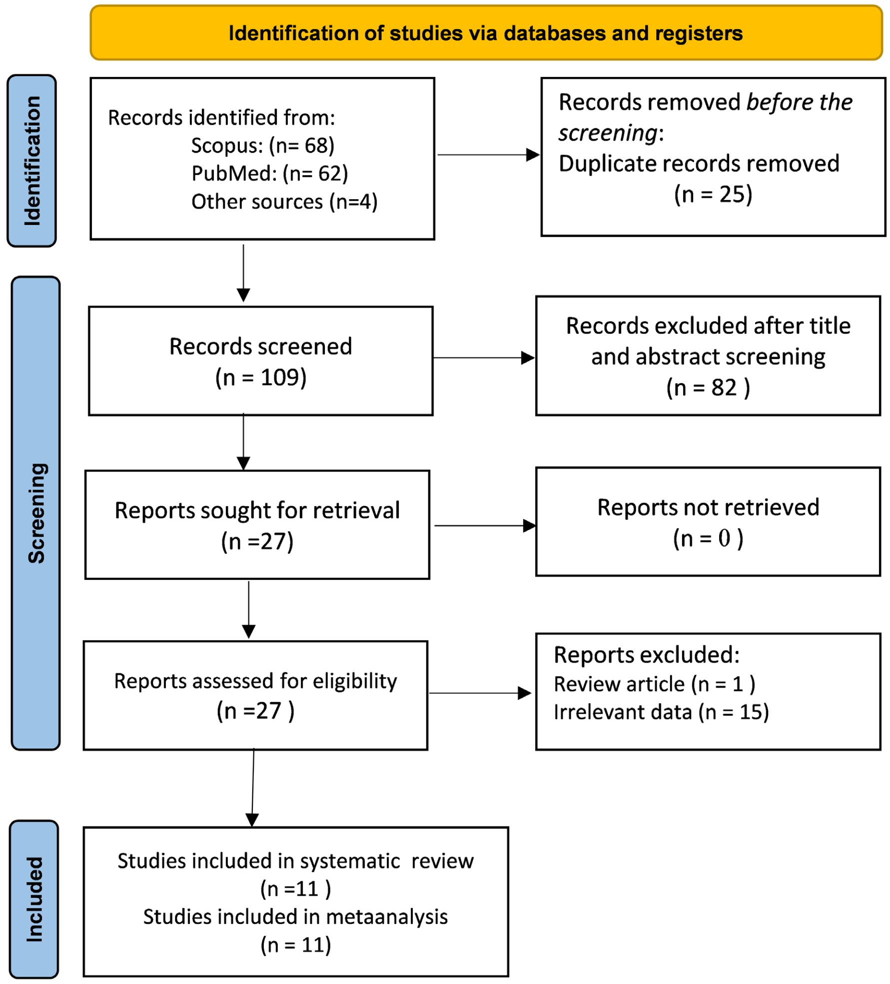

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) study selection framework.

they adopted, while the remaining 81.8% adopted the cross-sectional study designs. The majority of the studies, approximately 54.6% were conducted in central Uganda. Studies from the eastern region constituted 9.1% while the western and northern regions of the country have 18.2% respectively. One of the earliest works on urinary tract infections in the country was conducted in 2009 however, 54.5% of the studies were conducted within the last decade. 27.3% (n = 3) did not report the period within which they were conducted. In more than half of the studies, 63.4% (n = 7) recruited both men and women into their study while the remaining 36.4% (n = 4) was conducted among women only.

All studies collected urine samples and used conventional culture methods for microbiological isolation of uropathogens. Cumulatively, the eleven studies isolated a total of 814 uropathogens spread across fourteen (14) bacterial species. Gram-negative bacteria constitute 81.8% of the isolates while the remaining are Gram-positive. The Gram positives were predominantly; *Staphylococcus* species, *Enterococcus*, *Actinomycetes*, and *Streptococcus* species. The Gram negatives included: *Pseudomonas* species, *Escherichia coli*, Proteus species, *Citrobacter*, *Providencia*, *Klebsiella* species, *Enterobacter, Morganella*, and *Acinetobacter* species. The predominant uropathogens are *Escherichia coli* (n = 284), staphylococcus aureus (n = 122), and *Klebsiella pneumoniae* (n = 112). **Figure 2** presents the regional distribution of the predominant uropathogens in Uganda. Selected study characteristics are presented in **Table 2**.

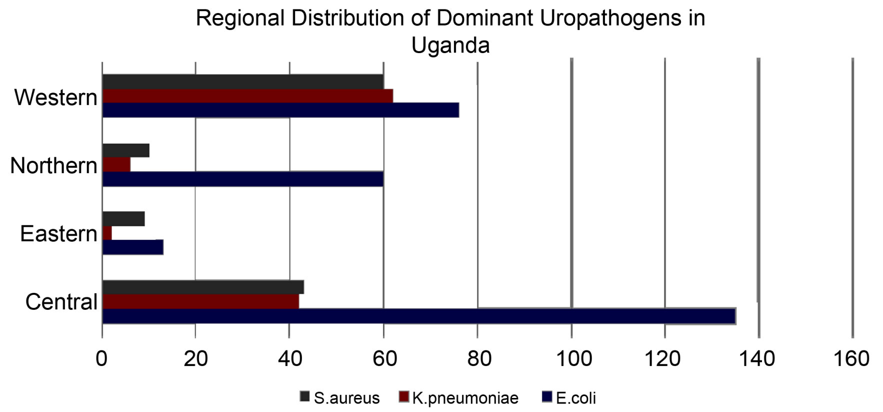

Figure 2. Regional distribution of dominant uropathogens in Uganda.

Table 2. Included studies with selected characteristics.

Studies	Publication Year	Country	Sample size	Patients with UTI	Study design	Study Period	Sample Specimen	Isolation Method	Region	Study population	TBI
Mwaka *et al.*, 2011	2011	Uganda	399	40	CRS	NR	urine	culture	Central	Females	40
Johnson *et al.*, 2021	2021	Uganda	400	140	CRS	2019	urine	culture	Western	Females	140
Calzada *et al.*, 2022	2022	Uganda	139	89	CRS	2019	urine	culture	Northern	Both	100
Nteziyaremye *et al.*, 2020	2020	Uganda	587	22	CRS	2019	urine	culture	Eastern	Females	22
Andabati *et al.*, 2010	2010	Uganda	218	29	NR	2009	urine	culture	Central	Females	29
Deus *et al.*, 2017	2017	Uganda	139	54	CRS	NR	urine	culture	Central	Both	82
Odoki *et al.*, 2020	2020	Uganda	267	86	CRS	NR	urine	culture	Western	Both	86
Ocokoru *et al.*, 2015	2015	Uganda	302	81	CRS	2014	urine	Culture	Central	Both	81
Gerald, 2021	2021	Uganda	120	120	CRS	2016	urine	Culture	Central	Both	120
Abongomera *et al.*,2021	2021	Uganda	200	32	CRS	2018	urine	culture	Central	Both	32
Odongo *et al.*, 2013	2013	Uganda	339	82	CRS	2011	urine	culture	Northern	Both	82

Keys: -*UTI: Urinary Tract Infections; *CRS: Cross-sectional; *TBI: Total Bacterial Isolate; *NR: Not reported; *Both: Male and Female.

Across eleven studies with a total of 3110 respondents, 775 were positive for urinary tract infections. The national pooled prevalence of urinary tract infection in Uganda is 24.92% (95% CI: ta - 26.479; I^2 = 98.85 [98.56% - 99.08%]). Our meta-analysis observed that the prevalence of UTI varies across the country ranging between 3.75% - 100% (95% CI: [2.36% - 5.62%]; [96.97% - 100.00%]; I^2 = 98.95% [98.7 - 99.20]). Interestingly, 69% of study respondents who tested positive for UTI were females. The distribution across other studies is presented below (**Table 3**, **Figure 3** and **Figure 4**).

We performed a sub-group meta-analysis of selected study characteristics including study region, study period, and gender (**Table 4**). Our meta-analysis shows that although the majority of the studies were conducted in central Uganda, the northern region of the country leads in the prevalence of UTI at 35.77% (95% CI: [31.47 - 40.25]; I^2: 99.0 [98.5 - 93.3]), followed by the western

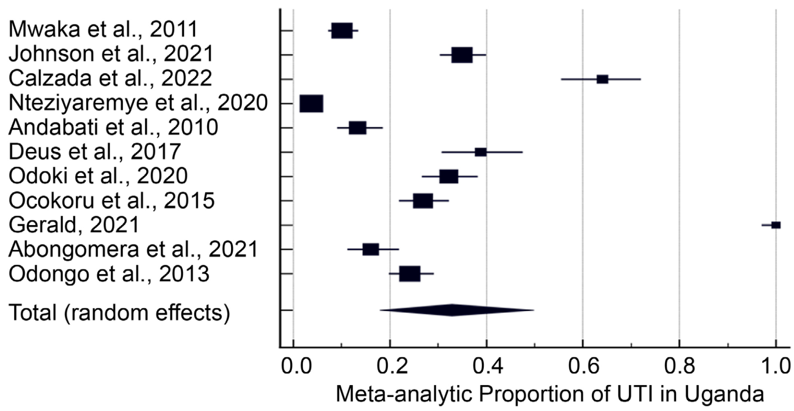

Figure 3. Forest plot of pooled prevalence of UTI in Uganda.

Table 3. Prevalence of urinary tract infections in Uganda.

Study	Sample size	Pooled Prevalence (%)	95% CI	Weight (%)	I^2 (95% CI)	P-value
Mwaka *et al.*, 2011	399	10.025	7.26 - 13.40	9.14		
Johnson *et al.*, 2021	400	35.000	30.33 - 39.90	9.14		
Calzada *et al.*, 2022	139	64.029	55.46 - 71.99	9.02		
Nteziyaremye *et al.*, 2020	587	3.748	2.36 - 5.62	9.16	98.95% (98.7 - 99.2)	
Andabati *et al.*, 2010	218	13.303	9.09 - 18.54	9.09		<0.0001
Deus *et al.*, 2017	139	38.849	30.71 - 47.48	9.02		
Odoki *et al.*, 2020	267	32.210	26.64 - 38.18	9.11		
Ocokoru *et al.*, 2015	302	26.821	21.91 - 32.20	9.12		
Gerald, 2021	120	100.000	96.97 - 100.00	8.99		
Abongomera *et al.*, 2021	200	16.000	11.21 - 21.83	9.08		
Odongo *et al.*, 2013	339	24.189	19.73 - 29.11	9.13		

Table 4. Sub-group meta-analytic prevalence of UTI in Uganda.

Study Characteristic	Sample size	Prevalence (%)	95% CI	Weight (%)	I^2 (95% CI)	P-value
Region						
Central	1378	25.84	23.54 - 28.23	25.14	99.0 (98.5 - 99.3)	<0.0001
Eastern	587	3.75	2.36 - 5.62	24.96		
Northern	478	35.77	31.47 - 40.25	24.89		
Western	667	33.88	30.29 - 37.62	25.00		
Study Period						
2009-2013	557	19.928	16.69 - 23.49	24.62	95.09 (90.4 - 97.5)	<0.0001
2014-2018	622	37.460	33.64 - 41.40	24.79		
2019-2023	1126	22.291	19.89 - 24.84	25.46		
Not Reported	805	22.360	19.53 - 25.40	25.13		
Gender						
Male & Female	1506	36.12	33.69 - 38.61	49.99	99.51 (99.2 - 99.7)	<0.0001
Female	1604	14.40	12.72 - 16.22	50.01		

Keys: *CI: Confidence interval; I^2: Measure of Heterogeneity.

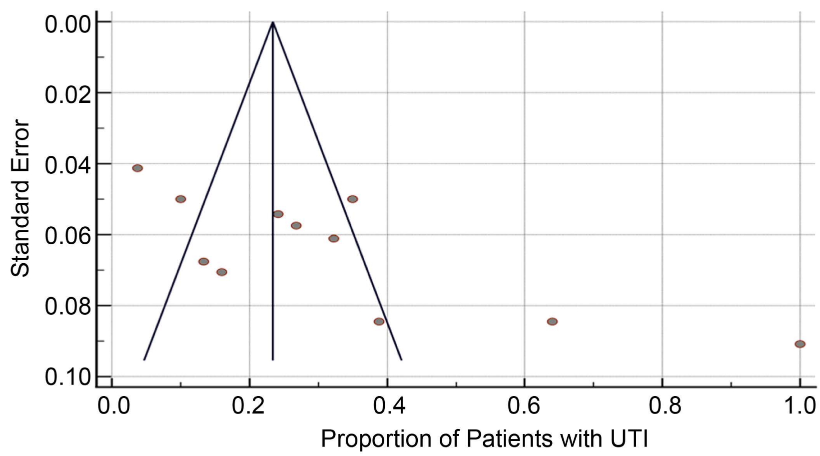

Figure 4. Funnel plot.

region. In regards to the study period, although 27.2% of the studies did not report when the study was conducted, our meta-analysis observed an increasing trend of UTI; 2.9—fold barely a decade after the first study. However, the period between 2014-2018 accrued the highest prevalence of UTI in the country 37.46% (95%CI: [33.64 - 41.40]; I^2: 95.09 [90.4 - 97.5]) (Table 4).

Several gram positive and negative uropathogens have been isolated from patients with urinary tract infections. Our systematic review and meta-analysis examined the pooled prevalence of these pathogens based on their Gram reaction. Across the different studies, Gram-negative bacteria pooled higher prevalences reflecting their dominance and role in urinary tract infection. However, two studies stood out with a higher prevalence of Gram-positive uropathogens compared to Gram-negatives; Odongo *et al*., 2013: 53.66% (95% CI: [42.30 - 64.75] I^2: 93.3% [89.9 - 95.4]) and Calzada *et al*., 2022: 76.4% (95% CI: [66.22 - 85.76] I^2: 93.3% [89.9 - 95.4]). **Table 5** presents this information alongside forest plots in **Figure 5** and **Figure 6**.

4. Discussion

In this meta-analysis, we systematically examined the prevalence of urinary tract infection (UTI) in Uganda by synthesizing the findings of several relevant studies (**Table 2**). The primary objective of our analysis was to provide a comprehensive overview of the current burden of UTIs in Uganda. By conducting a thorough search and employing rigorous inclusion criteria, we aimed to minimize bias and ensure the reliability of our findings (**Figure 1**). This finding underscores the significance of UTIs as a public health concern within the country. However, the distribution of UTIs was significantly higher (69%) among females compared to males (9.4%) signifying a 7.3-fold higher risk of UTIs in females (**Table 2**). This finding aligns with previous researches highlighting the gender disparity in UTI prevalence, where females are consistently reported to be at a higher risk [15] [16] [17]. This can partly be attributed to female biology, such as the anatomical proximity of the urethra to the anus and shorter urethral length in females, which make them more susceptible to UTIs [18] [19]. Additionally, hormonal fluctuations during menstrual cycles and pregnancy can further increase the risk among women [12] [20]. The observed gender disparity in UTI prevalence calls for targeted interventions and preventive strategies specifically tailored for females.

Table 5. Distribution of gram-positive and negative uropathogens in Uganda.

Study	Sample size	Pooled Prevalence (%) (95% CI)		I^2 (95% CI) & P-value	
		Gram −ve	Gram +ve	Gram −ve	Gram +ve
Abongomera *et al.*, 2021	32	100.00 (89.11 - 100.00)	3.13 (0.079 - 16.22)	92.99% (89.4 - 95.4) <0.0001	93.3% (89.9 - 95.4) <0.0001
Andabati *et al.*, 2010	29	72.41 (52.76 - 87.27)	27.59 (12.73 - 47.24)		
Calzada *et al.*, 2022	89	37.08 (27.07 - 47.97)	76.40 (66.22 - 84.76)		
Deus *et al.*, 2017	54	31.48 (19.52 - 45.55)	9.26 (3.08 - 20.30)		
Gerald, 2021	120	52.50 (43.19 - 61.69)	23.33 (16.10 - 31.93)		
Johnson *et al.*, 2021	140	76.43 (68.52 - 83.19)	23.57 (16.82 - 31.48)		
Mwaka *et al.*, 2011	40	62.50 (45.80 - 77.27)	37.50 (22.73 - 54.20)		
Nteziyaremye *et al.*, 2020	22	77.27 (54.63 - 92.18)	50.00 (28.22 - 71.78)		
Ocokoru *et al.*, 2015	81	86.42 (76.99 - 93.02)	19.75 (11.73 - 30.09)		
Odoki *et al.*, 2020	86	65.12 (54.08 - 75.08)	34.88 (24.92 - 45.92)		
Odongo *et al.*, 2013	82	46.34 (35.25 - 57.70)	53.66 (42.30 - 64.75)		

Keys: *CI: Confidence interval; *−ve: negative; *+ve : positive; *I^2: Measure of Heterogeneity.

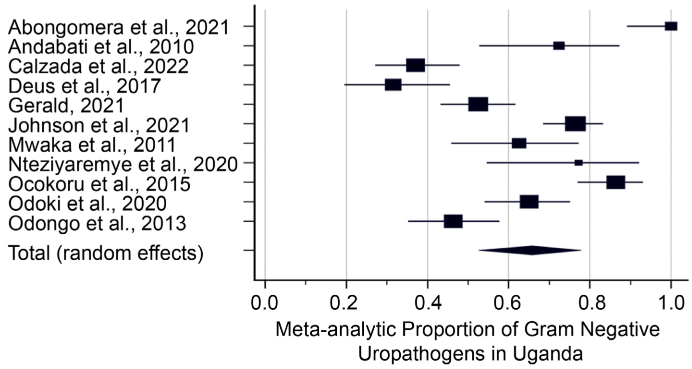

Figure 5. Showing forest plot for the meta-analytic prevalence of gram-negative uropathogens.

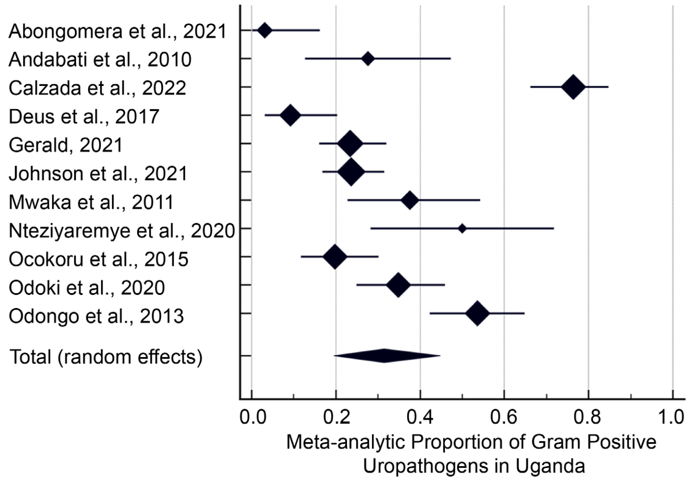

Figure 6. Forest plot for the meta-analytic prevalence of gram-positive uropathogens in Uganda.

Also, our systematic review and meta-analysis of the regional distribution of UTI in the country show higher prevalences leaning to the northern and western regions (**Figure 7**) and (**Table 4**). These findings highlight regional differences in UTI prevalence within Uganda and emphasize the need for targeted interventions in these areas. Several factors may contribute to the higher prevalence observed in the northern and western regions. Socioeconomic disparities [21], limited access to healthcare services [22], lifestyle behaviors [23], and inadequate sanitation infrastructure [24] may play a significant role in the increased burden of UTIs in these regions. To contextualize our results, we compared our findings with a recent systematic review of the etiology and prevalence of UTI in Sub-saharan Africa [25]. Notably, our estimated prevalence rate aligns with the range of prevalence reported across the sub-continent, highlighting the broader regional impact of UTIs in this part of the world. On the etiology of UTI in Uganda, our findings also align with Mwang'onde & Mchami (2022) with *Escherichia coli* being the prominent pathogen. Our meta-analysis, however, may be limited in some way. Firstly, lack of protocol registration. This work was

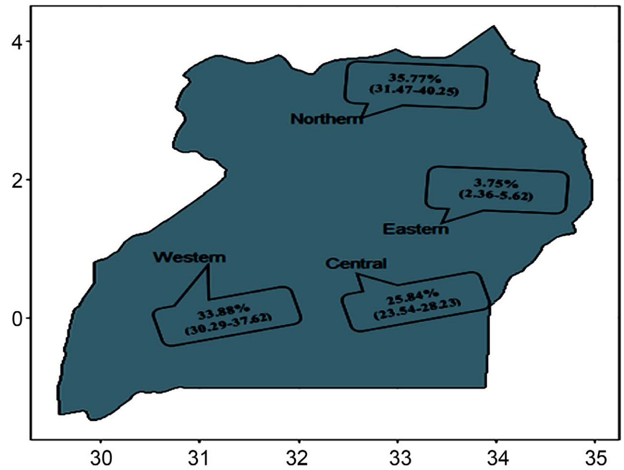

Figure 7. Map of Uganda showing the prevalence of UTI across four regions.

conceived as a student project and the authors deem it not necessary to register as it is not requisite for studies in this category. However, the authors acknowledged that no such work exists to the best of our knowledge at the time of conducting this review. Secondly, the studies included in our analysis exhibited high levels of heterogeneity (I^2) (**Table 3**), which may introduce variability in the prevalence estimates. Despite the limitations our analysis revealed a considerable overall prevalence of UTIs in Uganda, with a pooled prevalence of 24.92% (**Table 5**). Thirdly, publication bias may have influenced our results, as studies reporting lower prevalence rates may be less likely to be published. Overall, our findings provide a comprehensive overview of the prevalence of UTIs in Uganda, highlighting the significant burden of this condition within the country.

5. Conclusion

This review and meta-analysis observed a higher pooled prevalence of UTIs in Uganda however, most of the studies were done more in Central, Western and Northern region of the country with very few studies done in the Eastern region. "The most prevalent UTIs causing bacteria in Uganda as reported by the majority of researchers are *Escherichia coli* followed by *Staphylococcus aureus*, however, Calzada *et al.*, in their study reported gram positive bacteria as the most prevalent" (**Table 5**). We observed in this systematic review and meta-analysis that females are more affected with UTIs in all studies than males.

6. Recommendations

More studies on UTIs are required especially, in the eastern region of the country to give a general overview of the burden of UTIs prevalence in Uganda. Further studies should recruit more males to ascertain the prevalence of UTIs among males as many studies had focused on and recruited more females than males.

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Conflicts of Interest

The authors declare no conflicts of interest.

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