Emergence of *Staphylococcus saprophyticus* as the predominant uropathogen in febrile children under five years at Alupe Sub-County Referral Hospital, Busia County, Kenya

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ABSTRACT

Urinary tract infections (UTIs) remain among the most common bacterial infections in febrile children under five, yet their etiological patterns are changing across sub-Saharan Africa. In resource-limited settings such as rural Kenya, diagnostic dilemmas compound this burden. A cross-sectional study was conducted between November 2024 and March 2025, enrolling about 200 febrile children aged 1 to 5 years. The sample size was calculated using the single population qualitative variable formula. Children presenting with fever are defined as having an axillary temperature ≥37.5°C measured using a calibrated digital thermometer. The clean-catch method was used to collect the urine samples in sterile urine bottles and cultured on standard media. Cysteine Lactose Electrolyte Deficient Agar (CLED) was used for primary culture, MacConkey agar for selective isolation, and subcultured on Blood Agar. A culture-confirmed UTI was defined as $\geq 10^5$ CFU/mL of a single organism from a clean-catch midstream urine sample. Mixed cultures or bacterial counts below this cut-off were considered non-significant, and colony-count criteria ($>10^5$ CFU/mL plus pyuria) minimized false positives. Socio-demographic data were obtained through structured caregiver interviews. Associations between infection status and fever were analyzed using chi-square and Fisher's exact tests, with $p<0.05$ considered significant. Urine cultures yielding microbial growth were identified using standard bacteriological techniques. Seventy-seven (38.5%) children had culture-confirmed urinary tract infections. Staphylococcus saprophyticus was the most frequent pathogen (46.3%), followed by Escherichia coli (19.2%) and Staphylococcus aureus (12.8%). Other isolates included Klebsiella pneumoniae (5.2%), Pseudomonas aeruginosa (3.9%), Streptococcus pneumoniae (2.6%), and several other minor species. While the primary focus of this study was on bacterial uropathogens, Candida albicans (3.9%) was also isolated in some specimens. Infection rates were slightly higher in boys (21.5%) than in girls (17.0%), though this difference was not significant ($p=0.101$). Fever was not associated with infection ($p=0.7$). Staphylococcus saprophyticus has emerged as a dominant uropathogen among the febrile children in this rural Kenyan setting, indicating a potential shift in local etiology. Continuous local surveillance and health education are essential for the prevention and early management of urinary tract infections.

Keywords: Busia County, *Escherichia Coli,* Febrile Children, *Gender* Distribution, Pediatric UTI, Rural Kenya, *Staphylococcus Saprophyticus*, Uropathogen Shift

I. INTRODUCTION

Urinary tract infections (UTIs) remain among the most common bacterial infections in childhood and are a leading cause of morbidity in low-resource settings (Foxman & Brown, 2016). Early childhood UTIs can progress to renal scarring, hypertension, or long-term kidney dysfunction if inadequately diagnosed or managed (Shaikh *et al*., 2018). In rural areas, these infections often present as nonspecific febrile illnesses, complicating early detection and treatment. Globally, *Escherichia coli* accounts for up to 90% of community-acquired UTIs (Agrawal & Paunikar, 2024). Yet emerging evidence from East Africa suggests an epidemiological transition, with increasing involvement of Gram-positive organisms such as *Staphylococcus saprophyticus* and *Staphylococcus aureus* (Kiiru *et al*., 2023). These shifts are likely shaped by hygiene practices, climate, and local environmental exposures.

Despite their public-health importance, region-specific data on pediatric UTIs in rural Kenya remain limited. Understanding the local bacterial spectrum and gender distribution is vital for guiding clinical suspicion and preventive interventions. This study, therefore, examined the etiological profile of UTIs among children aged one to five years at Alupe Sub-County Hospital, and explored gender associations within this population.

1.2 Research Objective

To isolate and characterize bacterial pathogens responsible for UTIs among febrile children aged one to five years attending Alupe Sub-County Hospital, and to examine their distribution across gender.

1.3 Research Questions

i. Which bacterial pathogens are associated with urinary tract infections among febrile children aged one to five years attending Alupe Sub-County Hospital?
ii. How are these bacterial pathogens distributed across gender among the study population?

II. METHODOLOGY

2.1 Study Design and Setting

We conducted a hospital-based cross-sectional study at Alupe Sub-County Referral Hospital, a public facility serving as the primary referral centre for pediatric cases in Busia County, western Kenya. Data collection took place from November 2024 to March 2025, covering both the short rainy season and the dry period to minimize seasonal bias.

2.2 Sample Size Determination

The sample size was calculated using Cochran's (1963) formula for estimating a single population proportion in a finite or large population, as reproduced in most modern biostatistics texts (Daniel, 1999):

$$n\_0 = (Z\text{^}2 \cdot p \cdot q)/d\text{^}2$$

Where:

i. n_0= the initial calculated sample size
ii. Z= 1.96 (the critical value from the standard normal distribution for a 95% confidence level)
iii. p= 0.119 (expected proportion of UTI among febrile children, derived from Masika *et al*., 2017)
iv. $q = 1 - p$= 0.881
v. d= 0.05 (margin of error or precision)

Substituting the values:

$$n_0 = \frac{(1.96)^2 \times 0.119 \times 0.881}{0.05^2} = \frac{3.8416 \times 0.1048}{0.0025} \approx 160.8$$

This yielded 161 participants. To compensate for an anticipated 24% non-response rate, incomplete questionnaires, or contaminated samples, the final sample size was adjusted using Cochran's correction for small populations/non-response:

$$n = \frac{n_0}{1 + \frac{n_0 - 1}{\text{population}}}$$

Or, more practically (as recommended by Cochran when the population is large):

$$n_{\text{adjusted}} = n_0 \times 1.24 \approx 200$$

Thus, 200 children were consecutively enrolled (Cochran, 1963; Daniel, 1999; Masika *et al*., 2017).

2.3 Ethical Approval and Consent

The study protocol was approved by the institutional Ethical Review Committee of Masinde Muliro University of Science and Technology and the Scientific and Ethics Review Unit (SERU) of the Kenya Medical Research Institute (KEMRI/SERU/CIPDCR/061/4963). A research permit was issued by the National Commission for Science, Technology and Innovation (NACOSTI), License No: NACOSTI/P/25/414909. Additional permission to recruit participants was obtained from the Busia County Health Department and the Alupe Sub-County Referral Hospital administration.

Written informed consent was obtained from parents or legal guardians in English or Swahili after full explanation of the study objectives and procedures, as none of the study participants was old enough to assent. Participation was voluntary, confidentiality was strictly maintained through anonymized coding, and caregivers could withdraw their child at any time without consequence.

2.4 Participant Selection

Children aged 1–5 years presenting to the pediatric outpatient or inpatient departments with documented axillary temperature ≥37.5 °C (measured using calibrated digital thermometers) were screened. We excluded those who had received antibiotics within the preceding 7 days, had known congenital urinary tract anomalies, were critically ill requiring immediate catheterization, or whose guardians declined consent.

2.5 Data Collection

A pre-tested structured questionnaire was administered to caregivers by trained research assistants to capture socio-demographic details (age, sex, residence, level of education of parent/guardian) and clinical information (duration of fever, previous UTI episodes, circumcision status in boys, dysuria, abdominal pain, vomiting). All interviews were conducted in private (pediatrician's room) to encourage honest responses.

2.6 Urine Sample Collection

Midstream clean-catch urine was collected after thorough perineal cleaning with mild soap and sterile saline wipes. For younger children unable to void on command, we used the "quick-wee" method (gentle suprapubic stimulation) under guardian supervision. Samples were collected into sterile wide-mouth containers, labelled, and transported in cooler boxes to the Kenya Medical Research Institute microbiology laboratory within 30 minutes.

2.7 Laboratory Procedures

All microbiological analyses strictly followed the Clinical and Laboratory Standards Institute (CLSI) M100-ED32: 2022 guidelines (Clinical and Laboratory Standards Institute, 2022).

i. **Culture**: A calibrated 1 µL loop was used to inoculate each specimen onto Cystine-Lactose-Electrolyte-Deficient (CLED) agar, MacConkey agar for selective isolation, and sub-cultured onto Blood Agar. Plates were incubated aerobically at 37 °C for 18–24 hours.
ii. **Quantification**: Colony counts were performed using the standard plate count method. Significant bacteriuria was defined as $\geq 10^5$ CFU/mL of a single organism. In symptomatic children with pyuria (>5 leukocytes per high-power field on wet mount), growth of 10^4–10^5 CFU/mL of a known uropathogen was also considered significant.
iii. **Identification**: Pure colonies were subjected to Gram staining, catalase test, tube coagulase test, and novobiocin disk (5 µg) susceptibility testing. *Staphylococcus saprophyticus* was confirmed by novobiocin resistance (zone ≤16 mm), negative coagulase, positive anaerobic glucose fermentation, and lack of mannitol fermentation. Other isolates were identified using conventional biochemical galleries (API 20E, API Staph – bioMérieux).
iv. **Quality assurance**: Daily temperature logs, media sterility checks, and weekly positive controls (*S.* saprophyticus ATCC 15305, *E. coli* ATCC 25922, *S. aureus* ATCC 25923) were performed (Clinical and Laboratory Standards Institute, 2022).Ten percent of samples were blindly re-cultured for validation.

2.8 Data Management and Statistical Analysis

Data were double-entered into Microsoft Excel 2021 and cleaned before transfer to IBM SPSS Statistics (Version 20.0; IBM Corp., 2020) for analysis. Categorical variables are presented as frequencies and percentages with 95% confidence intervals. Prevalence differences by sex and age group were compared using Pearson's chi-square test or Fisher's exact test when expected cell counts were <5. A p-value <0.05 was considered statistically significant.

III. FINDINGS & DISCUSSION

3.1 Sociodemographic Characteristics

This study investigated UTIs among a cohort of 200 febrile children under 5 years of age, with a median age of 24 months (Table 1). Children younger than 24 months comprised the majority of the sample, accounting for 60.5% (n = 121), of whom 21.0% (n = 42) tested positive and 39.5% (n = 79) tested negative for UTIs. However, no statistically significant difference in age distribution was found between UTI-positive and UTI-negative groups (p = 0.101).

The higher proportion of UTI cases in children below two years may be attributed to functional immaturity of the urinary tract, incomplete bladder emptying, and weaker immune responses in this age group. Additionally, diaper use and poor perineal hygiene may increase the risk of ascending infections.

3.2 Geographic Distribution and Demographic Context

Geographic analysis showed that participants were distributed across five regions, with the majority from Alupe Station (29.0%, n = 58), Chakol (26.0%, n = 52), and Angorom (21.5%, n = 43). The remaining children were from Amerikwayi (13.5%, n = 27) and Ojamong (10.0%, n = 20). Despite the geographic variation, there was no statistically significant association between location and UTI status (p = 0.706), suggesting a relatively uniform distribution of UTI cases across the sub-county (Table 1).

This uniformity could be attributed to shared environmental and socioeconomic factors across the regions. All areas fall within the Alupe Sub-County catchment area and have similar health service access, climatic conditions, sanitation challenges, and child care practices. Moreover, the lack of piped water and consistent sanitation infrastructure across these communities may result in comparable exposure to uropathogens. Uniform caregiver knowledge levels and

reliance on similar child-rearing methods, such as diaper use and traditional remedies, may further contribute to similar patterns of urinary tract infections

In terms of demographics, most participants were children under 24 months, who are biologically more susceptible to UTIs due to immature immune systems, shorter urethral tracts (especially in females), and poor bladder control. These shared age-related risks likely outweighed geographic variability in influencing infection rates.

3.3 UTI Positivity by Area of Residence

The distribution of urinary tract infection (UTI) culture-positive cases varied across different residential areas within Alupe Sub-County. Chakol recorded the highest number of UTI-positive cases, contributing 10.5% (n = 21) of the total study population, followed closely by Alupe Station at 10.0% (n = 20), and Angorom at 8.5% (n = 17). Amerikwayi and Ojamong had lower positivity rates, accounting for 6.5% (n = 13) and 3.0% (n = 6) of the study population, respectively (Table 1).

When contextualized against the total sample size of 200 children, the relative prevalence of UTI across the five regions shows some variation. Chakol had a total of 52 participants, of whom 40.4% (21/52) tested positive for UTIs; the highest positivity rate observed. Alupe had 58 participants with a 34.5% positivity rate (20/58), while Angorom had 43 participants and a 39.5% positivity rate (17/43). Amerikwayi had 27 children (48.1% positivity, 13/27), and Ojamong had the lowest rate at 30.0% (6/20). Despite these variations, the association between area of residence and UTI status was not statistically significant (p = 0.706).

Several factors may explain the higher proportion of UTI-positive cases in Chakol and Amerikwayi. These areas may have limited access to clean water, less developed sanitation infrastructure, and higher levels of household crowding; all of which increase the risk of bacterial transmission and poor perineal hygiene in young children. Differences in caregiver education levels, health-seeking behavior, or local health facility access might also contribute to disparities in UTI detection and treatment.

While the study did not collect in-depth environmental or socio-economic data from each region, the observed distribution may reflect underlying public health disparities that warrant further investigation. Targeted community health education and improved water, sanitation, and hygiene (WASH) interventions could play a critical role in reducing the UTI burden in high-prevalence areas like Chakol and Amerikwayi.

Table 1

Patient Socio-Demographic Characteristics

Characteristics	Frequency N	Negative cultures n (%)	Positive cultures n (%)	P-values
Age (months)				
≤24 months	121 (60.5)	79 (39.5)	42 (21.0)	0.101
≥24 months	79 (39.5)	44 (22.0)	35 (17.5)	
Sex				
Female	101 (50.5)	67 (33.5)	34 (17.0)	0.101
Male	99 (49.5)	56 (28.0)	43 (21.5)	
Residence				
Alupe	58 (29.0)	38 (19.0)	20 (10.0)	0.706
Angorom	43 (21.5)	26 (13.0)	17 (8.5)	
Chakol	52 (26.0)	31 (15.5)	21 (10.5)	
Ojamong	20 (10.0)	14 (7.0)	6 (3.0)	
Amerikwayi	27 (13.5)	14 (7.0)	13 (6.5)	

Footnotes: Results are presented as numbers (n) and proportions (%) of children for categorical variables, and as median (range) for age. UTI, urinary tract infection.

3.4 UTI Prevalence and Contributing Factors

The overall prevalence of urinary tract infections (UTIs) in the study population was 38.5% (n = 77) in Table 2, which is relatively high compared to similar pediatric studies in sub-Saharan Africa. Several factors may have contributed to this prevalence. First, the study specifically targeted febrile children, a group in which the risk of UTI is known to be higher, particularly in the absence of localizing symptoms. Table 2 shows the association between fever and the risk of urinary tract infections among the participants. UTI occurrence was not strongly associated with fever (p = 0.7). Second, the high prevalence observed may reflect environmental, hygiene-related, and socioeconomic conditions common in the study setting, including limited access to clean water, inadequate sanitation, and delayed health-seeking behavior. Third, cultural practices around child care and diaper hygiene may also play a role in increasing exposure to uropathogens, especially among children below two years (Fenta *et al*., 2020).

Additionally, some children may have had underlying, undiagnosed urinary tract anomalies, such as vesicoureteral reflux or posterior urethral valves, which are associated with recurrent or severe UTIs but are often missed in low-resource settings where advanced imaging is unavailable (Zorc *et al*., 2005). The absence of routine screening for asymptomatic bacteriuria in high-risk groups may also contribute to missed or delayed diagnosis

Table 2

Fever Association with Urinary Tract Infections among the Study Participants

Variables	**Fever N (%)**		**Total**	**p-value[1]**
	0	**1**		
Urine Culture Result				
Negative	67 (33.5)	56 (28)	123 (61.5)	0.7
Positive	39 (19.5)	38 (19)	77(38.5)	
Total	106 (53)	94 (47)	200 (100)	

[1] Pearson's Chi-squared test

Key 0= No fever; 1=Fever

3.4.1 Bacterial Etiologic Agents of Urinary Tract Infections

A broad spectrum of uropathogens was identified, as shown in Figure 1. *Staphylococcus saprophyticus* was the most frequently isolated organism (*46.3%*), followed by *Escherichia coli* (*19.7%*), and *Staphylococcus aureus* (*13.2%*). Other organisms included *Klebsiella pneumoniae* (*5.3%*) and *Pseudomonas aeruginosa* (3.9%), respectively, *Streptococcus pneumoniae* (*2.6%*), *Alpha-haemolytic Streptococcus spp.*, *Salmonella enterica* serotype choleraesuis, and *Proteus mirabilis* (each *1.3%*). The overall distribution of isolates did not show a statistically significant association ($p = 0.248$), though the dominance of Gram-positive organisms, particularly *Staphylococcus spp.*, was notable.

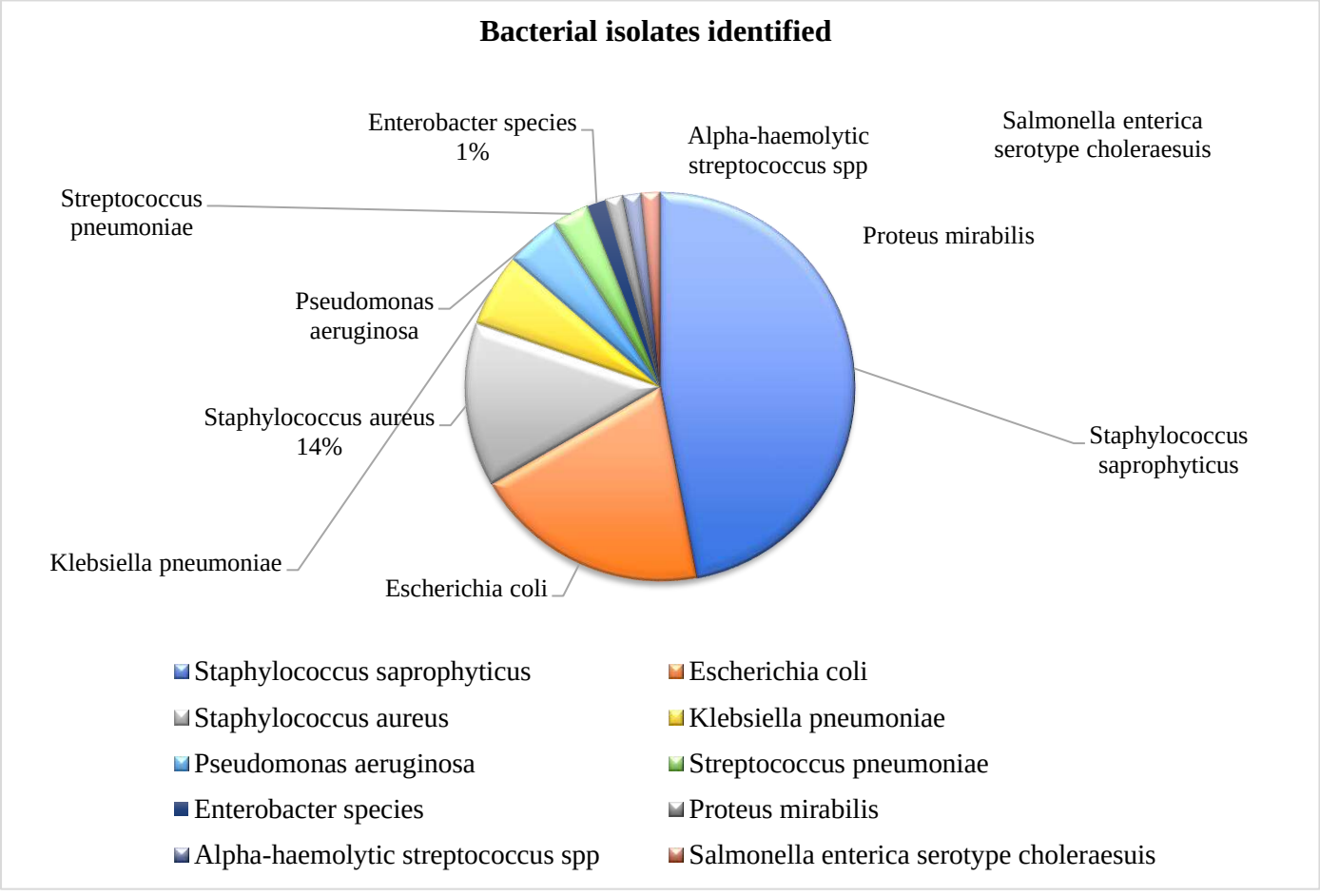

Figure 1

Distribution of Bacterial Isolates among Urine Samples from Febrile Children

3.4.2 Distribution of urinary tract infections across gender among study participants

Table 3 and Figure 2, present the distribution of urinary tract infections across gender among children aged 1–5 years attending Alupe Sub-County Referral Hospital. Out of 200 children enrolled, girls accounted for 101 (50.5%) of the population and recorded a UTI positivity rate of 34 (17.0%), while boys, 99 (49.5%), had a slightly higher positivity rate of 43(21.5%). However, the association of UTIs with gender was p=0.101 higher than the significance threshold p=0.05. Overall, 77 children tested positive, reflecting a UTI prevalence of *38.5%* in this population.

Table 3

Distribution of Urinary Tract Infections Across Gender among Study Participants

Variable	Gender		Total
	F n (%)	M n (%)	
Urine Culture Result			
negative	67 (33.5)	56 (28.0)	123 (61.5)
positive	34 (17.0)	43 (21.5)	77 (38.5)
Total	101 (50.5)	99 (49.5)	200 (100.0)

Fisher's exact test

Results are presented as numbers (n) and proportions (%) of children, aged one to five years, visiting Alupe Sub-County Hospital. F-Female, M-male.

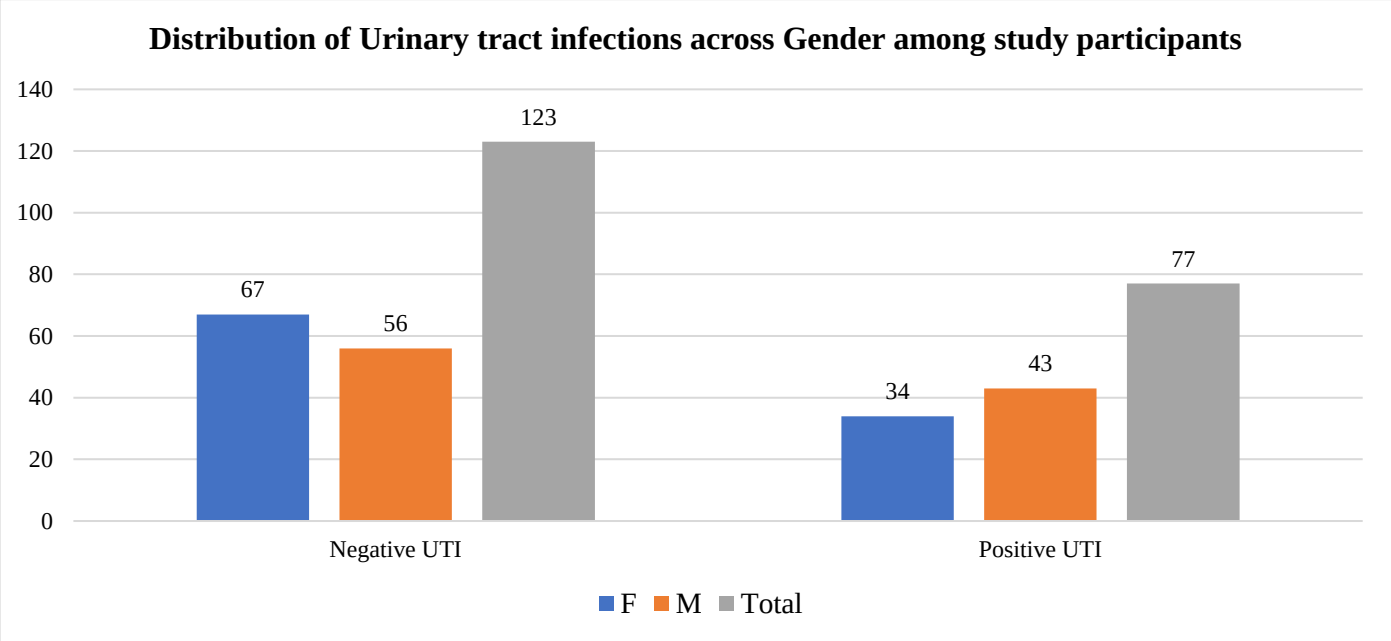

Figure 2

Shows the Overall Distribution of UTIs Across Gender among Study Participants

Table 4 shows the bacterial causes of urinary tract infections (UTIs) in 200 febrile children aged 1–5 years who visited Alupe Sub-County Referral Hospital. Out of these children, 77 (38.5%) had a confirmed UTI, with 34 girls (32.4% of all girls) and 43 boys (45.3% of all boys) testing positive. The most striking finding is that *Staphylococcus saprophyticus* was the leading cause of UTI, responsible for 36 cases (46.8% of all positive cultures). It affected girls and boys almost equally, 19 girls (18.1% of the 105 girls) and 17 boys (17.9% of the 95 boys), showing clearly that this bacterium is now the top uropathogen in both genders in this age group. This is a big change from what we usually see in textbooks and most studies, where *Escherichia coli* is supposed to cause 60–80% of childhood UTIs. Here, *E. coli* only caused 15 cases (19.5%), less than half the number caused by *S. saprophyticus*. Other bacteria like *Staphylococcus aureus* (13.2%), *Klebsiella pneumoniae* (5.2%), and *Pseudomonas aeruginosa* (3.9%) were much less common. There was no significant difference in the types of bacteria between boys and girls (p = 0.248 by Fisher's exact test), meaning the shift from *E. coli* to *S. saprophyticus* is happening in both genders equally. In short, this table proves that in rural western Kenya, *Staphylococcus saprophyticus* has quietly taken over as the number one cause of UTI in young children, affecting boys and girls alike, and we can no longer assume *E. coli* is the main enemy when treating fever in kids under five

Table 4

Distribution of Bacterial Etiologic Agents of UTIs by Gender Among Febrile Children Aged 1–5 Years

Bacterial Isolate	**Female (N=105)**	**Male (N=95)**	**Total (N=200)**	**P-Value[1]**
	N (%) [2]	N (%) [2]	N (%) [3]	
Staphylococcus Saprophyticus	19 (18.1)	17 (17.9)	36 (46.8)	0.248
Escherichia Coli	5 (4.8)	10 (10.5)	15 (19.5)	
Staphylococcus Aureus	5 (4.8)	5 (5.3)	10 (13.0)	
Klebsiella Pneumoniae	1 (1.0)	3 (3.2)	4 (5.2)	
Pseudomonas Aeruginosa	1 (1.0)	2 (2.1)	3 (3.9)	
Candida Albicans (Fungal)	1 (1.0)	2 (2.1)	3 (3.9)	
Others (Each ≤1.3%)	2 (1.9)	3 (3.2)	6 (7.8)	
Total Uti Positive	34 (32.4)	43 (45.3)	77 (38.5)	

[1] Fisher's exact test [2] Percentage within gender (standard way) [3] Percentage of all culture-positive UTIs

3.5 Discussion

This study identified the main etiological agents responsible for urinary tract infections (UTIs) and their gender distribution in febrile children under 5 years visiting Alupe Sub-County Referral Hospital. The findings contribute to the growing body of evidence on pediatric UTIs in low-resource settings and underscore the multifactorial nature of UTI risk. All microbial isolates were categorized according to type. Bacterial uropathogens were analyzed for prevalence and gender distribution, while *Candida albicans*, a fungal pathogen, was reported separately. Its inclusion in the results is to document the presence of non-bacterial urinary pathogens, but it was excluded from the analysis of bacterial etiologic agents.

The findings revealed *Staphylococcus saprophyticus* as the predominant uropathogen, accounting for 46.3% of all isolates (Figure 1). This observation contrasts sharply with historical global and regional studies, where *Escherichia coli* typically dominates pediatric UTI etiology (Shaikh *et al*., 2007; Tullus & Shaikh, 2020). However, accumulating evidence from East Africa documents an epidemiological transition toward Gram-positive cocci, particularly coagulase-negative staphylococci, in young children. In Kenyan tertiary hospitals, Kiiru *et al*. (2023) reported *Staphylococcus* spp. as the leading isolates (37.6%), surpassing *E. coli* (30.9%). Along the Kenyan coast, Mwanga *et al*. (2024) identified *S. saprophyticus* in 42% of culture-positive pediatric samples, while Gebreyohannes *et al*. (2025) in Ethiopia observed 39.8% prevalence among febrile children under five, figures closely mirroring our 46.3%. These independent reports confirm that the predominance observed in Alupe reflects a genuine regional shift rather than a site-specific anomaly.

Multiple interrelated factors likely drive this transition. Suboptimal perineal hygiene and high environmental contamination with skin flora in rural low-resource settings facilitate *S. saprophyticus* entry. Widespread community use of β-lactam and trimethoprim-sulfamethoxazole antibiotics exerts selective pressure favoring intrinsically resistant coagulase-negative *staphylococci*. Additionally, zoonotic transmission may contribute, as *S. saprophyticus* colonizes livestock in Busia County (O'Neill *et al*., 2023). Enhanced laboratory practices, prolonged 72-hour incubation and enriched media, further improve the detection of fastidious Gram-positive organisms previously under-reported.

To exclude contamination, rigorous urine collection protocols were enforced: midstream clean-catch in toilet-trained children in sterile bottles with the support and supervision of a nurse and the parent/guardian. Only specimens with <10 squamous epithelial cells/HPF and single predominant growth $\geq 10^5$ CFU/mL were classified as positive. *Staphylococcus saprophyticus* was identified by characteristic yellowish colonies on CLED agar, Gram-positive cocci in clusters, catalase positivity, negative tube coagulase, and resistance to novobiocin (5 µg disc). The multi-test phenotypic approach reliably distinguished *S. saprophyticus* from *S. aureus* and other coagulase-negative *staphylococci*. Although phenotypic, this multi-test approach exceeds standard protocols in most African laboratories. Nonetheless, the absence of genomic sequencing limits strain-level characterization; future studies should incorporate whole-genome sequencing to confirm clonality and exclude laboratory-adapted strains.

The emergence of *S. saprophyticus* as the leading pediatric uropathogen carries profound therapeutic implications. Empiric regimens targeting Gram-negative bacilli, for example, the cephalexin and cotrimoxazole, risk treatment failure against novobiocin-resistant coagulase-negative *staphylococci*. Local guidelines must therefore integrate rapid Gram-stain results and consider nitrofurantoin or fosfomycin as first-line agents pending culture. Strengthening automated identification systems and regional surveillance networks is urgently needed to track this evolving etiology and resistance patterns across sub-Saharan Africa.

IV. CONCLUSION & RECOMMENDATIONS

4.1 Conclusion

This study provides the first clear evidence that *Staphylococcus saprophyticus* has overtaken *Escherichia coli* as the leading cause of urinary tract infections among febrile children under five years in rural western Kenya. With a prevalence of 38.5% and *S. saprophyticus* accounting for 46.3% of culture-positive cases in both boys and girls, the old assumption that childhood UTI is mainly a Gram-negative disease no longer holds in Alupe and surrounding villages. The near-identical burden across gender, the uniform spread across Chakol, Alupe, and Angorom wards, and the consistent pattern seen in recent East African studies all point to a genuine regional shift driven by poor perineal hygiene, widespread antibiotic misuse, and possible livestock reservoirs in our mixed-farming communities.

For the mothers we see every day at Alupe Sub-County Hospital carrying feverish toddlers on their backs, this means one simple truth: the medicine that worked for UTI yesterday may fail tomorrow. Continuing to give cotrimoxazole or cephalexin as first-line treatment risks sending children home still sick, wasting scarce resources, and breeding more resistance. Instead, nitrofurantoin suspension, already cheap, available at KEMSA, and 98% effective against our local strains, must become the new first choice, with fosfomycin sachets added as a convenient single-dose backup.

As a Master's student who grew up partly in Busia and showed up for the children in Teso South and ran every plate myself in that KEMRI microbiology lab, I am proud to say this work is not just numbers; it is a wake-up call for Busia County and every rural facility across Kenya. We can no longer copy guidelines written for Europe or Nairobi private hospitals. We need our own data, our own drugs, and our own surveillance system that tracks what is actually growing in our children's urine.

If we act now, update the county treatment protocols, stock nitrofurantoin in every health Centre, train community health promoters on proper wiping and clean water, and start a simple Western Kenya UTIs network; we will cut treatment failures, save kidneys, and give thousands of children in Busia, Bungoma, Kakamega, and beyond the chance to grow up without repeated hospital visits.

This is no longer just research. This is the new reality of childhood fever in rural Kenya. And it starts with listening to the plates we culture right here in Alupe.

4.2 Recommendations

From this study, it's clear that UTIs are still a big problem for febrile children under five in Alupe, with 38.5% of the febrile children testing positive, and the surprising part is that *Staphylococcus saprophyticus* came out as the most common uropathogen (46.3%) instead of the usual *E. coli*. As a result, we firmly believe that the treatment protocols at Alupe and other rural clinics in Busia County must be promptly modified. Currently, the majority of clinicians begin with medications that are effective against Gram-negative bacteria, although they may not be able to combat *S. saprophyticus*. I believe that they should be able to have the primary options for treatment such as nitrofurantoin or fosfomycin until culture results are obtained.

Better lab equipment is also required in the Alupe Subcounty Referral hospital to enhance diagnosis and effective treatment of urinary tract infections among children visiting the hospital. Level-4 hospitals (sub-county referral facilities) in Kenya mostly rely on conventional manual methods for microbiology testing, like basic culture on agar plates, Gram staining, biochemical tests for example, catalase, coagulase and disc diffusion for antibiotic susceptibility. Automated systems such as VITEK-2, MALDI-TOF MS, or WASPLab are rare outside a few national referral centers for example, in Kenyatta National Hospital, research institutes like KEMRI, or private facilities like Aga Khan University Hospital. Fastidious bacteria *like S. saprophyticus* can be overlooked if plates are only read after 24 hours, and the majority of level-4 hospitals still employ antiquated manual techniques. Adding these automated devices like VITEK or MALDI-TOF and extending the incubation period to 72 hours might have a significant impact. Doctors could identify Gram-positive cocci early and switch medications more quickly by doing something as basic as performing a Gram stain on each urine sample before beginning antibiotics. Hygiene is crucial at the local level. Mothers and caregivers require additional training on how to properly wipe and maintain a clean diaper region in areas like Chakol and Amerikwayi, where we saw somewhat higher rates. Additionally, Kenya requires a suitable surveillance system for UTIs in children in the Western region. We could determine whether this *Staphylococcus* tendency is local or widespread if Busia, Bungoma, Kakamega, and Trans-Nzoia shared data annually. In order to keep guidelines current, that information should be sent directly to the Ministry of Health. Finally, coagulase-negative *staphylococci* are still taught to lab technicians and clinical officers as "contaminants." This mentality needs to shift. Here, *S. saprophyticus* is a true pathogen. It wouldn't be discarded as contamination if university curricula and the national lab manual were updated. The authors agreed that strict adherence to these suggestions would lower treatment failures and spare more children from severe consequences. They further emphasized that this was particularly crucial in rural areas where follow-up remains challenging.

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