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Urinary Infections in Children in Two Hospitals in Burkina Faso

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Abstract

Objective: To study urinary tract infections (UTIs) in children hospitalised in the paediatric wards of the Hôpital Saint Camille de Ouagadougou (HOSCO) and the CHU Yalgado OUEDRAOGO (CHUYO). **Methodology:** This was a retrospective descriptive cross-sectional study covering the period from 1 January 2018 to 31 December 2022, including children aged 0 to 15 years hospitalised in paediatric wards with suspected UTI. **Results:** Only 337 patients out of 31,889 were included. The overall hospital frequency of suspected cases was 1.06% and that of UTI 24.33% (82 cases out of 337). The mean age of the study population was 41.64 months and that of patients with UTI (n = 82) 44.76 months. UTI was predominantly female (sex ratio M/F 0.58). The infectious syndrome (64.63%) and digestive signs (59.76%) were the main reasons for hospitalisation for UTIs. The average duration of antibiotic treatment prior to urine cytobacteriological examination (UCE) in patients with UTI was 5.08 days. Enterobacteriaceae were the most common cause of UTIs (55.17%), with *E. coli*, Klebsiella and Cedecea lapagei accounting for 39.08%, 14.94% and 1.15% of cases respectively. Gram-positive cocci accounted for 27.59%. Yeasts (Candida) accounted for 14.94%. *Acinetobacter baumannii* (2.30%) was the only non-fermenting gram-negative bacillus found. The clinical course was favourable in 78.05% of cases, and the factors associated with the occurrence of urinary tract infection were female gender (OR 2.3, p-value 0.002), the presence of functional urinary signs (OR 1.98, p-value 0.014) and functional intestinal disorders (OR 1.77, p-value 0.046). **Conclusion:** Urinary tract infection is a frequent pathology in paediatrics. The worrying trend towards antibiotic

resistance in uropathogenic germs means that urgent measures need to be taken.

Keywords

Paediatrics, UTI, UCE

1. Introduction

Urinary tract infection (UTI) is an invasion of the normally sterile urinary system (bladder and kidneys) by bacterial, viral, parasitic, or fungal agents [1]. It corresponds to any infection causing an inflammatory response in the epithelium of the urinary tract [2] [3] and is one of the most common bacterial infections in pediatrics [4]. It ranks second among bacterial infections in children, after respiratory tract infections [5].

Its prevalence depends on multiple factors, including age and sex, but it is during the first year of life that the incidence of the first episode of urinary infection is greatest, and the risk of bacteremia is highest [6]. The age of onset of urinary infection in children is bimodal, with one peak in the first year of life and another between the ages of 2 and 4 years [7].

The prevalence of urinary infections is two to four times higher among Hispanic and white children compared to Black children. In general, recurrence rates are between 30% and 50%. In developed countries, urinary tract infection accounts for about 5% of hospitalization reasons. Studies in Africa indicate variable frequencies ranging from 8.3% to 30% [8]. In Burkina Faso, in 2015, urinary infections in children represented 0.7% of hospitalizations [7].

With the aim of improving the management of urinary infections in children, this study is initiated in two hospitals in the city of Ouagadougou to study the epidemiological, clinical, therapeutic, and evolutionary aspects.

The objectives of the study were to describe the clinical characteristics of children hospitalized for urinary tract infections in the services, identify the germs responsible for these infections, determine the sensitivity of the isolated bacterial strains to commonly used antibiotics, and analyze the factors associated with UTI in hospitalized children.

2. Methology

This was a retrospective study with a descriptive and analytical aim, conducted over a period of 4 years in the pediatric departments of Saint Camille and Yalgado Ouédraogo hospitals in Ouagadougou. The study included children aged 0 to 15 years who were diagnosed with UTI, hospitalized in the pediatric departments of HOSCO and CHU-YO, and for whom urine test results (ECBU) were available. Clinical records that were unusable were not included in the study. The collected data were entered and processed using French version 5 (V5) of the Sphinx Lexica

software, French version 25 of SPSS Statistics, and Epi Info version 5.2.

In univariate analysis, the Karl Pearson chi-square test was used for observations with sample sizes greater than or equal to 5, and Yates' corrected chi-square test was used for observations with sample sizes less than 5. Associations between variables were considered statistically significant at a probability threshold of 0.05.

In the multivariate analysis of factors associated with UTI, factors with a p-value of less than 0.05 following the comparison of proportions were included in a binary logistic regression model.

From an ethical perspective, the study received approval from the ethics committees of both centers through the general management. The gathered data were kept strictly confidential and anonymous.

3. Results

3.1. Hospital Frequency

Out of a total of 31,889 children hospitalized in the two study centers, 349 suspected cases of UTI were reported, representing an overall hospital frequency of 1.06%. The three hundred thirty-seven (337) patients who underwent a urine test (ECBU) were included in our study. Figure 1 illustrates the flow diagram of the study population.

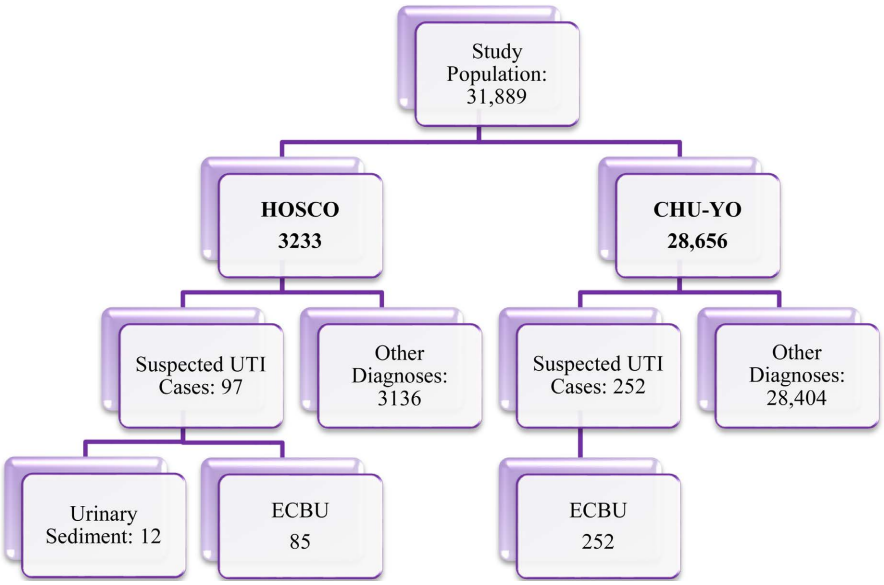


Figure 1. Flow diagram of the study population.

The hospital frequency was 0.88% (252 out of 28,656) at CHU YO and 2.63% (85 out of 3233) at HOSCO.

3.2. Sociodemographic Characteristics

The sex ratio was 0.58 with a female predominance of 33.62% (approximately 5 girls for every 3 boys).

The average age of patients with confirmed UTI was 44.76 months ± 49.92

months (3.73 years ± 4.16) with extremes of 8 days and 14 years. The median age was 20 months. Among the positive cases, 45.12% were infants, as shown in Table 1.

Children from urban areas represented 43% of patients, those from semi-urban areas 39.80%, and those from rural areas 17.20%.

Table 1 shows the distribution of suspected UTI patients according to age group.

Table 1. Distribution of patients suspected of UTI by age group.

	Positive ECBU		Negative ECBU	
	No.	Percentage	No.	Percentage
Newborn	7	8.54	40	15.69
Infant	37	45.12	98	38.43
Preschool Age	14	17.07	61	23.92
School Age	19	35.19	35	13.73
Adolescent	5	23.17	21	8.24
Total	82	100	255	100

3.3. Clinical Characteristics

3.3.1. Mode of Admission

10.70% Referrals accounted for 49%, self-referrals 40.40%, and transferred children 10.70%.

3.3.2 Reason for Hospitalization

Infectious syndrome (62.31%) and digestive symptoms (48.66%) were the most common reasons for admission, as noted in Table 2.

Table 2. Distribution of hospitalized patients by reason for hospitalization.

Reason for Admission	No.	Percentage
Infectious Syndrome	210	62.31
Digestive Symptoms	164	48.66
Respiratory Symptoms	69	20.47
Urinary Symptoms	63	18.69
Edema	40	11.87
Neurological Symptoms	38	11.28
AEG	33	9.79
Anemia	26	7.72
Jaundice	19	5.64
Incessant Crying	14	4.15
Flu-like Syndrome	3	0.89

3.3.3. General Examination

The general condition was good in 62.61% of cases and impaired in 37.39%.

The temperature was normal at 35.61% and elevated at 63.50%. Hypothermia was present in 0.89%.

Approximately 80.12% of hospitalized patients had good nutritional status, while there was 15.73% with severe acute malnutrition (SAM) and 4.15% with moderate acute malnutrition (MAM).

3.3.4. Urinary Functional Signs

No urinary signs were found in 59.94% of the patients.

Table 3 illustrates the distribution of hospitalized patients according to the different urinary functional signs found in the pediatric departments.

Table 3. Distribution of hospitalized patients according to the different urinary functional signs found in the pediatric departments.

Functional Urinary Signs	No.	Percentage
None	202	59.94
Burning Sensation During Urination	12	3.56
Dysuria	69	20.47
Hematuria	10	2.97
Hemoglobinuria	19	5.64
Straining to Urinate	7	2.08
Pyuria	4	1.19
Oliguria	35	10.39
Acute Urinary Retention	1	0.30
Anuria	3	0.89
Lower Back Pain	1	0.30

3.3.5. Diagnoses Associated with UTI

No diagnosis was associated with UTI in 45.12% of cases.

Gastroenteritis was present in 15.85% of patients with UTI. Table 4 illustrates the different associated diagnoses.

3.3.6. Etiological Characteristics

Out of 337 urine tests (ECBU) conducted, 82 results came back positive, accounting for 24.33% of cases.

Among the total 31,889 children hospitalized in the two study centers, these 82 patients represent 0.26%.

Urinary tract colonization was present in 17.25% of patients, as illustrated in Table 5.

3.4. Isolated Germs

Enterobacteria accounted for 55.17% of UTIs, Gram-positive cocci 27.59%, yeasts

Table 4. Distribution of hospitalized patients with UTI according to associated diagnosis.

Associated Diagnosis	UTI No.	Percentage
None	37	45.12
Gastroenteritis	13	15.85
Severe Malaria	9	10.98
Neonatal Infection	9	10.98
Acute Glomerulonephritis	6	7.32
IRA	5	6.10
Chronic Glomerulonephritis	3	3.66
Renal Insufficiency	2	2.44
Dengue	2	2.44
Nephrotic Syndrome	2	2.44
Encephalopathy	1	1.22
Osteoarthritis	1	1.22
Epilepsy	1	1.22
Spinal Cord Compression	1	1.22
Bone Marrow Aplasia	1	1.22
Encephalomyelitis	1	1.22

Table 5. Distribution of negative ECBU according to bacteriuria.

	Urinary Sign Present		Urinary Sign Absent		Total	
	No.	(%)	No.	(%)	No.	(%)
Bacteriuria Present	20	7.84	44	17.25	64	25.10
Bacteriuria Absent	76	29.80	115	45.10	191	74.90
Total	96	37.65	159	62.35	255	100

(Candida) 14.94%, and non-fermenting Gram-negative bacilli (*Acinetobacter baumannii*) 2.30%.

Escherichia coli represented 39.08% of UTIs and Enterococcus sp. 11.49%. Table 6 summarizes the different germs found.

3.5. Isolated Germs by Age

The distribution of isolated germs in hospitalized patients by age is illustrated in Table 7.

3.6. Therapeutic Data

Antibiotics were used before conducting the urine test (ECBU) in 47.58% of patients, consisting respectively of third-generation cephalosporins (24.40%) and aminoglycosides (23.18%).

Table 6. Distribution of isolated germs in hospitalized patients with UTI.

Isolated Germs	No. (n = 87)	Percentage
Escherichia coli	34	39.08
Enterococcus sp.	10	11.49
Klebsiella pneumoniae	9	10.34
Candida albicans	7	8.05
Staphylococcus aureus	6	6.90
Klebsiella sp.	4	4.60
Enterococcus faecalis	3	3.45
Non-albicans Candida	3	3.45
Enterococcus faecium	3	3.45
Candida sp.	3	3.45
Acinetobacter baumannii	2	2.30
Streptococcus sp.	1	1.15
Staphylococcus epidermidis	1	1.15
Cedecea lapagei	1	1.15

Table 7. Distribution of isolated germs in hospitalized patients with age.

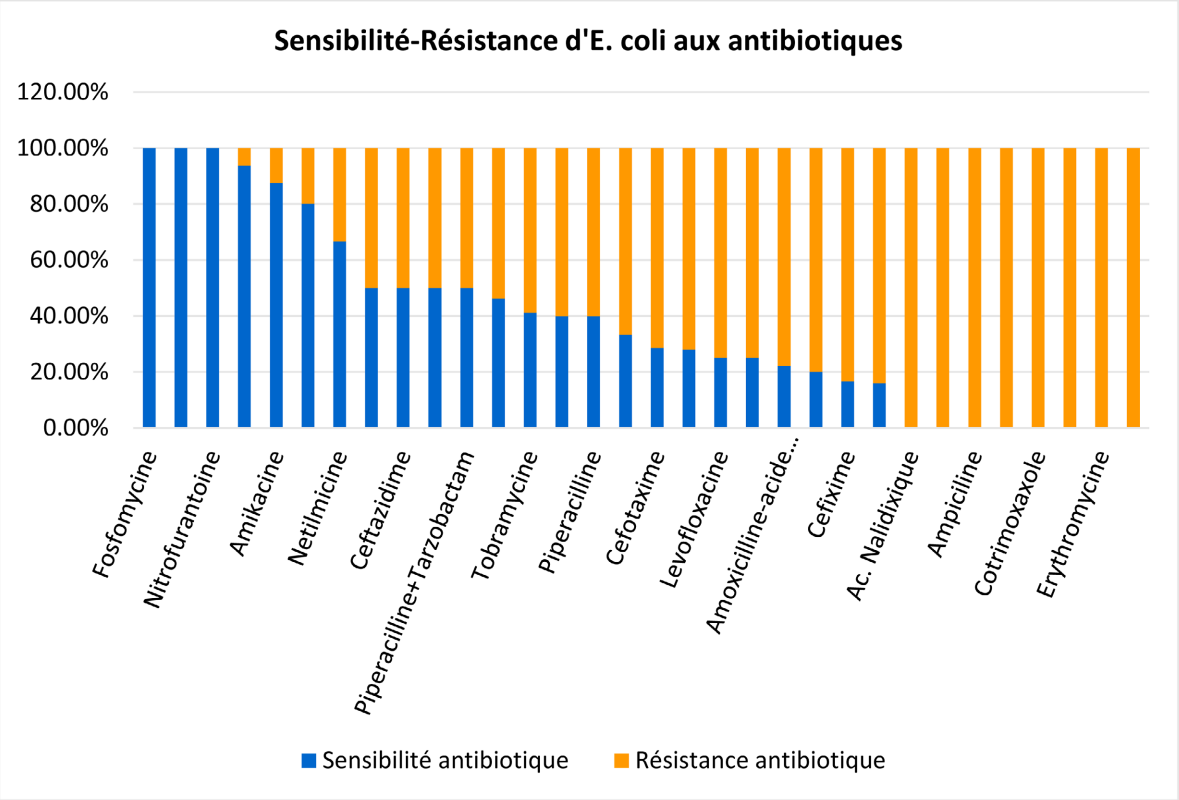
Identified Germs	Newborn		Infant		Preschool Age		School Age		Adolescent	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Acinetobacter baumannii	0	0.00	0	0.00	2	100.00	0	0.00	0	0.00
Candida	0	0.00	4	28.57	4	28.57	4	28.57	2	14.29
Cedecea lapagei	0	0.00	0	0.00	0	0.00	1	100.00	0	0.00
Enterococcus	1	6.25	13	81.25	0	0.00	2	12.50	0	0.00
Escherichia coli	4	11.76	12	35.29	8	23.53	8	23.53	2	5.88
Klebsiella	1	7.69	7	53.85	1	7.69	3	23.08	1	7.69
Staphylococcus	0	0.00	3	42.86	0	0.00	2	28.57	2	28.57
Streptococcus sp.	1	100.00	0	0.00	0	0.00	0	0.00	0	0.00

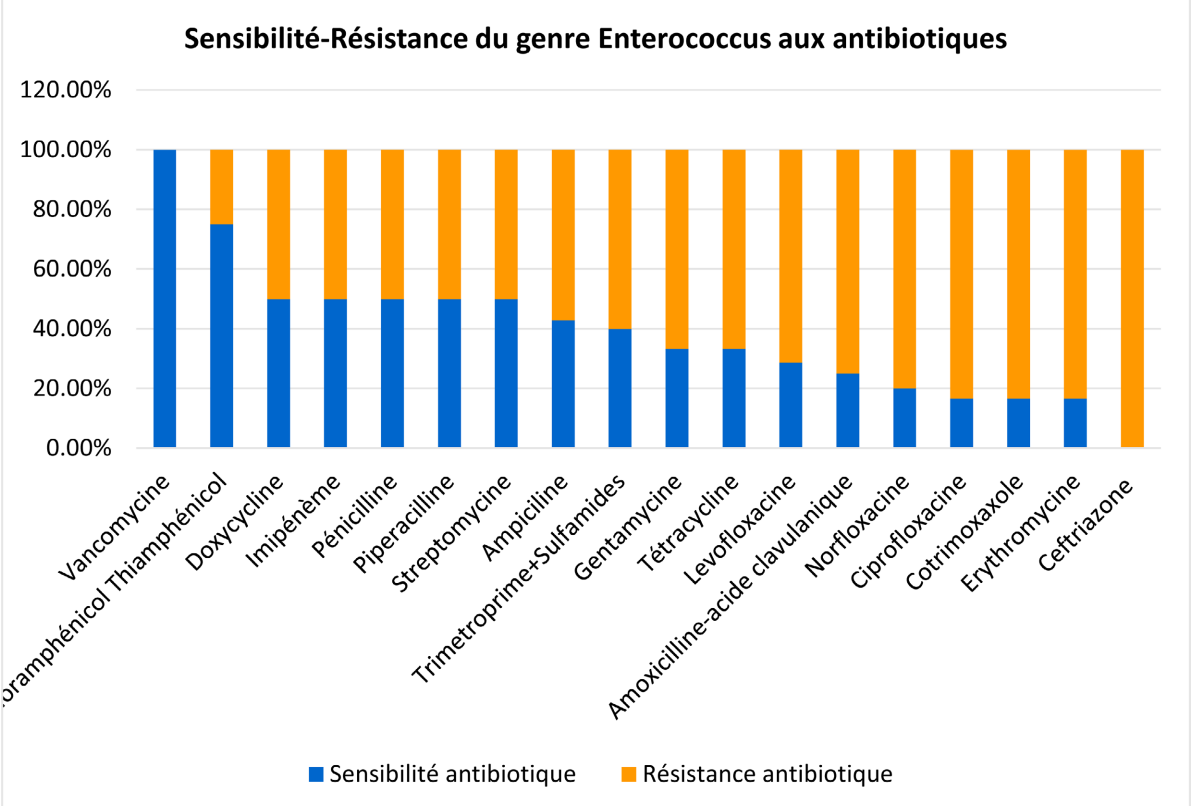
The average duration of antibiotic therapy before urine examination in patients with UTI was 5.08 days, with extremes ranging from 1 to 14 days.

Sensitivity of the Isolated Bacterial Strains to Commonly Used Antibiotics

The sensitivities of the isolated bacterial strains, including *E. coli*, the genus Enterococcus, Klebsiella, Staphylococcus, and Candida, are illustrated in Figure 2. *E. coli* was 100% sensitive to fosfomycin, meropenems, and nitrofurantoin, 93.75% sensitive to imipenem, 50% sensitive to gentamicin, 22.22% sensitive to amoxicil-

lin-clavulanic acid, and 16% sensitive to ceftriaxone.





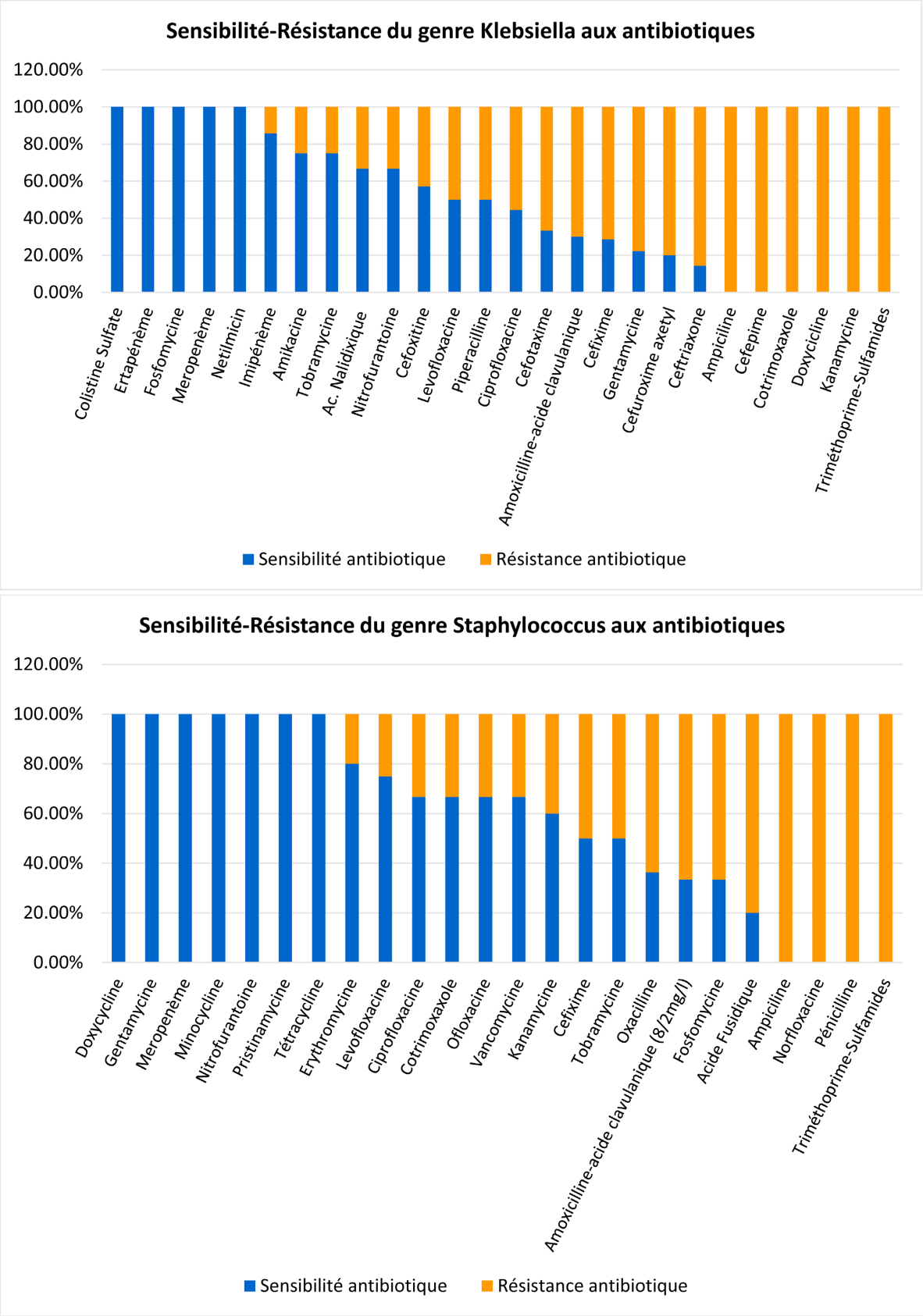


Figure 2. Sensitivity-resistance of isolated bacterial strains to antibiotics.

3.7. Evolutionary Data

3.7.1. Mode of Discharge

The outcome was recovery for 78.05% of the patients. Complications were found in 10.98% of the patients, with renal failure at 100%. Table 8 presents the different outcomes.

Table 8. Distribution according to outcome.

Mode of Discharge	Positive urine culture result	
	No.	Percentage
Recovery	64	78.05
Complications	9	10.98
Deceased	3	3.66
Discharged Against Medical Advice	2	2.44
Absconded	2	2.44
Transferred	2	2.44
Total	82	100.00

3.7.2. Average Length of Hospital Stay

The average length of hospital stay for UTI cases was 13.35 days, with extremes ranging from 2 days to 34 days.

3.8. Associated Risk Factors

Multivariate analysis revealed a statistically significant association between UTI and the following factors: female gender (odds ratio of 2.3), presence of urinary signs (odds ratio of 1.98), and intestinal disorders (odds ratio of 1.77). Table 9 illustrates the distribution of hospitalized children according to the factors associated with UTI in multivariate analysis.

Table 9. Distribution of hospitalized children according to factors associated with UTI in multivariate analysis.

Variable	ECBU+	ECBU-	OR	[IC 95%]	p-value
Gender					
Female	39	77	2.3	[1.34 - 3.95]	0.002
Male	43	178	1		
Urinary Signs					
No	40	159	1		0.014
Yes	42	96	1.98	[1.15 - 3.42]	
Intestinal Disorders					
Yes	42	96	1		0.046
No	38	157	1,77	[1.01- 3.09]	

4. Discussion

4.1. Hospital Frequency

With an overall frequency of 0.26% for UTIs, our results are significantly lower than those of Maleb *et al.* in Morocco and Ganesh in Nepal, who reported frequencies of 6.91% and 23.1%, respectively [2] [3]. This low frequency could be explained by the particular clinical characteristics of children, who may not display the classic clinical signs of a UTI and may resemble other febrile illnesses [9].

Additionally, the healthcare infrastructure in Nepal and Morocco differs from that of Burkina Faso, which could justify the lower overall frequency in our country, as it greatly influences the provision of care.

In our country, where malaria is endemic, a child with a fever is often presumptively treated for malaria, rather than being tested for a urinary tract infection.

The fact that UTIs are most often treated on an outpatient basis also helps to reduce the frequency of hospital visits.

The nearly systematic use of antibiotics in children in our context during febrile infectious diseases also contributes to reducing this frequency.

The absence of certain predictive factors for urinary infection, such as circumcision and the black race, contributes to decreasing the frequency [10].

4.2. Sociodemographic Data

4.2.1. Gender

In our study, urinary infections were more prevalent in girls than boys, with a boy/girl sex ratio of 0.58.

Urinary tract infections are much more common in girls than boys due to the shorter urethral length in girls [2].

4.2.2. Age

The average age of patients with UTI was 44.76 months ± 49.92 months (3.73 years ± 4.16) with extremes from 8 days to 14 years. The median age was 20 months. The age groups from 29 days to 2 years and from 6 to 10 years were the most represented in our series (45.12% and 35.19%).

These results are in line with those found in Burkina Faso and the sub-region:

Savadogo *et al.* [5] at the Charles-de-Gaulle Pediatric University Hospital in Ouagadougou in 2021 reported an average age of 43.1 months and an age group of 0 to 2 years at 50.3% (in our study, this age group is 53.66%).

Boni Cisse *et al.* [8] in 2015 at the University Hospital of Yopougon in Côte d'Ivoire noted that the most represented age group was 1 to 5 years, with 54% of cases (in our study, this age group is 70.73%).

Kahindo Kangitsi *et al.* in 2019 at the North Kivu Provincial Hospital in Congo [11] found the same trends as our study, with the most represented age group being 29 days to 2 years (56.3%).

The prevalence of urinary infections appears to have a bimodal trend, with a first peak during the first year of life and a second between 2 and 4 years, corre-

sponding to the learning of cleanliness [12].

In our study, this first peak is observed and corresponds to newborns plus infants (53.66%). However, the second peak is not observed and instead corresponds to school-age children (6 - 10 years) in our study.

4.3. Clinical Characteristics

4.3.1. Reasons for Hospitalization

Fever and digestive symptoms were the most common reasons for hospitalization in our series, accounting for 62.31% and 48.66%, respectively.

Our results are similar to those of Savadogo *et al.* [5] in 2021 from Burkina Faso regarding fever (58.1%), but they are higher for digestive issues (41.1%).

Compared to the data found by Che Pantalius Nji *et al.* [13] in the Buea health district in Cameroon in 2020, our results were lower for digestive symptoms (74.5%). Fever, on the other hand, showed a similar trend to that in our study (62%).

Kahindo Kangitsi *et al.* from Congo in 2019 [11] also found similar trends to our study, with fever (81.3%), diarrhea (75%), and vomiting (75%) being the main complaints.

Fever is a common symptom of urinary tract infections in children under 5 years old. The high frequency of fever can be explained by the fact that most patients are young [5].

4.3.2. General Examination

The majority of hospitalized patients with UTI (62.61%) had a good general condition. This could be explained by the fact that UTI is generally a benign condition, usually managed on an outpatient basis.

In our series, 15.73% of the patients were in a state of severe acute malnutrition (SAM).

Our results align with those of Uwaezuoke *et al.* [14] in Nigeria in 2019 and Masika *et al.* [9] in the pediatric department of the Webuye Sub-county Hospital in Kenya in 2017, who found similar trends with SAM in children suffering from UTI at 17% and 16.7%, respectively.

Malnutrition in children is a real global health challenge in developing countries, particularly in sub-Saharan Africa. Undernourished children have an immunological imbalance and are, therefore, more susceptible to various childhood infections [14].

4.4. Urinary Functional Signs

In our study, no urinary signs were found in 59.94% of the patients with UTI. This result can be explained by the age of the patients. Indeed, 53.66% of the patients with UTI were under 2 years old. Identifying signs in this age group is difficult, and their ability to communicate is limited.

4.5. Associated Diagnoses

In our study, gastroenteritis was the main diagnosis associated with UTI, affecting

15.85% of patients. Severe malaria and neonatal infection each accounted for 10.98%.

Our results regarding malaria are consistent with those of Masika *et al.* [9] from Kenya in 2017, who found similar trends with malaria at 10.6%. However, our result for acute gastroenteritis was higher than theirs (4.3%).

The association between UTI and malaria might be explained by the fact that malaria is an endemic disease that occurs year-round in our country.

In our context, the majority of pediatric patients are admitted for acute gastroenteritis. It is a fecal-oral disease that significantly affects infants. Indeed, among the patients with UTI in our study, more than 50% were under 2 years old.

4.6. Isolated Germs

In our study, enterobacteria accounted for 55.17% of UTIs, Gram-positive cocci for 27.59%, yeasts (Candida) for 14.94%, and non-fermenting Gram-negative bacilli for 2.30%.

In Morocco in 2019, Maleb *et al.* in Oujda [3] reported a similar rate of non-fermenting Gram-negative bacilli at 4.56%, a higher rate of enterobacteria at 90.50%, and a lower rate of Gram-positive cocci at 4.94%.

In our study, *Escherichia coli* was the most prevalent, accounting for 39.08% of UTIs, followed by Enterococcus sp. at 11.49%, *Klebsiella pneumoniae* at 10.34%, *Candida albicans* at 8.05%, *Staphylococcus aureus* at 6.90%, and Klebsiella sp. at 4.60%.

Our results were lower than those of Douti *et al.* in Lomé, Togo, in 2015 [15], Maleb *et al.* in Oujda (Morocco) in 2019 [3], and Henniche *et al.* in Algeria in 2021 [16], where *E. coli* was the most frequently isolated germ, with respective frequencies of 51.6%, 73.38%, and 63.71%.

However, our results were similar to those of Zahir *et al.* in Marrakech, Morocco, in 2019 [17], and Savadogo *et al.* in Burkina Faso in 2021 [5], where *E. coli* also dominated the bacteriological profile of UTIs, with respective rates of 39.1% and 35.2% of all isolated bacteria.

The strong colonization of the perineum by enterobacteria, particularly *Escherichia coli* [5], as well as the ascending pathophysiology of UTI, explain this predominance [17].

Klebsiella pneumoniae ranked second in the studies by Zahir [17] and Savadogo [5], unlike in our study, where it ranked third. This discrepancy may be explained by the low proportion of newborns in our study, as Klebsiella is a common UTI agent in pediatric settings, particularly in neonatology [4].

4.7. Therapeutic Data

The average duration of antibiotic therapy before urine examination in patients with UTI was 5.08 days, with extremes ranging from 1 to 14 days.

The majority of patients with UTI (35.37%) received antibiotic treatment for 5 to 9 days. 32.93% of patients received antibiotic treatment for 1 to 4 days. Only 26.83% of patients had not received antibiotics before the urine test (ECBU).

However, 4.88% of patients received antibiotic therapy between 10 and 14 days before the ECBU.

In 2015, Cohen *et al.* from France emphasized that it was necessary and important to perform the ECBU before starting antibiotic treatment [18] (or after at least 48 hours of stopping such treatment) to avoid preventing the growth of bacteria during laboratory culture [19].

Sensitivity of Isolated Bacterial Strains to Commonly Used Antibiotics

The study revealed high rates of resistance to commonly used antibiotics in our context during pediatric hospitalizations. This situation calls for everyone to reflect on the almost systematic use of antibiotics.

Ganesh *et al.* stated that inappropriate policies, poor surveillance, self-medication, misdiagnosis, poor quality of antibiotics, and inadequate doses have all contributed to the increase in antimicrobial resistance in recent years. The inappropriate use of antibiotics in healthcare has increased the risk of the growth of antimicrobial resistance [2].

4.8. Evolutionary Modalities

4.8.1. Mode of Discharge

The progression of patients with UTI mostly led to recovery (78.05%). Complications, specifically renal failure, were found in 10.98% of cases. Deaths accounted for 3.66%, while discharges against medical advice, absconded patients, and transfers each represented 2.44%.

Kahindo Kangitsi *et al.* [11], in North Kivu, DRC, in 2019, described a similar trend, with recovery in 84.4%, absconding in 9.4%, and deaths in 6.2%.

These rates confirm that UTI is generally a benign condition, although serious complications like renal failure can occur. The recorded deaths were more related to the clinical presentations and comorbidities of the patients than to the UTI itself.

4.8.2. Associated Factors

Multivariate analysis showed that male patients were 2.3 times more likely not to have a UTI. Additionally, the presence of urinary signs and intestinal disorders in a patient increased the risk of UTI by 1.98 and 1.77, respectively.

According to Becknell *et al.* in 2015 in Columbus, USA, in cases of intestinal disorders, the risk of urinary infection increases; most urinary infections result from retrograde fecal-perineal-urethral ascent of uropathogens. For example, the bacterial load in the stool increases in cases of constipation, and a colon filled with stool can impair bladder emptying and increase the risk of urinary infection [20].

In our study, there was no link between age groups and the occurrence of UTI at a 5% threshold. This could be due to the size of our sample, which did not allow us to obtain a larger population.

5. Conclusion

Urinary tract infection is one of the most common infections in pediatrics. The

overall hospital frequency of urinary tract infection was 1.06% in the pediatric departments of the Yalgado Ouédraogo University Hospital and the Saint Camille Hospital in Ouagadougou.

The emergence of multi-antibiotic-resistant bacteria poses a significant therapeutic challenge and increasingly complicates the successful treatment of infections.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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