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Prevalence and aetiological agents of childhood urinary tract infections at the University Teaching Hospital (CHU) of Bouaké, Côte d'Ivoire

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Abstract:

Background: Urinary tract infections (UTIs) are common in paediatric environment. The microbial ecology is often modified by over-prescription of antibiotics. The aim of this study was to determine the prevalence and etiological agents responsible for paediatric UTIs, with a view to improving care for children in Bouaké, Côte d'Ivoire.
Methodology: The study was carried out in the Paediatrics Department and the Microbiology Laboratory of Bouaké University Hospital Center over a 30-month period from June 2020 to December 2022. A total of 219 children were included and urine samples were collected. Bacterial strains were identified using conventional bacteriology techniques. Antibiotic susceptibility testing was carried out using the disk diffusion method, and interpretation was made according to CASFM/EUCAST recommendations for the current year.
Results: Among the 219 children included, 28 (12.8%) cases of UTIs were diagnosed and urinary tract anomalies in 21.4% of the UTI cases (6/28). The median age of the UTI cases was 96 months, females accounted for 60.7% (17/28) with a M/F of 0.65. Fever and urinary symptoms were reported by 47.0% and 17.3% respectively. Community acquired UTIs occurred in 25.0% (7/28), while hospital acquired UTIs occurred in 75.0% (21/28). *Escherichia coli* (60.7%) and *Klebsiella pneumoniae* (17.9%) were the most frequent bacteria isolated. Resistance rates to standard beta-lactam antibiotics ranged from 56.3% to 62.3%.
Conclusion: The epidemiology of paediatric urinary tract infections was dominated by *E. coli,* with high rates of resistance to standard antibiotics at Bouaké University Hospital Center.

Key words: Urinary tract infections, Paediatrics, Antibiotic resistance, Côte d'Ivoire

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Prévalence et agents étiologiques des infections urinaires de l'enfant au CHU de Bouaké, Côte d'Ivoire

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Résumé:

Contexte: Les infections urinaires (IU) sont fréquentes en milieu pédiatrique. L'écologie microbienne est souvent modifiée par la prescription abusive des antibiotiques. L'objectif de cette étude était de déterminer la prévalence et les agents étiologiques responsables d'IU pédiatrique pour une meilleure prise en charge des enfants à Bouaké.
Méthodologie: L'étude a été réalisée dans les services de Pédiatrie et le Laboratoire de Microbiologie du CHU de Bouaké durant une période 30 mois allant de Juin 2020 à Décembre 2022. Un total de 219 enfants a été inclus et des échantillons d'urines ont été prélevés. Les souches bactériennes ont été identifiées selon les techniques de

bactériologie conventionnelle. Le test de sensibilité des bactéries aux antibiotiques a été réalisé par la méthode de diffusion en milieu gélosé Mueller-Hinton et l'interprétation a été faite selon les recommandations CASFM/ EUCAST de l'année en cours.
Résultats: Parmi les 219 enfants inclus, 28 cas d'infections urinaires ont été diagnostiqués (12,8%) et les anomalies de l'appareil urinaire 21,4% (6/28). L'âge médian=96 mois. Les femmes représentaient 60,7% (17/28) avec une sex-ratio H/F=0,65. La fièvre et les signes d'appel urinaire étaient évoqués respectivement 47% et 17,3%. Par ailleurs, le taux d'infection urinaire d'origine communautaire était de 25,0% (7/28) contre 75,0% (21/28) en milieu hospitalier. *Escherichia coli* (60,7%), *Klebsiella pneumoniae* (17,9%) étaient les principales bactéries isolées. Les taux de résistance aux bêta lactamines usuels étaient variables de 56,3 à 62,3%.
Conclusion: l'épidémiologie des infections urinaires pédiatrique était dominé par *E. coli* avec des taux de résistances élevés vis-à-vis des antibiotiques usuels au CHU de Bouaké.

Mots-clés: Infections urinaires, Pédiatrie, Résistance aux antibiotiques, Côte d'Ivoire

Introduction:

After respiratory tract infections (RTI), urinary tract infections (UTIs) are the second most common clinical conditions for consultations and antibiotic prescriptions (1). They can affect the urinary tract at any age, but are a frequent source of infection in infants and young children in particular (2,3). There are around 150 million cases of UTIs every year worldwide, including almost 2 million in France, making it a major public health concern (4). In developed countries, it accounts for around 5% of hospital admissions in general paediatric wards (5). In Morocco, Zahir (6) reported a frequency of UTI of 30.2%.

In Burkina Faso, the frequency of UTI was 18.7% at the Centre Hospitalier Universitaire pédiatrique de Ouagadougou in 2012 (7). At the Paediatrics Department of Yopougon University Hospital, Côte d'Ivoire in 2014, the frequency of UTI was estimated to be 25%, and at Cocody University Hospital, UTI accounted for 18.9% of neonatal infections (8).

Urinary tract infection in children is responsible for serious complications such as arterial hypertension and chronic kidney disease (9) and therefore requires rapid and effective treatment. However, the urine cytobacteriological examination (ECBU), which confirms the presence of a UTI and identifies the bacteria responsible, is rarely carried out as part of the management of the infection due to the low socio-economic status of most patients (8). In this context, treatment is generally empirical, leading to frequent therapeutic failures with antibiotics prescribed as first-line treatment.

The increasing antibiotic resistance of bacteria involved in UTIs also limits the choice of antibiotics, hence the importance of bacteriological documentation of UTIs and the choice of appropriate antibiotic therapy (10). The aim of this study was to determine the prevalence and aetiological agents responsible for paediatric UTIs in order to improve management of children in Bouaké.

Materials and method:

Study setting, design and duration:

This was a descriptive cross-sectional study conducted in the Paediatrics Department and the Microbiology Laboratory of the University Hospital of Bouaké over a period of 30 months (June 2020 to December 2022). The study population was represented by children aged 0 to 15 years, regardless of sex, presenting with fever with or without urinary symptoms, or in whom urine cytobacteriological examination (ECBU) had been prescribed. Patients who had received antibiotic therapy for more than 48 hours prior to the ECBU were excluded.

Ethical considerations:

The Scientific Medical Department (DMS) of the University Hospital Centre (CHU) of Bouaké, acting as the Ethics Committee, approved the study. Informed consent was obtained from the children's parents or legal guardians.

Clinical sample collection:

Fresh urine was collected in a sterile container. In neonates and infants, samples were taken after rigorous asepsis of the perineal area using Urinicols. These devices were left in place for a maximum of 30 minutes until urination. In young and older children, urine was collected in sterile urine jars using the jet medium technique (11). The urine samples were transported to the laboratory immediately for bacteriological analysis

Bacteriological analysis:

The urine collected was analysed using conventional bacteriological techniques including macroscopic examination to assess the clarity of the urine and macroscopic haematuria, and direct microscopic examination after Gram staining. Cytological analysis (qualitative and quantitative) was performed to assess leukocyturia.

Urine samples were cultured on Eosin Methylene Blue (EMB) and Bromocresol Purple

(BCP) media and samples meeting the Kass positivity criteria (leucocyturia of > 10^4 leucocytes/ml and bacteriuria of >10^5CFU/ml) were identified for further processing.

Enterobacteriaceae were identified using conventional morphological and biochemical test scheme. Gram-positive cocci were tested for catalase and sub-cultured on Chapman and Bile Esculin Azoture (BEA) media, enabling staphylococci strains to be distinguished from enterococci. Pastorex Staph-Plus kits were used to distinguish *Staphylococcus aureus* from other staphylococci. The Novobiocin disc was used to identify *Staphylococcus saprophyticus*.

Antibiotic susceptibility testing and resistance detection:

Antibiotic susceptibility of each isolate was determined using the disk diffusion method on Mueller-Hinton agar. Inhibition diameters were interpreted as sensitive, intermediate or resistant according to CASFM/EUCAST criteria for the current year.

Enterobacteriaceae were tested for ex tended-spectrum beta-lactamase (ESBL) production using the double disk synergy test with a central disc of amoxicillin + clavulanic acid 30 mm from the cefotaxime, ceftriaxone and aztreonam discs. The presence of ESBL was noted in the presence of a 'champagne cork' appearance.

Statistical analysis of the data:

The variables studied were epidemiological (sex, age, patient origin), clinical and bacteriological data, and the rate of bacterial resistance to antibiotics. The data were analysed using EPI-INFO 7.2.2.6 software, and the Chi² test was used to compare qualitative variables with significance level set at $p< 0.05$.

Results:

Prevalence of UTI:

During the study, urine samples were collected from 219 patients, who were hospitalized in paediatric department in 75.3% (165/219) and from the community (paediatric consultation) in 24.7% (54/219). The median age of the patients was 6 years, with a range of 1 day to 15 years. The 6-15 years age group was the most represented (50.7%), followed by the 2-5 years age group (28.8%) (Table 1).

The most frequent symptom for requesting ECBU was fever (47.0%), followed by urinary burning (17.3%) and dysuria (8.2%) (Table I). Antibiotic therapy had been initiated in 29.6% of patients and for at least 24 hours in 78.5% of them (Table 1). The antibiotics most frequently prescribed were ceftriaxone (41.5%) and amoxicillin-clavulanic acid (24.6%).

Table 1: Clinical and demographic characteristics of the study participants

Variable	Number (%)
Age group (years)	
0-2	45 (20.5)
2-5	63 (28.8)
6-15	111 (50.7)
Sex	
Male	134 (61.2)
Female	85 (38.8)
Clinical symptoms	
Fever	103 (47.0)
Urinary burning	38 (17.3)
Dysuria	18 (8.2)
Antibiotic therapy	
Yes	65 (29.7)
No	154 (70.3)

Bacteriological data:

Urine cytology revealed leukocyturia (> 10^4 WBC/mm^3) in 24.2% (53/219). Gram staining revealed the presence of bacteria in 17.8% (39/219) of cases. These were Gram-negative bacilli in 89.7% (35/39) and Gram-positive cocci in 10.3% (4/39) of cases. The bacterial culture positivity rate was 16.34% (36/219).

According to the Kass criteria, 28 voided urine samples met the criteria for UTI i. e. 12.8% (28/219). These infections were community-acquired in 25.0% (7/28), and hospital-acquired in 75.0% (21/28) of cases (Table 2). The infections also occurred more frequently in patients who have not been on antibiotic treatment but no significant statistical relationship (p=0.3).

The prevalence of UTI was significantly higher in the females (19.5%, 17/85) than the males (8.2%, 11/134) (OR 2.8, p=0.01) (Table 2). Urinary tract abnormalities were observed in 21.4% (6/28). The median age of patients presenting with a UTI was 96 months with range from 2 to 168 months.

The bacterial groups isolated were Enterobacteriaceae (89.3%, n=25) followed by enterococci (7.1%, n=2) and staphylococci (3.6%, n=1). *Escherichia coli* (60.7%, n=17) was the most frequent isolate, followed by *Klebsiella pneumoniae* (17.9%, n=5) and *Enterobacter* spp (7.1%, n=2). Among the Gram-positive cocci, *Enterococcus faecalis* (7.1%, n=2) and *Staphylococcus saprophyticus* (3.6%, n=1) were isolated (Table 3).

Table 2: Epidemiological and clinical characteristics of children with urinary tract infections

Variable	Number (%)	x^2	OR (95% CI)	*p* value
Kass criteria				
Yes	28 (12.8)			
No	191 (87.2)			
Origin				
Hospital (n=165)	21 (12.7)	0.002	1.0 (0.4-2.5)	1.00
Community (n=54)	7 (12.9)			
Sex				
Male (n=134)	11 (8.2)	5.47	2.8 (1.3 - 6.3)	0.01*
Female (n=85)	17 (19.5)			
Age group (years)				
0-2 (n=45)	7 (15.6)	1.9		0.39
2-5 (n=63)	5 (7.9)			
6-15 (n=111)	16 (14.4)			

x^2 = Chi square; OR = Odd ratio; CI = Confidence interval; * = statistically significant

Table 3: Bacterial isolates of urinary tract infections

Uropathogens	Number (%)
Enterobacteriaceae	**25 (89.3)**
Escherichia coli	17 (60.7)
Klebsiella pneumoniae	5 (17.9)
Enterobacter spp	2 (7.1)
Salmonella spp	1 (3.6)
Gram-positive cocci	**3 (10.7**)
Enterococcus faecalis	2 (7.1)
Staphylococcus saprophyticus	1 (3.6)
Total	**28 (100.0)**

Antibiotic sensitivity of isolated bacteria:

The rate of resistance of Enterobacteriaceae to beta-lactam antibiotics was over 50%. The rates for ampicillin and amoxicillin-clavulanic acid were 88.0% and 48% respectively. Susceptibility to 3rd generation cephalosporins was also affected, with resistance levels rising to 64.0% for ceftriaxone and cefotaxime respectively (Table 4).

Resistance to fluoroquinolones (ciprofloxacin) and aminoglycosides (gentamycin and amikacin) were 52.0%, 52.0% and 32.0% respectively. Resistance of Enterobacteriaceae to imipenem (16.0%) and meropenem (12%) remained low.

Escherichia coli, the most frequent Enterobacteriaceae isolated, expressed high levels of resistance to amino-penicillins (93.8%), amoxicillin-clavulanic acid (56.3%) and cotrimoxazole (87.5%). Resistance to cefotaxime and ceftriaxone were 75.0% and 62.3% respectively (Table 5).

Thirty-two percent (8/25) of the Enterobacteriaceae were extended-spectrum beta-lactamase (ESBL) producers. These were *E. coli* (62.5%; n=5/8), *Klebsiella pneumoniae* (25.0%, n= 2/8), *Enterobacter* spp (12.5%, n=1/8).

Enterococcus faecalis strains were all sensitive to ampicillin, but 50.0% were resistant to norfloxacin, chloramphenicol and gentamicin (high level of resistance to aminoglycosides). Resistance to cyclins (minocycline, tetracycline) was 100.0%. *Staphylococcus saprophyticus* strain was resistant to penicillin G (100.0%), sulfamethoxazole-trimethoprim (100.0%) and cyclins (100.0%). All Gram-positive cocci were sensitive to vancomycin (Table 4).

Discussion:

Antibiotic resistance is a growing public health problem, which has an impact on the choice of first-line treatments for the most common infections, such as paediatric urinary tract infections (12). As a result, international organizations and associations such as the European Centre for Disease Prevention and Control (ECDC), the Infectious Diseases Society of America (IDSA) and the American Association of Pediatrics (AAP) consider it essential to disseminate local information on antimicrobial resistance in order to develop our own treatment guidelines (12,13).

The results of our study show that data were obtained from 219 patients, 75.4% of whom were hospitalised and 24.6% ambulatory. The most frequent symptoms for ECBU request in children was fever (47%), followed by urinary burning (17.3%) and dysuria (8.2%). Similar data had been reported by Cissé et al (14) who, in a study carried out in 2014 on 202 patients, reported the following as the main presenting symptom; fever in 100% of cases, digestive problems in 80.7% of patients and no urinary symptoms (7.05%).

Antibiotic therapy has been initiated in 29.7% of the patients in our study. The compliance and appropriateness of these antibiotic prescriptions had not been studied. Our rate is lower than that of Mabiala et al., (15) in the Congo, who in 2009 found a hospital prevalence of antibiotic prescribing in paediatrics of 61.5%, with beta-lactam antibiotics accounting for 79.0% of prescriptions (15).

Twenty-eight of 219 (12.8%) children in our study met the criteria for UTI, with

Table 4: Resistance rates of the bacterial isolates against the antibiotics tested

Antibiotic	**Bacteria isolates**		
	Enterobacteriaceae n=25 (%)	***Enterococcus faecalis* n=2 (%)**	***Staphylococcus saprophyticus* n=1 (%)**
Chloramphenicol	3 (12.0)	1 (50.0)	-
Minocycline	12 (48,0)	2 (100.0)	1 (100.0)
Ampicillin	22 (88.0)	0	-
Amoxicillin-clavulanic acid	12 (48.0)	-	-
Cefotaxime	16 (64.0)	-	-
Ceftriaxone	16 (64.0)	-	-
Imipenem	4 (16.0)	0	-
Norfloxacin		1 (50.0)	-
Ciprofloxacin	13 (52.0)	1 (50.0)	
Gentamicin	13 (52.0)	1 (50.0)	
Amikacin	8 (32.0)	-	0
Vancomycin	-	0	0
Cotrimoxazole	20 (80.0)	2 (100.0)	1 (100.0)
Penicillin G	-	-	1 (100.0)
Cefoxitin	-	-	0
Fusidic acid	-	-	1 (100.0)

Table 5: Resistance rates of *Escherichia coli* and *Klebsiella pneumoniae* isolates to the antibiotics tested

Antibiotic	***Escherichia coli* [n=16 (%)]**	***Klebsiella* pneumoniae [n=5 (%)]**
Chloramphenicol	1 (6.3)	1 (20.0)
Minocycline	9 (56.3)	3 (60.0)
Ampicillin	15 (93.8)	*RN
Amoxicillin-clavulanic acid	9 (56.3)	2 (40.0)
Cefotaxime	12 (75.0)	2 (40.0)
Ceftriaxone	10 (62.3)	3 (60.0)
Imipenem	3 (18.8)	0
Ciprofloxacin	8 (50.0)	4 (80.0)
Gentamicin	7 (43.8)	3 (60.0)
Amikacin	5 (31.2)	3 (60.0)
Cotrimoxazole	14 (87.5)	4 (80.0)

60.7% of them being females. The prevalence of UTI in the females (19.5%) was significantly higher than that in the males (8.2%) (OR 2.8, p=0.01). The prevalence of UTI was also higher among infants (1 month to 2 years) (15.6%) and children 6-15 years (14.4%) compared to children in the age group 2-5 years (7.9%) but the difference was not statistically significant (p=0.39).

Our findings are similar to those of Ouedraogo et al., (7) in Burkina Faso, who reported a frequency of paediatric UTI of 18.7%, with a predominance of females. Bouskraoui et al., in Morocco (16) reported a low frequency of paediatric UTIs of 1.33%, with a clear predominance of females at 65.7% (16). The female predominance is in line with data in the literature according to which 8% of females compared with 2% of males are likely to contract a UTI before the age of 7 years (17).

Furthermore, the higher susceptibility of females to UTIs could be explained by the relatively shorter length of the female urethra and the regular colonisation of the perineum by enteric organisms (18). In addition, UTIs occurred more frequently in hospitalised children (75%), which corroborates a previous study that reported UTIs accounting for 40% of all nosocomial infections (19).

The bacteriological profile of UTI in this study was dominated by Enterobacteriaceae in 89.3% of cases, with *E. coli* (60.7%) being the most frequent bacterium, followed by *Klebsiella pneumoniae* (17.9%). Several studies throughout the world confirm this trend. Bouskraoui (16) and Ferjani (20), from Morocco and Tunisia respectively, reported *Escherichia coli* in 72-80.4% of cases, followed by *Klebsiella* spp (9.8-14%) and *Proteus mirabilis*

(5.9%). Similarly in Saudi Arabia, Tahir et al., (21) reported *E. coli* to be the main uropathogen (75.7%), followed by *Klebsiella pneumoniae* (9.4%) and *Pseudomonas aeruginosa* (5.9%).

Enterococcus spp (3.5%) was the main Gram-positive cocci, which agrees with studies in the literature (22,23), which reported that *E. coli* accounts for 80-90% of urinary tract infections in children. In fact, majority of UTIs result from bacteria ascending from the periurethral zone, migrating retrograde via the urethra to reach the bladder and potentially the upper urinary tract.

With regard to the sensitivity of the bacteria to antibiotics, the Enterobacteriaceae were resistant to aminopenicillins (88.0%), penicillin+inhibitor combination (48.0%) and 3rd generation cephalosporins such as cefotaxime and ceftriaxone (64.0%), and 52.0% expressed resistance to quinolones. Similar data was reported by Boni (5) in Côte d'Ivoire, with high rates of resistance to the amoxicillin-clavulanic acid combination (51-85%) and to ciprofloxacin (64-75%).

Carbapenems remained the most active antibiotics against Enterobacteriaceae. *E. coli,* the main Enterobacteriaceae isolated, expressed high levels of resistance to aminopenicillins (93.8%), amoxicillin-clavulanic acid (56.3%) and cotrimoxazole (87.5%). Resistance of the isolates to cefotaxime, ceftriaxone and cefepime remained high.

Conclusion:

Paediatric UTIs are frequent and particularly affect infants and children at Bouaké University Hospital. Antibiotics such as ampicillin, amoxicillin, amoxicillin-clavulanic acid and ceftriaxone are no longer effective as first-line empirical treatment of paediatric UTIs in Bouaké. There is need to set up a multidisciplinary antibiotic stewardship team in Bouaké University Hospital to promote appropriate use of antimicrobials.

Contributions of authors:

GKJ and AC designed the study; OKH, AIA, VM, KMO, and TF carried out the surveys; GKJ, TJON, VM, and NM carried out the experimental work; GKJ, NM, and MP analysed the data and wrote the manuscript; AC, GKJ, TJON, NM and MP participated in the critical review of the manuscript. All authors approved the final manuscript submitted for publication.

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References:

1. Mutombo, C. K., Mukandila, A. M., Mikenji, J. B., Katumbayi, G. N., and Kashi, F. M. Bacteriological profile of gravid urinary tract infection (Case of Bonzola Hospital in Mbujimayi, DR Congo). Rev Med Madag. 2015; 5 (3): 626-633.
2. Buettcher, M., Trueck, J., Niederer-Loher, A., et al. Swiss consensus recommendations on urinary tract infections in children. Eur J Pediatr. 2021;180(3):663-674. https://doi.org/10.1007/s00431-020-03714-4
3. Joan, L. R., Jane, C. F, Mia, E. L., and Robert, B. Canadian Paediatric Society. Diagnosis and management of urinary tract infections in infants and children. Paediatr Child Health. 2014;19 (6): 320-325. doi:10.1093/pch/19.6.315
4. Lavigne, J. P., Moing, V. L., and Sotto, A. Which antibiotics to use in routine practice for community-acquired urinary tract infections in France. Spectra Biologie. 2005; 24 (146}: 18-23.
5. Boni, C., Zaba, F., Meite, S., et al. Profil bactériologique des infections urinaires en milieu pédiatrique: cas du chu de Yopougon. J Sci Pharm Biol.2015; 16: 34-41.
6. Zahir, H., Draiss, G., Rada, N., et al. Microbial ecology and antibiotic susceptibility of bacteria isolated from urinary tract infections in children in Morocco. Rev Francoph Lab. 2019; 2019 (511): 65-70. https://doi.org/10.1016/S1773-035X(19)30229-1
7. Ouédraogo-Yugbaré, S., Kouéta, F., Dao, L., et al. Urinary tract infection in children: epidemiological and bacteriological aspects at the Centre Hospitalier Universitaire Pédiatrique Charles de Gaulle de Ouagadougou (Burkina Faso). Mali Med. 2012; 27 (4): 11-17.
8. Amorissani, M. F., M'bengue, A. K., Dainguy, E., et al. Neonatal urinary tract infections: clinical and bacteriological profiles. Int J Med Sci. 2006; 8 (1):45-49.
9. Sreenarasimhaiah, S., and Hellerstein, S. Urinary tract infections per se do not cause end-stage kidney disease. Pediatr Nephrol. 1998; 12(3): 210-213. https://doi.org/10.1007/s004670050439
10. Courcol, R., Marmonier, A., and Piemont, Y. Les difficultés d'interprétation de l'examen cyto-bactériologique des urines. Rev Francoph Lab. 2005; 2005 (370): 21-25. https://doi.org/10.1016/S0338-9898(05)80032-0
11. Cattoir, V., Denis, F., Martin, C., Ploy, M. C., and Poyart, C. Bactériologie médicale: Techniques usuelles. Elsevier Health Sciences; 2016: 599
12. Rosado, M. R., Molina, A. G., Velasco, A. L., et al. Urinary Tract Infection in Pediatrics: Study of Uropathogens and Their Resistance in a Madrid Hospital. Arch Esp Urol. 2022; 75 (9): 791-797. https://doi.org/10.56434/j.arch.esp.urol.20227509.115
13. Roberts, K. B. Subcommittee on Urinary Tract Infection SC on QI and M. Urinary Tract Infection: Clinical Practice Guideline for the Diagnosis and Management of the Initial UTI in Febrile Infants and Children 2 to 24 Months. Pediatr. 2011; 128 (3):595-610. https://doi.org/10.1542/peds.2011-1330
14. Cissé, L., Lagou, D., Ouattara, G. J., et al. Childhood urinary tract infection during a febrile attack at Port-Bouët General Hospital (Abidjan Ivory Coast). Rev Afr Malg. 2017; 5 (1): 105-109.
15. Babela, J. R. M., Ikobo, L. C. O., Cardorelle, A. M., and Moyen, G. Evaluation of initial antibiotic

therapy in paediatric settings at Brazzaville University Hospital (Congo). Trop Med Health. 2013; 23 (2): 189-192. https://doi.org/10.1684/mst.2013.0173

16. Bouskraoui, M., Ait Sab, I., Draiss, G., Bourrouss, M., and Sbihi, M. Epidemiology of urinary tract infection in children in Marrakech. Arch Pédiatr. 2010; 17: S177-S178. https://doi.org/10.1016/S0929-693X(10)70921-0
17. Millner, R., and Becknell, B. Urinary tract infections. Pediatr Clin North America. 2019; 66 (1): 1-13. https://doi.org/10.1016/j.pcl.2018.08.002
18. Leung, A. K., and Robson, W. L. Urinary tract infection in infancy and childhood. Adv Pediatr. 1991; 38: 257-285.
19. Kalsi, J., Arya, M., Wilson, P., and Mundy, A. Hospital-acquired urinary tract infection. Int J Clin Pract. 2003; 57 (5): 388-391.
20. Ferjani, A., Mkaddemi, H., Tilouche, S., et al. Epidemiological and laboratory characteristics of urinary tract infection. Arch Ped. 2011; 18(2): 230-234. https://doi.org/10.1016/j.arcped.2010.09.024
21. Tahir, H, Al Nafeesah A, Chishti S, Al Shaalan M, Al Fakeeh K. Community-acquired urinary tract infections in children: Resistance patterns of uropathogens in a tertiary care center in Saudi Arabia. Int J of Ped & Adolescent Med. 2019;6(2):51-4. https://doi.org/10.1016/j.ijpam.2019.02.010
22. Leung AKC, Wong AHC, Leung AAM, Hon KL. Urinary Tract Infection in Children. Rec Pat Inflamm Allerg Drug Discov. 2019; 13 (1): 2-18. https://doi.org/10.2174/1872213X13666181228154940
23. Clark CJ, Kennedy WA, Shortliffe LD. Urinary Tract Infection in Children: When to Worry. Urol Clin North Am. 2010; 37 (2): 229-241. https://doi.org/10.1016/j.ucl.2010.03.009