SARPRIC-UTI

Surveillance of Antimicrobial Resistance in PRImary Care – Urinary Tract Infections

RESULTS 2024

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EXECUTIVE SUMMARY

Background

Antimicrobial resistance (AMR) poses a significant threat to global health, causing approximately 33,000 deaths annually in Europe. The Belgian National Action Plan on AMR highlights the need for robust surveillance of antimicrobial use and resistance, particularly in ambulatory care where such data are scarce.

Urinary tract infections (UTIs) are among the most common reasons for antimicrobial prescriptions in outpatients. To inform empirical treatment guidelines, the SARPRIC-UTI study was launched, focusing on active surveillance of uropathogens and their resistance patterns in uncomplicated UTIs in ambulatory care.

Method

Between January and December 2024, 113 general practitioners across 48 practices in Belgium accepted to recruit female patients (≥18 years) presenting with uncomplicated UTI symptoms. Exclusion criteria included complicated UTI symptoms, pregnancy, and recent antibiotic use. Demographic, clinical, and treatment data were collected via standardized questionnaires. Midstream urinary samples were analyzed using validated guidelines to identify pathogens and EUCAST breakpoints to determine antimicrobial susceptibility.

Findings

Between January 15 and December 13, 2024, data were collected from 247 female patients with a mean age of 52.5 years. The most common symptoms reported were burning sensation during urination (81.0%) and frequent urination (77.3%). Nitrofurantoin was the most prescribed antimicrobial agent (65.0%). Of 247 collected urine samples, 182 (73.7%) were positive for growth of uropathogens. *Escherichia coli* was confirmed as the most commonly isolated uropathogen/microorganism (70.5%), followed by *Staphylococcus saprophyticus* (8.1%), *Klebsiella* spp. (5.2%) and *Enterococcus* spp. (4.6%). Overall resistance to ampicillin, trimethoprim and nitrofurantoin was 45%, 13% and 6.7%, respectively. In *E. coli* resistance to ampicillin was 43%, to trimethoprim 14.9%, and to nitrofurantoin 0.8%. Overall, menopausal status did not influence the susceptibility of *E. coli.*

Conclusion

The SARPRIC-UTI study highlights the prevalence of *Escherichia coli* as the dominant uropathogen in uncomplicated UTIs in Belgian ambulatory care, with low resistance rates to first-line antibiotics such as nitrofurantoin. These findings support the continued use of nitrofurantoin as an empirical treatment for uncomplicated UTIs. Furthermore, the study underscores the importance of ongoing surveillance to inform evidence-based antimicrobial prescribing and address emerging resistance trends in ambulatory care settings.

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ABBREVIATIONS

AB	Antibiotics
AMCRA	AntiMicrobial Consumption and Resistance in Animals vzw
AMR	AntiMicrobial Resistance
AST	Antimicrobial Susceptibility Test
BAPCOC	Belgian Antibiotic Policy Coordination Commission
CFU	Colony-Forming Unit
CP	CarbaPenemase
CPE	Carbapenemase Producing Enterobacteriaceae
EARS-BE	European Antimicrobial Resistance Surveillance for Belgium
ECDC	European Centre for Disease Prevention and Control
EFLM	European Federation of Clinical Chemistry and Laboratory Medicine?
ESBL	Extended-Spectrum Beta-Lactamase
EUCAST	EUropean Committee on Antimicrobial Susceptibility Testing
FPS – Public Health	Federal Public Service – Public Health, Food Chain Safety & Environment
GP	General Practitioner
NAP-AMR	National Action Plan on the fight against AntiMicrobial Resistance
SSMG	Société Scientifique de Médecine Générale
UTI	Urinary Tract Infection

INTRODUCTION

Antimicrobial resistance (AMR) poses a significant threat to global health, causing up to 33,000 deaths annually in Europe (1,2). Estimates for Belgium of predominantly healthcare-associated infections have found an attributable mortality of around 600-700 casualties for the period 2016-2020 (3). The Belgian action plan on AMR (NAP-AMR) underscores the necessity of comprehensive surveillance systems to monitor antimicrobial use and rapid detection of resistance patterns (4). While hospital-based AMR surveillance is well-established and even mandatory by law for specific pathogens in Belgium (Royal Decree of January 8, 2015), surveillance data on primary care remains limited.

Urinary tract infections (UTIs) are a major reason for antimicrobial prescriptions in outpatients. Past experience has already shown that effective treatment of these infections can be initiated empirically (5). However, to develop empirical treatment guidelines, data on uropathogens and their sensitivity to antibiotics are needed. To address this need, Sciensano initiated the SARPRIC-UTI study in January 2024, aiming to actively monitor AMR in primary care, focusing on uncomplicated UTIs.

Since 2017, some initiatives to explore AMR trends in the primary care sector have been undertaken within the European Antimicrobial Resistance Surveillance System for Belgium (EARS-BE), coordinated by Sciensano. Since then, the EARS-BE program has been collecting AMR data from urine isolates (in addition to the invasive blood and cerebrospinal fluid isolates recommended by the European protocol), thus extending the program to the non-hospital sector (6). Besides the advantage of working with existing laboratory data and avoid increasing the coding burden for healthcare professionals, this passive surveillance has several limitations. The origin of the isolate and the associated clinical diagnosis are not known. A second limitation is that, because urine sampling for uncomplicated UTIs is not recommended, it is likely that these data are associated with a population with risk factors, recurrent infections or complicated UTIs, which may put into question the extrapolation of the results to current treatment guidelines in primary care. A third limitation is the low participation rate of non-hospital laboratories, preventing a representative national surveillance coverage to allow for local guidance (6). Before engaging in efforts to increase the participation of non-hospital laboratories in this passive surveillance, it is necessary to verify its representativeness of the AMR situation in primary care. To achieve this, active monitoring through observational studies is necessary.
Such studies, conducted at the University of Ghent, Belgium explored the distribution and antimicrobial susceptibility of pathogens responsible for uncomplicated cystitis. However, these studies were limited to a small number of samples and to a specific region of Belgium (East Flanders), which prevents comparison with data from national laboratories and an overview of the AMR situation in the whole country (7–9).

METHODS

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1. Participating microbiology laboratories

Technical and microbiological diagnosis of urinary tract infections in the primary care population are offered by hospital and non-hospital laboratories. Sciensano's Service 'Quality of laboratories' provided a list of 83 hospital-associated and 30 non-hospital microbiological laboratories in Belgium. Laboratories using EUCAST (European Committee for Antimicrobial Susceptibility Testing) clinical breakpoints for antimicrobial susceptibility testing (AST) were invited to participate in the SARPRIC-UTI study, ensuring adequate geographical representation. Informational letters and protocols (10) were shared, followed by direct contact to encourage participation. Participating labs also received an informational letter and information flyer to share with their network of general practitioners (GPs).

A total of 16 laboratories (11 in Flanders, 5 in Wallonia, and 0 in Brussels) agreed to participate in the SARPRIC-UTI study. After the recruitment of the GPs, 12 laboratories (8 in Flanders, 4 in Wallonia, and 0 in Brussels) ultimately participated in the data collection.

2. General practitioners and study population

Initially, general practitioners (GPs) were recruited by the laboratories. To enhance the participation rate, an informational folder was developed and distributed through Belgian GP organizations (Domus Medica, SSMG). Between January 2024 and December 2024, a total of 113 GPs across 48 practices (36 in Flanders, 12 in Wallonia and 0 in Brussels) participated in the SARPRIC-UTI study. Female patients aged 18 years and above with complaints of acute dysuria and/or new or marked increase in urgency, and/or urinary frequency were included. Patients were excluded if they had already participated in the study, had symptoms suggestive for complicated UTI at presentation (symptoms lasting longer than 7 days, an axillary temperature >38.0 °C) or had predisposing factors such as pregnancy, urologic or nephrological problems, diabetes mellitus, other immunocompromising diseases, recurrent UTI (more than three occurrences in the last year), had received antibiotics during the past 4 weeks, or had obvious gynaecologic complaints (abnormal discharge, labial irritation, intermittent vaginal blood loss, or vaginal itch).

3. Data collection

For each included patient, GPs completed a questionnaire (Annexes 1 and 2) covering demographic details, symptoms and prescribed treatments, including antimicrobial agent (dosage, duration) and any non-antimicrobial treatment). Midstream urinary samples were collected, labelled and sent to participating laboratories for analysis within 24 hours. The paper questionnaires, completed by the GPs, were also submitted to the laboratories, where the data were entered into an online LimeSurvey platform developed by Sciensano. Data collection was completed by the end of December 2024.

4. Bacteriological analyses

Urine samples were cultured to identify pathogens according to European guidelines and the laboratory standards. The labs used one of the following four guidelines for bacteriological culture:

- European Federation for Urinalysis (EFU) guidelines,
- Clinical microbiology procedures handbook (Leber, A. L. (Ed.) (2016) ((4th ed.). American Society for Microbiology)
- Internal procedures using the Kass criterion
- Référentiel en microbiologie Médical 2022 (REMIC 7).

Samples with more than two different pathogens were reported as contaminated. Since 2022, all laboratories in Belgium are required to use EUCAST guidelines (version 10.0 or higher) for AST, reporting results as S (susceptible at standard exposure), I (susceptible at increased exposure), or R (resistant).
Additional tests for extended-spectrum β-lactamase (ESBL) and carbapenemases (CP) detection could be performed at the discretion of the laboratory but was not mandatory. Unprocessed samples were stored at -80°C for potential later analysis.

5. Data transfer & ethical approval

Laboratory staff encoded both clinical data (from the paper forms completed by GPs) and microbiological results into a LimeSurvey questionnaire. This ensured timely and accurate data transmission.
Ethical approval was obtained from the Vrije Universiteit Brussel (EC-2023-227). All participants received oral and written information and provided signed informed consent.

6. Statistical analyses

A sample size calculation was performed based on results of previous Belgian studies aiming to monitor the prevalence of uropathogens isolated from uncomplicated UTIs as well as their antimicrobial susceptibility patterns (11).

The estimated proportion of *Proteus mirabillis,* detected at a frequency of 0.9% in a study conducted in Belgium in 2021, was used for these calculations (11). This is the least frequently isolated pathogen in this study belonging to the category of 'fairly common' pathogens detected in midstream urine according to the European guidelines for urinalysis (12). A precision of 5% and a confidence level of 95% were used. A sample size of 1500 positive samples was calculated. Based on previous studies, we expect that 20%-25% of samples to be negative or contaminated, so a collection target of 2000 samples has been set.

Chi-squared tests were performed to compare antibiotic susceptibility results between menopausal and non-menopausal women, limited to antimicrobial agents for which at least 10 AST results were available in both groups. In addition, chi-squared tests were performed to compare the prescription patterns of specific antibiotics between menopausal and non-menopausal women, as well as between patients from Flanders and Wallonia. To ensure reliable statistical testing, analyses were limited to antibiotics with sufficient sample sizes (≥5 prescriptions in both groups). A significance level of 0.05 was used, with Bonferroni correction applied to adjust for multiple comparisons.

A multivariable logistic regression model was constructed to assess factors independently associated with antibiotic prescription. Covariates included region, age, menopausal status, presence of urinary tract infection-related symptoms and the duration of these symptoms . Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated, and a significance level of 0.05 was used.

7. Funding

This study was funded by the Federal Public Service – Public Health as part of the subproject *"Étude portant sur l'amélioration technique de la collecte de données sur l'utilisation et la résistance aux antimicrobiens"* (Study on the technical improvement of data collection on antimicrobial use and resistance), carried out within the framework of the Belgian National Action Plan on Antimicrobial Resistance (2023–2024).

RESULTS

1. Characteristics of the study population

Between January 15 and December 13 2024, data were collected from 264 female patients, of which 247 met all inclusion criteria and were included in the analysis. Table 1 summarizes the demographic and clinical characteristics of the study population, including age distribution, menopausal status and symptoms. Of the included patients, 205 were recruited in Flanders and 42 in Wallonia; no data were collected from Brussels.

Table 1. Demographic and clinical information of the study population, SARPRIC-UTI, Belgium, January - December 2024

Characteristics	N (%)
Number of patients	**247**
Mean age (years)	**52.5**
Mean age premenopausal women (years)	**36.6**
Mean age postmenopausal women (years)	**66.1**
Menopausal status	
Yes	130 (52.6%)
No	106 (42.9%)
Unknown	11 (4.5%)
Symptoms	
Burning sensation during urination	200 (81.0%)
Need to urinate frequently	191 (77.3%)
Lower abdominal pain	148 (59.9%)
Urinating small amounts	141 (57.1%)
Cloudy urine	85 (34.4%)
Blood in urine	53 (21.5%)
Other*	22 (8.9%)

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* Other symptoms reported include: Headache, Itching, Reflux/Nausea and Feeling general unwell.

2. Microbiological analysis

Of the 247 urine samples retrieved, 182 (73.7%) were positive for bacterial growth. Among these, 153 samples (61.9%) contained a single pathogen, 10 samples (4%) contained two pathogens, and 19 samples (7.7%) were classified as contaminated. *Escherichia coli* emerged as the most commonly isolated uropathogen, representing 70.5% (122/173) of isolated pathogens. Further details on the distribution of uropathogens can be found in table 2.

Table 2. Distribution of uropathogens (N = 173) from positive samples with one or two uropathogens, SARPRIC-UTI, January–December 2024

Uropathogen	Number (%)
Escherichia coli	122 (70.5%)
Staphylococcus saprophyticus	14 (8.1%)
Klebsiella spp.	9 (5.2%)
Enterococcus spp.	8 (4.6%)
Proteus mirabilis	6 (3.5%)
Citrobacter spp.	4 (2.3%)
Enterobacter spp.	2 (1.2%)
Morganella morganii	1 (0.6%)
Proteus vulgaris	1 (0.6%)
Serratia spp.	1 (0.6%)
Staphylococcus aureus	1 (0.6%)
Other*	4 (2.3%)

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*Other pathogens include: Acinetobacter johnsonii (N=1) and Streptococcus agalactiae (N=3)

Antimicrobial susceptibility results are displayed in Table 3 for pathogens that occurred more than 10 times, ensuring meaning interpretation of the data, namely *Escherichia coli* and *Staphylococcus saprophyticus*. Additionally, the estimated global susceptibility profile for all isolated pathogens combined is provided to offer a comprehensive overview of antimicrobial resistance patterns.

Table 3. Susceptibility of *Escherichia coli* (N = 122), *Staphylococcus saprophyticus* (N = 14) and all pathogens combined (N = 173) to various antibiotics, SARPRIC-UTI, January – December 2024

	Susceptibility / Tested (%)		
Tested antibiotic	***E. coli***	***S. saprophyticus***	**All pathogens**
Amikacin	116/117 (99.1%)	ND	142/143 (99.3%)
Amoxicillin	50/90 (55.6%)	ND	63/120 (52.5%)
Amoxicillin clavulanic acid (iv)*	60/90 (66.7%)	ND	81/114 (71.1%)
Amoxicillin clavulanic acid (oral uUTI)*	90/119 (75.6%)	ND	115/149 (77.2%)
Ampicillin	69/121 (57.0%)	ND	83/151 (55.0%)
Cefepime	117/121 (96.7%)	ND	142/147 (96.6%)
Cefotaxime (non meningitis)*	102/108 (94.4%)	ND	122/130 (93.8%)
Ceftazidime	113/120 (94.2%)	ND	137/145 (94.5%)
Ceftriaxone (non meningitis)*	17/17 (100.0%)	ND	22/23 (95.7%)
Cefuroxime (iv)*	99/107 (92.5%)	ND	116/126 (92.1%)
Cefuroxime (oral)*	109/119 (91.6%)	ND	130/144 (90.3%)
Ertapenem	113/113 (100.0%)	ND	136/136 (100.0%)
Fosfomycin (iv)*	15/15 (100.0%)	ND	18/19 (94.7%)
Fosfomycin (oral uUTI)*	116/118 (98.3%)	ND	130/139 (93.5%)
Gentamicin	105/114 (92.1%)	ND	136/146 (93.2%)
Imipenem	ND	ND	11/11 (100.0%)
Meropenem (non meningitis)*	122/122 (100.0%)	ND	148/149 (99.3%)
Nitrofurantoin	120/121 (99.2%)	12/12 (100.0%)	153/164 (93.3%)
Piperacillin tazobactam	114/122 (93.4%)	ND	142/150 (94.7%)
Temocillin	118/120 (98.3%)	ND	136/138 (98.6%)
Trimethoprim sulfamethoxazole	103/121 (85.1%)	12/12 (100.0%)	140/161 (87.0%)

SARPRIC-UTI : Surveillance of Antimicrobial Resistance in PRImary Care, with a focus on uncomplicated Urinary Tract Infections * Information between brackets refer to the specific breakpoints according to EUCAST for interpreting susceptibility for different antibiotic applications as used by the participating laboratories. Iv = intravenous, uUTI= uncomplicated urinary tract infection, ND = not determined, less than 10 isolates were tested.

To explore whether menopausal status influences the susceptibility of *E. coli* to commonly used antibiotics, we stratified the data into non-menopausal and menopausal groups. Table 4 presents the susceptibility of *E. coli* to various antibiotics in these two populations.

Table 4. Susceptibility of *Escherichia coli* in non-menopausal women (N = 44) and menopausal women (N = 74) for tested antibiotics, SARPRIC-UTI, January – December 2024

	Susceptibility / Tested (N, %)		
Tested antibiotic	**Non-menopausal**	**Menopausal**	**p-value**
Amikacin	41/42 (97.6%)	71/71 (100.0%)	0.790
Amoxicillin	21/34 (61.8%)	27/54 (50.0%)	0.390
Amoxicillin clavulanic acid (iv)*	26/36 (72.2%)	31/51 (60.8%)	0.381
Amoxicillin clavulanic acid (oral uUTI)*	34/43 (79.1%)	53/73 (72.6%)	0.579
Ampicillin	28/44 (63.6%)	37/73 (50.7%)	0.241
Cefepime	44/44 (100.0%)	69/73 (94.5%)	0.292
Cefotaxime (non meningitis)*	39/39 (100.0%)	61/67 (91.0%)	0.137
Ceftazidime	43/44 (97.7%)	66/72 (91.7%)	0.353
Cefuroxime (iv)*	39/41 (95.1%)	57/63 (90.5%)	0.622
Cefuroxime (oral)*	41/43 (95.3%)	65/73 (89.0%)	0.408
Ertapenem	41/41 (100.0%)	69/69 (100.0%)	NA
Fosfomycin (oral uUTI)*	39/41 (95.1%)	74/74 (100.0%)	0.241
Gentamicin	40/40 (100.0%)	61/70 (87.1%)	0.045
Meropenem (non meningitis)*	44/44 (100.0%)	74/74 (100.0%)	NA
Nitrofurantoin	44/44 (100.0%)	72/73 (98.6%)	1.000
Piperacillin tazobactam	43/44 (97.7%)	67/74 (90.5%)	0.261
Temocillin	43/44 (97.7%)	71/72 (98.6%)	1.000
Trimethoprim sulfamethoxazole	37/43 (86.0%)	63/74 (85.1%)	1.000

SARPRIC-UTI : Surveillance of Antimicrobial Resistance in PRImary Care, with a focus on uncomplicated Urinary Tract Infections
* Information between brackets refer to the specific breakpoints according to EUCAST for interpreting susceptibility for different antibiotic applications as used by the participating laboratories SARPRIC-UTI : Surveillance of Antimicrobial Resistance in PRImary Care, with a focus on uncomplicated Urinary Tract Infections, IV: intravenously, uUTI: uncomplicated urinary tract infections, NA: non applicable

3. Prescribed therapies

Out of the 247 included women suffering from uncomplicated urinary tract infection (UTI), 236 (95.5%) received a treatment. Among them, 217 (87.9%) were treated with antibiotics, while 67 (27.1%) received a non-antimicrobial treatment, either as an alternative or as a complement to antibiotics.
The most commonly prescribed antibiotic was nitrofurantoin, used in 141 cases (65.0%), followed by fosfomycin (54 cases, 24.9%). Other antibiotics were prescribed less frequently, including cotrimoxazole (7 cases, 3.2%), trimethoprim (5 cases, 2.3%), ciprofloxacin (3 cases, 1.4%), amoxicillin and

amoxicillin/clavulanic acid (2 cases each, 0.9%), as well as levofloxacin and norfloxacin (2 and 1 cases respectively).
Regarding non-antimicrobial treatments, cranberry-based nutritional supplements were the most frequently reported (32 cases, 13.0%), followed by non- NSAID (13 cases, 5.3%), NSAID painkillers (5 cases, 2.0%), and bearberry extracts (uva-ursi) (3 cases, 1.2%). Other types of non-antimicrobial interventions were reported in 32 cases (13.0%).

Table 5 compares prescribed antibiotics between non-menopausal and menopausal women with uncomplicated UTIs . Nitrofurantoin and fosfomycin were the most commonly prescribed antibiotics in both groups. Other antibiotics, such as cotrimoxazole, trimethoprim, and ciprofloxacin, were rarely prescribed and therefore not compared between the two groups. A small proportion of participants (13.2% of non-menopausal and 10.0% of menopausal women) did not receive antibiotics. When comparing menopausal and non-menopausal women, no significant differences were found in the prescription patterns of the most commonly used antibiotics. Nitrofurantoin (58.5% vs. 56.2%; $p = 0.819$) and Fosfomycin (22.6% vs. 22.3%; $p = 1.000$) were prescribed at nearly identical rates in both groups. Similarly, the proportion of women who did not receive any antibiotic treatment did not differ significantly between the groups (13.2% vs. 10.0%; $p = 0.572$).

Table 5. Antimicrobials prescribed to non-menopausal (N = 106) and menopausal (N = 130) women with uncomplicated urinary tract infection, SARPRIC-UTI, January – December 2024

Prescribed antibiotics	Non-menopausal	Menopausal	P-value
Nitrofurantoin	62 (58.5%)	73 (56.2%)	0.819
Fosfomycin	24 (22.6%)	29 (22.3%)	1.000
No antibiotic prescribed	14 (13.2%)	13 (10.0%)	0.572

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Table 6 compares prescribed antibiotics between patients with uncomplicated UTIs in Flanders and Wallonia. We observed significant regional differences in the prescription of specific antibiotics. Nitrofurantoin was prescribed more frequently in Flanders compared to Wallonia (62.4% vs 31.0%; $p < 0.001$). Conversely, fosfomycin was prescribed less often in Flanders (42.9%) than in Wallonia (17.6% vs 42.9%; $p < 0.001$). The proportion of women who did not receive any antibiotic treatment did not differ significantly between regions (11.7% vs. 14.3%; $p = 0.836$).

Table 6. Antimicrobials prescribed to women with uncomplicated urinary tract infection in Flanders (N = 205) and Wallonia (N = 42), SARPRIC-UTI, January – December 2024

Prescribed antibiotics	Flanders	Wallonia	P-value
Nitrofurantoin	128 (62.4%)	13 (31.0%)	< 0.001
Fosfomycin	36 (17.6%)	18 (42.9%)	< 0.001
No antibiotic prescribed	24 (11.7%)	6 (14.3%)	0.836

SARPRIC-UTI : Surveillance of Antimicrobial Resistance in PRImary Care, with a focus on uncomplicated Urinary Tract Infections. Statistical comparisons performed using chi-squared tests.

Table 7 compares the demographic and clinical characteristics of women who received antibiotics (AB-treated) versus those who did not receive antibiotics (non-AB-treated) in the SARPRIC-UTI study. We conducted a multivariable logistic regression analysis to identify factors associated with whether patients received antibiotic treatment. No significant associations were found for age, menopausal status, or

region. However, several urinary tract-related symptoms were significantly associated with a higher likelihood of receiving antibiotics. Specifically, patients reporting a burning sensation during urination (OR: 3.59; 95% CI: 1.26–10.3; p = 0.016), frequent urination (OR: 3.93; 95% CI: 1.42–11.1; p = 0.008), and lower abdominal pain (OR: 3.41; 95% CI: 1.30–9.54; p = 0.015) were significantly more likely to be treated with antibiotics. Additionally, a shorter duration of symptoms was associated with antibiotic treatment (OR: 0.88 per day; 95% CI: 0.80–0.96; p = 0.003). Other symptoms, such as cloudy urine, blood in urine, urinating small amounts, and other reported symptoms, did not show statistically significant associations.

Table 7. Comparison of characteristics between antibiotic-treated (N=218) and non-antibiotic-treated (N=29) women with uncomplicated UT, SARPRIC-UTI, January-December 2024

Characteristics	AB-treated N (%)	Non AB- treated N (%)	Odds ratio (95% CI)	p-value
Mean age (years)	**52.5**	**50.3**	**1.00 (0.96 – 1.05)**	**0.976**
Menopausal	118 (54.1%)	12 (41.4%)	1.59 (0.47-4.88)	0.583
Region				
Flanders	182 (83.5%)	23 (79.3%)	1.59 (0.47-4.88)	0.431
Wallonia	36 (16.5%)	6 (20.3%)	0.63 (0.20–2.10)	0.431
Symptoms				
Burning sensation during urination	181 (83.0%)	20 (69.0%)	3.59 (1.26 -10.3)	0.016
Need to urinate frequently	176 (80.7%)	17 (58.6%)	3.93 (1.42-11.1)	0.008
Lower abdominal pain	137 (62.8%)	13 (44.8%)	3.41 (1.30-9.54)	0.015
Urinating small amounts	131 (60.7%)	11 (37.9%)	2.17 (0.83-6.03)	0.123
Cloudy urine	76 (34.9%)	9 (31.0%)	1.10 (0.40-3.26)	0.852
Blood in urine	49 (22.5%)	4 (13.8%)	1.80 (0.52-8.61)	0.400
Other	13 (6.0%)	1 (3.5%)	2.25 (0.33-46.1)	0.480
Duration of Symptoms (days)	4.0	6.4	0.88 (0.80-0.96)	0.003

SARPRIC-UTI : Surveillance of Antimicrobial Resistance in PRImary Care, with a focus on uncomplicated Urinary Tract Infections
Odds ratios (OR) with 95% confidence intervals from multivariable logistic regression.
AB: antibiotic, CI: confidence interval

DISCUSSION

This study represents the first nationwide prospective active surveillance of uncomplicated urinary tract infections (UTIs) in Belgium, offering critical insights into uropathogen distribution, antimicrobial susceptibility patterns, and prescribing practices in primary care**.** Unlike the passive EARS-BE surveillance system, which primarily collects data from hospitals and to a lower-extent private laboratories, this study actively collected clinical and microbiological data from general practice, thus capturing a more accurate picture of community acquired infections.

Uropathogen distribution and antimicrobial susceptibility

Escherichia coli was the most frequently isolated uropathogen (69.9%), followed by *Staphylococcus saprophyticus* (8.0%). Both pathogens showed high susceptibility to nitrofurantoin *(*99.1% for *E. coli* and 100% for *S. saprophyticus*), confirming the continued relevance of this first-line treatment in Belgium. Fosfomycin also demonstrated high efficacy against *E.coli* (100% susceptibility), though the tested number of *S. saprophyticus* isolates was insufficient to report a reliable susceptibility rate.
Trimethoprim, recommended particularly for older patients, showed an 85.1% susceptibility rate for *E. coli* and 100% for *S. saprophyticus*, reinforcing its suitability as an empiric treatment option for UTIs (13).

Patient characteristics and clinical implication

The mean age of participants was 52 years, with slightly more than 50% showing peri- or post-menopausal signs. Age and hormonal changes are known risk factor for developing uncomplicated UTIs, which may explain the higher percentage of postmenopausal patients (14).
However, antimicrobial susceptibility patterns sis not differ significantly between non-menopausal and menopausal women for the susceptibility of *E. coli*. The susceptibility to nitrofurantoin is 100% in non-menopausal women. Nitrofurantoin showed 100% susceptibility in non-menopausal and 98.5% in menopausal women, while Fosfomycin susceptibility was slightly higher in the latter (100% vs. 95.1%). Trimethoprim exhibits similar susceptibility rates in both groups, at 86.0% for non-menopausal and 85.1% in menopausal women, suggesting a consistent effectiveness of this antibiotic across these populations.
Symptom perception may also differ between pre- and postmenopausal women, potentially influencing treatment-seeking behaviour and prescribing choices. Nonetheless, our findings indicate that empirical therapy can remain consistent across age groups (9,14).

Prescribing practices

Nitrofurantoin was the most commonly prescribed antibiotic, followed by fosfomycin consistent with Belgian guidelines (13). While pivmecillinam is considered a well-established treatment option in Scandinavia and the United Kingdom (15,16) (17), it has been registered on the Belgian market in November 2020 but has not yet been included in the BAPCOC guidelines.
Interestingly, 13.9% of women suffering from uncomplicated UTI symptoms were treated with non-antibiotic (AB) therapies, such as a cranberry-based nutritional supplements. While some studies suggest that cranberry may have a role in preventing recurrent UTIs by preventing bacterial adhesion to urinary tract, recent research suggests that non-AB treatments may reduce the likelihood of full recovery (18–20).
Variations in prescribing practices (e.g., higher fluoroquinolone use in some regions) may explain differences in resistance rates across countries. International comparisons suggest that agreement on first choice antibiotics across countries could help reduce resistance on a broader scale. Thus, harmonisation of empirical guidelines across Europe may be a future strategic goal (16,21–23).

Implementation challenges and limitations

Despite low additional workload, the study faced logistical challenges in recruiting laboratories and general practitioners (GPs). GPs were not reimbursed for their participation, which may have influenced their willingness to contribute. To lower the barrier for participation, laboratories were allowed to follow their own validated guidelines, and no standardized technical protocol was imposed on each participating lab, but not all performed susceptibility testing for all relevant antibiotics (E.g. pivmecillinam), limiting comparability.

As of December 13, 2024, only 247 urine samples were collected—far below the 2000 target, resulting in underrepresentation of less frequently isolated pathogens like *Klebsiella pneumoniae* and *Proteus mirabilis*. Furthermore, regional participation was also skewed with Flemish laboratories (n=8) and GPs (n=36) overrepresented compared to Walloon labs (n=4) and GPs (n=12), while no participants were recruited in Brussels. These limitations affect the national representativeness of the findings.

Implications and future perspectives

In Belgium, collecting a urine sample during GP consultations for uncomplicated UTIs is not routine practice, meaning these infections are typically excluded from passive surveillance systems like EARS-BE. This underscores the value of active surveillance in providing clinically relevant, real-world data to guide empirical treatment and inform public health policies.

Going forward, routine active surveillance or the establishment of a sentinel network of GPs could offer a sustainable approach. By systematically collecting and analyzing clinical and microbiological data from suspected infections in the community (including respiratory infections), such a system would allow early detection of resistance trends, ensure timely updates of treatment guidelines, and reinforce national antimicrobial stewardship efforts.

Conclusion

Despite its limitations, this study confirms the effectiveness of current empirical treatments—particularly nitrofurantoin and fosfomycin—for uncomplicated UTIs. There is no significant difference in resistance patterns between menopausal and non-menopausal women, supporting uniform empirical treatment across age groups. To maintain accurate, evidence-based guidelines and respond swiftly to evolving resistance, continued investment in community-level surveillance is essential. Comparing these active surveillance results to national passive surveillance (EARS-BE) will also help ensure alignment between primary care and hospital settings in the fight against antimicrobial resistance.

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ANNEXES

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1. Survey General Practitioner Dutch version

SARPRIC-UTI

SURVEILLANCE VAN ANTIMICROBIËLE RESISTENTIE IN DE EERSTE LIJN MET EEN FOCUS OP ONGECOMPLICEERDE URINEWEGINFECTIES

- 2023 -

VRAGENLIJST PATIËNT

Datum: ……./……./……23

Gegevens van de patiënt			
Inclusiecriteria:	o Vrouwelijke patiënt o > 18 jaar o Dysurie, aandrang en/of pollakisurie o Geen symptomen van een gecompliceerde UWI (>38°C, voorgeschiedenis...)	Leeftijd:	⌊_⌊_⌋ jaar
Is de patiënte reeds in de menopauze?	o Ja	o Neen	o Onbekend
Ongecompliceerde urineweginfectie			
Symptomen:	o Branderig gevoel bij het plassen o Troebele urine o Onderbuikspijn o Frequent moeten plassen	o Plassen van kleine hoeveelheden o Bloed in de urine o Andere _____ _____ _____	
Hoelang zijn deze symptomen reeds aanwezig?	⌊_⌊_⌋ dagen		
Werd AB voorgeschreven?	o Ja	o Nee	
Welke AB werd voorgeschreven?	o Amoxicilline o Amoxicilline/clavulaanzuur o Cefuroxim o Ciprofloxacine o Cotrimoxazol (trimethoprim/sulfamethoxazole)	o Fosfomycine o Levofloxacine o Nitrofurantoïne o Norfloxacine o Pivmecillinam o Trimethoprim o Geen	
Voorgeschreven dosis:	_____mg/g _____/dg	Duur behandeling:	⌊_⌊_⌋ dagen/weken
Welk niet-antimicrobiële behandeling werd voorgeschreven?	o Geen behandeling o Voedingssupplement gebaseerd op cranberry o Berendruif (arctostaphylos, uva-ursi)	o Niet NSAID pijnstiller o NSAIDS o Andere _____ _____	
Had u los van deze studie ook een urinestaal afgenomen?	o Ja	o Nee	

2. Survey General Practitioner French version

SARPRIC-UTI

SURVEILLANCE DE LA RÉSISTANCE AUX ANTIMICROBIENS DANS LES SOINS PRIMAIRES, EN PARTICULIER POUR LES INFECTIONS URINAIRES NON COMPLIQUÉES

- 2023 -

QUESTIONNAIRE MÉDECIN GÉNÉRALISTE

Date: ……./……./……23

Données du patient			
Critères d'inclusion:	o Patiente féminine o > 18 ans o Dysurie, besoins impérieux et/ou pollakiurie o Pas de symptôme d'infection urinaire compliquée (>38°C, antécédents...)	Âge:	⌊_⌊_⌋ ans
La patiente est-elle ménopausée?	o Oui	o Non	o Inconnu
Infection urinaire non compliquée			
Symptômes:	o Sensation de brûlure lors de la miction o Urine trouble o Douleur abdominale basse o Pollakiurie (besoins fréquents)	o Uriner en petites quantités o Sang dans les urines o Autres _____ _____ _____	
Depuis combien de temps ces symptômes sont-ils présents ?	⌊_⌊_⌋ jours		
Un AB a-t-il été prescrit ?	o Oui	o Non	
Quel AB a été prescrit?	o Amoxicilline o Amoxicilline/acide clavulanique o Cefuroxim o Ciprofloxacine o Cotrimoxazol (trimethoprim/sulfamethoxazole)	o Fosfomycine o Levofloxacine o Nitrofurantoïne o Norfloxacine o Pivmecillinam o Trimethoprim o Aucun	
Dose prescrite:	_____mg/g _____/jour	Durée du traitement:	⌊_⌊_⌋ jours/semaines
Quel traitement non antimicrobien a été prescrit ?	o Aucun o Complément alimentaire à base de canneberge o Busserole (*Arctostaphylos, uva-ursi)*	o Analgésique non AINS o AINS o Autres _____ _____ _____	
Auriez-vous également prélevé un échantillon d'urine en dehors de cette étude ?	o Oui	o Non	

3. Survey laboratories Dutch version

SARPRIC-UTI

SURVEILLANCE VAN ANTIMICROBIËLE RESISTENTIE IN DE EERSTE LIJN MET EEN FOCUS OP ONGECOMPLICEERDE URINEWEGINFECTIES

- 2023 -

VRAGENLIJST LABO

Datum: ……./……./……23

Gegevens van de patiënt			
Inclusiecriteria	o Vrouwelijke patiënt o > 18 jaar o Dysurie, aandrang en/of pollakisurie o Geen symptomen van een gecompliceerde UWI (>38°C, voorgeschiedenis...)	Leeftijd:	⌊_⌊_⌋ jaar
Is de patiënte reeds in de menopauze?	o Ja	o Neen	o Onbekend

Ongecompliceerde urineweginfectie		
Symptomen:	o Branderig gevoel bij het plassen o Troebele urine o Onderbuikspijn o Frequent moeten plassen	o Plassen van kleine hoeveelheden o Bloed in de urine o Andere _____ _____
Hoelang zijn deze symptomen reeds aanwezig?	⌊_⌊_⌋ dagen	
Werd AB voorgeschreven?	o Ja	o Nee
Welke AB werd voorgeschreven?	o Amoxicilline o Amoxicilline/clavulaanzuur o Cefuroxim o Ciprofloxacine o Cotrimoxazol (trimethoprim/sulfamethoxazole)	o Fosfomycine o Levofloxacine o Nitrofurantoïne o Norfloxacine o Pivmecillinam o Trimethoprim o Geen
Voorgeschreven dosis:	_____mg/g _____/dg	Duur behandeling: ⌊_⌊_⌋ dagen/weken
Welk niet-antimicrobiële behandeling werd voorgeschreven?	o Geen behandeling o Voedingssupplement gebaseerd op cranberry o Berendruif (arctostaphylos, uva-ursi)	o Niet NSAID pijnstiller o NSAIDS o Andere _____ _____ _____
Had u los van deze studie ook een urinestaal afgenomen?	o Ja	o Neen

Bacteriologische cultuur			
Zijn er pathogenen aanwezig in het urinestaal?			
o Negatief	o 1 pathogeen	o 2 pathogenen	o > 2 pathogenen (gecontamineerd)
Duid aan welk pathogenen (max 2) werden gedetecteerd:			

1e pathogeen:	o *Negatief* o *Escherichia coli* o *Staphylococcus saprophyticus* o *Enterobacterales spp.,* o *Enterococcus spp.* o *Klebsiella spp.* o *Proteus mirabilis* o *Pseudomonas aeruginosa*	o *Citrobacter spp.* o *Morganella morganii* o *Proteus vulgaris* o *Serratia spp.* o *Staphylococcus aureus* o *Andere* _____ _____
Concentratie pathogeen 1	10 └┴┘ CFU/mL	Code pathogeen 1 └┴┴┴┴┴┘
2e pathogeen	o *Negatief* o *Escherichia coli* o *Staphylococcus saprophyticus* o *Enterobacterales spp.,* o *Enterococcus spp.* o *Klebsiella spp.* o *Proteus mirabilis* o *Pseudomonas aeruginosa*	o *Citrobacter spp.* o *Morganella morganii* o *Proteus vulgaris* o *Serratia spp.* o *Staphylococcus aureus* o *Andere* _____ _____
Concentratie pathogeen 2	10 └┴┘ CFU/mL	Code pathogeen 2 └┴┴┴┴┴┘

AST (voor elke gedetecteerde pathogeen)

o Welke EUCAST richtlijnen werden gebruikt?	o EUCAST guidelines V9	o EUCAST guidelines v13.0

o Amikacin	o S	o I	o R	o Niet getest
o Amoxicillin	o S	o I	o R	o Niet getest
o Amoxicillin-clavulanic acid : systemic infection breakpoint	o S	o I	o R	o Niet getest
o Amoxicillin-clavulanic acid: uncomplicated urinary tract infection breakpoint	o S	o I	o R	o Niet getest
o Ampicillin	o S	o I	o R	o Niet getest
o Cefepime	o S	o I	o R	o Niet getest
o Cefotaxime: non-meningitis breakpoint	o S	o I	o R	o Niet getest
o Ceftazidime	o S	o I	o R	o Niet getest
o Ceftriaxone : non-meningitis breakpoint	o S	o I	o R	o Niet getest
o Cefuroxime : uncomplicated urinary tract infection breakpoint	o S	o I	o R	o Niet getest
o Cefuroxime : systemic infection breakpoint	o S	o I	o R	o Niet getest
o Colistin	o S	o I	o R	o Niet getest
o Ertapenem	o S	o I	o R	o Niet getest
o Fosfomycin : uncomplicated urinary tract infection breakpoint	o S	o I	o R	o Niet getest
o Fosfomycin : systemic infection	o S	o I	o R	o Niet getest
o Gentamicin	o S	o I	o R	o Niet getest
o Imipenem	o S	o I	o R	o Niet getest
o Meropenem : non-meningitis breakpoint	o S	o I	o R	o Niet getest
o Nitrofurantoin	o S	o I	o R	o Niet getest
o Piperacillin–tazobactam	o S	o I	o R	o Niet getest
o Pivmecillinam	o S	o I	o R	o Niet getest
o Temocillin	o S	o I	o R	o Niet getest
o Trimethoprim	o S	o I	o R	o Niet getest
o Trimethoprim–sulfamethoxazole	o S	o I	o R	o Niet getest

ESBL	o Pos	o Neg	o Niet getest
CPE	o Pos	o Neg	o Niet getest

4. Survey laboratories French version

SARPRIC-UTI

SURVEILLANCE DE LA RÉSISTANCE AUX ANTIMICROBIENS DANS LES SOINS PRIMAIRES, EN PARTICULIER POUR LES INFECTIONS URINAIRES NON COMPLIQUÉES

- 2023 -

QUESTIONNAIRE POUR LES LABORATOIRES

Date: ……./……./……23

Données du patient			
Critères d'inclusion:	o Patiente féminine o > 18 ans o Dysurie, besoins impérieux et/ou pollakiurie o Pas de symptôme d'infection urinaire compliquée (>38°C, antécédents...)	Âge:	⌊_⌊_⌋ ans
La patiente est-elle ménopausée?	o Oui	o Non	o Inconnu
Infection urinaire non compliquée			
Symptômes:	o Sensation de brûlure lors de la miction o Urine trouble o Douleur abdominale basse o Pollakiurie (besoins fréquents)	o Uriner en petites quantités o Sang dans les urines o Autres _____ _____ _____	
Depuis combien de temps ces symptômes sont-ils présents ?	⌊_⌊_⌋ jours		
Un AB a-t-il été prescrit ?	o Oui	o Non	
Quel AB a été prescrit?	o Amoxicilline o Amoxicilline/clavulaanzuur o Cefuroxim o Ciprofloxacine o Cotrimoxazol (trimethoprim/sulfamethoxazole)	o Fosfomycine o Levofloxacine o Nitrofurantoïne o Norfloxacine o Pivmecillinam o Trimethoprim o Aucun	
Dose prescrite:	_____mg/g _____/jour	Durée du traitement:	⌊_⌊_⌋ jours/semaines
Quel traitement non antimicrobien a été prescrit ?	o Aucun o Complément alimentaire à base de canneberge o Busserole (*Arctostaphylos, uva-ursi*)	o Analgésique non AINS o AINS o Autres _____ _____ _____	
Auriez-vous également prélevé un échantillon d'urine en dehors de cette étude ?	o Oui	o Non	
Culture bactériologique			

Des agents pathogènes sont-ils présents dans l'échantillon d'urine ?			
o Négatif	o 1 pathogène	o 2 pathogènes	o > 2 pathogènes (contaminé)

Indiquer quels agents pathogènes (2 au maximum) ont été détectés :		
Pathogène 1	o *Négatif* o *Escherichia coli* o *Staphylococcus saprophyticus* o *Enterobacterales spp.,* o *Enterococcus spp.* o *Klebsiella spp.* o *Proteus mirabilis* o *Pseudomonas aeruginosa*	o *Citrobacter spp.* o *Morganella morganii* o *Proteus vulgaris* o *Serratia spp.* o *Staphylococcus aureus* o *Autre:* _____

Concentration du pathogène 1	10 └┴┘ CFU/mL	Code pathogène 1 pour la conservation	└┴┴┴┴┴┘

Pathogène 2	o *Négatif* o *Escherichia coli* o *Staphylococcus saprophyticus* o *Enterobacterales spp.,* o *Enterococcus spp.* o *Klebsiella spp.* o *Proteus mirabilis* o *Pseudomonas aeruginosa*	o *Citrobacter spp.* o *Morganella morganii* o *Proteus vulgaris* o *Serratia spp.* o *Staphylococcus aureus* o *Autre:* _____

Concentration du pathogène 2	10 └┴┘ CFU/mL	Code pathogène 2 pour la conservation	└┴┴┴┴┴┘

AST (pour chaque agent pathogène détecté)				
o Quelles sont les lignes directrices EUCAST utilisées ?	o EUCAST guidelines V9			o EUCAST guidelines v13.0
o Amikacin	o S	o I	o R	o Non testé
o Amoxicillin	o S	o I	o R	o Non testé
o Amoxicillin-clavulanic acid : systemic infection breakpoint	o S	o I	o R	o Non testé
o Amoxicillin-clavulanic acid: uncomplicated urinary tract infection breakpoint	o S	o I	o R	o Non testé
o Ampicillin	o S	o I	o R	o Non testé
o Cefepime	o S	o I	o R	o Non testé
o Cefotaxime: non-meningitis breakpoint	o S	o I	o R	o Non testé
o Ceftazidime	o S	o I	o R	o Non testé
o Ceftriaxone : non-meningitis breakpoint	o S	o I	o R	o Non testé
o Cefuroxime : uncomplicated urinary tract infection breakpoint	o S	o I	o R	o Non testé
o Cefuroxime : systemic infection breakpoint	o S	o I	o R	o Non testé
o Colistin	o S	o I	o R	o Non testé
o Ertapenem	o S	o I	o R	o Non testé
o Fosfomycin : uncomplicated urinary tract infection breakpoint	o S	o I	o R	o Non testé
o Fosfomycin : systemic infection	o S	o I	o R	o Non testé
o Gentamicin	o S	o I	o R	o Non testé
o Imipenem	o S	o I	o R	o Non testé
	o S	o I	o R	o Non testé

o Meropenem : non-meningitis breakpoint	o S	o I	o R	o Non testé
o Nitrofurantoin	o S	o I	o R	o Non testé
o Piperacillin–tazobactam	o S	o I	o R	o Non testé
o Pivmecillinam	o S	o I	o R	o Non testé
o Temocillin	o S	o I	o R	o Non testé
o Trimethoprim	o S	o I	o R	o Non testé
o Trimethoprim–sulfamethoxazole				
ESBL	o Positif	o Négatif		o Non testé
CPE	o Positif	o Négatif		o Non testé

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