

Age and sex mainly predict antimicrobial resistance in *E. coli* from urinary tract specimens: Analysis of 7'361 urine samples

EP 0074



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Background and Purpose

Antimicrobial resistance of urinary tract pathogens is an increasing problem and complicates antibiotic treatment of urinary tract infections.

Purpose of the study: to determine patient's demographic and baseline characteristics affecting antibiotic resistance of *Escherichia coli* urine isolates at a tertiary care hospital in Switzerland to guide appropriate empirical treatment of urinary tract infections.

Methods

All consecutive urine samples with significant growth ($\geq 10^3$ cfu/ml) of *E. coli* obtained from 1/2012-5/2015 were analyzed for antimicrobial susceptibility determined according to standard laboratory procedures.

Results were stratified for age, sex, location of urine sampling (in-/outpatient) and type of urine (catheter, midstream).

Non-susceptible (in the following named „resistant“) was defined as being resistant or intermediate according to EUCAST breakpoints.

Results (1)

- Antimicrobial susceptibility testing of *E. coli* urine isolates was available for 6'045 of total 7'361 specimens.
- 21.8% of the urine specimens were obtained from male patients, 59.9% from patients >65 years and 78.6% from outpatients. Clean-catch midstream urines accounted for 59.1%, single-use catheters for 13.8%, indwelling catheters for 11.7%, and urines of unknown origin for 15.4%.
- Amoxicillin (45.1%), followed by Cotrimoxazole (25.8%) and Ciprofloxacin (20.3%), had the highest resistance rate (Table). 6.3% of the *E. coli* were ESBL producers.

Table: Antibiotic resistance of 6'045 *E. coli* urin samples

	Amoxicillin	Amoxicillin/ Clavulanic acid	Piperacillin/ Tazobactam	Ceftriaxone	Cefepime	Meropenem	Ciprofloxacin	Cotrimoxazole	Nitrofurantoin	Amikacin	Fosfomycin
All samples	45.1%	16.6%	4.4%	6.7%	5.2%	0.0%	20.3%	25.8%	1.8%	2.3%	0.9%
Age	1	1	1	1	1	2	1	1	2	2	2
0-20y	44.6%	18.7%	1.5%	4.3%	4.3%	0.0%	6.5%	22.3%	1.4%	na	na
21-40y	44.3%	14.2%	3.1%	4.7%	4.2%	0.0%	12.0%	25.9%	1.4%	2.0%	0.9%
41-60y	47.3%	18.9%	4.9%	8.0%	6.0%	0.0%	19.4%	29.2%	1.2%	2.8%	0.8%
61-80y	48.1%	18.8%	5.6%	8.5%	6.9%	0.0%	24.5%	27.9%	2.4%	2.5%	1.0%
>80y	40.5%	13.6%	3.4%	4.8%	3.2%	0.0%	21.3%	21.3%	1.8%	2.0%	1.0%
Location	2	2	2	2	2	2	2	2	2	2	2
Outpatients	45.0%	16.3%	4.2%	6.4%	5.0%	0.0%	20.2%	25.8%	1.9%	2.3%	0.9%
Inpatients	45.7%	17.8%	5.0%	7.7%	6.0%	0.0%	20.4%	25.8%	1.6%	2.1%	0.8%
Type	1	1	2	2	2	2	1	2	2	1	2
Indwelling catheter	50.1%	19.2%	5.3%	7.9%	5.9%	0.0%	25.9%	29.0%	1.7%	2.3%	1.0%
Single use catheter	44.6%	15.9%	3.4%	5.6%	4.8%	0.0%	24.6%	26.6%	2.8%	1.7%	0.5%
Midstream urine	44.2%	15.6%	4.6%	6.5%	5.0%	0.0%	17.6%	24.8%	1.6%	2.0%	0.9%
Unknown origin	45.5%	19.3%	3.5%	7.4%	5.6%	0.0%	22.1%	26.4%	2.0%	4.0%	1.3%

¹ p < 0.05; ² p ≥ 0.05 (not significant; Chi-square test); na, not applicable

Results (2)

Figure 1: *E. coli* resistance stratified for gender

Male patients showed significant up to 2-fold higher resistance rates for all antibiotics except Fosfomycin (figure). For Ciprofloxacin, *E. coli* isolates were resistant in 34.1% of urine samples deriving from males and in 16.5% from females (p<0.001)

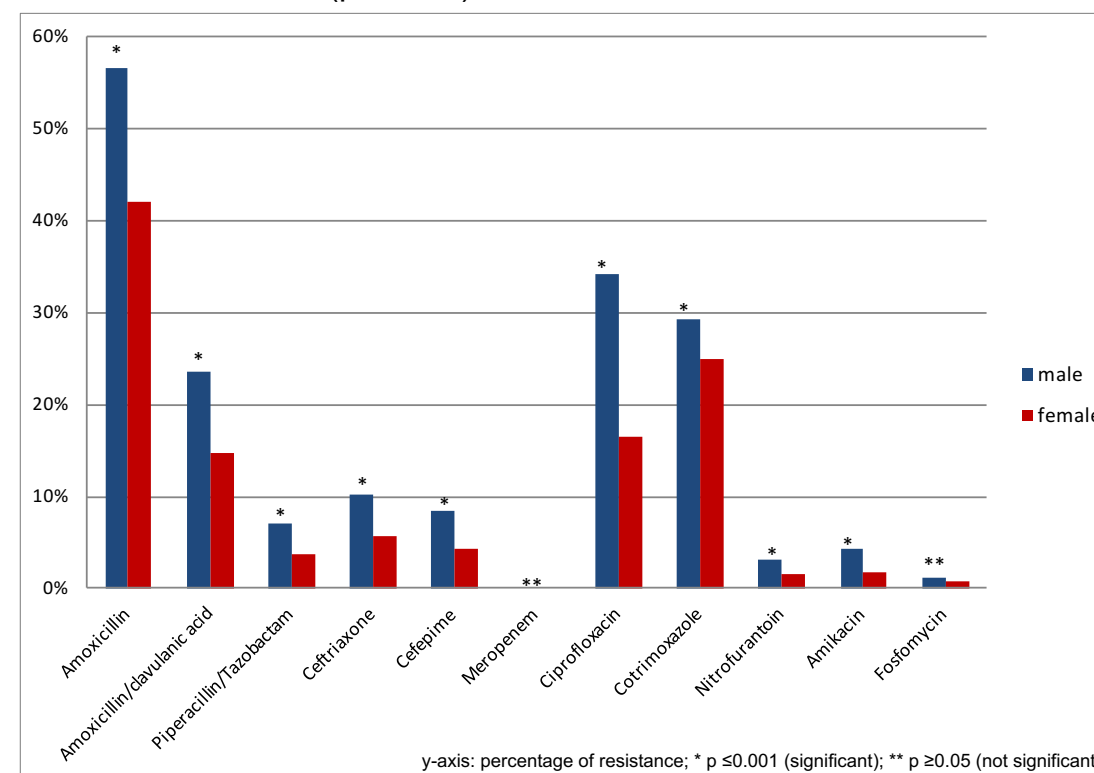
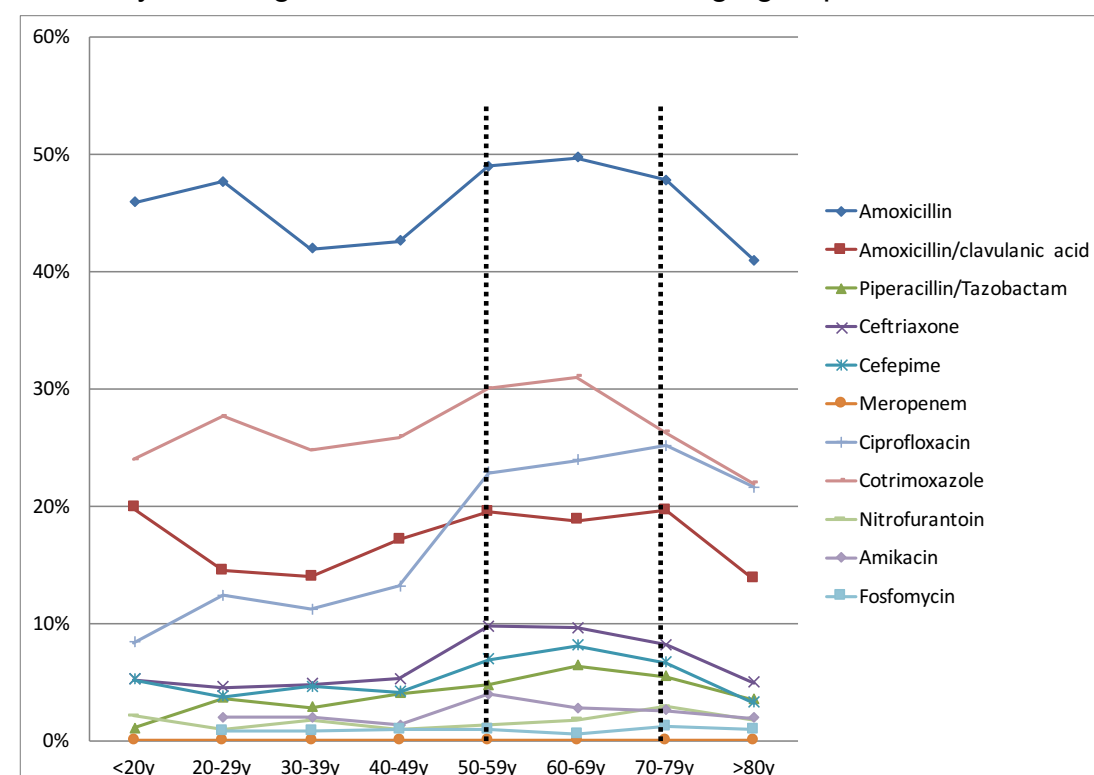


Figure 2: *E. coli* resistance stratified for age

Antimicrobial resistance to beta-lactam antibiotics, Cotrimoxazole and Ciprofloxacin peaks between the age of 50 and 80 years, and decreases again in patients >80 years. For Meropenem, Amikacin, Nitrofurantoin and Fosfomycin no significant difference between age groups was found.



E. coli resistance profile did not differ significantly between in- and outpatient urine samples (Figure 3).

E. coli isolates from indwelling catheters showed the highest resistance rates compared to single use catheter or midstream obtained urine specimens for all antibiotics (except Nitrofurantoin), however this association was significant only for Amoxicillin (+/- clavulanic acid), Ciprofloxacin and Amikacin (Figure 4).

Figure 3: *E. coli* resistance stratified for in-/out-patients

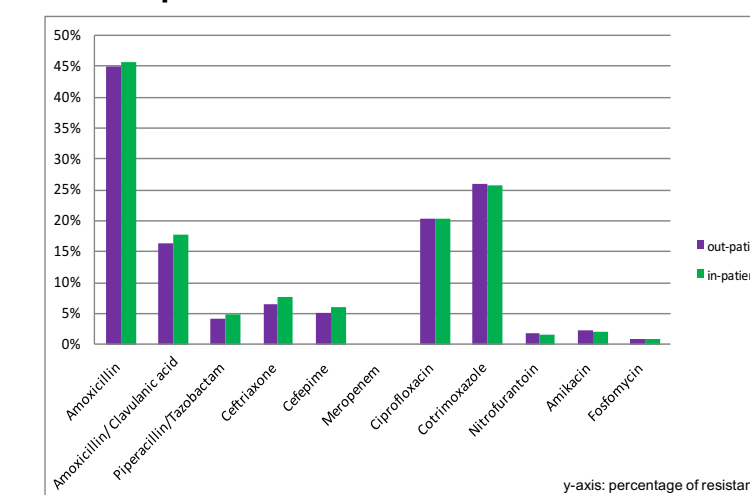
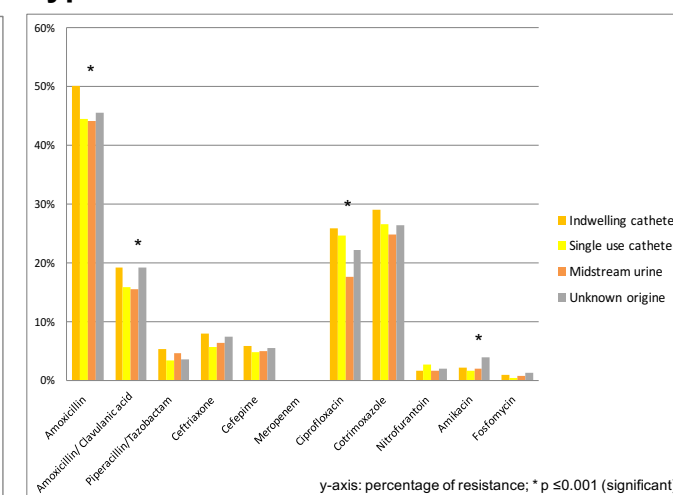


Figure 4: *E. coli* resistance stratified for type of urine



Discussion and Conclusions

- The antimicrobial susceptibility profile of *E. coli* from urinary tract samples is mainly determined by age and sex with the highest resistance rate detected in men and middle-aged patients.
- Simple demographic patient data such as age and sex can help guiding empirical antimicrobial treatment of urinary tract infections with *E. coli*.
- Urine specimens from long-term catheters or hospitalized patients seem to have inferior influence on antimicrobial resistance of *E. coli*.