Trends in Antimicrobial Resistance Among Outpatient Urine *E. coli* Isolates in US Females ≥12 Years of Age: A Multicenter Evaluation From 2011 to 2019

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Introduction

- Surveillance data from the US suggest increasing antimicrobial resistance (AMR) in *E. coli*, although recent data from the outpatient setting are limited
- We characterized AMR trends for *E. coli* isolated from females with outpatient urine cultures in the US from 2011 to 2019

Methods

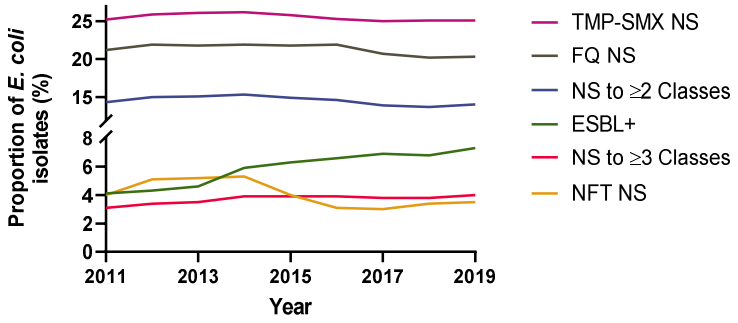
- A retrospective, multicenter, cohort study of antimicrobial susceptibility using data from the Becton, Dickinson and Company (BD) Insights Research Database in the US
- Outpatient (emergency department, physician's office, ambulatory clinic) *E. coli* urine culture isolates were collected from females ≥12 years of age from 2011–2019
- Urine isolates were restricted to 30-day non-duplicates or the first isolate of a genus/species per subject in 30 days
- *E. coli* isolates were identified as not-susceptible (NS) if: intermediate or resistant to trimethoprim-sulfamethoxazole (TMP-SMX), fluoroquinolone (FQ), or nitrofurantoin (NFT); extended-spectrum β-lactamase positive (ESBL+); and were categorized as multi-drug resistant if NS to ≥2 or ≥3 drug classes

Data analysis/statistics

- Resistance over time was evaluated descriptively via cross-tabulation tables and line charts
- Generalized estimating equations (GEE) were used to assess changing patterns of resistance over time while accounting for within-hospital correlation and temporal autocorrelation of data

Between 2011 and 2019, the prevalence of **antimicrobial resistance in *E. coli* was persistently high** in US females, with ≥25% of urine isolates being non-susceptible to trimethoprim-sulfamethoxazole and >20% being non-susceptible to fluoroquinolones

Figure 1. Trends in AMR in *E. coli* Outpatient Urine Isolates Among US Females from 2011–2019, Descriptive Data



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Results

- Overall, 1,513,882 non-duplicate *E. coli* isolates were tested at 106 to 295 US centers between 2011 and 2019
- Modeling confirmed a significant increasing trend for the ESBL+ (7.7%/year) and MDR (≥3 drugs) phenotypes (2.7%/year) (p<0.0001), with decreasing or no trend change for NFT NS and other AMR phenotypes (**Figure 1**,**Table 1**)
- Modeling also demonstrated significant variation for each resistance category across US census regions (p<0.0001; **Table 1**)

Table 1. Overall Model-Estimated AMR Trend Over Year (2011–2019) and Census Region Differences in *E. coli* Outpatient Urine Isolates Among US Females

	Phenotype Category (N=1,513,882)					
	TMP-SMX NS (n=384,304)	FQ NS (n=319,354)	NFT NS (n=56,954)	ESBL+ (n=96,306)	NS ≥2 drug classes (n=217,329)	NS ≥3 drug classes (n=57,637)
Overall model estimate, % (95% CI)	26.0 (25.9 to 26.1)	23.0 (22.9 to 23.2)	4.0 (4.0 to 4.1)	6.8 (6.7 to 6.8)	15.7 (15.5 to 15.8)	4.2 (4.1 to 4.3)
Trend over year (2011 to 2019): average yearly change in NS, % (95% CI)	0.0 (–0.2 to 0.1%; p=0.6737)	–0.6 (–0.8 to –0.4%; p<0.0001)	–6.1 (–6.5 to –5.6%; p<0.0001)	7.7 (7.2 to 8.2%; p<0.0001)	–0.8 (–1.1 to –0.6%; p<0.0001)	2.7 (2.2 to 3.2%; p<0.0001)
Variation by US Census Region (2011–2019), % (95% CI)						
East North Central	22.3 (21.8 to 22.7)	15.2 (14.8 to 15.7)	3.4 (3.2 to 3.6)	4.1 (3.9 to 4.4)	10.7 (10.3 to 11.1)	2.8 (2.6 to 3.0)
East South Central	29.4 (28.9 to 30.1)	22.8 (22.2 to 23.5)	4.5 (4.2 to 4.7)	6.5 (6.1 to 6.9)	16.7 (16.1 to 17.3)	4.4 (4.1 to 4.7)
Middle Atlantic	21.9 (21.4 to 22.3)	15.8 (15.3 to 16.3)	3.7 (3.5 to 4.0)	4.7 (4.4 to 5.0)	11.3 (10.9 to 11.8)	3.1 (2.8 to 3.3)
Mountain	21.6 (21.0 to 22.2)	14.8 (14.3 to 15.4)	3.8 (3.5 to 4.1)	3.9 (3.6 to 4.2)	10.3 (9.8 to 10.8)	2.2 (2.0 to 2.4)
New England	17.1 (16.3 to 17.9)	10.6 (10.0 to 11.2)	2.5 (2.2 to 2.9)	3.0 (2.7 to 3.4)	7.0 (6.5 to 7.5)	1.6 (1.4 to 1.9)
Pacific	25.3 (24.7 to 25.9)	16.5 (16.0 to 17.0)	3.6 (3.4 to 3.9)	7.5 (7.0 to 8.0)	12.9 (12.4 to 13.4)	3.7 (3.4 to 4.0)
South Atlantic	26.2 (25.6 to 26.8)	19.3 (18.7 to 19.9)	4.4 (4.2 to 4.7)	5.1 (4.8 to 5.5)	13.9 (13.4 to 14.4)	3.5 (3.2 to 3.8)
West North Central	21.3 (20.4 to 22.2)	11.7 (11.1 to 12.4)	3.1 (2.7 to 3.5)	3.5 (3.2 to 3.9)	8.5 (7.9 to 9.1)	1.6 (1.4 to 1.8)
West South Central	29.1 (28.5 to 29.7)	20.1 (19.5 to 20.7)	3.7 (3.5 to 3.9)	5.9 (5.4 to 6.1)	14.7 (14.2 to 15.3)	3.5 (3.3 to 3.8)

Models were adjusted by hospital characteristics (bed size, urban/rural status, and teaching status)
East North Central: IL, IN, MI, OH, WI; East South Central: AL, KY, MS, TN; Middle Atlantic: NJ, NY, PA; Mountain: AZ, CO, ID, MT, NM, NV, UT, WY; New England: CT, MA, ME, NH, RI, VT; Pacific: AK, CA, OR, WA; South Atlantic: DE, DC, FL, GA, MD, NC, SC, VA, WV; West North Central: IA, KS, MN, MO, ND, NE, SD; West South Central: AR, LA, OK, TX.
CI, confidence interval

Disclosures

AM, NES-O, AVJ, and FSM-G are employees of, and hold shares in, GlaxoSmithKline plc.; VG, GY and KY are employees of Becton, Dickinson and Company, which received funding from GlaxoSmithKline plc. to conduct this study. VG and KY also hold shares in Becton, Dickinson and Company; KSK reports no conflicts of interest

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