

Prevalence, Regional Distribution, and Trends of Antimicrobial Resistance Among Female Outpatients With Urine *Klebsiella pneumoniae* Isolates: A Multicenter Evaluation

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Introduction

- Infections caused by extended spectrum β -lactamase-producing (ESBL+) Enterobacterales are a serious health threat¹
- There has been a notable increase in antimicrobial resistance (AMR) and multidrug resistance (MDR) among uropathogens,²⁻⁴ including *Klebsiella pneumoniae* (*K. pneumoniae*)⁵ causing uncomplicated urinary tract infections (uUTIs) in outpatients
- Urine cultures are seldom ordered for uUTI (~17% of cases) as treatment is often empiric; local AMR surveillance data may therefore be limited⁶
- Available data are focused on inpatients and on invasive isolates from urine; however, data on outpatient urinary tract infections are lacking
- Previous work determined the prevalence and geographic distribution of AMR among urine *Escherichia coli* isolates, the predominant pathogen in uUTI⁷
- The study objective was to determine the prevalence and geographic distribution of AMR among *K. pneumoniae* isolates from urine of female outpatients in the United States (US)

Methods

- This was a retrospective, cross-sectional study of 30-day non-duplicate urine isolates identified from female outpatients (≥ 12 years of age) being treated for urinary tract infection at 304 facilities, with ≥ 3 months of data collected January 2019 to December 2019
- Isolates representing each distinct susceptibility pattern within 30 days of index urine samples were used to assess regional AMR in 2019, and AMR trends from 2011 to 2019 via summary statistics
- K. pneumoniae* isolates were identified as the following microbiological phenotypes:
 - Not susceptible (NS) if facility-reported as intermediate/resistant to any of the following: nitrofurantoin (NFT), trimethoprim/sulfamethoxazole (SXT), or fluoroquinolones (FQs)
 - ESBL+/NS confirmed by commercial panel or NS to ceftriaxone, cefotaxime, ceftazidime, or cefepime
- Relative mean annual percent change in AMR from 2011 to 2019 was estimated using generalized estimating equations for each of 4 phenotype categories (NFT NS, SXT NS, ESBL+/NS, and FQ NS)
- Covariate adjustment included patient age and healthcare facility characteristics (urban/rural status, bed size, and teaching/non-teaching status)

References

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- Among 250,719 *K. pneumoniae* isolates evaluated, AMR prevalence increased between 2011 and 2019 for all studied antimicrobials, except NFT (Table)
- The overall prevalence of AMR (2011 to 2019) for all census regions was highest for NFT NS (56.6%), followed by SXT NS (9.6%), ESBL+/NS (4.6%), then FQ NS (4.4%)
- The prevalence of AMR phenotypes in 2019 varied by US census regions (Figure)

Table. Model-Estimated Trends of Relative Average Annual Percentage Change of *K. pneumoniae* AMR Over Time (2011 to 2019) by Age and Census Region

Characteristics	Phenotype category, % (95% CI)			
	NFT NS (n=141,799)	SXT NS (n=24,027)	ESBL+/NS (n=11,181)	FQ NS (n=11,075)
Overall resistance	56.6 (56.3-56.9)	9.6 (9.5-9.7)	4.6 (4.5-4.7)	4.4 (4.3-4.5)
Trend over years 2011-2019*	-0.3 (-0.6 to -0.1) ↓	+2.1 (1.6 to 2.7) ↑	+5.4 (4.3 to 6.5) ↑	+2.1 (1.1 to 3.0) ↑
Patient age				
12-17	61.4 (58.8-64.1)	8.3 (7.3-9.4)	1.9 (1.5-2.4)	1.4 (1.1-1.9)
18-54	59.1 (58.4-59.9)	8.9 (8.2-9.7)	3.0 (2.8-3.2)	2.9 (2.5-3.4)
55-64	57.4 (56.5-58.4)	11.6 (10.7-12.6)	4.7 (4.3-5.0)	5.3 (4.6-6.2)
65-74	55.0 (54.2-55.8)	11.2 (10.4-12.2)	4.4 (4.2-4.7)	5.2 (4.5-6.1)
> 74	52.2 (51.6-52.9)	10.2 (9.4-11.0)	4.4 (4.2-4.7)	5.5 (4.8-6.4)
AMR 2011-2019 by census region				
New England	57.7 (55.0-60.5)	9.0 (7.8-10.4)	2.5 (2.0-3.2)	2.8 (2.2-3.6)
Middle Atlantic	54.4 (53.5-55.3)	9.8 (9.1-10.6)	3.4 (3.1-3.6)	3.8 (3.3-4.5)
East North Central	56.2 (55.4-57.0)	9.8 (9.1-10.6)	3.2 (3.0-3.4)	3.7 (3.2-4.3)
West North Central	56.0 (53.2-59.0)	8.6 (7.4-10.1)	2.5 (1.9-3.2)	2.4 (1.8-3.1)
South Atlantic	61.6 (60.6-62.6)	10.2 (9.4-11.1)	3.9 (3.6-4.3)	4.4 (3.7-5.1)
East South Central	55.5 (54.6-56.5)	11.4 (10.6-12.3)	3.5 (3.2-3.7)	3.8 (3.3-4.5)
West South Central	56.0 (55.1-56.9)	12.1 (11.2-13.1)	4.9 (4.5-5.3)	4.6 (3.9-5.3)
Mountain	56.8 (55.2-58.5)	8.9 (8.0-9.8)	3.1 (2.7-3.6)	3.6 (3.0-4.3)
Pacific	58.6 (57.5-59.7)	10.3 (9.5-11.2)	5.4 (5.0-5.9)	4.4 (3.7-5.1)

*Relative average annual percentage change in resistance rate, NFT NS p=0.0041, other phenotypes p<0.0001. Significant variation observed across age groups (p<0.0001) and census regions (p<0.0001) for all phenotypes. Abbreviations: CI, confidence interval.

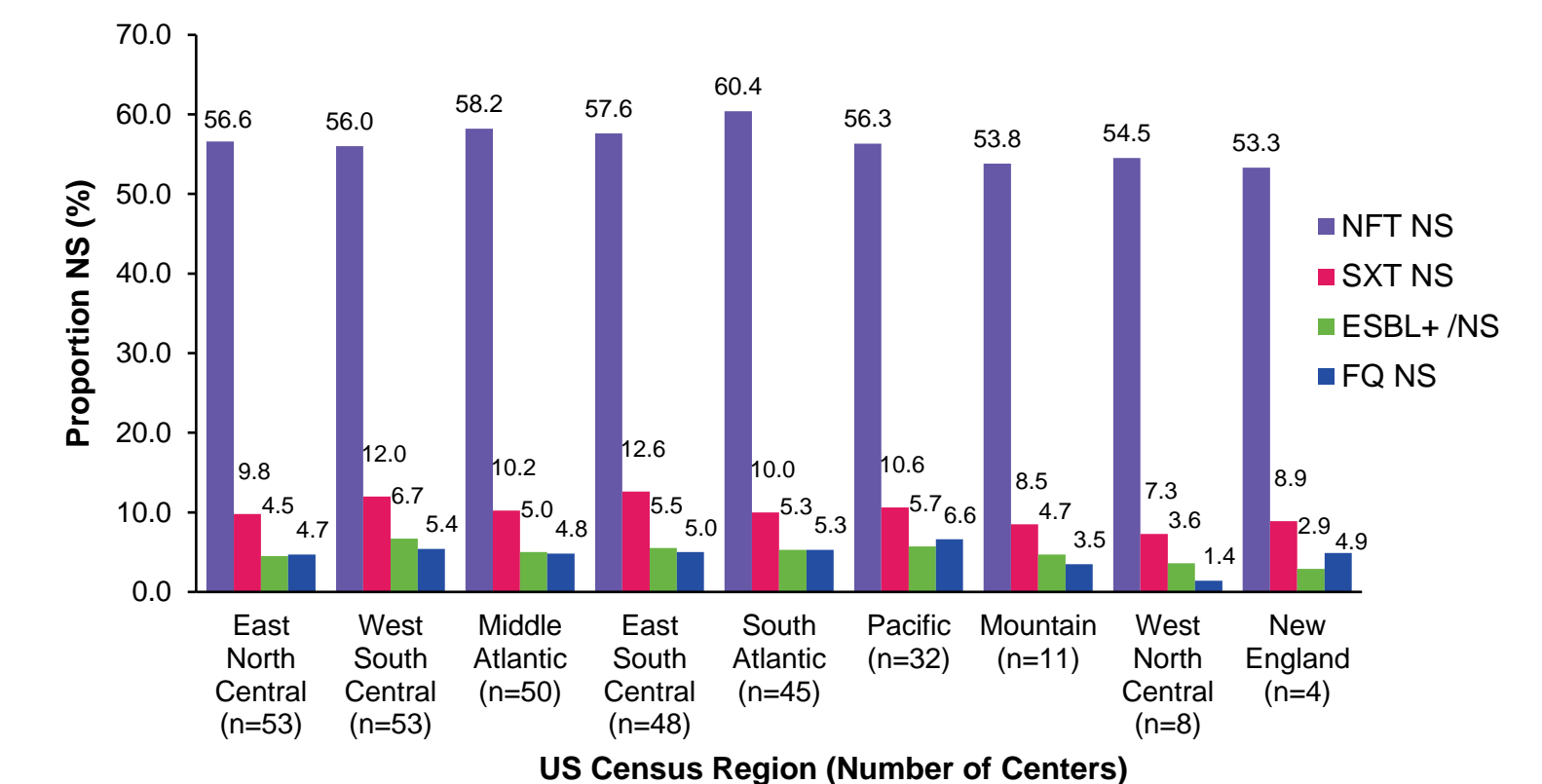
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Results

- Among the 304 centers included in the study, the most represented US census regions were East North Central (n=53), West South Central (n=53), and Middle Atlantic (n=50) (Figure)
- For all microbiological phenotypes evaluated from 2011 to 2019, there was significant variation in resistance among *K. pneumoniae* isolates (250,719) across all US census regions (p<0.0001)
- There was an increase in adjusted AMR rates by age group with higher AMR rates in women ≥ 55 , except for NFT, which showed the highest resistance in those aged < 55 (Table)

Figure. Prevalence of AMR Among *K. pneumoniae* Isolates in 2019 by US Census Region



Conclusions

- There was a trend of increased AMR between 2011 and 2019 for all studied antimicrobials except NFT
- AMR was notable among non-duplicate *K. pneumoniae* isolates from female outpatient urine samples, particularly for NFT NS (56.6%) and SXT NS (9.6%)
- There were significant differences in AMR by region and by age, with trends of increasing resistance in older patients for all studied antimicrobials except NFT
- These analyses inform, and may be used to help optimize, the empiric treatment of uUTI regionally

Disclosures

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