

Comparison of an Emergency Department-Specific Antibigram to Hospital Antibigram: Influence of Patient Risk Factors on Susceptibility

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BACKGROUND

- Up to 50% of antimicrobial use is unnecessary or inappropriate leading to unintended consequences
- Antimicrobials are the 2nd largest medication class prescribed in the Emergency Department (ED)
- Antibiograms
 - Provide local susceptibility data to guide clinicians in empiric antimicrobial selection
 - Rarely unit-specific and do not account for patient-specific risk factors

METHODS

- Single-center, retrospective descriptive study
- Included all positive cultures obtained in the ED during 2016
- Excluded all positive cultures obtained from locations outside of the ED

Primary objective

- Develop an ED-specific antibiogram and compare the susceptibilities of the most commonly identified organisms to the existing hospital antibiogram

Secondary objectives

- Stratify susceptibilities in the ED-specific antibiogram based on the following patient risk factors:
 - Age ≥ 65 years
 - Antimicrobial exposure in the past 30 days
 - Hospitalization in the past 30 days
 - Presenting location prior to ED arrival (e.g. healthcare facility or community)

Statistical Analysis

- Descriptive statistics performed for all data
- Pearson Chi-Square/Fisher's Exact Tests were used to compare group differences
- Logistic regression performed for *E. coli*
- Two-tailed *p*-value of <0.05 considered statistically significant in all analyses

Table 1: Baseline Demographics

	EC (n = 1244)	KP (n = 232)	PM (n = 131)	PA (n = 103)	SA (n = 303)	EF (n = 145)
Age, years						
≥ 65	602 (48)	133 (57)	81 (62)	56 (54)	100 (33)	83 (57)
< 65	642 (52)	99 (43)	50 (38)	47 (46)	203 (66)	62 (43)
Previous Residence						
HC facility	146 (12)	38 (16)	54 (41)	38 (37)	48 (16)	34 (23)
Community	1098 (88)	194 (84)	77 (59)	65 (63)	255 (84)	111 (77)
Antimicrobials within 30 days						
Yes	233 (19)	51 (22)	41 (31)	51 (49)	97 (32)	57 (39)
No	1011 (81)	181 (78)	90 (69)	52 (51)	206 (68)	88 (61)
Hospitalization within 30 days						
Yes	108 (9)	40 (17)	23 (18)	32 (31)	33 (11)	27 (19)
No	1136 (91)	192 (83)	108 (82)	71 (69)	270 (89)	118 (81)

Data are expressed as n (%). The ED antibiogram comprises 2158 *E. coli* (EC), *K. pneumoniae* (KP), *P. mirabilis* (PM), *P. aeruginosa* (PA), *S. aureus* (SA), and *E. faecalis* (EF) isolates.

RESULTS

- A total of 2,158 isolates from the ED were included: *Escherichia coli* (EC) (n=1244), *Klebsiella pneumoniae* (KP) (n=232), *Proteus mirabilis* (PM) (n=131), *Pseudomonas aeruginosa* (PA) (n=103), *Staphylococcus aureus* (SA) (n=303), and *Enterococcus faecalis* (EF) (n=145).

Table 2: ED Antibigram vs. Standard Hospital Antibigram

Antimicrobial	Gram-negative									Gram-positive									
	ED (n = 1244)	S (n = 2396)	<i>p</i>	ED (n = 232)	S (n = 575)	<i>p</i>	ED (n = 131)	S (n = 317)	<i>p</i>	ED (n = 103)	S (n = 1025)	<i>p</i>	Antimicrobial	ED (n = 303)	S (n = 1038)	<i>p</i>	ED (n = 145)	S (n = 388)	<i>p</i>
Ampicillin	48	47	0.472	-	-	-	63	64	0.978	-	-	-	Ampicillin	-	-	-	99	99	0.999
Ampicillin/sulbactam	58	56	0.202	77	77	0.973	78	72	0.989	-	-	-	Clindamycin	70	68	0.495	-	-	-
Cefazolin	80	77	0.049	87	86	0.905	58	58	0.996	-	-	-	Oxacillin	61	62	0.728	-	-	-
Cefazolin - Urine	88	85	0.028	90	88	0.586	95	93	0.679	-	-	-	Vancomycin	100	100	0.999	94	98	0.073
Ceftriaxone	90	88	0.033	90	89	0.898	99	97	0.249	-	-	-	Minocycline	98	97	0.287	-	-	-
Ciprofloxacin	76	72	0.006	89	90	0.812	58	61	0.647	76	69	0.191	Tetracycline	96	94	0.151	-	-	-
Nitrofurantoin	97	96	0.465	47	43	0.249	-	-	-	-	-	-	Gentamicin	-	-	-	65	71	0.215
TMP/SMX	71	73	0.320	83	85	0.581	62	63	0.886	-	-	-	TMP/SMX	94	96	0.139	-	-	-

ED, emergency department; S, standard; Data are expressed as % susceptible.

Figure 1: *E. coli*: Age

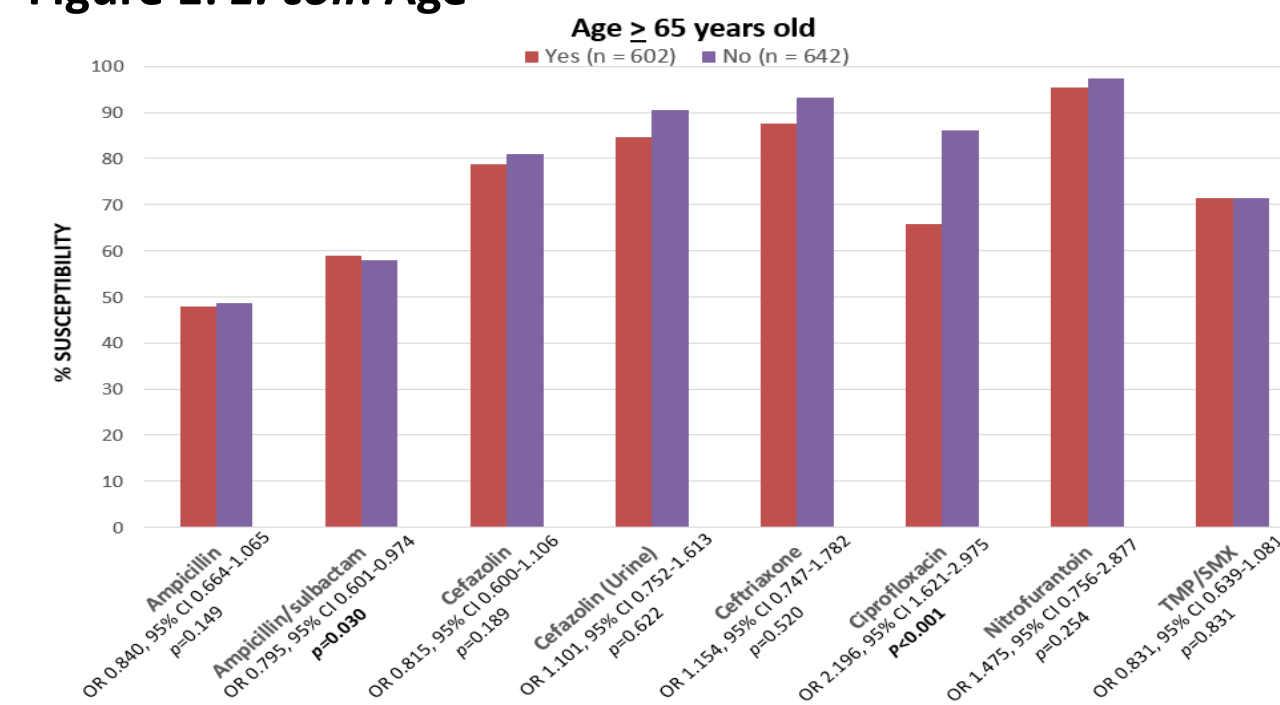


Figure 3: *E. coli*: Previous Hospitalization

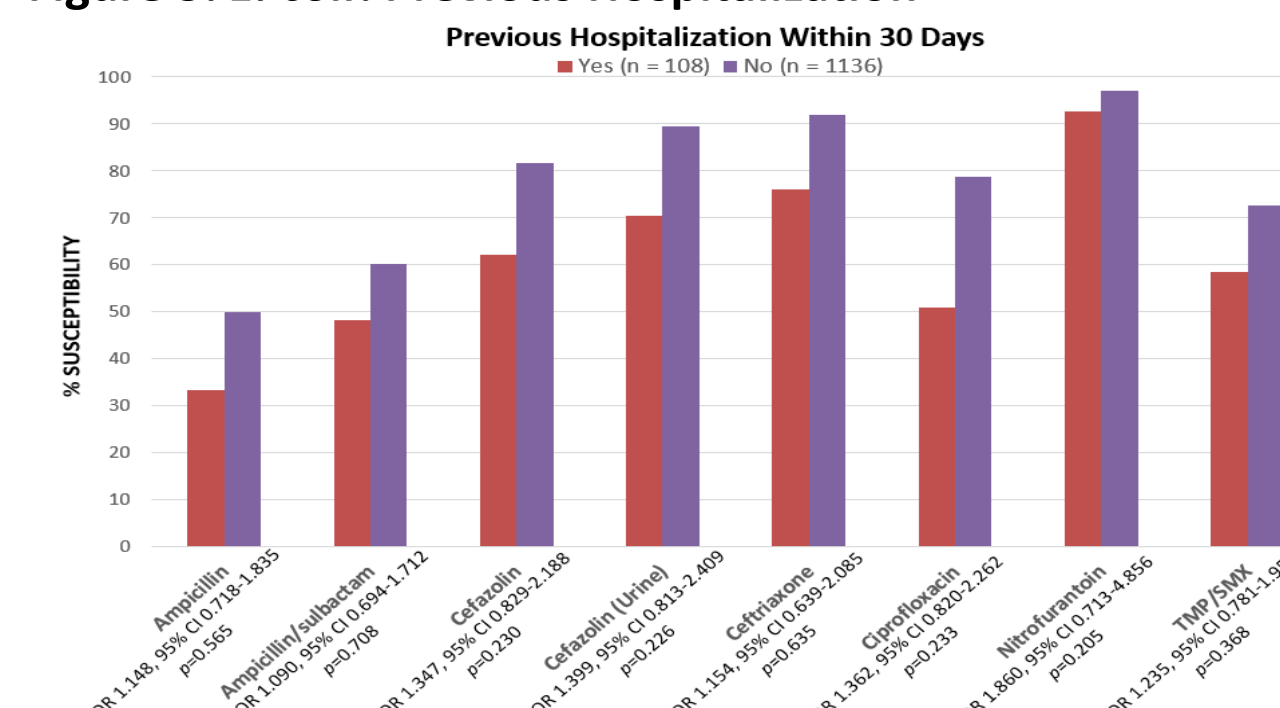


Table 3: *K. pneumoniae*: Risk Factor Assessment

Antimicrobial	Age, years		<i>p</i>	Previous Residence		<i>p</i>	Antimicrobials ≤ 30 days		<i>p</i>	Hospitalization ≤ 30 days		<i>p</i>
	≥ 65 (n=133)	< 65 (n=99)		HC (n=38)	Comm (n=194)		Yes (n=51)	No (n=181)		Yes (n=40)	No (n=192)	
Ampicillin/sulbactam	105 (79)	74 (75)	0.451	25 (66)	154 (79)	0.068	24 (47)	155 (86)	<0.001	26 (65)	153 (80)	0.044
Cefazolin	117 (88)	84 (85)	0.489	29 (76)	172 (89)	0.041	31 (61)	170 (94)	<0.001	31 (78)	170 (89)	0.062
Cefazolin - Urine	119 (90)	89 (90)	0.916	29 (76)	179 (92)	0.003	34 (67)	174 (96)	<0.001	31 (78)	174 (96)	0.006
Ceftriaxone	119 (90)	89 (90)	0.916	29 (76)	179 (92)	0.003	34 (67)	174 (96)	<0.001	31 (78)	174 (96)	0.006
Ciprofloxacin	117 (88)	90 (91)	0.475	30 (79)	177 (91)	0.025	34 (67)	173 (96)	<0.001	31 (78)	176 (92)	0.009
Nitrofurantoin	65 (49)	45 (46)	0.606	16 (42)	94 (49)	0.474	13 (26)	97 (54)	<0.001	12 (30)	98 (51)	0.015
TMP/SMX	113 (85)	80 (81)	0.403	27 (71)	166 (86)	0.029	28 (55)	165 (91)	<0.001	27 (68)	166 (87)	0.004

Data are expressed as n (%).

Figure 2: *E. coli*: Previous Antimicrobial Use

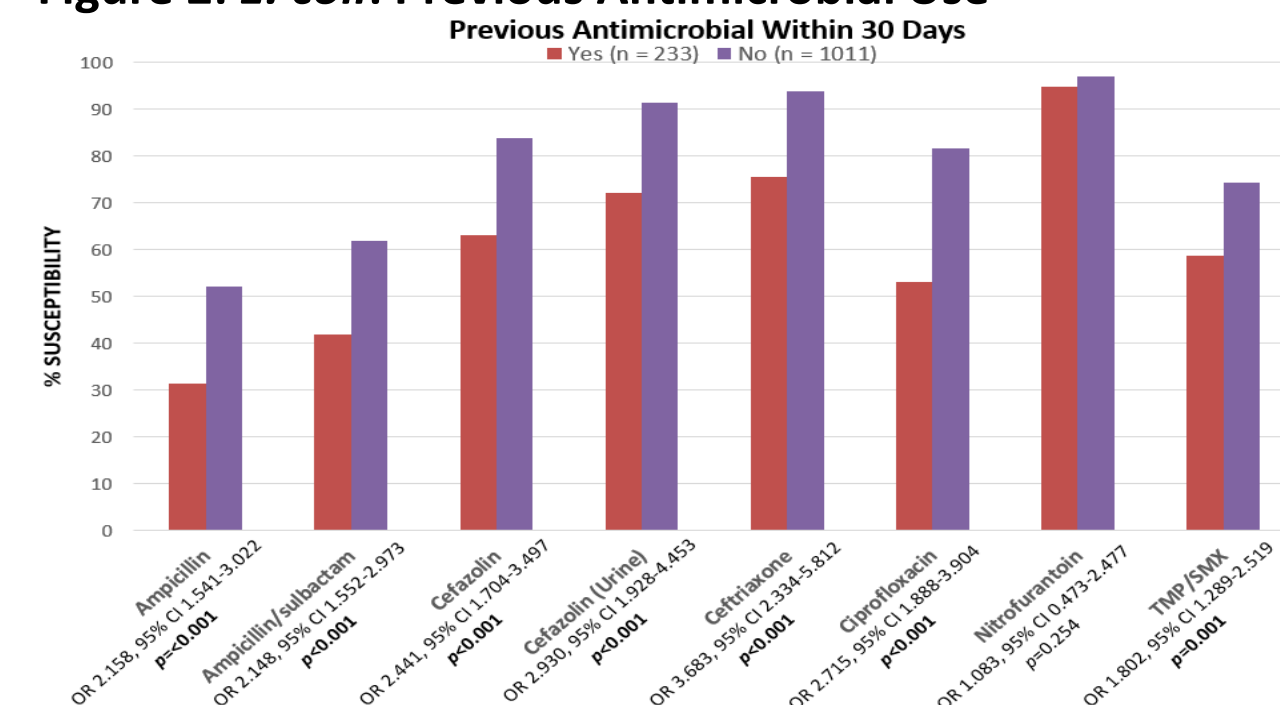
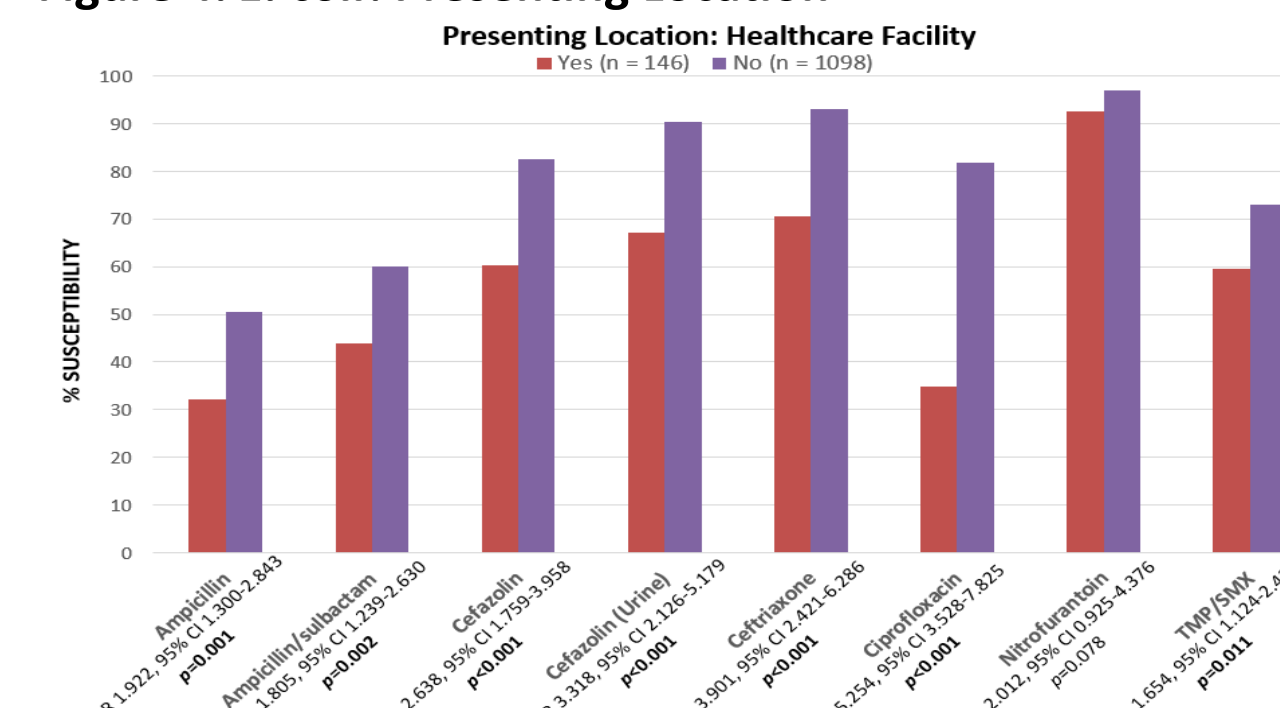


Figure 4: *E. coli*: Presenting Location



RESULTS

- P. mirabilis***
 - Age, previous residence, and previous hospitalization within 30 days had minimal impact on susceptibility
 - Exception of ciprofloxacin (age, 72% vs. 49%, $p=0.011$; HC facility residence, 75% vs. 33%, $p<0.001$; previous hospitalization, 62% vs. 39%, $p<0.043$)
 - Previous antimicrobial use had the greatest impact
 - Statistically significant for ampicillin, ampicillin/sulbactam, cefazolin, ciprofloxacin, and TMP/SMX
- P. aeruginosa***
 - Results statistically significant for HC facility for ciprofloxacin (91% vs. 50%, $p<0.001$)
- S. aureus* and *E. faecalis***
 - Risk factor assessment had minimal impact on susceptibility
- Unit location (ED to home, general medicine, and ICU) was assessed to determine influence on susceptibility (data not presented)
 - ICU had reduced susceptibility than ED to home or GM however, 88% of ICU patients had one or more risk factor for resistance compared to 31.7% and 79% in the ED to home and GM units, respectively

CONCLUSIONS

- ED antibiogram was similar to the hospital antibiogram
 - Exception: hospital antibiogram overestimated resistance rates for *E. coli* isolates
- Risk factor assessment
 - HC facility and previous antimicrobial use within 30 days had the largest impact on susceptibilities
 - Age had the least impact on susceptibilities
 - The antimicrobial most impacted by the risk factor assessment was ciprofloxacin
- Development of an ED-specific antibiogram can aid healthcare providers in prescribing appropriate empiric therapy when risk factors are included

LIMITATIONS

- Retrospective chart review
- ED susceptibilities are included in the hospital antibiogram (not mutually exclusive)
- ED antibiogram development labor-intensive
 - Further antimicrobial stewardship resources needed to continue intervention

ACKNOWLEDGEMENTS

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