

Antibiograms - Part 2

How to Use Them

Ashley Wilde, PharmD, BCIDP

Director, Infectious Diseases Clinical Programs and Research

Norton Infectious Diseases Institute

Antibiograms Part 2 Outline

- Empiric antibiotic regimen selection
- Advanced antibiograms
- Epidemiology
- Education

Empiric Antibiotic Regimen Selection

- Different empiric antibiotics are used for different sources of infection
 - Variations in likely pathogens
 - Differences in antibiotic pharmacokinetics
- Evidence based guidelines
 - 19 different antibiotic regimens for intra-abdominal infections!

Community-acquired infection in adults	
Mild-to-moderate severity: perforated or abscessed appendicitis and other infections of mild-to-moderate severity	High risk or severity: severe physiologic disturbance, advanced age, or immunocompromised state
Cefoxitin, ertapenem, moxifloxacin, tigecycline, and ticarcillin-clavulanic acid	Imipenem-cilastatin, meropenem, dori- penem, and piperacillin-tazobactam
Cefazolin, cefuroxime, ceftriaxone, cefotaxime, ciprofloxacin, or levoflox- acin, each in combination with metronidazole ^a	Cefepime, ceftazidime, ciprofloxacin, or levofloxacin, each in combination with metronidazole ^a

Empiric Antibiotic Regimen Selection

- Knowledge of common pathogens
- “Can (insert any bacteria) cause (insert any infection)?”
- Institution antibiograms are **critical** for empiric antibiotic selection
 - Frequency of bacteria encountered
 - Resistance patterns
- Example: Urinary tract infections

Top Uropathogens:

1. *E. coli*

2. *E. coli*

3. *E. coli*

Pick the “Best” Antibiotic

Norton Hospital 2021	Number Tested	Penicillins					Cephalosporins					Monobactam	Carbapenems		Aminoglycosides			Gram + Coverage					Others					
		Amoxicillin/Clavulanate	Ampicillin	Ampicillin/Sulbactam	Oxacillin	Penicillin	Piperacillin/Tazobactam	Oral cephalosporins for uncomplicated UTI	Cefazolin	Cefepime	Ceftazidime	Ceftriaxone	Aztreonam	Ertapenem	Meropenem	Amikacin	Gentamicin	Gentamicin Synergy	Tobramycin	Clindamycin [1, 2]	Erythromycin [2]	Vancomycin	Linezolid	Daptomycin	Ciprofloxacin	Levofloxacin	Nitrofurantoin [2]	Tetracycline
Acinetobacter baumannii complex [3]	20	0	0	75	0	0		0	65	80		0	0	75	85	75		85	0	0	0	0	0	85	75			75
Citrobacter freundii complex [4]	29	0	0	0	0	93		0	97	83	79	83	97	97	100	90		93	0	0	0	0	0	90	93	89		83
Citrobacter koseri	19	89	0	84	0	95		89	100	100	89	95	100	100	100	100		100	0	0	0	0	0	89	100	62		95
Enterobacter cloacae complex [5]	89	0	0	0	0	79		0	88	71	56	65	82	97	100	99		98	0	0	0	0	0	97	100	21		94
Escherichia coli	965	85	47	55	0	97	86	66	92	91	87	88	99	99	99	91		91	0	0	0	0	0	74	75	97		72
Klebsiella aerogenes	41	0	0	0	0	88		0	98	83	80	83	93	100	100	100		100	0	0	0	0	0	93	93	18		98
Klebsiella oxytoca	53	98	0	81	0	100		15	98	94	96	94	100	100	100	100		96	0	0	0	0	0	98	98	80		96
Klebsiella pneumoniae	224	88	0	77	0	94	88	79	94	90	89	90	98	99	100	96		95	0	0	0	0	0	92	95	37		89
Morganella morganii	17	0	0	0	0	100		0	94	53	53	71	100	100	100	94		94	0	0	0	0	0	88	94	0		94
Proteus mirabilis	125	92	79	90	0	99	87	66	94	95	92	89	99	100	100	90		90	0	0	0	0	0	75	78	0	0	79
Proteus vulgaris	12	92	0	92	0	100		0	100	92	50	33	100	100	100	100		100	0	0	0	0	0	100	100	0	0	100
Pseudomonas aeruginosa	166	0	0	0	0	84		0	83	80	0	70	0	89	96	81		94	0	0	0	0	0	81	83	0	0	0
Serratia marcescens	47	0	0	0	0	57		0	98	43	53	38	100	100	98	96		91	0	0	0	0	0	100	100	0		98
Stenotrophomonas maltophilia	33	0	0	0	0	0		0		45	0	0	0	0	0	0		0	0	0	0	0	0		88	0		94
Staphylococcus aureus	682	47			47			47				0							77	33	100	100	99				91	98
Methicillin-resistant S. aureus	391	0			0			0				0							74	13	100	100	99				94	97
Methicillin-susceptible S. aureus	331	100			100			100				0							81	56	100	100	100				89	99
Staphylococcus capitis	10	100			100			100				0							*	*	100	100	100			*	100	100
Staphylococcus epidermidis	126	37			37			37				0							56	34	100	100	100			100	81	65
Staphylococcus haemolyticus	15	27			27			27				0							*	*	100	100	100			*	93	60
Staphylococcus lugdunensis	36	83			83			83				0							71	63	100	100	100			*	92	97
Other coagulase-negative staphylococci	25	50			50			50				0							46	40	100	100	100			*	80	84
Enterococcus faecalis	119		99			99		0	0	0	0	0			0	0	71	0	0	26	91	100	99			*	33	0
Enterococcus faecium	38		29			29		0	0	0	0	0			0	0	79	0	0	3	39	100	97			*	29	0

E. coli – 2021 Norton Hospital Antibiogram

	% Susceptible
Ampicillin	47
Cefazolin	66
Trimethoprim/sulfamethoxazole	72
Ciprofloxacin	74
Ceftriaxone	87
Tobramycin	91
Cefepime	92
Piperacillin/tazobactam	97
Nitrofurantoin	97
Meropenem	99



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Too Little

Goldilocks
Dilemma

Just
Right?

>80% to
>90%

Too Much

When NOT to Use an Antibiogram

Once culture and susceptibilities are known

Susceptibility	
	Escherichia coli MIC
Ampicillin	<=2 Susceptible
Cefazolin	<=2 Susceptible
Ciprofloxacin	<=0.5 Susceptible
Gentamicin	<=1 Susceptible
Trimethoprim/Sulfamethoxazole	<=0.5/9.5 Susceptible

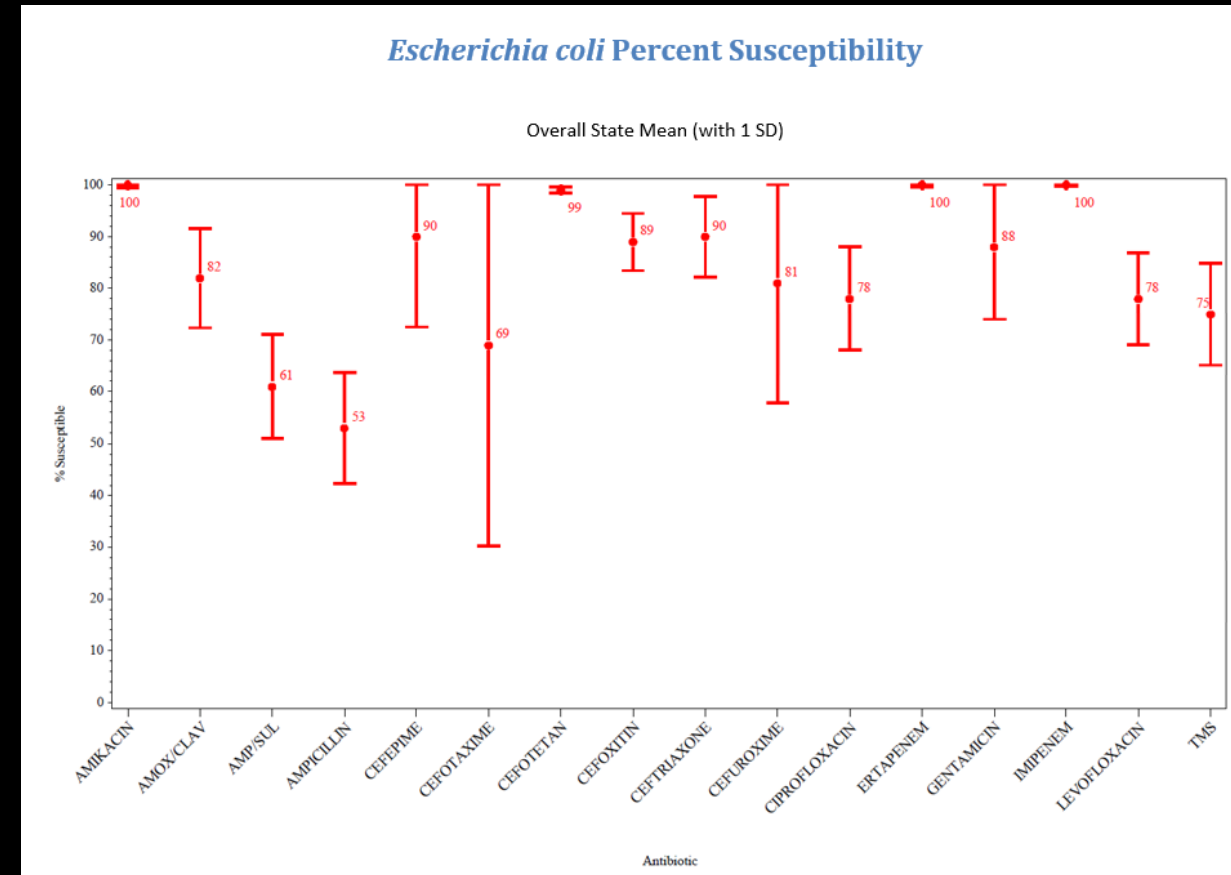
When a patient has a recent history* of bad bugs

Susceptibility	
	Escherichia coli MIC
Amikacin	<=16 Susceptible
Amoxicillin/Clavulanate	16/8 Intermediate
Ampicillin	> 16 Resistant
Ampicillin/Sulbactam	> 16/8 Resistant
Cefazolin	> 16 Resistant
Cefepime	> 16 Resistant
Ceftazidime	> 16 Resistant
Ceftriaxone	>32 Resistant
Ciprofloxacin	>2 Resistant
Gentamicin	>8 Resistant
Levofloxacin	>4 Resistant
Meropenem	<=1 Susceptible
Piperacillin/Tazobactam	<=16 Susceptible
Tobramycin	>8 Resistant
Trimethoprim/Sulfamethoxazole	<=2/38 Susceptible

*rule of thumb is past ~90 days

Advanced Antibiograms

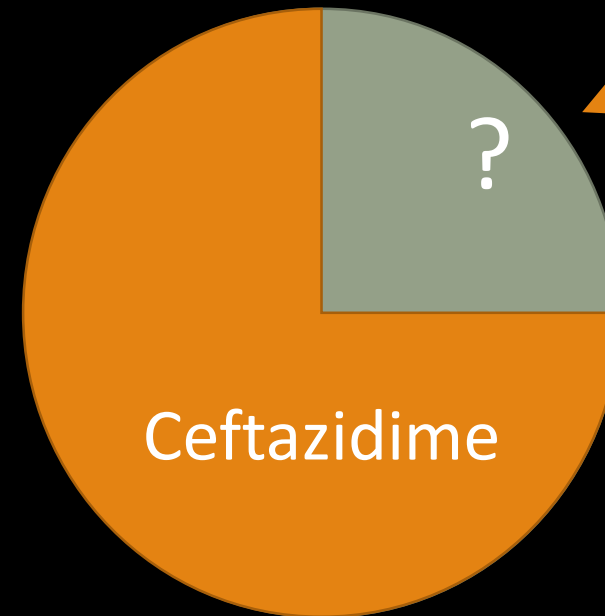
- Disease state antibiograms
 - Antibiogram by culture source, e.g. blood, urine, respiratory
- Unit specific antibiograms
 - What's spreading around the unit?
 - Attribution is difficult
 - Useful for ventilator-associated pneumonia (VAP)
- Statewide/nationwide antibiogram
- Combination therapy antibiogram



Combination Therapy AntibioGrams

- *Pseudomonas aeruginosa* – “two-drug-bug”
 - Beta-lactam + either a fluoroquinolone or an aminoglycoside

<i>Pseudomonas aeruginosa</i>	% S
Aztreonam	34
Cefepime	55
Meropenem	66
Piperacillin/tazobactam	68
Imipenem	74
Ceftazidime	75



Ceftazidime R,
Levofloxacin S?

Ceftazidime R,
Tobramycin S?

Combination Therapy Antibiograms

- *Pseudomonas aeruginosa* – two drug bug
 - Beta-lactam + either a fluoroquinolone or an aminoglycoside

<i>Pseudomonas aeruginosa</i>	% Susceptible		
	Monotherapy	Add Levofloxacin	Add Tobramycin
Aztreonam	34	56	85
Cefepime	55	62	84
Meropenem	66	72	88
Piperacillin/tazobactam	68	73	89
Imipenem	74	83	93
Ceftazidime	75	80	94

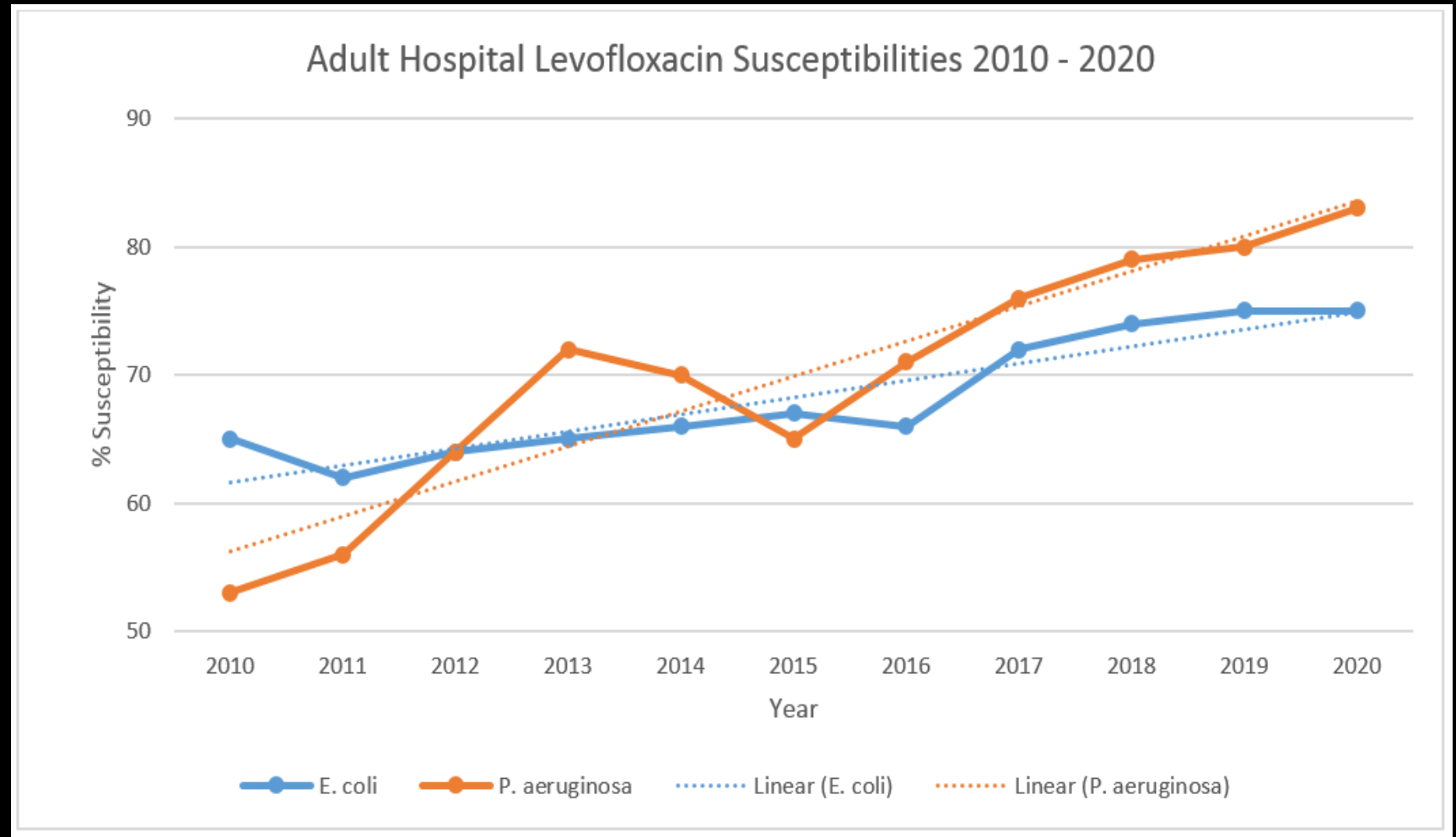
Combination Therapy Antibiograms

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Imipenem	74	83	93
Ceftazidime	75	80	94

Antibiograms for Epidemiology

- Substantial number of isolates needed
- No change in breakpoints



Antibiograms for Education

“Does (insert any antibiotic) have activity against (insert any bacteria)?”

		Penicillin G	Amox-Clav	Amp-Sulb	Pip-Tazo	Doripenem	Ertapenem	Imipenem	Meropenem	Aztreonam	Ciprofloxacin
E. faecalis	—	++	+	+	+	±	±	±	±	0	±
S. lugdunensis	—	±	+	+	+	+	+	+	+	0	+
S. saprophyticus	—	±	++	+	+	+	+	+	+	0	+
Strep. anginosus gp	—	++	+	+	+	+	+	+	+	0	±
Strep. gp A,B,C,F,G	—	++	+	+	+	+	+	+	+	0	±
Strep. pneumoniae	—	++	+	+	+	+	+	+	+	0	±
Viridans Strep.	—	±	±	±	±	+	+	+	+	0	0
Arcanobacter. sp	—	+	+	+	+	+	+	+	+	0	+

Questions?

- Ashley.Wilde@nortonhealthcare.org



Medical Laboratory Professionals Week

- April 23rd - 29th, 2023