

# ANTIBIOGRAM

EMPIRIC ANTIBIOTICS OF CHOICE FOR COMMON CLINICAL ENTITIES based on Community Hospital Antibiotic Formulary

Site of Infection	Common Causative Organism	Empiric Antibiotic Treatment	Alternative Antibiotic Choices - Comments
<b>Skin or Soft Tissue</b>	<b>Uncomplicated, "Spontaneous" Cellulitis</b> Strep - Group A , B or C Staph aureus (role of MRSA unknown)	IV: Cefazolin PO: Cephalexin	Vancomycin (if MRSA suspected) * Vancomycin goal AUC/MIC 400-600 mcg*hr/mL
	<b>Complicated Cellulitis</b> 2° to diabetic vascular or pressure ulcer; trauma or surgery - polymicrobial	IV: Amp/Sulbactam +/- Vancomycin or Pip/Tazo +/- Vancomycin	Levofloxacin + Metronidazole +/- Vancomycin
	<b>Necrotizing Fasciitis</b> Staph Aureus, β-hemolytic strep, GNRs, anaerobes including Clostridia	Pip/Tazo plus Vancomycin plus Clindamycin	Vancomycin + Meropenem (ID or Intensivist only)
	<b>Skin Abscess</b> MRSA, MSSA	IV: Vancomycin, PO: Sulfamethoxazole/TMP or Doxycycline May use cephalexin for MSSA	PO: Linezolid <i>Drainage of abscess is the most important therapy</i>
<b>Bone and Joint</b>	<b>Osteomyelitis, acute</b> Staph aureus (hematogenous)	Vancomycin *	* Vancomycin goal AUC/MIC 400-600 mcg*hr/mL for bone and joint infection
	<b>Septic Arthritis</b> Staph aureus, Strep species, GNR, Neisseria	Vancomycin * Add Ceftriaxone if GC is suspected	Consider addition of Rifampin if prosthetic joint
<b>CNS</b>	<b>Bacterial Meningitis - Community Acquired</b> S. pneumoniae, N. meningitis	Ceftriaxone High dose (2g q12h) plus Vancomycin* (add Ampicillin (if patient is >65 years old or immuno-compromised))	* Vancomycin goal AUC/MIC 400-600 mcg*hr/mL for CNS infections
	<b>Post-Neurosurgical</b> Pseudomonas, Staph aureus and Epidermidis, GNR	Vancomycin* plus Ceftazidime	Vancomycin + Meropenem (ID and intensivist only) if resistant GNR
<b>Upper Respiratory</b>	<b>Sinusitis</b> Viruses, S. pneumoniae, H. influenzae, Moraxella	PO: Amox/Clavulanate or Levofloxacin	No antibiotics indicated for acute rhinosinusitis
	<b>Pharyngitis</b> Group A strep	PO: Penicillin, or Amoxicillin, or Azithromycin	

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<b>Pneumonia</b>	<b>Community Acquired (CAP)</b> S.pneumoniae, Mycoplasma, H. influenzae, Legionella, Moraxella catarrhalis. Less common - Staph aureus, virus, GNRs	Outpatients: PO Azithromycin or Levofloxacin 750mg daily	Assess for and document risk for GNR pneumonia (esp pseudomonas): Alcoholism, bronchiectasis, structural lung disease, immune compromise, tracheostomy, etc.
	<b>Hospitalized patients with CAP</b>	Non-ICU patients Ceftriaxone (1g q24h) plus Azithromycin (500mg daily) Or Levofloxacin alone (750mg daily)	Assess risk for Staph aureus: post-influenza or necrotizing pneumonia
	<b>ICU patients with CAP</b>	Azithromycin plus Ceftriaxone or Pip-Tazo plus (Levofloxacin or ciprofloxacin) +/- (Vancomycin* or Linezolid (ID or intensivist only)	* Vancomycin goal AUC/MIC 400-600 mcg*hr/mL
	<b>Aspiration pneumonia</b> Mixed oral flora, Anaerobes, S. aureus, GNR in hospital acquired aspiration	Ceftriaxone 1g q24h plus Metronidazole 500mg q12h Or Amp/Sulbactam alone	Pip/tazo plus Vancomycin for hospital acquired aspiration Levofloxacin plus metronidazole if beta-lactam allergy
	<b>Hospital Associated (HAP) and Ventilator Associated (VAP)</b> CAP organisms. + GNRs, MRSA	Pip/Tazo (+/-) Levofloxacin (750mg daily) or Aminoglycoside (+/-) Linezolid (ID, Intensivist only) or Vancomycin* (* Vancomycin goal AUC/MIC 400-600 mcg*hr/mL)	Pip/tazo (3.375g or 4.5g q8h 4 hr infusion Assess for MDRO including ESBL, may need carbapenem (Meropenem - ID, Intensivist only))
<b>Genito-urinary infection</b>	<b>Cystitis</b> E. coli, Staph saprophyticus	PO: Sulfamethox/trimethoprim (Septra-DS) (bid) or Cephalexin 500mg q12h	Alternative Nitrofurantoin (Macrobid) 100mg BID <i>Check for resistance to Sulfa or cephalosporin</i>
	<b>Uncomplicated Pyelonephritis</b> E. coli, Proteus, other GNRs	PO: Ciprofloxacin 500mg bid IV/IM: Ceftriaxone 1g q24h	
	<b>Complicated Pyelonephritis</b> Resistant GNR, Enterococci	Ceftriaxone 1g q24h or Pip/Tazo	Ertapenem or Meropenem (ID or intensivist only) if MDRO suspected
	<b>Prostatitis - Acute</b> GNRs, GC  <b>Prostatitis - Chronic</b> GNRs, Staph aureus	Ciprofloxacin* (+/-) Ceftriaxone if GC suspected	* GC commonly resistant to quinolones
<b>Abdominal</b>	<b>Cholangitis, Diverticulitis, Bowel Perforation, etc</b> Enteric GNR (Klebsiella, E. coli, Proteus) +/- Enterococci, anaerobes	Pip/Tazo alone or Ceftriaxone plus Metronidazole	Levofloxacin (750mg) plus Metronidazole or Aztreonam plus Metronidazole +/- Vancomycin
	<b>Hospitalized patient or prior antibiotic use:</b> Above bacteria plus Pseudomonas and Candida.	Pip/Tazo +/- Fluconazole or Ceftazidime plus Metronidazole +/- Fluconazole	Aztreonam plus Metronidazole Consider carbapenem if MDRO suspected
	<b>C. difficile colitis</b>	Metronidazole PO 500mg TID or 500mg IV q8h	Vancomycin PO Liquid 125mg PO q6h

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<b>SEPSIS Syndrome</b>	GNR, Staph aureus	Pip/Tazo plus Vancomycin (may add Aminoglycoside or Levofloxacin 750mg)	Ceftazidime plus Vancomycin Aztreonam plus Vancomycin (may add Aminoglycoside or Levofloxacin) Add metronidazole if bowel source
<b>Acute Native Valve Endocarditis</b>	Strep viridans (30-40%), Enterococcus (5-15%), Staph aureus (20-35%)	Vancomycin* (+/-) Gentamicin (1mg/kg q8h) (+/-) Ceftriaxone (2g q24h)	Begin antibiotics after cultures unless patient is acutely ill or in heart failure
<b>Prosthetic Valve Endocarditis</b>	Staph aureus or Staph epidermidis	Vancomycin plus Gentamicin plus Rifampin	ID Consult strongly advised
<b>Febrile Neutropenia</b>	GNRs, Pseudomonas, Staph aureus, Strep viridans	Pip/Tazo (+/-) Aminoglycoside Or Ceftazidime (2g q8h) (+/-) Aminoglycoside Add Vancomycin if line associated infection suspected	Meropenem (ID or intensivist) (+/-) Vancomycin Low risk patients PO Cipro plus Amox/Clav (Augmentin)

SUGGESTED DURATION OF ANTIMICROBIAL THERAPY FOR COMMON INFECTIONS	
Infection	Duration
Pneumonia CAP HCAP VAP or infections due to pseudomonas or other NFGNR	~ 5 days 7 days 10-14 days
Complicated intra-abdominal infection	4-7 days (with source control)
Urinary tract infection Uncomplicated cystitis in female UTI in males Pyelonephritis	- 3-5 days 10-14 days 10-14 days
Cellulitis - Skin, soft tissue infection Diabetic foot infection	5-10 days 7-21 days depending on severity of infection

### CLINICAL PEARLS

1. IV and PO formulations are equally bioavailable for Doxycycline, Fluconazole, Levofloxacin, Ciprofloxacin, Metronidazole, Azithromycin. Use PO formulations when possible.
2. Avoid redundant anaerobic coverage, no need for Metronidazole for patients on Piperacillin/Tazobactam or Ampicillin/Sulbactam unless you are also treating *C. difficile*.
3. Generally there is no need to “double cover” *pseudomonas* infection while awaiting complete susceptibility information except in neutropenic patients or in patients with suspected resistance.

### CONTRIBUTORS

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INPATIENT ANTIBIOGRAM 2019 - URINE SOURCE ONLY

Gram Negative -  
Urine Only

	Aminoglycosides			Beta lactams/Beta lactam inhibitor			Carbapenems			Cephalosporin Class					Fluoroquinolones		Folate Pathway inhibitor	Fosfomycin	Monobactams	Nitrofurans	
	Amikacin	Gentamicin	Tobramycin	Amoxicillin + Clavulanate	Ampicillin	Ampicillin + Sulbactam	Piperacillin + Tazobactam	Ertapenem	Imipenem	Meropenem	Cefazolin	Cefazolin Urine	Cefepime	Ceftazidime	Ceftriaxone	Ciprofloxacin	Levofloxacin	Trimethoprim + Sulfamethoxazole	Fosfomycin	Aztreonam	Nitrofurantoin
Citrobacter freundii complex [39 Isolates]		92	87				69	100	100	100				63	63	87	100	72			85
Citrobacter koseri [42 Isolates]		100	100	95			83	100	100	100	75			100	98	98	98	98			32
Enterobacter cloacae complex [54 Isolates]		100	100				75	98		100				65	65	94	96	92			22
Escherichia coli [1,572 Isolates]	100	93	93	89	60	64	98	100	100	100		94		98	98	84	86	77		100	98
Escherichia coli, ESBL [142 Isolates]		63	53				100	99	99	100						20	22	51	95		92
Klebsiella aerogenes [43 Isolates]		98	98				80	98	100	100				78	78	93	100	95			34
Klebsiella oxytoca/Raoultella ornithinolytica [48 Isolates]		100	98	87		33	91	100	100	100	17			100	98	98	98	98			89
Klebsiella pneumoniae [214 Isolates]		99	99	98		88	97	100	100	100		96		99	99	98	99	93			39
Klebsiella pneumoniae ESBL [18 Isolates]		44	50					100	100	100						17	33	17			17
Klebsiella variicola [18 Isolates]		100	100	94		81	100	100	100	100	94			100	100	94	94	94		100	78
Morganella morganii [17 Isolates]		88	88			24	100	100		100				94	94	82	88	76			
Proteus mirabilis [169 Isolates]		88	88	98	78	89	99	100		100		88		98	97	75	77	79		100	1
Pseudomonas aeruginosa [121 Isolates]	99	96	96				94		86	96			99	95		85	84			87	

Cefazolin predicts results for the oral agents-Cefactor, cefdinir, cefpodoxime, cefprozil, cefuroxime axetil and loracarbef when used for therapy of uncomplicated UTI's due to E. coli, K. pneumoniae, and P. mirabilis.

A valid statistical analysis should include 30 or more isolates, organisms with less than 30 isolates are listed for informational purpose only

COMMENTS:

1. Data are obtained from MIC and disk diffusion testing methods.
2. Isolate counts are in parenthesis to the right of the organism name.
3. Inpatient MRSA (methicillin resistant *Staph aureus*): In 2019, 290 of 789 (36.76%) inpatient *Staph aureus* isolates were MRSA. Prior years were as follows: 2018 - 39.4%, 2017 - 37.8%, 2016 - 41.3%, 2015 - 35.6%, 2014 - 52.5%.
4. ESBL (extended spectrum beta lactamases): In 2019, 355 of 4292 (8.27%) *E coli* isolates (combined inpatient and outpatient) produced ESBL. Prior years as follows: 2018 - 8.3%, 2017 - 7.5%, 2016 - 8.1%, 2015 - 8.3%, 2014 - 6.8%, 2013 - 5%.
5. Penicillin Resistant *Streptococcus pneumoniae*: In 2019, 1 of 34 (2.94%) *Streptococcus pneumoniae* isolates (combined inpatient and outpatient) were Penicillin resistant.

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	Aminoglycosides			Ansamycins	Beta lactams/Beta lactam inhibitor		Cephalosporin Class	Fluoroquinolones	Folate Pathway inhibitor	Glycopeptides	Lincosamides	Lipopeptides	Nitrofurans	Oxazolidinones
	Tetracycline	Gentamicin	Gentamicin Synergy Screen		Rifampin	Ampicillin								
Enterococcus faecalis [241 Isolates]	19		50		100			86		100		100	100	100
Enterococcus faecium [17 Isolates]	43				53			50		64		100		100
Methicillin Resistant Staphylococcus aureus [28 Isolates]	71	68		93				7	89	100	100	100	100	100
Staphylococcus aureus [47 Isolates]	100	98		100		100	100	78	98	100		100	100	100
Staphylococcus epidermidis [21 Isolates]	90	100		100		19	19	38		100		100	100	95
Staphylococcus haemolyticus [2 Isolates]	100	50		100		50	50			100		100	100	100
Staphylococcus lugdunensis [1 Isolates]	100	100		100		100	100	100		100		100	100	100

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	Tetracycline	Tigecycline	Amikacin	Gentamicin	Tobramycin	Amoxicillin + Clavulanate	Ampicillin	Ampicillin + Sulbactam	Piperacillin + Tazobactam	Ertapenem	Imipenem	Meropenem	Cefazolin	Cefepime	Ceftazidime	Ceftriaxone	Ciprofloxacin	Levofloxacin	Trimethoprim + Sulfamethoxazole	Aztreonam	Nitrofurantoin
Citrobacter freundii complex [13 Isolates]				100	100				83	100	100	100			83	83	92	92	92		
Citrobacter koseri [11 Isolates]				100	100	100		80	90	100	100	100	70		90	78	90	90	100		
Enterobacter cloacae complex [49 Isolates]			100	100	100				88	95		98			83	83	88	90	90	75	
Escherichia coli [293 Isolates]			100	92	91	86	56	58	98	100	100	100	77	100	98	97	83	83	74	100	100
Escherichia coli, ESBL [35 Isolates]		100	100	67	67			50		100	100	100					75	75	100		
Klebsiella aerogenes [16 Isolates]			100	100	100				93	100		100			93	93	100	100	100	100	
Klebsiella oxytoca/Raoultella ornithinolytica [44 Isolates]	100		100	100	100	87		51	89	100	100	100	42		97	95	97	100	100	100	100
Klebsiella pneumoniae [93 Isolates]			100	99	98	93		84	99	100	100	100	91		99	100	98	99	93	100	100
Klebsiella pneumoniae ESBL [3 Isolates]										100	100	100									
Klebsiella variicola [10 Isolates]				100	100	100		100	100	100	100	100	100		100	100	100	100	100		
Morganella morganii [12 Isolates]	100			100	100			18	100	100		100			91	100	80	91	100	100	
Proteus mirabilis [62 Isolates]			100	87	89	96	80	91	98	100		100	2		98	96	87	89	89	100	
Pseudomonas aeruginosa [131 Isolates]			100	96	97				86		85	94		95	84		84	80		80	

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	Doxycycline	D-test R means positive	Penicillin	Tetracycline	Gentamicin	Gentamicin Synergy Screen		Streptomycin Synergy Screen	Rifampin	Amoxicillin + Clavulanate	Ampicillin	Ampicillin + Sulbactam		Oxacillin	Penicillin (meningitis)	Penicillin (oral)	Meropenem	Cefazolin	Ceftaroline							Ceftriaxone
Enterococcus faecalis [93 Isolates]			100			76	100		99											50		98		100		99
Enterococcus faecium [16 Isolates]						100			60													80		100		87
Methicillin Resistant Staphylococcus aureus [252 Isolates]				90	94		98									100				21	92	100	59	100	11	100
Staphylococcus aureus [421 Isolates]				96	99		100			100	100			100	100					86	98	100	82	100	69	100
Staphylococcus epidermidis [81 Isolates]	100			89	100		94	100			44				44				100	70		99	64	100	24	92
Staphylococcus haemolyticus [4 Isolates]				75	50		100				25				25					25		100	67	100	25	100
Staphylococcus lugdunensis [35 Isolates]				88	91		100				100				100					100		100	82	100	82	100
Streptococcus pneumoniae [26 Isolates]		100	96									75	75				100	100		96		100	75		67	

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