

# Suggested Empiric Antimicrobial Agents of Choice In Hospitalized Adults

(12th Edition)

Aspirus Wausau Hospital  
2018 - 2020

Antimicrobial Stewardship  
Subcommittee  
&  
Pharmacy and Therapeutics  
Committee



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# ISOLATES	ASPIRUS REFERENCE LAB ANTI-BIOGRAM REPORTED AS % SUSCEPTIBLE JAN.2018-DEC.2018	GRAM-POSITIVE COCCI
66	Enterococcus faecium	52
1018	Enterococcus faecalis	99
2233	Staphylococcus aureus	71
1586	MSSA (71% of Staph aureus)	100
647	MRSA (29% of Staph aureus)	0
202	Staphylococcus coag negative	70
581	Staphylococcus epidermidis	47
178	Staphylococcus lugdunensis	95
67	Staphylococcus saprophyticus	49
140	Streptococcus agalactiae (GrpB)	100
84	Streptococcus pneumoniae	100
	82 Non-meningitis	99
	2 Meningitis <sup>a</sup>	100
	<b>CY 2018 Haemophilus influenzae n=11, 34% Beta-lactamase positive</b>	
	<sup>a</sup> Should not be used alone to treat staphylococcal infections	
	SVN: Synergy with Ampicillin or Vancomycin	
	<sup>b</sup> Strep pneumoniae Meningitis breakpoints are lower than pneumonia/bacteremia	

# ISOLATES	ANTIBIOGRAM GRAM NEGATIVE BACILLI REPORTED AS % SUSCEPTIBLE JAN.2018-DEC.2018	GRAM-NEGATIVE BACILLI
242	Citrobacter freundii	Ampicillin
140	Enterobacter aerogenes	Amp/Sul
324	Enterobacter cloacae complex	Pip/Tazo
8357	Escherichia coli	Aztreonam
281	Klebsiella oxytoca	Cefazolin
1113	Klebsiella pneumoniae	Ceftriaxone
694	Proteus mirabilis	Ceftazidime
654	Pseudomonas aeruginosa	Cefepime
126	Serratia marcescens	TMP/SMX
		Levofloxacin
		Gentamicin
		Tobramycin
		Nitrofurantoin
		Ertapenem
		Meropenem

Intravenous Antimicrobial Renal Dose Adjustments					
Antimicrobial	Usual Dose	CrCl 50-30mL/min	CrCl 30-10mL/min	CrCl < 10mL/min	HD*
Ampicillin	1-2g q4-6h	1-2g q6-8h		1-2g q8-12h	HD: 1-2g q8-12h
Ampicillin/Sulbactam	1.5-3g q6h	1.5-3g q6-8h	1.5-3g q12h	(<15 mL/min) 1.5-3g q24h	HD: 1.5-3g q24h (post HD)
Aztreonam	1-2g q8h	1-2g q8h	1-2g q12h	1-2g q24h	HD: 1-2g q24h (post HD)
Cefazolin	1-2g q8h		(<35 mL/min) 0.5-1g q12h	1 g q24h	HD: 1g q24h (post HD)
Cefepime	1g q6h	(60-30mL/min) 1g q8h	1g q12h	1g q24h (post HD)	
Cefepime (Neutropenic fever)	2g q8h	(60-30mL/min) 2g q12h	1g q12h	1g q24h (post HD)	
Ciprofloxacin	400mg q12h		400 mg q24h		HD: 400mg q24h (post HD)
Ciprofloxacin (Pseudomonas, critically ill)	400mg q8h		400 mg q12h	400 mg q24h	HD: 400mg q24h (post HD)
Ertapenem	1g q24h		500mg q24h		HD: 500mg q24h (post HD)
Fluconazole	100-400mg q24h	50% of dose q24h			HD: 50% of dose q24h (post HD)
Levofloxacin	500mg q24h	(50-20mL/min) 500mg x1, then 250mg q24h	(20-10mL/min) 500mg x1, then 250mg q48h	500mg x1, then 250mg q48h	
Levofloxacin (Nosocomial PNA, skin, intraabdominal, pyelo)	750mg q24h	(50-20mL/min) 750mg q48h	(20-10mL/min) 750mg x1, then 500mg q48h	750mg x1, then 500mg q48h	
Meropenem	500mg q6h	(50-26 mL/min) 500mg q8h	(25-10 mL/min) 500mg q12h	500mg q24h	HD: 500mg q24h (post HD)
Penicillin G	2-4 mU q4	1-3 mU q4h		1-2 mU q6h	HD: 1-2 mU q6h
Piperacillin/Tazobactam (Extended-infusion)	3.375g q8h	3.375g q8h	(<20mL/min) 3.375g q12h	3.375g q12h	
TMP/SMX (Dose based on TMP)	5mg/kg q12h		5mg/kg q24h (post HD)		
TMP/SMX (Dose based on TMP, PCP treatment)	5 mg/kg q6-8h		2.5 mg/kg q6-8h	2.5 mg/kg q8h	HD: 2.5 mg/kg q8h
Amikacin, Gentamicin, Tobramycin, Vancomycin	Dosing per pharmacy				

\*For antimicrobials dosed every 24 hours in patients on hemodialysis, doses should be administered after dialysis on dialysis days. Alternatively, all doses may be administered once daily in the evening to ensure administration after dialysis on dialysis days.

## I. ANTIMICROBIAL STEWARDSHIP

1) Before initiating empiric therapy or changing antibiotics (abx) due to lack of response to a current regimen, make certain that all relevant cultures have been obtained or repeated.

2) Switch & De-escalate: “switch” IV to PO, and change to narrower-spectrum agent(s) (“de-escalate”) based on microbiology results.

- Consider discontinuing Vancomycin if: cultures are negative for MRSA, MRSE, or penicillin-resistant *Enterococcus*; and, no Hx of MRSA colonization; and, no Type I allergy to penicillins (PCNs).

- Combination therapy with [Ciprofloxacin OR Levofloxacin] PLUS [Pip-tazo, Cefepime, OR Aztreonam] is not beneficial beyond 48h - [Cipro or Levo] should be discontinued.

3) ESBL - Ertapenem is the drug of choice for infections due to ESBL-producing Gram-negative rods, except for *Pseudomonas*, which would require Meropenem.

4) Bioavailability: Levofloxacin, TMP/SMX, Clindamycin, Azithromycin, Fluconazole, and Metronidazole are highly bioavailable (90-100% GI absorption). They should be given PO if the GI tract is functional.

5) Use of Cephalosporins in Patients with Penicillin (PCN) Allergy: After taking a careful history, cephalosporins may be given safely to any patient without a history of a Type I rxn to PCN (immediate hypersensitivity = anaphylaxis, hives, angioedema).

6) Empiric antimicrobial choices in EPIC order set: **=AWH Blue Card – Empiric Antibiotics**

## II. SEPSIS OF UNKNOWN ETIOLOGY

1) Community-Acquired/Normal Host:  
Ceftriaxone 2g q 24h PLUS Vancomycin

- ± Tobramycin x1 (if septic shock)

2) Health Care-Associated/Compromised Host:  
[Pip-Tazo 3.375g q8h (x4h) PLUS Vancomycin]  
OR [Cefepime 1g q6h PLUS Vancomycin]± Tobramycin x1 with above options (if septic shock)

3) Type I PCN Allergy:  
Aztreonam 2g q8h PLUS Vancomycin  
PLUS Tobramycin 7mg/kg q24h

## III. SKIN AND SOFT TISSUE INFECTIONS

- Nonpurulent/Moderate Severity (Cellulitis): Preferred: Penicillin-G 4 million units q6h (Alternative: Cefazolin 1-2g q8h)

- Type I PCN Allergy: Vancomycin

- Purulent (Abscess): I&D + C&S.  
TMP/SMX 1-2DS q12h OR Doxycycline 100mg q12h (if severe: Vancomycin). Switch to Nafcillin or Cefazolin if MSSA in C&S.

- Nonpurulent/Severe (Necrotizing): Surgical intervention (C&S).  
Pip-Tazo 3.375g q8h (x4h) PLUS Clindamycin 600mg q8h PLUS Vancomycin

- Type I PCN Allergy: Aztreonam 2g q8h  
PLUS Metronidazole 500mg q8h PLUS Linezolid 600mg q12h

- Diabetic or Ischemic Foot Infection (AFTER deep tissue, or bone biopsy culture):

[Pip-tazo 3.375g q8h (x4h) PLUS Vancomycin]  
OR [Cefepime 1g q6h PLUS Vancomycin PLUS Metronidazole 500mg q8h]

- D/C Vanco if no MRSA/MRSE/Enterococcus
- Type I PCN Allergy: Aztreonam 2g q8h  
PLUS Metronidazole 500mg q8h  
PLUS Vancomycin

## IV. COMMUNITY-ACQUIRED PNEUMONIA (CAP)

- Ceftriaxone 1g q 24h  
PLUS [Azithromycin 500mg q 24h OR Doxycycline 100mg q12h]

- Type I PCN Allergy: Levofloxacin 750mg q 24h

- If aspiration, add Metronidazole to above regimens

## V. HOSPITAL-ACQUIRED/VENTILATOR-ASSOCIATED PNEUMONIA (HAP/VAP)

- [Cefepime 1g q6h OR Pip-Tazo 3.375g q8h (x4h)] PLUS Vancomycin (D/C Vancomycin at 48h if no MRSA in a quality respiratory culture)

- Type I PCN Allergy: Aztreonam 2g q8h PLUS Tobramycin 7mg/kg q24h PLUS Vancomycin

- Consider addition of inhaled Tobramycin

- If aspiration, add Metronidazole to [Cefepime OR Aztreonam] above

- Duration = 7 days (including *Pseudomonas*)

## VI. COMPLICATED INTRA-ABDOMINAL (cIAI) or BILIARY TRACT INFECTIONS, and PANCREATITIS

Note: At Aspirus, only ~85% of *E. coli*, and ~65% of *P. mirabilis* are susceptible to Levofloxacin/Ciprofloxacin, or TMP/SMX; *E. coli* sensitivity to Amp-sul is only 69%.

- Community-Acquired/Normal Host and Mild-Moderate Severity:  
Ceftriaxone 2g q24h PLUS Metronidazole 500mg q8h

- Community-Acquired/Compromised Host or High Severity:  
[Pip-Tazo 3.375g q8h (x4h)]  
OR [Cefepime 1g q6h PLUS Metronidazole 500mg q8h]

- Type I PCN Allergy: Aztreonam 2g q8h PLUS Metronidazole 500mg q8h PLUS Vancomycin

- Health Care-Associated (HCA):  
[Pip-Tazo 3.375g q8h (x4h) PLUS Vancomycin PLUS Fluconazole 400mg q24h]

OR

[Cefepime 1g q6h PLUS Metronidazole 500mg q8h PLUS Vancomycin PLUS Fluconazole 400mg q24h]

- Type I PCN Allergy: Aztreonam 2g q8h PLUS Metronidazole 500mg q8h PLUS Vancomycin PLUS Fluconazole 400mg q24h

- Duration: 4-7 days after adequate source control.

- Pancreatitis: Routine “prophylactic” antibiotics on admission are NOT routinely recommended. Abx indicated if admission CT, or repeat CT w/contrast 48h after admit has  $\geq$  30% pancreatic necrosis. Then CT-directed FNA for cx to guide abx.

## VII. MANAGEMENT of *Staph aureus* BACTEREMIA

- MSSA = Nafcillin OR Cefazolin (Vancomycin NOT recommended due to worse outcomes)

- MRSA = Vancomycin (unless MIC > 1)

1) Repeat BCx daily until negative x48hrs.

2) Remove indwelling IV catheters.

3) Obtain TTE. If prosthetic valve, or TTE negative and fever/bacteremia not resolved in 48hr, obtain TEE.

4) Duration = 4-6 wks IV abx from most recent negative BCx. 2wks IV abx may be considered in select cases (ID consult).

5) In general, obtain ID consult to guide management.

## VIII. URINARY TRACT INFECTIONS (UTI)

1) Asymptomatic Bacteriuria (ASB) in Noncatheterized Adults:

- Except in pregnancy or prior to urologic procedures, urine studies (UA and/or C&S) in noncatheterized adults should NOT be obtained in the absence of UTI Signs and Symptoms, defined as any 2 of the following: fever (> 38 C); worsened urgency or frequency; new dysuria; suprapubic tenderness; CVA pain or tenderness; and, in the frail elderly a change (unresponsive to hydration) in mental status or character of urine (odor, color).

- Frail, disabled older adults have a prevalence of pyuria and/or bacteriuria as high as 45% in the absence of UTI symptoms.

- ASB should NOT be treated.

2) Catheter-Associated UTI (CA-UTI) and Catheter-Associated Asymptomatic Bacteriuria (CA-ASB).

- CA-UTI - Signs and Symptoms: new onset or worsening fever, altered mental status, malaise, or lethargy with no other identified cause; flank pain; CVAT; acute hematuria; pelvic discomfort; AND > 10,000 cfu/mL AND pyuria (> 10WBC/hpf). The absence of pyuria in a symptomatic patient (i.e. fever) suggests a diagnosis other than CA-UTI.

- CA-ASB:  $\geq$  100,000 cfu/mL, with or without pyuria, in the absence of sx of UTI. Pyuria in the absence of sx is NOT an indication for antibiotics.

3) Uncomplicated UTI (uUTI)/Cystitis:

- Nitrofurantoin 100mg PO BID x5d;  
OR TMP/SMX 1DS PO BID x3d;  
OR Cefpodoxime 100mg PO BID x7d

4) Complicated UTI (cUTI) and Pyelonephritis:

- Symptomatic UTI = signs and symptoms of UTI (above), AND bacteriuria (>100,000 CFU/mL) AND pyuria (>10 WBC/hpf).

- Community-Acquired/Normal Host:  
Ceftriaxone 1g q 24h

- Type I PCN Allergy: Aztreonam 1g q8h

- Health Care-Associated:  
Cefepime 1g q 6h PLUS Ampicillin 2g q6h

- Type I PCN Allergy: Aztreonam 1g q8h  
PLUS Vancomycin

## Beta-Lactam Cross-Reactivity Table

Agent	FDA-Approved Beta-Lactam Antibiotics with Similar/Identical Side Chains
Amoxicillin	Ampicillin
Ampicillin	Amoxicillin
Aztreonam	Ceftazidime
Cefadroxil	Amoxicillin
Cefdinir	Cefixime
Cefepime	Ceftriaxone
Cefixime	Cefdinir
Cefprozil	Amoxicillin
Cefpodoxime	Ceftriaxone
Cefprozil	Amoxicillin
Cefuroxime	Ceftriaxone
Cefazolin	Penicillin G
Ceftriaxone	Cefepime
Cefuroxime	Ceftriaxone
Cefixime	Cefdinir
Cefepime	Ceftriaxone
Cefdinir	Cefixime
Cefepime	Ceftriaxone
Ceftriaxone	Cefepime
Cefazolin	Penicillin G
Cefuroxime	Ceftriaxone
Cefixime	Cefdinir
Cefepime	Ceftriaxone
Cefdinir	Cefixime
Cefepime	Ceftriaxone
Ceftriaxone	Cefepime
Amoxicillin	Ampicillin
Ampicillin	Amoxicillin
Ceftriaxone	Cefepime
Cefepime	Ceftriaxone
Ceftriaxone	Cefepime
Cefepime	Ceftriaxone
Cefdinir	Cefixime
Cefixime	Cefdinir
Cefepime	Ceftriaxone
Cefdinir	Cefixime
Cefepime	Ceftriaxone
Ceftriaxone	Cefepime
Cefazolin	Penicillin G
Cefuroxime	Ceftriaxone
Cefprozil	Amoxicillin
Cefuroxime	Ceftriaxone
Cefixime	Cefdinir
Cefepime	Ceftriaxone
Cefdinir	Cefixime
Cefepime	Ceftriaxone
Ceftriaxone	Cefepime
Amoxicillin	Ampicillin
Ampicillin	Amoxicillin
Ceftriaxone	Cefepime
Cefepime	Ceftriaxone
Ceftriaxone	Cefepime
Cefepime	Ceftriaxone
Cefdinir	Cefixime
Cefixime	Cefdinir
Cefepime	Ceftriaxone
Cefdinir	Cefixime
Cefepime	Ceftriaxone
Ceftriaxone	Cefepime
Cefazolin	Penicillin G
Cefuroxime	Ceftriaxone
Cefprozil	Amoxicillin
Cefuroxime	Ceftriaxone
Cefixime	Cefdinir
Cefepime	Ceftriaxone
Cefdinir	Cefixime
Cefepime	Ceftriaxone
Ceftriaxone	Cefepime
Amoxicillin	Ampicillin
Ampicillin	Amoxicillin
Ceftriaxone	Cefepime
Cefepime	Ceftriaxone
Ceftriaxone	Cefepime
Cefepime	Ceftriaxone
Cefdinir	Cefixime
Cefixime	Cefdinir
Cefepime	Ceftriaxone
Cefdinir	Cefixime
Cefepime	Ceftriaxone
Ceftriaxone	Cefepime
Cefazolin	Penicillin G
Cefuroxime	Ceftriaxone
Cefprozil	Amoxicillin
Cefuroxime	Ceftriaxone
Cefixime	Cefdinir
Cefepime	Ceftriaxone
Cefdinir	Cefixime
Cefepime	Ceftriaxone
Ceftriaxone	Cefepime
Amoxicillin	Ampicillin
Ampicillin	Amoxicillin
Ceftriaxone	Cefepime
Cefepime	Ceftriaxone
Ceftriaxone	Cefepime
Cefepime	Ceftriaxone
Cefdinir	Cefixime
Cefixime	Cefdinir
Cefepime	Ceftriaxone
Cefdinir	Cefixime
Cefepime	Ceftriaxone
Ceftriaxone	Cefepime
Cefazolin	Penicillin G
Cefuroxime	Ceftriaxone
Cefprozil	Amoxicillin
Cefuroxime	Ceftriaxone
Cefixime	Cefdinir
Cefepime	Ceftriaxone
Cefdinir	Cefixime
Cefepime	Ceftriaxone
Ceftriaxone	Cefepime

- 10% of patients report a PCN allergy, but only 1% are found to be real.
- Over time patients lose their Type I allergy to PCNs. After 10 years, 80% of patients won't have the allergy anymore.
- Cross-reactivity between beta-lactams is associated with similar or identical side chains. The cross-reactivity table above can be used to identify beta-lactam antibiotics to AVOID administering to patients with reported allergies due to similar/identical side chains. Find the agent the patient is allergic to in the first column. Avoid administering any of the agents with similar/identical side chains in the row following it. If an agent is not listed as being similar/identical to the patient's allergen then it can be safely administered as cross-reactivity between PCNs and cephalosporins or PCNs and carbapenems is <1%.
  - o For example, a patient with a Type I allergy of rapid-onset hives to amoxicillin should NOT receive cephalixin as they have similar R1 side chains. Ceftriaxone, with a dissimilar side chain, would be a good choice.

