

2016-2017 UCLA Health ADULT ANTI-INFECTIVE DOSING GUIDELINES

Approved by the Antimicrobial Subcommittee & the Pharmacy and Therapeutics Committee 9/2016. Department of Pharmaceutical Services.

For assistance in antimicrobial dosing and selection, contact the Antimicrobial Stewardship Pharmacist 310-267-7567. For diagnosis and management recommendations or formal consultation, contact the ID consult service: RRUMC general ID service pager 98771, RRUMC transplant ID service pager 93424, SMH ID service pager 96002. For antimicrobial treatment guidelines visit <http://www.asp.mednet.ucla.edu>

Doses are those recommended for systemic infections commonly treated with these agents.
Abbreviations: IV-PO=high oral bioavailability – consider initiating with/switching to oral therapy when patient tolerating orals; LD = loading dose, MD = maintenance dose, PHD = post HD
 Recommended dosing weights: **IBW** = ideal body weight, **TBW** = total body weight, **ABW** = adjusted body weight
 Dialysis: HD=intermittent (high-flux) hemodialysis. CRRT=continuous renal replacement therapy (assumes an ultrafiltration rate of 2L/h with CVVHD, dialysate flow rate of 1L/h with CVVHDF, residual native GFR <10mL/min).

Drug	CrCl >50 mL/min	CrCl 10 - 50 mL/min	CrCl <10 mL/min (ESRD not on HD)	Dialysis (HD or CRRT)
Acyclovir ^{IBW}	<u>Herpes simplex infections</u> 5 mg/kg/dose IV Q8h	5 mg/kg/dose IV Q12 - 24h	2.5 mg/kg IV Q24h	HD: 2.5mg/kg IV x1 now then 2.5 mg/kg IV QPM (give PHD on HD days) CRRT: 5mg/kg Q24h
	<u>HSV encephalitis/Varicella zoster</u> 10 mg/kg/dose IV Q8h	10 mg/kg/dose IV Q12 - 24h	5 mg/kg IV Q24h	HD: 5mg/kg IV x1 now then 5 mg/kg IV QPM (give PHD on HD days) CRRT: 5-10mg/kg IV Q12h -24h
Amikacin ^{IBW} *Use ABW for obese patients (BMI ≥ 30 kg/m ²) <i>Aminoglycoside dosing & monitoring per pharmacy available. Order in CareConnect.</i>	Extended interval dosing (preferred)			
	<u>> 60 mL/min</u> 15-20 mg/kg/dose IV Q24h	<u>40 - 60 mL/min</u> 10-15 mg/kg/dose IV Q36h	<u>20 - 40 mL/min</u> 10-15 mg/kg/dose IV Q48h	<u>< 20 mL/min</u> Call pharmacy
	Extended dosing allows for high peak to MIC ratios potentially improving efficacy and reducing the risk of nephro- and ototoxicity. An extended-interval level drawn between 6-14 hours (after the start of the infusion) is recommended any time after the first dose. Peak levels are not necessary and trough levels should be undetectable. Call pharmacy for assessment of aminoglycoside levels.			
	Traditional dosing			
	<u>> 60 mL/min</u> 7.5 mg/kg/dose IV Q12h	<u>40 - 60 mL/min</u> 5-7.5 mg/kg/dose IV Q12-Q24h	<u>20 - 40 mL/min</u> 5 mg/kg/dose IV Q24h-Q48h	<u>< 20 mL/min</u> 2.5-5 mg/kg/dose IV Q48h-Q72h
	Target amikacin levels: PEAK = 25-35 mg/L and TROUGH = < 5 mg/L. Peak levels should be drawn ½ hour following a ½ hour infusion. Trough levels should be obtained prior to the fourth dose of the regimen.			
Liposomal Amphotericin B (AmBisome) ^{TBW}	3-5 mg/kg/dose IV Q24h	No Change Dose adjustment is unnecessary for pre-existing renal dysfunction however, decreased renal function caused by amphotericin may warrant dose adjustment (e.g. dose reduction or q48h dosing)		
Ampicillin	<u>Meningitis or endovascular infection</u> 2 g IV Q4h	2 g IV Q6h-Q8h	2 g IV Q12h	HD: 1-2g IV Q12-24h CRRT: 1-2g IV Q8-12h
	<u>Uncomplicated Infection</u> 1-2 g IV Q6h	1 g IV Q6h-Q8h	1 g IV Q12h	
Ampicillin/sulbactam	3 g IV Q6h	3 g IV Q8h	3 g IV Q12h	HD: 3g IV Q12-24h CRRT: 3g IV Q8-12h
Aztreonam	2 g IV Q6-8h	1 g IV Q8h	500 g IV Q8h	HD: 1g IV x1 now then 500mg IV Q12h CRRT: 1-2g IV Q8-12h
Caspofungin <small>Hepatic dysfunction- Child- Pugh class B/C:70mg LD, then 35mg IV daily</small>	LD=70 mg x1, then 50 mg Q24h <small>Increase maintenance dose to 70mg when given with phenytoin, rifampin, carbamazepine, dexamethasone, nevirapine, efavirenz</small>	No Change	No Change	No Change
Cefazolin	<u>Gram Negative or Complicated Gram Positive</u> 2 g IV Q8h	1 - 2 g IV Q12h	1 g IV Q24h	HD: 1g IV Q24h CRRT: 2g IV Q12h
	<u>Uncomplicated Gram Positive</u> 1 – 2 g IV Q8h			
Cefepime	<u>>60 mL/min</u> 1g IV Q8h	<u>30-60 mL/min</u> 1g IV Q12h	<u>10-30 mL/min</u> 1g IV Q24h	<u><10 mL/min</u> 500mg IV Q24h
	<u>Febrile neutropenia, meningitis, Pseudomonas, critically ill</u> 2g IV Q8h	2 g IV Q12h	2 g IV Q24h	1 g IV Q24h
Ceftriaxone	1 g IV Q24h	No Change	No Change	No Change
	<u>Meningitis</u> 2 g IV Q12h			
	<u>Endocarditis & Osteomyelitis</u> 2 g IV Q24h			
Ciprofloxacin ^{IV-PO}	<u>>60mL/min</u> 400mg IV Q12h 500-750mg PO Q12h	<u>30-60 mL/min</u> No Change	<u>10-30 mL/min</u> 200-400mg IV Q12h	<u><10 mL/min</u> 200mg IV Q12h
	<u>Pseudomonas, critically ill</u> 400mg IV Q8h 750mg PO Q12h	No Change	250-500mg PO Q12h	250mg PO Q12h
Clindamycin	600 - 900 mg IV Q8h 300 - 450 mg PO Q8h	No Change	No Change	No Change
Colistin ^{IBW} <small>Dosed in mg of base activity (CBA) **ID CONSULT REQUIRED (HS1444)</small>	<u>≥ 50 mL/min</u> LD: 5 mg/kg IV x1, then 2.5 mg/kg/dose IV Q12h	<u>20-50 mL/min</u> LD: 5mg/kg IV x1, then 2.5mg/kg/dose IV Q24h	<u>< 20 mL/min</u> LD: 5mg/kg IV x1, then 2.5mg/kg/dose IV Q48h	HD: 5mg/kg IV x1, then 30 mg IV Q12h CRRT: 5 mg/kg IV x1, then 100 mg IV Q12h
Daptomycin ^{TBW} <small>Not effective in treatment of pneumonia</small>	4-8 mg/kg IV Q24h Dose depends on indication & pathogen	<u><30 ml/min</u> 4-8 mg/kg IV Q48h		HD: 4-8 mg/kg IV Q48h CRRT: 4-8 mg/kg IV Q48h
Doxycycline ^{IV-PO}	100 mg IV/PO Q12h	No Change	No Change	No Change
Ertapenem	1g IV Q24h	<u><30 ml/min</u> 500 mg IV Q24h		HD: 500mg IV Q24h CRRT:500mg IV Q24h
Ethambutol ^{IBW}	15 - 20 mg/kg PO Q24h	<u><30 ml/min</u> 15-25 mg/kg PO 3x/week		HD: 15-25mg/kg PO 3x/week (PHD) CRRT: 15-25mg/kg PO 3x/week
Fluconazole ^{IV-PO} <small>Oropharyngeal Candidiasis: 100mg daily Esophageal Candidiasis: 200mg daily Severe Infections : 400mg daily</small>	100 - 400 mg IV/PO Q24h	50 - 200 mg IV/PO Q24h	50 -100 mg IV/PO Q24h	HD: 200 mg IV/PO daily CRRT: 400 – 800 mg IV/PO Q24h
Ganciclovir ^{ABW} Induction	<u>> 70 mL/min</u> 5 mg/kg/dose IV Q12h	<u>50 - 69 mL/min</u> 2.5 mg/kg/dose IV Q12h	<u>25-49 mL/min</u> 2.5mg/kg/dose IV Q24h	<u>10-24 mL/min</u> 1.25 mg/kg/dose IV Q24h
	<u>< 10 mL/min</u> 1.25 mg/kg/dose IV 3x/week			
Ganciclovir ^{ABW} Maintenance	<u>> 70 mL/min</u> 5 mg/kg/dose IV Q24h	<u>50 - 69 mL/min</u> 2.5 mg/kg/dose IV Q24h	<u>25-49 mL/min</u> 1.25 mg/kg/dose IV Q24h	<u>10-24 mL/min</u> 0.625 mg/kg/dose IV Q24h
			<u>< 10 mL/min</u> 0.625 mg/kg/dose IV 3x/week	HD: 1.25mg/kg IV PHD only CRRT: 2.5-5 mg/kg IV Q24h
Gentamicin ^{IBW} *Use ABW for obese patients (BMI ≥ 30 kg/m ²) <i>Aminoglycoside dosing & monitoring per pharmacy available. Order in CareConnect.</i>	Extended interval dosing (preferred)			
	<u>> 60 mL/min</u> 5-7 mg/kg IV Q24h	<u>40 - 60 mL/min</u> 5-7 mg/kg IV Q36h	<u>20 - 39 mL/min</u> 5-7 mg/kg IV Q48h	<u>< 20 mL/min</u> Call pharmacy
	Extended dosing allows for high peak to MIC ratios potentially improving efficacy and reducing the risk of nephro- and ototoxicity. An extended-interval level drawn between 6-14 hours (after the start of the infusion) is recommended anytime after the first dose. Peak levels are not necessary and trough levels should be undetectable. Call pharmacy for assessment of aminoglycoside levels.			
	Traditional dosing			
	<u>> 60 mL/min</u> 1-2 mg/kg/dose IV Q8h-Q12h	<u>40 - 60 mL/min</u> 1.2-1.5 mg/kg/dose IV Q12h-Q24h	<u>20 - 39 mL/min</u> 1.5 mg/kg/dose IV Q24-Q48h	<u>< 20 mL/min</u> 1-1.5 mg/kg/dose IV Q48h-Q72h
	Target gentamicin and tobramycin levels: PEAK = 5-10 mg/L and TROUGH = < 1 mg/L. Peak levels should be drawn ½ hour following a ½ hour infusion. Trough levels should be obtained prior to the fourth dose of the regimen. Traditional dosing is the preferred method for Gram-positive synergy dosing in infective endocarditis. For patients with CrCl > 60 ml/min for whom synergy dosing is required, recommend 1 mg/kg/dose IV Q8h. Gram-positive synergy PEAK = 3-4 mcg/mL and TROUGH = undetectable.			

Drug	CrCl >50 mL/min	CrCl 10 - 50 mL/min	CrCl <10 mL/min (ESRD not on HD)	Dialysis (HD or CRRT)
Isoniazid	300 mg PO Q24h	No Change	No Change	No Change
Levofloxacin ^{IV-PO}	Urinary tract infections 250-500mg IV/PO Q24h	500mg x1, then 250mg IV/PO Q24h	500mg x1, then 250mg IV/PO Q48h	HD: 500mg x1, then 250mg Q48h CRRT: 750mg x1, then 250mg-500mg Q24h
	Non-urinary tract infections 750mg IV/PO Q24h	750mg x1, then 750mg IV/PO Q48h	750mg x1, then 500mg IV/PO Q48h	
Linezolid ^{IV-PO}	600mg IV/PO Q12h	No Change	No Change	No Change
Meropenem	> 50mL/min 1 g IV Q8h	<u>25 - 50 mL/min</u> 1g IV Q12h	<u>10-25 mL/min</u> 0.5g IV Q12h	HD: 500mg IV x1 now then 500mg QPM (give post HD on HD days) CRRT: 1g IV Q8-12h* *Recommend 1g Q8h for CVVHD ultrafiltration rates exceeding 2L/hr
	Meningitis 2g IV Q8h	2g IV Q12h	1g IV Q12h	
Metronidazole ^{IV-PO}	500 mg IV/PO Q8h	500 mg IV/PO Q8h	500 mg IV/PO Q12h ESRD not on HD	500 mg IV/PO Q8h
Oxacillin ¹ Administered as a continuous infusion over 24 hours	12g IV Q24h ¹	No Change	No Change	No Change
Penicillin G ¹ Administered as a continuous infusion over 24 hours	18-24 MU IV Q24h ¹	8-16 MU IV Q24h ¹	8-12 MU IV Q24h ¹	HD: 8-12 MU IV Q24h CRRT: 8-16 MU IV Q24h ¹
Piperacillin/tazobactam ¹ Administered as an extended infusion over 4 hours	≥ 20 mL/min 3.375g IV x1 bolus, then 3.375g IV Q8h ¹		< 20 mL/min 3.375g IV x1 bolus, then 3.375g IV Q12h ¹	HD: 3.375g IV x1 bolus, then 3.375g IV Q12h ¹ CRRT: 3.375g IV x1 bolus, then 3.375g IV Q8h ¹
Posaconazole Solution must be administered with high-fat meal or nutritional shake e.g. Ensure Formulation dependent dosing: ¹ Solution ² Enteric coated tablet/Intravenous	Treatment of invasive fungal infections 400 mg PO Q12h ¹ or 200 mg PO Q6h ¹ Neutropenia/GVHD prophylaxis 200 mg PO Q8h ¹ or 300 mg PO/IV q12h x2 doses, then 300 mg PO/IV daily ²	No Change	No Change	No Change
Pyrazinamide ^{IBW}	20 - 25 mg/kg/day PO Q24h	<30 ml/min 25-35 mg/kg 3x/week		HD: 25-35 mg/kg three 3x/week PHD CRRT: 25-35 mg/kg 3x/week
Rifampin ^{IV-PO} Known to interact with many medications- review of concurrent medications strongly recommended	Mycobacterial infections 600 mg IV/PO Q24h Endocarditis 300 mg IV/PO Q8h Prosthetic device infections 450 mg IV/PO Q12h	No Change	No Change	No Change
Tobramycin	See Gentamicin			
TMP/SMX ^{IV-PO, ABW*} When switching to oral therapy, consider that a single-strength tablet has 80mg of TMP, a double-strength tablet 160mg of TMP. *May consider TBW for serious infections	Systemic GNR infections 10 mg TMP/kg/day IV divided Q6 - 12h <i>Pneumocystis pneumonia</i> , <i>Stenotrophomonas maltophilia</i> 15 - 20 mg TMP/kg/day IV divided Q6 - 12h	5 - 7.5 mg TMP/kg/day IV divided Q12 - 24h 10 - 15 mg TMP/kg/day IV divided Q12 - 24h	2.5 - 5.0 mg TMP/kg IV Q24h 5 - 10 mg TMP/kg IV Q24h	HD: 2.5-5mg TMP/kg/day Q24h CRRT: 5-7.5mg TMP/kg/day divided Q12-24h
Vancomycin ^{TBW} Round dose to nearest 250mg increment Maximum: 2 gram/dose Vancomycin dosing & monitoring per pharmacy available. Order in CareConnect.	>60mL/min <u>Uncomplicated Infections¹</u> 10-15mg/kg IV Q12h <u>Serious Infections²</u> Consider loading dose of 25mg/kg IV x1 followed by 15-20mg/kg IV Q8-12h	<u>40-60 mL/min</u> 10-15mg/kg IV Q12h-Q24h <u>20-40mL/min</u> 5-10mg/kg IV Q24h <u>10-20 mL/min</u> 5-10mg/kg IV Q24h-Q48h	<10 mL/min 10-15mg/kg IV loading dose x1, then redoes according to levels	HD: 15-20mg/kg loading dose x1 followed by 0.5-1g PHD only CRRT: 10-15mg/kg IV Q24h
Trough levels should be obtained within 30 minutes before the 4 th dose for a new regimen or dose change. Vancomycin troughs are not recommended if anticipated duration of therapy is \leq 3 days. ¹ For uncomplicated infections, the target trough is 10-15 mcg/mL. ² For serious infections due to MRSA (i.e. CNS infections, endocarditis, pneumonia, bacteremia, or osteomyelitis), target trough is 15-20 mcg/mL, ID consult recommended.				
Voriconazole ^{IV-PO, ABW}	400 mg PO Q12h x 2 doses, then 200 mg PO Q12h ¹	No Change ²	No Change ²	No Change ²
PO should be used when possible, as oral bioavailability >95%. IV dose: LD=6 mg/kg/dose Q12h x 2 doses, then 4mg/kg/dose (ABW) Q12h. ¹ In obese patients consider using a weight-based PO regimen (4mg/kg Q12h) using ABW, consult ID/ID-pharmacy for assistance. ² Use of the IV formulation should be avoided if possible in patients with CrCl < 50 mL/min due to accumulation and renal toxicity. Voriconazole may require dose adjustment in hepatic dysfunction and has numerous drug interactions. For patients taking PO, administer on an empty stomach.				

UCLA HEALTH SYSTEM ADULT INPATIENT ABBREVIATED SUSCEPTIBILITY DATA 2016

See UCLA Guidebook for complete antibiogram: <http://www.asp.mednet.ucla.edu/pages/anti-suscep-summ>

NA-testing NOT APPLICABLE to organism (e.g. intrinsic resistance), AMIK- amikacin, AMP – ampicillin, A/S- ampicillin/sulbactam, CIP-ciprofloxacin, CLIN-clindamycin, CZOL-cefazolin

CTRX-ceftriaxone, CFPM-cefepime, DAPTO- daptomycin, DOX-doxycycline, ERT-ertapenem, ERY-erythromycin, GEN-gentamicin, LIN-linezolid MER-meropenem, OX-oxacillin, PCN-penicillin

P/T-piperacillin-tazobactam, RIF- rifampin, TOB-tobramycin, T/S-trimethoprim/sulfamethoxazole, VANC-vancomycin

Gram-negative isolates, non-urine isolates

Organism	Location	No. Isolates	AMP	A/S	P/T	CZOL	CTRX	CFPM	ERT	MER	AMIK	GENT	TOB	CIP	T/S
<i>Enterobacter cloacae</i>	IP ¹	33	R ³	R	76	R	See note ⁴	85	88	97	99	94	94	94	88
	ICU ²	64	R	R	67	R	-	88	95	98	98	97	97	98	91
<i>Escherichia coli</i>	IP	106	33	43	90	49	65	75	97	99	96	73	72	45	43
	ICU	92	20	31	77	33	65	69	95	99	96	71	71	46	46
<i>Klebsiella pneumoniae</i>	IP	84	R	58	80	56	70	75	85	87	89	80	75	74	69
	ICU	111	R	68	83	68	80	83	91	91	91	88	86	82	77
<i>Proteus mirabilis</i>	IP	17 ⁵	71	88	99	24	88	94	99	99	99	88	94	53	71
	ICU	18 ⁵	78	78	99	44	99	99	99	99	99	89	89	61	61
<i>Pseudomonas aeruginosa</i>	IP	96	R	R	77	R	R	84	R	78	95	93	94	63	R
	ICU	114	R	R	72	R	R	78	R	68	92	90	93	68	R
<i>Acinetobacter baumannii</i>	All locations	49	R	69	49	R	-	63	R	71	74	65	69	63	67

¹ IP -- inpatient

² ICU – intensive care unit

³ R – intrinsic resistance

⁴ not appropriate for treatment of serious *E. cloacae* infections

⁵ calculated from fewer than the standard recommendation of 30 isolates

Gram-positive isolates, non-urine isolates

Organism	Location	No. Isolates	AMP	OX	PCN	CIP	CLIN	DAPTO	ERY	LIN	T/S	VANC	CTRX
<i>Staphylococcus aureus</i>	ALL	1479	-	71 ¹	<10	66	73	99	54	99	98	99	-
Coagulase-negative staphylococcus	ALL	448	-	48	<10	48	61	99	39	99	63	99	-
<i>Streptococcus pneumoniae</i>	ALL	29 ¹	²	-	See note ³	See note ⁴	86	-	55	-	79	100	See note ⁵
<i>Enterococcus spp.</i>	ALL	450	75	-	-	53	R	99	-	99	R	100	R
<i>Enterococcus faecalis</i>	ALL	82	99	-	-	62	R	99	-	99	R	98	R
<i>Enterococcus faecium</i> ⁶	ALL	108	8	-	-	5	R	97	-	99	R	19	R

Staphylococcus resistant to oxacillin are resistant to cefazolin, cephalixin, ceftriaxone and all other beta-lactams, except cefazolin.

²97% of isolates are susceptible to amoxicillin.

³In patients with meningitis, 52% of isolates are penicillin-resistant. In patients without meningitis, 5% of isolates are penicillin-resistant.

⁴99% of isolates are susceptible to levofloxacin. Levofloxacin should be used instead of ciprofloxacin to treat *S. pneumoniae*.

⁵In patients with meningitis, 89% of isolates are susceptible to ceftriaxone. In patient without meningitis, 99% of isolates are susceptible to ceftriaxone. NOTE: For the treatment of meningitis, pending susceptibilities, VANC should be empirically added to the regimen since failures due to highly resistant isolates have been reported with ceftriaxone and cefotaxime.

⁶58% of enterococcal bloodstream were caused by *E. faecium*: 85% of these were vancomycin resistant.

⁷Calculated from fewer than the standard recommendation of 30 isolates.