

2019 Antibiotic Stewardship Guidebook

On Call Infectious Disease Physician

Beacon Center Phone 303-415-8850

Person on Call Icon in Citrix

**ID doctors can also be contacted on Voalte for non-urgent issues*

Pharmacy Phone Extensions: see Voalte

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PEARLS

- Take a daily “antibiotic time out” to assess the appropriateness of antibiotic therapy.
- Document the indications for specific antibiotic use in H&P and daily in progress note.

2019 Antibiotic Stewardship Guidebook

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Empiric Antimicrobial Guidelines for Hospitalized Adults 2019

Suggested initial therapies based on guidelines¹⁻⁹ and local resistance patterns, these guidelines are *not* a substitution for an ID consult.

Indication	Likely Pathogens	Empiric Therapy	Alternative Therapy	Duration	Oral Empiric Step Down
Community Acquired Pneumonia¹	S. pneumo., H. flu, Mycoplasma, C. pneumoniae, Legionella, S. aureus, respiratory viruses <i>Isolate and rule out influenza at pertinent times of year</i> <i>Blood and respiratory cultures recommended, in cases of severe pneumonia send legionella urinary antigen.</i>	Ceftriaxone 1gm IV q24h + Azithromycin 500mg IV q24h OR Levofloxacin 750mg IV q24h ICU admit + Risks for MDR: consider HAP antibiotic recs +/- Levofloxacin 750mg IV q24h	β lactam allergy Levofloxacin 750mg IV q24h Risk for Prolonged QT Use Doxycycline 100mg IV/PO q12h for atypical coverage	5-7 days If abscess or empyema is present, ID consult recommended	<ul style="list-style-type: none"> • Amox/Clav + Azithromycin • 3rd gen PO Cephalosporin +Azithro • Levofloxacin
HCAP	Treat as CAP unless specific risks for MDR then HAP recommendations	MDR Risks: prior IV antibiotic use last 90 days, past cultures demonstrating MDR or MRSA risk factors			
HAP/VAP^{2*}	Enteric GNR, Pseudomonas, MRSA	Cefepime 2gm IV 8h OR Pip/taz 4.5gm IV q6h +/- Vancomycin IV	Severe β lactam allergy Consult ID	7 days	Depends on microbiologic data
Aspiration PNA^{1,2,3}	Streptococcus, H flu, S. Aureus, Enterobacteriaceae. Anaerobes considered less common 1) <i>Clear CXR +mild to moderate illness consider withholding antibiotics and monitoring</i> 2) <i>If no evidence of infection after 2 days following witnessed aspiration in the hospital, consider discontinuation of antibiotics</i>	Community acquired Amp/Sulbactam 3gm IV q6h OR Ceftriaxone 1gm IV daily Hospital acquired Low risk: same as community acquired High risk: antibiotics in last 90 days and/or hospitalized 5 days Pip/taz 3.375gm to 4.5gm IV q6h	β lactam allergy Moxifloxacin 400mg IV/PO q24h	7-10 days If abscess or empyema is present, ID consult recommended	<ul style="list-style-type: none"> • Amox/Clav • Moxifloxacin • PCN + Metronidazole • Clindamycin
Community Acquired Intra-abdominal Infection⁵	E coli, other enteric GNR, Enteric streptococci, Bacteroides, anaerobes	Ceftriaxone 1gm IV q24h + Metronidazole 500mg IV q8h	Severe β lactam allergy Levofloxacin 750mg q24h + Metronidazole 500mg IV q8h <i>22% local E coli resistance to Levofloxacin</i>	5-7 days with source control	Based on cultures Empiric <ul style="list-style-type: none"> • Amox/Clav • Levofloxacin + Metronidazole
Severe Sepsis with Peritonitis or Hospital Acquired Intra-abdominal Infection⁵	ESBL E coli, Pseudomonas, strep sp, enterococcus, staph, MRSA, yeast	Pip/taz 4.5gm IV q6h +/- Vancomycin IV (MRSA colonized or failing current therapy) Consider yeast coverage	β lactam allergy Meropenem 1gm IV q8h Severe β lactam allergy Consult ID	7-14 days depending on source control ID Consult Recommended	Based on cultures Empiric <ul style="list-style-type: none"> • Levofloxacin + Metronidazole

*Blood and respiratory cultures recommended, in cases of severe pneumonia send legionella urinary antigen.

NOTE: Antibiotic dosing in this chart does not take into account renal or liver dysfunction.

Empiric Antimicrobial Guidelines for Hospitalized Adults 2019

Suggested initial therapies based on guidelines¹⁻⁹ and local resistance patterns, these guidelines are *not* a substitution for an ID consult.

Indication	Likely Pathogens	Empiric Therapy	Alternative Therapy	Duration	Oral Empiric Step Down
Febrile Neutropenia⁴	Enteric gram neg, Pseudomonas, Streptococcus sp, Staphylococcus	Cefepime 2gm IV q8h +/- Vancomycin IV (cath related, SSTI, PNA, unstable) +/- Metronidazole IV 500mg q8h (abdominal symptoms) OR Meropenem 1gm IV q8hr +/- Vancomycin IV (cath related, SSTI, PNA, unstable)	Severe β lactam allergy Consult ID	Depends on clinical response/ source/count recovery	<ul style="list-style-type: none"> Levofloxacin Amox/Clav
Meningitis⁵	S. pneumo., N. meningitis, Listeria, Viral (enterovirus, HSV, VZV) <i>Suspect HSV/VZV » consult ID</i>	Ceftriaxone 2gm IV q12h + Vancomycin IV +/- Ampicillin 2gm IV q4h (Listeria, consider if >50y/o, preg, immunocompromised) +/- Dexamethasone 0.15 mg/kg IV q6h administered 10-20 min before, or concomitant with, 1st dose of antibiotics with suspected/proven pneumococcal meningitis	Nosocomial/post-neurosurgical Consult ID Severe β lactam allergy Consult ID	7-21 days depending on pathogen: consult ID	Not applicable
Skin and Soft Tissue Infections	Erysipelas, Non-purulent⁶ Streptococcus	Cefazolin 1gm IV q8h	β lactam allergy Vancomycin IV OR Clindamycin 600mg IV q8h	5-7 days	<ul style="list-style-type: none"> Dicloxacillin Cephalexin Clindamycin (check antibiogram)
	Purulent/abscess⁶ Staphylococcus sp <ul style="list-style-type: none"> Consider Surgical consult for I&D Obtain culture 	Vancomycin IV	Allergy to Vancomycin IV Consult ID	Variable, if abscess evacuated consider shorter 5-7 days	Empiric or MRSA TMP/SMX or Doxycycline MSSA Dicloxacillin or Cephalexin
	Necrotizing Fasciitis ⁶ Type 1 Polymicrobial Type 2 S. pyogenes (GAS) <i>Immediate Surgical and ID consult recommended.</i>	Vancomycin IV +Pip/taz 4.5gm IV q6h +/- Clindamycin IV 600 IV q8h (if high concern S. pyogenes)	Severe β lactam allergy Consult ID	Variable	Not applicable

NOTE: Antibiotic dosing in this chart does not take into account renal or liver dysfunction.

Empiric Antimicrobial Guidelines for Hospitalized Adults 2019

Suggested initial therapies based on guidelines¹⁻⁹ and local resistance patterns, these guidelines are *not* a substitution for an ID consult.

Indication	Likely Pathogens	Empiric Therapy	Alternative Therapy	Duration	Oral Empiric Step Down
Diabetic Foot Infection⁷	Polymicrobial: Staphylococcus, Streptococcus predominant Consider ESBL GNR, Pseudomonas, anaerobes as well.	Amp/sulbactam 3gm IV q6h OR Ertapenem 1gm IV q24h +/- Vancomycin IV <i>Recommend culture from deep tissue, obtained by biopsy or curettage after the wound cleansed and debrided.</i>	Concern for Pseudomonas Pip/taz 4.5gm IV q6h Severe β lactam allergy Levofloxacin 750mg IV q24h + Clindamycin 600mg IV q8h +/-Vancomycin IV	Variable	Based on cultures
Urinary Tract Infection^{8,9}	See pages 5-6				

ID consult available for any ID condition, but strongly recommended for bacteremia, fungemia, meningitis, necrotizing fasciitis, severe intra-abdominal infection and endocarditis

NOTE: Antibiotic dosing in this chart does not take into account renal or liver dysfunction.

REFERENCES:

- 1 CID 2007; 44:S27-72
- 2 CID 2016; 63(5):e61
- 3 CID 2010; 50:133-64 & Surg Infect 2017; 18:1-56
- 4 CID 2011; 52(4):e56-e93
- 5 CID 2004; 39:1267-84
- 6 CID 2014 Jul 15; 59(2):147-59
- 7 CID 2012; 54(12):132-173
- 8 CID 2011; 52(5):e103-e120 & NEJM 2019; 380:651-63
- 9 CID 2010; 50:625-663

PEARLS

- a) Penicillin allergy: Cross reactivity with 3rd and 4th generation cephalosporin or carbapenem is low < 10%.
- b) 28% of non-urine staphylococcus aureus isolates are MRSA.
- c) Rate of non-urine ESBL is 6-9% among E coli and Klebsiella

BCH Empiric Antibiotic Therapy for Severe Sepsis and Septic Shock of **Unknown** Source

Risk factors for Resistant Organisms

Hospitalized previous 90 days
Long term HD
Immunosuppressed
Broad spectrum antibiotics in last 90 days
NH or LTC
Known MDR organism

NO

YES

1. Refer to specific sections in antibiotic guidelines for specific sources of infection. Sepsis treatment should be targeted at the specific source whenever possible.
 2. Review prior microbiology data
 3. Blood cultures should be collected **PRIOR** to antibiotics.
- NOTE: Dosing below assumes Normal Renal Function

Ceftriaxone 2gm IV q24h
(q12hrs for CNS)
+/-
Vancomycin IV
(IF suspect MRSA or resistant *S. pneumoniae*)

OPTIONAL TREATMENT

Atypical CAP coverage:
Azithromycin 500mg IV q24h
Anaerobic coverage : Metronidazole
IV 500mg q8h

Pip/Tazo 4.5gm IV q6hrs
OR
Meropenem 1gm IV q8h
(reserve for h/o ESBL, more resistant GNRs)
+/-
Vancomycin IV
+/-
Atypical CAP coverage:
Azithromycin 500mg IV q24h

SEVERE BETA LACTAM ALLERGY

Aztreonam 2gm IV q8h
OR
Levofloxacin 750mg IV daily
+
Vancomycin IV
+/-
Anaerobic coverage: Metronidazole
IV 500mg q8h

Broad-spectrum empiric therapy used while cultures are pending i.e. first 48-72 hours. Antibiotic regimen should be evaluated daily and streamlined based on culture data.

SEVERE SEPSIS

If patient meets ALL 3 of the criteria listed below, the patient has severe sepsis:

1. Suspected infection

2. ≥ 2 SIRS Criteria:

- Temperature greater than 100.4 F (38°C) or less than 96.8 F (36°C)
- Heart rate greater than 90 bpm
- Respiratory rate greater than 20 or PaCO₂ less than 32 mmHg or mechanical ventilation
- WBC greater than 12,000 or less than 4,000 mm³

3. Any one of the following measures of organ dysfunction:

- Systolic BP less than 90 mmHg, MAP <65
- Serum lactate ≥ 2
- INR >1.5
- Creatinine >2
- Platelets <100,000
- Bilirubin >2
- Need for intubation or PPV

EMPIRIC TREATMENT WITH NO CLEAR SOURCE

Two sets of blood cultures must be obtained **prior** to initiating antibiotics to help guide therapy.

For proper bundle compliance, use the physician Sepsis Order set in Meditech. This is required as part of the BCH sepsis bundle:

- Blood cultures x 2 sets prior to antibiotics
- Lactate
- Broad spectrum antibiotics (see flow sheet on page 4)
- IV Fluids of 30 mL/kg bolus, unless direct contraindication.

Medicare core measures also require the following within 6 hours of time of presentation as part of the sepsis bundle:

- Repeat lactate level if the initial lactate level is elevated
- If hypotension persists after IVF administration: Repeat volume status and tissue perfusion assessment consisting of either a focused physical exam or 2 of 4 of the following: CVP measurement, central venous oxygen measurement, bedside ultrasound, additional fluid challenge or passive leg raise

PEARLS

- Two beta-lactam agents should not be used concurrently (e.g. Pip/Tazo/Cefepime/Meropenem).
- Potential sources (e.g. pneumonia, peritonitis, central venous catheters) must be considered when selecting therapy.
- Broad-spectrum empiric therapy is ONLY appropriate while cultures are pending i.e. first 48-72 hours. Antibiotic regimen should be evaluated daily and regimen should be streamlined based on culture data.

Guidelines for Management of Urinary Tract Infection in the Inpatient and Outpatient Setting

GENERAL RULE: Limit development of resistant bacteria by ONLY using antibiotics when ALL three things exist:

1. Symptoms, 2. Abnormal urinalysis, 3. Positive urine culture (>10⁵ CFU/mL of 1 organism in clean catch or 10⁵ CFU/mL in catheterized specimen)

See antibiogram for BCH patterns of resistance. More than half of urinary isolates are E coli. E coli resistance to levofloxacin is 22% in NON-urine isolates, 10% in urinary isolates and Bactrim is 27% in NON-urine isolates and 19% urine isolates. ESBL rate in urine is 4% outpatient and 12% inpatient combining E. coli, Klebsiella.

Typical Symptoms of an Infection along the Urinary Tract	Symptoms NOT Indicative of UTI in the <i>Absence</i> of Typical Symptoms
<ul style="list-style-type: none"> Dysuria, frequency, urinary urgency, urinary retention, hematuria Pelvic pain, suprapubic pain, flank pain Complicated UTI: Localizing urinary symptoms with new onset or worsening fever, rigors, AMS, or lethargy without other identifiable cause. Spinal cord injury: increased spasticity, autonomic dysreflexia 	Foul smelling urine, dark urine, cloudy urine, sediment in urine

	Definition / Comments	Organisms	Inpatient Treatment	Outpatient Treatment
Asymptomatic Bacteriuria	10 ⁵ bacteria in the urine without symptoms <i>Pearl: Pyuria does NOT differentiate UTI, PPV for infection between 30 and 56.</i>		No antibiotic treatment recommended (exceptions: pregnancy, planned urinary instrumentation, or 1st month following renal transplant)	
Uncomplicated Cystitis	Guidelines suggest that UA/Culture not needed with uncomplicated UTI in women, but with increasing resistance rates, may be clinically justified. Indications for culture: Male, History of MDR positive culture, inpatient stay at health care facility, broad spectrum antibiotic use in last 90 days, recent travel to areas with high rates of MDR (eg, India, Israel, Spain, Mexico)	E. coli, Klebsiella, Proteus S. saprophyticus (women) r/o STDs in sexually active individuals	N/A	Listed in order of recommendation: Nitrofurantoin 100mg PO BID x 5 days* Fosfomycin 3gm PO x1 dose* Cephalexin 500mg PO BID x 5 days Bactrim DS 1 PO BID x 3-5 days Cipro 250 or 500mg PO BID x 3 days Men should receive 7 days of therapy except fluoroquinolones 5 days adequate. GC/Chlamydia: Ceftriaxone 250mg IM x1 PLUS doxycycline 100mg PO BID x 7 d OR Azithromycin 1gm PO x1 dose

*Not recommended if concern for pyelonephritis. Short term use of Macrobid okay for CrCl >30. One study did show Fosfomycin inferior to Macrobid for cystitis (JAMA. 2018; 319(17):1781-1789).
PPV = positive predictive value, MDRO = multidrug resistant organisms

Renal dose adjustments not included in this chart, see pages 10 to 11.

Severe β lactam allergy: Consult ID

	Definition / Comments	Organisms	Inpatient Treatment	Outpatient Treatment
Complicated UTI including pyelonephritis	Upper or lower tract disease associated with factor(s) that increase(s) risk of failing therapy and generally requires hospitalization. <i>Pearl: May need to order Urine Culture separately if suspicious of pyelonephritis as pyuria may not be present.</i>	E. coli, Klebsiella, Enterococcus, Pseudomonas	General admit Ceftriaxone 1gm IV q24h Moderate to severe illness and/or Concern for Pseudomonas Cefepime 1-2gm IV q8h OR Pip/taz 4.5gm IV q6h +/- Vancomycin IV H/O MDRO: Ertapenem 1gm IV q24h	Specific antibiotic guided by cultures from inpatient. Duration of therapy 5 to 14 days depending on rapidity of response and antibiotic used to complete therapy. (fluoroquinolones 5-7 days, TMP-SMX 7-10 days, beta-lactams 10-14 days) Outpatient therapy for pyelonephritis <i>Obtain Urine culture</i> Levofloxacin 750mg daily x 5-7 days Consult ID for Ceftriaxone 1gm IV daily x 7d
CAUTI	Urinary catheter placed during hospitalization: With fever, limit evaluation of urine with 1) clinical signs: suprapubic pain or CVA tenderness, or 2) risk factors such as: kidney transplant, recent GU surgery, evidence of obstructive uropathy, profound immunosuppression or neutropenia. <i>Pearl: Urinary tract infection is rarely a cause of fever in hospitalized patient.</i> <i>Pearl: PPV of pyuria is low for infection in catheterized patients (15 to 28%)</i>	E. coli, Klebsiella, Staphylococcus, Enterococcus, Pseudomonas	Change or discontinue Foley Uncomplicated Ceftriaxone 1gm IV q24h Antibiotics in last 90 days/ Severe sepsis/ Concern for Pseudomonas or MDRO Cefepime 2gm IV q8h OR Meropenem 1gm IV q8h +/- Vancomycin IV	Based on cultures
Acute Prostatitis	Symptoms of cystitis PLUS fever, chills, malaise, myalgias, pelvic or perineal pain, or obstructive symptoms. Swollen, tender prostate on exam. <i>Pearl: Only instance when urine culture may be repeated after approximately 7 days of antibiotics to assure clearance of bacteriuria.</i>	Gram negative rods r/o STDs in sexually active individuals	Moderate disease Ceftriaxone 1gm IV q24h ICU admission/Concern for Pseudomonas Cefepime 2gm IV q8h	Based on cultures, possible empiric therapy: Bactrim DS 1 PO BID OR Cipro 500mg PO BID Duration 6 weeks Consider empiric Rx for GC/Chlamydia if high risk. Ceftriaxone 250mg IM x1 PLUS Doxycycline 100mg PO BID x 10 days Consider urology referral

PPV = positive predictive value, MDRO = multidrug resistant organisms

Renal dose adjustments not included in this chart, see pages 10 to 11.

Severe β lactam allergy: Consult ID

REFERENCES:

O'Grady, et al Crit Care Med 2008 (36): 1330; Mody, et al., JAMA 2014 (311):844; Gupta, et al., CID 2011;52(5):e103-e120; Hooton, et al., CID 2010; 50:625-663;
CAUTI Guidelines. <http://www.cdc.gov/hicpac/pdf/CAUTI/CAUTIguideline2009final.pdf> . Schaeffer, et al. NEJM 2016; 374: 562-71. Nicolle LE, et al. CID 2019; 68:e83-e110.

Testing Algorithm for *Clostridium difficile*.

Hospitalized patient with clinically-significant diarrhea
(3 or more loose/liquid stools per day for at least 1-2 days)

NO →

Observe for 24 hours to assess for persistence of symptoms.
Do not order test for *C. diff*.

YES ↓

Has patient received laxatives, tube feedings, or oral contrast
over the past 24-48 hours?

YES →

Stop medication and gauge clinical response for ≥ 24 hrs PRIOR to
ordering *C. diff* testing.

NO ↓

Does patient meet clinical criteria for *C. diff* colitis:

Risk factor: recent antibiotic exposure

S/s: fever, dehydration, abdominal distension/pain, ileus,
unexplained white count

NO →

Consider alternate diagnosis for diarrhea.

YES ↓

Order test: **C. diff PCR**

→

C. diff. order will automatically cancel after 24 hours if not collected.



C. diff test results positive?

NO →

Consider alternate diagnosis for diarrhea.

YES* ↓

Start Vancomycin 125mg PO QID.

Do not send test of cure.

* Patients with a positive *C. diff* test should be put into
Contact Isolation with **Additional Precautions** for 30 days.

Ambulatory Management of Upper Respiratory Tract Infections in Adults

	Definition / Comments	Organisms	Non-Antibiotic Treatments	Antibiotics
Acute Sinusitis	<p>90-98% of cases are viral</p> <p>Only consider antibiotics if:</p> <ul style="list-style-type: none"> • Persistent: >10 days without improvement • Worsening: 3-4 days • Symptoms: Fever >39 °C, facial/tooth pain 	<p>Respiratory viruses</p> <p>Bacterial: S. pneumoniae, H. influenzae, M. catarrhalis, S. aureus</p>	<p>Acetaminophen/NSAIDs</p> <p>Nasal saline</p> <p>Nasal steroid</p> <p>Decongestants</p>	<p>ONLY IF meets criteria for bacterial sinusitis, Rx 5-7 days:</p> <p>Augmentin: 500mg q8h OR 875mg q12h</p> <p>Doxycycline: 100mg q12h</p> <p>Cefpodoxime: 200mg q12h OR Cefixime: 400mg q24h</p> <p>Risk for resistance or severe beta-lactam allergy: Respiratory fluoroquinolone*</p>
Pharyngitis	<p>Majority viral, 5-10% GAS</p> <ul style="list-style-type: none"> • GAS and viral pharyngitis cannot be distinguished by clinical symptoms • Send GAS testing: fever, tonsillar exudates, tender cervical, lymphadenopathy, absence of cough 	<p>Respiratory viruses</p> <p>Group A Streptococcus (GAS), Fusobacterium</p>	<p>Acetaminophen/NSAIDs</p> <p>Lozenges</p>	<p>Penicillin V: 500mg q12h x10 days</p> <p>Amoxicillin: 500mg q12h x10 days</p> <p>Cephalexin: 500mg q12h x10 days</p> <p>If true allergy or anaphylaxis to Penicillin: Clindamycin: 300mg TID x10 days**</p>
Acute Uncomplicated Bronchitis	<ul style="list-style-type: none"> • Mostly viral or non-infectious causes • Colored sputum does not indicate bacterial infection • Consider pneumonia, underlying lung disease, pertussis in Ddx 	<p>Respiratory viruses</p>	<p>Cough suppressants</p> <p>Antihistamines</p> <p>Decongestants</p> <p>Beta-agonists</p>	<p>Rarely recommended regardless of cough duration</p>

*Risk of fluoroquinolones generally outweighs benefits for sinusitis. Levofloxacin 750 mg q24h or moxifloxacin 400 mg q24h can be used but should be reserved for those who:
1. Cannot tolerate other antibiotic options, 2. Have risks for resistance (e.g. hospitalization last 5 days, antibiotic use in last month, immune compromise), or 3. Have severe disease with systemic toxicity.

**Patients prescribed clindamycin for pharyngitis should have scheduled follow-up to assess resolution due to increasing rates of GAS resistance

Antimicrobial Dosing Guidelines for Hospitalized Adults

Suggested initial doses, these guidelines are *not* a substitution for an ID or Pharmacy consult.

Antibiotic category	Antibiotic	Route	Dose for normal renal function	Reduced renal function mL/min	Hemodialysis (HD)*
PENICILLIN	Amoxicillin/clavulanate	PO	500-875mg BID or 500mg TID	11-29: 250-500mg BID ≤10: 250-500mg q24h	500mg q24h, give after HD on HD days
	Amoxicillin	PO	500mg TID	11-29: 500mg q12h ≤10: 250-500mg q24h	500mg q24h, give after HD on HD days
	Ampicillin/sulbactam	IV	1.5-3gm q6h	30-49: 1.5-3gm q6-8h 15-29: 1.5-3gm q12h ≤14: 1.5-3gm q24h	1.5-3gm q24h, give after HD on HD days
	Ampicillin	IV	2gm IV q4h	11-49: 2gm q6h ≤10: 2gm q12h	1-2gm q24h, give after HD on HD days
	Dicloxacillin	PO	250-500mg PO q6h	No adjustment	No adjustment
	Penicillin G	IV	2-4MU q4-6h, max 24 MU/day	High KCl, cautious use in renal failure 11-49: 1-2MU q6-8h ≤10: 1-2 MU q8-12h	1-2 MU q8-12h after HD
	Penicillin VK	PO	250-500mg q6h	<10: 250-500mg TID	250-500mg TID after HD
	Nafcillin	IV	1-2gm q4-6h	No adjustment	No adjustment
	Piperacillin/tazobactam	IV	Standard dose 3.375gm q6h	21-39: 2.25gm q6h ≤20: 2.25gm q8h	2.25gm q12h after HD
			Severe Infection or Pseudomonas 4.5gm q6h	21-39: 3.375gm q6h ≤20: 2.25gm q6h	2.25gm q8h dosed after HD
CARBAPENEM	Ertapenem	IV	1gm q24h	<30: 0.5gm q24h	0.5gm q24h after HD
	Meropenem	IV	1gm q8h *higher doses may be needed for severe infection or meningitis, Consult ID	26-50: 1gm q12h 10-25: 0.5gm q12h <10: 0.5gm q24h	0.5gm q24h after HD
CEPHALOSPORIN					
1st	Cefazolin	IV	Mild to Moderate Infection 1gm q8h	11-49: 1g q12h ≤10: 1gm q24h	1g dosed 3x/week after HD
			Severe Infection 2gm q8h	11-49: 2g q12h ≤10: 2gm q24h	2g dosed 3x/week after HD
	Cephalexin	PO	500mg – 1000mg TID to QID	31-49: 250-500mg TID 11-30: 250-500mg BID ≤10: 250mg BID	250mg BID after HD

‡ Oral and IV dosing is equivalent.

*Consider Pharmacy consult

Antimicrobial Dosing Guidelines for Hospitalized Adults

Antibiotic category	Antibiotic	Route	Dose for normal renal function	Reduced renal function mL/min	Hemodialysis (HD)*
2nd	Cefoxitin	IV	1-2gm q6-8h	30-50: 1-2gm q8-12h 10-29: 1-2gm q12-24h ≤10: 1gm q24h	1-2gm q24h after HD
	Cefuroxime	IV	0.75gm to 1.5gm q8h	10-20: 0.75 to 1.5gm q12h <10: 0.75 to 1.5gm q24h	0.75 to 1.5gm after HD
		PO	250-500mg BID	30-10: 250-500mg q24h <10: 250-500mg q48h	250-500mg after HD
3rd	Ceftriaxone	IV	Standard dose 1gm q24h	No adjustment	No adjustment
			Bacteremia, Endocarditis, Osteomyelitis 2gm q24h **Consult ID		
Meningitis 2gm q12h					
	Cefdinir	PO	300mg PO q12h	<30: 300mg q24h	300mg q48h
4th	Cefepime	IV	Mild to Moderate Infection, Pneumonia 1-2gm q12h	30-59: 1-2gm q24h 11-29: 0.5-1gm q24h ≤10: 0.5gm q24h	1gm dosed 3x weekly after HD
			Severe Infection (Pseudomonas, Neutropenia) 2gm q8h **Consult ID	30-59: 2gm q12h 11-29: 2gm q24h ≤10: 1gm q24h	2gm dosed 3x weekly after HD
FLUORO- QUINOLONES	Ciprofloxacin	PO	Mild to Moderate Infection, Uncomplicated cystitis 250-500mg BID Severe Infection 750mg BID	<30: same dose q24h	Same dose as for <30, dose after HD
		IV	Mild to Moderate Infection 400mg q12h Severe Infection (OM, neutropenic fever, nosocomial PNA) 400mg IV q8h	<30: same dose q24h	Same dose as for <30, dose after HD
	Levofloxacin†	PO/IV	Mild to Moderate Infection 500mg q24h CAP, Severe Infection 750mg q24h	20-49: 500mg load then 250mg q24h <20: 500mg load then 250mg q48h 20-49: 750mg load then 750mg q48h <20: 750mg load then 500mg q48h	Same dose as for <20, dose after HD

† Oral and IV dosing is equivalent.

*Consider Pharmacy consult

Antimicrobial Dosing Guidelines for Hospitalized Adults

Antibiotic category	Antibiotic	Route	Dose for normal renal function	Reduced renal function mL/min	Hemodialysis (HD)*	
TETRACYCLINE	Doxycycline*	PO/IV	100mg q12h	No adjustment	No adjustment	
MACROLIDE	Azithromycin*	PO/IV	250-500mg q24h	<10: use with caution	Consult ID	
MISC	Vancomycin	IV	See Nomogram			
	Vancomycin	PO	125mg PO q6h (<i>Only for C. diff</i>)	No adjustment, not absorbed	No adjustment	
	Trimethoprim/ Sulfamethoxazole (TMP/Sulfa)	IV	**Consult ID if using IV			
		PO	1-2 DS tab BID (5-8mg TMP/kg/day total) Severe Infection or PJP suspect, **Consult ID	Consult ID		
	Clindamycin	PO	300mg QID or 450mg TID	No adjustment	No adjustment	
		IV	600-900mg q8h	No adjustment	No adjustment	
Metronidazole*	PO/IV	500mg q8h	No adjustment	No adjustment		
ANTIFUNGAL	Fluconazole*	PO/IV	Mild to Moderate Infection 200-400mg q24h **Severe infection, Consult ID	<50: 200-400mg load, then 100-200mg daily	Consult ID or pharmacy	
	Micafungin	IV	ID restricted			
ANTIVIRAL	Acyclovir	PO	Shingles 800mg 5 times daily	10-25: 800mg TID <10: 800mg BID	800mg BID post HD	
	Acyclovir <i>Dose based in ideal body weight.</i>	IV	HSV skin lesions in immunocompromised/ICU 5mg/kg IV q8h	25-49: 5mg/kg q12h 11-24: 5mg/kg q24h <10: 2.5mg/kg q24h	2.5mg/kg IV q24h, give after HD on HD days	
			HSV encephalitis, Primary varicella, or shingles >1 dermatome, disseminated 10mg/kg IV q8h **Consult ID	25-49: 10mg/kg q12h 11-24: 10mg/kg q24h <10: 5mg/kg q24h	5mg/kg IV q24h, give after HD on HD days	
Valacyclovir	PO	Shingles Valacyclovir 1000mg TID x 7 days	30-49: 1gm BID 10-29: 1gm q24h <10: 500mg q24h	500mg q24h post HD		

‡ Oral and IV dosing is equivalent.

*Consider Pharmacy consult

REFERENCES:

Sanford Guide of Antimicrobial Therapy 2018, Micromedex, Ahern, JW. Am J Health Syst Pharm January 1, 2003; 60:178-81; Sowinski, KM. Am J Kidney Dis. 2001; 37:766-76; Heintz, BH Pharmacotherapy. 2009 May;29(5):562-77

Recommended Prophylactic Antibiotics by Procedure*

Surgical Procedure	Organisms	Recommended IV Antibiotics*	Dosing	Redosing Hours**
Cardiovascular surgery, thoracic, cardiac device insertion, vascular surgery	Staphylococcus & streptococcus	Cefazolin	<120kg: 2gm IV >120kg: 3gm IV	4
		OR Severe β lactam allergy Vancomycin	15mg/kg IV (max 2gm). Start 60 to 120 min prior to procedure.	—
Spinal procedures, hip fracture, internal fixation, total joint replacement	Staphylococcus & streptococcus	Cefazolin	<120kg: 2gm IV >120kg: 3gm IV	4
		OR Severe β lactam allergy Vancomycin	15mg/kg IV (max 2gm). Start 60 to 120 min prior to procedure.	—
Appy, Colon Surgery, Biliary, Gastroduodenal***	Enteric GNR, anaerobes, enterococcus	Ceftriaxone + metronidazole	Ceftriaxone 1gm IV Metronidazole 500mg IV	—
		OR Cefoxitin	2gm IV	2
		OR Severe β lactam allergy Vancomycin + Cipro + metronidazole	Vanco 15mg/kg IV (max 2gm). Start 60 to 120 min prior to procedure. Cipro 400mg IV Metronidazole 500mg IV	—
				—
				—
				—
Hernia	Staphylococcus & streptococcus	Cefazolin	<120kg: 2gm IV >120kg: 3gm IV	4
		OR Severe β lactam allergy Vancomycin	15mg/kg IV (max 2gm). Start 60 to 120 min prior to procedure.	—
Hysterectomy	Enteric GNR, anaerobes, GBS, enterococcus	Cefazolin	<120kg: 2gm IV >120kg: 3gm IV	4
		OR Cefoxitin	2gm IV	2
		OR Severe β lactam allergy Vancomycin + Cipro	Vanco 15mg/kg IV (max 2gm). Start 60 to 120 min prior to procedure. Cipro 400mg IV	—
				—
C section	Staphylococcus & streptococcus	Cefazolin	<120kg: 2gm IV >120kg: 3gm IV	4
		OR Severe β lactam allergy Vancomycin + Gentamicin	Vanco 15mg/kg IV (max 2gm). Start 60 to 120 min prior to procedure. Gentamicin 5mg/kg IV	—
				—

* Additional pre-op antibiotic not needed for patients already on systemic antibiotics which would provide protection against expected surgical pathogens.

** If surgery longer 2 to 4 hours or loss 1500cc blood or more

*** Neomycin PLUS erythromycin base or metronidazole on Pre-Op day for elective colon procedures. ERCP: No antibiotics needed if no obstruction

Surgical Procedure	Organisms	Recommended IV Antibiotics*	Dosing	Redosing Hours**
Laparoscopic or Open GU procedures	Enteric GNR, enterococcus	Cefazolin	<120kg: 2gm IV >120kg: 3gm IV	4
		PLUS Metronidazole (for entry into intestine)	500mg IV	—
		OR Cefoxitin	2gm IV	2
		OR Severe β lactam allergy Vancomycin + Cipro [^]	Vanco 15mg/kg IV (max 2gm). Start 60 to 120 min prior to procedure Cipro 400mg IV	— —
Cystoscopy with manipulation or upper tract instrumentation ^{^^}	Enteric GNR, enterococcus	Cefazolin	<120kg: 2gm IV >120kg: 3gm IV	4
		OR Bactrim DS	160mg TMP/800mg SMX PO/IV	—
		OR Cipro	400mg IV or 500mg PO	—
Prostate Biopsy	Enteric GNR, enterococcus, sometimes skin flora	Cipro	400mg IV or 500mg PO	12
		OR Bactrim DS	160mg TMP/800mg SMX PO/IV	12
Head and neck surgery	Staphylococcus aureus, S. epidermidis, streptococci. Sometimes: GNR, anaerobes	Cefazolin	<120kg: 2gm IV >120kg: 3gm IV	4
		PLUS Metronidazole (for contaminated case)	500mg IV	—
		OR Ampicillin-sulbactam	3gm IV	2
		OR Clindamycin	900mg IV	—
Plastic surgery with risk factors, breast surgery	Staphylococcus aureus, S. epidermidis, streptococcus	Cefazolin	<120kg: 2gm IV >120kg: 3gm IV	4
		OR Severe β lactam allergy Vancomycin	15mg/kg IV (max 2gm). Start 60 to 120 min prior to procedure.	—

* Additional pre-op antibiotic not needed for patients already on systemic antibiotics which would provide protection against expected surgical pathogens.

** If surgery longer 2 to 4 hours or loss 1500cc blood or more

[^] In rare circumstances of known resistance patterns & severe β lactam allergy, Clindamycin 600mg IV plus gentamicin 5mg/kg may be used

^{^^} Urine culture prior to procedure recommended to direct antibiotic therapy.

NOTE: Vancomycin is preferred for over clindamycin for severe β lactam allergy for prevention of Group A and B streptococcus due to up to 55% resistance to clindamycin locally.

Vancomycin should also be considered if known history of MRSA. Other risk factors for use of vancomycin: High risk patient with recent hospital stay, High risk patient from nursing home, Dialysis, Transfer from another hospital in the last three days.

Recommended documentation of known or suspected infection present at time of surgery (PATOS):

- Document evidence of infection intraoperatively in operative note or report of surgery (appropriate terms include: purulence, abscess, feculent peritonitis, infected appendix that has ruptured).
- The following verbiage ALONE does NOT meet the PATOS definition: colon perforation, necrosis, gangrene, fecal spillage, nicked bowel, and inflammation or use of term with "itis" such as diverticulitis, peritonitis, appendicitis.

SELECTED REFERENCES:

Obstet Gynecol May 2009; 113(5): 1180-1189, Am J Health Syst Pharm. 1999;56:1839-1888, Am J Health-Syst Pharm. 2013; 70:195-283, CID. 2004;38:1706-1715, CID. 1994; 18:422-427, The Sanford Guide to Antimicrobial Therapy 2018., N Engl J Med. 2006 Dec 21; 355 (25): 2640-2651, Infect Control Hosp Epidemiol. 1999; 20:247-280, Med Lett Drugs Ther. 2016; 58: 63-68, Arch Surg. 1993; 128:79-88.

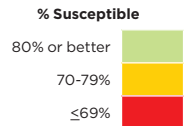
Antibiogram 2018

Species with less than 30 isolates, sensitivities should be interpreted with caution. Grey boxes indicate organism has intrinsic resistance to corresponding antimicrobial or resistance testing is not applicable.

Gram Negative NON-URINE Isolates Inpatient and Emergency Department	Total # Isolates	Ampicillin	Ampicillin-Subbactam	Piperacillin-Tazobactam	Cefazolin	Ceftriaxone	Ceftazidime	Cefepime	Ertapenem	Meropenem	Ciprofloxacin	Levofloxacin	Trimethoprim Sulfamethoxazole	Gentamicin	Tobramycin
Organism	# Results	%S	%S	%S	%S	%S	%S	%S	%S	%S	%S	%S	%S	%S	%S
Acinetobacter	4					50%	75%	100%		100%	100%	100%	100%	100%	100%
Citrobacter	8		38%	100%	13%	100%		100%	100%	100%	88%	88%	88%	100%	100%
Enterobacter	19			78%		79%		95%	84%	100%	100%	100%	100%	100%	100%
Escherichia coli	120	49%	54%	93%	77%	93%		93%	100%	100%	77%	78%	73%	94%	94%
Klebsiella	50		70%	98%	82%	96%		96%	100%	100%	100%	100%	92%	100%	100%
Proteus	12	83%	90%	100%	58%	83%		100%	100%	100%	75%	75%	92%	92%	92%
Pseudomonas aeruginosa	31			81%			87%	90%		77%	81%	81%		100%	100%
Serratia	9			78%		78%		100%	100%	100%	100%	100%	100%	100%	100%
Stenotrophomonas	6						83%					100%	100%		

Haemophilus influenzae beta-lactamase positive 28%, n=69

Carbapenem Resistant Ps. aeruginosa (CRPA): 1) NON-URINE 23%, 2) URINE 21%

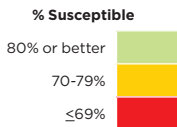


Antibiogram 2018

Species with less than 30 isolates, sensitivities should be interpreted with caution. Grey boxes indicate organism has intrinsic resistance to corresponding antimicrobial or resistance testing is not applicable.

Gram Negative URINE Inpatient Isolates		Total # Isolates	Ampicillin	Amp-sulbactam	Cefazolin	Ceftriaxone	Ceftazidime	Cefepime	Ertapenem	Meropenem	Levofloxacin	Trimethoprim-Sulfamethoxazole	Nitrofurantoin	Tetracycline
Organism	# Results	%S	%S	%S	%S	%S	%S	%S	%S	%S	%S	%S	%S	%S
Acinetobacter	5				60%	100%	60%			100%	100%	80%		
Citrobacter	17				65%			88%	94%	100%	100%	82%	88%	82%
Enterobacter	13				77%			92%	69%	100%	100%	100%	62%	100%
Escherichia coli	154	56%	60%	89%	95%			97%	96%	100%	84%	84%	99%	82%
Escherichia coli (ED/Outpatient)	2591	66%	68%	93%	95%			92%	95%	100%	90%	81%	99%	80%
Klebsiella	76		61%	72%	96%			97%	89%	100%	97%	95%	55%	89%
Proteus	30	80%	93%	87%	90%			100%	87%	100%	83%	97%		
Pseudomonas aeruginosa	35						91%	100%		79%	76%			
Stenotrophomonas	1						0%				0%	100%		

ESBL Rate (E.coli and Klebsiella): Inpatient: 1) NON-URINE 6%, 2) URINE 12%; Outpatient: 1) NON-URINE 9%, 2) URINE 4%

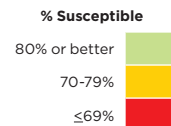


Antibiogram 2018

Species with less than 30 isolates, sensitivities should be interpreted with caution. Grey boxes indicate organism has intrinsic resistance to corresponding antimicrobial or resistance testing is not applicable.

Gram Positive NON-URINE Sterile Site Isolates Inpatient and Emergency Department	Total # Isolates	Penicillin G	Penicillin G (meningitis)	Oxacillin ²	Ceftriaxone	Ceftriaxone (meningitis)	Clindamycin	Levofloxacin	Trimethoprim Sulfamethoxazole	Vancomycin	Gentamycin synergy	Tetracycline	Erythromycin
Organism	# Results	%S	%S	%S	%S	%S	%S	%S	%S	%S	%S	%S	%S
Enterococcus faecalis	31	100%								100%	90%		
Enterococcus faecium	14	64%								64%	100%		
Streptococcus pneumoniae (all locations) ¹	36	94%	83%		100%	100%	94%	100%	69%	100%			72%
Viridans Strep (includes S.anginosus) ³	23	87%			96%		87%			100%			
Streptococcus pyogenes (Group A)	22	100%			100%		45%			100%			45%
Streptococcus agalactiae (Group B)	4	100%			100%		75%			100%			75%
Staphylococcus aureus	241			72%			76%		93%	100%		96%	
Staphylococcus aureus (Outpatient)	957			84%			78%		97%	100%		93%	
Staphylococcus epidermidis	29			44%			60%					80%	
Staphylococcus lugdunensis (all locations)	29			100%			79%					100%	

1. CLSI requires publication of two breakpoints for all pneumococcal isolates designated: meningitis and non-meningitis.
2. Oxacillin results can be applied to other anti-staph penicillins and β -lactam/ β -lactamase inhibitors, cephalosporins and carbapenems.
3. Viridans Strep non-susceptible to penicillin 67% (n=3) were intermediate (MIC 0.25-2.0).



Antibiogram 2018

Species with less than 30 isolates, sensitivities should be interpreted with caution. Grey boxes indicate organism has intrinsic resistance to corresponding antimicrobial or resistance testing is not applicable.

Gram Positive URINE Isolates Inpatient and Emergency Department	Total # Isolates	Penicillin G	Oxacillin ²	Trimethoprim Sulfamethoxazole	Vancomycin	Nitrofurantoin	Tetracycline
Organism	# Results	% S	% S	% S	% S	% S	% S
Enterococcus faecalis	44	100%			95%	100%	24%
Enterococcus faecium	6	50%			83%		50%
Staphylococcus aureus	33		76%	97%		100%	97%
Staphylococcus aureus (Outpatient)	123		85%	98%		100%	95%

MRSA rate:

1) NON-URINE Inpatient/ED 28% & Outpatient 16%,

2) URINE Inpatient/ED 24% & Outpatient 15%

VRE rate:

Inpatient/ED: Inpatient/ED

1) NON-URINE 11%,

2) URINE 4%

PTD = pharmacy to dose

% Susceptible

80% or better

70-79%

≤69%



BCH Antimicrobial Cost Information

Medication	Route	Cost per Dose (\$)	Cost per Day (\$)	Relative Cost/Day
Acyclovir	IV	4.60	13.8	\$\$\$
Acyclovir	PO	0.36	1.8	\$\$
Amoxicillin	PO	0.09	0.258	\$
Ampicillin	IV	3.72	14.88	\$\$\$
Augmentin	PO	0.40	0.80	\$
Azithromycin	IV	7.07	7.07	\$\$
Azithromycin	PO	1.65	1.65	\$\$
Bactrim	IV	8.78	17.56	\$\$\$
Bactrim	PO	0.15	0.30	\$
Cefazolin	IV	7.16	21.48	\$\$\$
Cefdinir	PO	1.53	3.06	\$\$
Cefepime	IV	14.99	29.98	\$\$\$\$
Cefoxitin	IV	8.50	25.50	\$\$\$
Ceftriaxone	IV	57.37	57.37	\$\$\$\$
Cephalexin	PO	0.08	0.32	\$
Ciprofloxacin	IV	2.16	4.32	\$\$
Ciprofloxacin	PO	0.19	0.38	\$
Clindamycin	IV	13.49	40.47	\$\$\$\$
Clindamycin	PO	0.16	0.48	\$
Dicloxacillin	PO	0.35	1.40	\$\$
Ertapenem	IV	70.52	70.52	\$\$\$\$

Medication	Route	Cost per Dose (\$)	Cost per Day (\$)	Relative Cost/Day
Fluconazole	IV	6.76	6.76	\$\$
Fluconazole	PO	2.70	2.70	\$\$
Levofloxacin	IV	4.59	4.59	\$\$
Levofloxacin	PO	0.42	0.42	\$
Meropenem	IV	40.76	122.28	\$\$\$\$
Metronidazole	IV	1.23	3.69	\$\$
Metronidazole	PO	0.60	1.80	\$\$
Micafungin	IV	181.05	181.05	\$\$\$\$
Nafcillin	IV	13.78	55.12	\$\$\$\$
Penicillin G	IV	3.00	12.00	\$\$\$
Penicillin VK	PO	0.15	0.60	\$
Unasyn	IV	4.70	18.80	\$\$\$
Valacyclovir	PO	2.16	6.48	\$\$
Vancomycin	IV	15.49	15.49	\$\$\$
Zosyn	IV	17.78	71.12	\$\$\$\$

BCH Adult Vancomycin Dosing and Monitoring Guidelines.

***Please contact pharmacy or get ID consult if concerns about vancomycin dosing. It is important to consider if other renal toxic agents are being co-administered when dosing vancomycin.**

Goal Trough (mcg/mL)	Indication	
10-15	UTI, Cellulitis, Prophylaxis	PTD
15-20	MRSA Bacteremia, MRSA Osteomyelitis, Endocarditis, Meningitis, Documented MRSA PNA	Consult ID
MRSA Vancomycin MIC greater than or equal to 2: Alternate therapy is suggested & ID should be consulted		

Vancomycin Loading Doses (actual body weight)	
Non-critically ill	15-20mg/kg
Complicated infections in seriously ill	25mg/kg
Renal Impairment, CRRT, IHD, PD	15-25mg/kg
Preoperative antimicrobial prophylaxis	15mg/kg
Maximum of 2 grams per dose	

Vancomycin Maintenance Dosing in Dialysis	
IHD level < 10-15	500-1000mg (5-10mg/kg) after each session
PD level < 10-15	500-1000mg Q48-72h
CRRT level < 1-15	1000 mg (10-15mg/kg) daily dose may vary by type of CRRT and rate of filtration

Vancomycin Maintenance Doses: Goal 10-15mg/L -15mg/kg per Dose										
		Creatinine Clearance (mL/min)								
		20	30	40	50	60	70	80	90	≥100
Actual Body Weight (kg)	50	750mg q48h	500mg q24h	750mg q24h	750mg q24h	1000mg q24h	1000mg q24h	500mg q12h	750mg q12h	1000mg q12h
	60	750mg q48h	750mg q24h	750mg q24h	1000mg q24h	1250mg q24h	750mg q12h	750mg q12h	1000mg q12h	1000mg q12h
	70	1000mg q48h	750mg q24h	1000mg q24h	1250mg q24h	1500mg q24h	750mg q12h	750mg q12h	1000mg q12h	1250mg q12h
	80	1250mg q48h	750mg q24h	1000mg q24h	1250mg q24h	1500mg q24h	750mg q12h	1000mg q12h	1250mg q12h	1250mg q12h
	90	1250mg q48h	1000mg q24h	1250mg q24h	1500mg q24h	1750mg q24h	1000mg q12h	1250mg q12h	1250mg q12h	CALL ID
	100	1500mg q48h	1000mg q24h	1250mg q24h	1500mg q24h	1000mg q12h	1000mg q12h	1250mg q12h	CALL ID	CALL ID
	110	1750mg q48h	1000mg q24h	1500mg q24h	1750mg q24h	1000mg q12h	1000mg q12h	1250mg q12h	CALL ID	CALL ID
	120	1750mg q48h	1250mg q24h	1500mg q24h	1750mg q24h	1000mg q12h	1250mg q12h	CALL ID	CALL ID	CALL ID
	130	2000mg q48h	1250mg q24h	1500mg q24h	1000mg q12h	1000mg q12h	1250mg q12h	CALL ID	CALL ID	CALL ID
	140	2000mg q48h	1500mg q24h	1750mg q24h	1000mg q12h	1250mg q12h	CALL ID	CALL ID	CALL ID	CALL ID
150	1000mg q24h	1500mg q24h	1750mg q24h	1000mg q12h	1250mg q12h	CALL ID	CALL ID	CALL ID	CALL ID	

Notify ID if required calculated daily dose equals or exceeds 3 grams

Vancomycin Maintenance Doses: Goal 15-20mg/L -20mg/kg per Dose
Notify Infectious Disease for:
<ul style="list-style-type: none"> Any indication with a goal trough of 15-20 Any order with a goal trough of 15-20 Any MRSA with an MIC of 2 or greater Any patient requiring greater than or equal to 3 grams vancomycin total per day
If infectious Disease is unavailable, pharmacists may order the first dose of vancomycin to a goal trough of 15 for listed indications. Infectious Disease will be notified ASAP.

BCH Adult Vancomycin Dosing and Monitoring Guidelines.

***Please contact pharmacy or get ID consult if concerns about vancomycin dosing. It is important to consider if other renal toxic agents are being co-administered when dosing vancomycin.**

Timing of First Vancomycin Trough or Level	
Dosing Interval	Timing
Q8h	Trough 30 min prior to 4th or 5th dose
Q12h	
Q24h	Trough 30 min prior to 3rd or 4th dose
Q48h	Random level w/in 24 hours of first dose Begin maintenance dose if random is <15
CrCl <20, ARF, IHD, CRRT	Random level prior to re-dose Wait at least 4-6 hours after IHD before drawing level

Additional Monitoring Labs which can be initiated following a PTD order	
Renal function	SCr, BUN, urine output
Response to therapy	WBC, Segs/Bands, ANC, TMax
Appropriateness of therapy	Culture, Sensitivity, Levels
Toxicity	Alb/Tbili, Platelets

Frequency of Trough Monitoring	
Stable patient following trough at goal	At least once weekly
Following change in dose	Trough prior to 3rd or 4th dose
Change in renal function SCr increase ≥ 0.3 , decreased urine output	Trough prior to next dose
Change in renal function SCr increase ≥ 0.5 OR $\geq 50\%$ from baseline	Hold vancomycin AND trough prior to next dose *Contact provider*
Obese patients (BMI > 30)	Trough every 3 days to avoid risk of supra-therapeutic levels due to accumulation
CrCl < 20, ARF, IHD, CRRT	Random level prior to dose
Hemodynamically unstable OR rapidly changing renal function	Daily troughs may be warranted

General Recommendation for Dose Adjustment Based on Levels		
Actual Trough	Target Trough	Recommendation
≤ 5	10-15	Decrease dosing interval AND keep TDD same
	15-20	Decrease dosing interval
6-9	10-15	Increase dose by 250mg
	15-20	Decrease dosing interval OR increase dose by 500mg
10-15	10-15	No change required
	15-20	Increase dose by 250mg
15-20	10-15	Decrease dose by 250mg
	15-20	No change required
> 20	10-15	Increase dosing interval OR decrease dose by 500mg
	15-20	Decrease dose by 250mg

General Calculation Strategy if Interval Remains the Same:
 $(\text{Current vancomycin dose})/(\text{Vancomycin trough}) = (\text{New vancomycin dose})/(\text{Desired trough})$

For more information about the Infectious Disease Team at BCH see:
bch.org/beaconcenter

Antibiotic Stewardship Team

Amie Meditz, MD, Co-Chair
Christopher Zielenski, PharmD, Co-Chair

Members

Mark King, MD	Susie Pfister, RN, BSN, ONC
Casey Diekmann, PharmD	Kristin Robson, MPH
Katherine Macchi, PharmD	Kylie Chilton, MPH, CIC
Joslyn Winterland, PharmD	Michelle Johler, BS, HACCP
Jaime Mesenbrink, PharmD	Kate Norris, BS
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Cynthia Littlehorn, SM (ASCP), MB	Tracy Nagell, RN, MSN, MHA