UCSF Benioff Children's Hospital San Francisco
2016 Empiric Antimicrobial Therapy Guidelines

These are guidelines only and not intended to replace clinical judgment. Modification of therapy may be indicated based on patient comorbidities, previous antibiotic therapy or infection history. Doses provided are usual doses but may require modification based on patient age or comorbid conditions. Refer to Pediatric Antimicrobial Dosing Guideline for further guidance on dosing in children, and Neonatal Dosing Guideline for infants < 1 month of age. Consult a pediatric pharmacist for individualized renal or hepatic dose adjustment. For additional guidance, please contact Pediatric Infectious Diseases (ID) at 443-2384 or the Pediatric Antimicrobial Stewardship Program (ASP) at 514-1275. Approved by UCSF Pharmacy and Therapeutics Committee June 2016.

Condition	Major Pathogens	First Choice Therapy	Alternative Therapy	Comments
BONE AND JOINT INFECTIONS				
Acute osteomyelitis in child > 3 months old without medical comorbidities or penetrating trauma	*Staphylococcus aureus* Group A streptococcus *Kingella kingae* in children < 3 years Incomplete immunization: *Streptococcus pneumoniae*	**Clinically stable:** Clindamycin 13mg/kg/dose IV q8h (max 900mg/dose) **Ill-appearing or known positive blood culture (while awaiting final ID and susceptibility):** Vancomycin 20mg/kg/dose IV q6-8h (initial max 1g/dose) AND Ceftriaxone 50mg/kg/dose IV q24h (max 2g/dose)		ID and Orthopedic Surgery consults recommended Therapy should be tailored to the identified organism. Change from IV to PO and total duration of therapy should be determined in consultation with ID based on the patient's clinical course
Septic arthritis in child > 3 months old without medical comorbidities or penetrating trauma	*Staphylococcus aureus* Group A streptococcus *Kingella kingae* in children < 3 years Incomplete immunization: *Haemophilus influenzae* *Streptococcus pneumoniae*	**Clinically stable:** Clindamycin 13mg/kg/dose IV q8h (max 900mg/dose) **Ill-appearing or known positive blood culture (while awaiting final ID and susceptibility):** Vancomycin 20mg/kg/dose IV q6-8h (initial max 1g/dose) AND Ceftriaxone 50mg/kg/dose IV q24h (max 2g/dose)		ID and Orthopedic Surgery consults recommended Joint aspirate should be performed *before* antibiotics unless patient is clinically unstable or has known bacteremia Consider adjunctive anti-inflammatory therapy prior to or concurrent with initial antibiotic dose – consult ID early for guidance on choice of steroid vs. NSAID
Chronic osteomyelitis	Variable based on risk factors	Antibiotic therapy should generally be withheld pending operative cultures from the involved site, and is selected based on individual patient risk factors – consult ID for guidance		ID and Orthopedic Surgery consults recommended
Bone or joint infection in patient with significant medical comorbidities, age 0-3 months, incomplete immunization, penetrating trauma, contiguous infection or other modifying factors	Variable based on risk factors	Consult ID for guidance before initiating empiric therapy		ID and Orthopedic Surgery consults recommended

UCSF Benioff Children's Hospital San Francisco
2016 Empiric Antimicrobial Therapy Guidelines

Condition	Major Pathogens	First Choice Therapy	Alternative Therapy	Comments
CNS INFECTIONS				
Meningitis 0-28 days old	Group B streptococcus Enteric Gram negatives *Listeria monocytogenes*	Ampicillin AND Cefotaxime Consider: Acyclovir 20mg/kg/dose IV q8h empirically while awaiting HSV PCR of CSF in neonate with CSF pleocytosis *unless* infant was symptomatic at < 48 hours of life, discontinue Acyclovir if bacterial pathogen identified or HSV PCR negative		Refer to Neonatal Dosing Guideline for antibiotic doses and intervals ID consult recommended LP is recommended *before* antibiotics for most cases.
Bacterial meningitis > 28 days old, community-onset	*Streptococcus pneumoniae,* *Neisseria meningitidis* *Haemophilus influenzae* Group B streptococcus, enteric Gram negatives in young infants *Listeria monocytogenes* for immunocompromised patients	Ceftriaxone 50mg/kg/dose IV q12h (max 2g/dose) AND Vancomycin 20mg/kg/dose IV q6-8h (initial max 1g/dose) Consider: Acyclovir 20mg/kg/dose IV q8h for infants <= 6 weeks old, discontinue if bacterial pathogen identified or HSV PCR negative ADD Ampicillin 300mg/kg/day divided q4-6h (max 2g q4h) if patient immunocompromised (for *Listeria)* For suspected bacterial meningitis in children ≥ 6 weeks old, consider dexamethasone 0.15 mg/kg/dose IV q6h (max 10mg/dose) to start 10-20 minutes before or concurrently with the initial antibiotic dose and for first 2-4 days of therapy	**Corrected gestational age <44 weeks:** Use Cefotaxime per Neonatal Dosing Guideline in place of ceftriaxone --- **Severe beta lactam allergy:** Vancomycin 20mg/kg/dose IV q6-8h (initial max 1g/dose) AND Aztreonam 30mg/kg/dose IV q6h (max 2g/dose) ADD Trimethoprim/ Sulfamethoxazole (Bactrim) 5mg/kg/dose trimethoprim IV q8h if patient immunocompromised (for *Listeria*)	ID consult recommended LP is recommended *before* antibiotics for most cases. If LP must be delayed due to cardiopulmonary instability, coagulopathy, elevated intracranial pressure or need for preceding neuroimaging (see below), blood culture should be drawn, antibiotics and steroids should be given promptly, and LP performed as soon as clinical condition stabilizes/contraindications resolve. Neuroimaging is recommended before LP in the following situations: - Immunodeficiency - Exam with papilledema or focal neurologic deficit - CSF shunt present - Hydrocephalus - CNS trauma - History of neurosurgery or space-occupying lesion
Brain abscess > 3 months old, community-onset Or intracranial extension of sinus, orbital or ear infections	Streptococci (aerobic & anaerobic) Anaerobic oral and sinus flora Other organisms depending on source	Ceftriaxone 50mg/kg/dose IV q12h (max 2g/dose) AND Metronidazole 10mg/kg/dose IV q8h (max 500mg/dose) AND Vancomycin 20mg/kg/dose IV q6-8h (initial max 1g/dose)	**Severe beta lactam allergy:** Vancomycin 20mg/kg/dose IV q6-8h (max 1g/dose) AND Aztreonam 30mg/kg/dose IV q6h (max 2g/dose) AND Metronidazole 10mg/kg/dose IV q8h (max 500mg/dose)	ID consult recommended
CNS infection, hospital-acquired or following neurosurgical intervention, or following trauma	Variable based on risk factors	Consult ID for recommendations		ID consult recommended

UCSF Benioff Children's Hospital San Francisco
2016 Empiric Antimicrobial Therapy Guidelines

Condition	Major Pathogens	First Choice Therapy	Alternative Therapy	Comments
GASTROINTESTINAL INFECTIONS				
Bacterial gastroenteritis, community-onset[13] Characterized by frequent, sometimes bloody, small-volume diarrhea associated with abdominal pain and cramping	*Escherichia coli* *Salmonella* spp *Shigella* spp *Campylobacter jejuni* *Yersinia enterocolitica*	**Supportive care is the primary therapy for most patients.** Antibiotics can predispose to complications such as hemolytic uremic syndrome with Shiga-toxin producing *E. coli* infection. **Consider empiric therapy for toxic-appearing patient, young infant, or immunocompromised host:** Azithromycin 10mg/kg/dose PO daily (max 500mg/dose) OR Ceftriaxone 50mg/kg IV q24h (max 1g/dose) **For traveler's diarrhea (enterotoxigenic *E. coli*):** Azithromycin 10mg/kg/dose PO daily x 3 days (max 500mg/dose) – provide un-reconstituted powder for suspension to infants and children traveling in high-risk areas		Stool bacterial culture should be sent, also consider testing for *C. difficile* if patient has recent hospital or antibiotic exposure. Blood cultures should be sent for patients who are hospitalized and/or toxic-appearing with suspected bacterial gastroenteritis. Directed therapy may be indicated early in the course for specific pathogens (e.g. *Campylobacter, Shigella*) but in most cases should be deferred until a positive stool culture is obtained.
Clostridium difficile associated diarrhea – initial episode, mild/moderate[14] Mild/Moderate disease defined by lack of the following: WBC ≥ 15,000 cells/μL Cr > 1.5x pre-disease baseline Ileus, shock, megacolon or perforation	*Clostridium difficile*	Metronidazole 10mg/kg/dose PO 3 times daily (max 500mg/dose) x 10-14 days Note: IV metronidazole is suboptimal for *C. difficile* treatment compared to PO metronidazole If no response to Metronidazole in 5 days, CHANGE to: Vancomycin 10mg/kg/dose PO 4 times daily (max 125mg/dose) x 10-14 days		Discontinue inciting antimicrobials **Duration:** 10-14 days Avoid re-testing unless symptoms of *C. difficile* infection recur Refer to Guidelines for Management of *C. difficile* Infection (idmp.ucsf.edu) for more information
Clostridium difficile associated diarrhea – initial episode, severe, uncomplicated (no ileus, shock, megacolon, perforation)[14] Severe disease defined by: WBC ≥ 15,000 cells/μL or Cr > 1.5x pre-disease baseline without any of the following: ileus, shock, megacolon, or perforation	Same	Vancomycin 10mg/kg/dose PO 4 times daily (max 125mg/dose) x 10-14 days		Discontinue inciting antimicrobials **Duration:** 10-14 days Avoid re-testing unless symptoms of *C. difficile* infection recur Refer to Guidelines for Management of *C. difficile* Infection (idmp.ucsf.edu) for more information
Clostridium difficile associated diarrhea – initial episode, severe, complicated[14] Severe, complicated disease defined by: Ileus, shock, megacolon, or perforation	Same	Vancomycin 10mg/kg/dose PO 4 times daily (max 500mg/dose) x 14 days AND Metronidazole 10mg/kg/dose IV q8h (max 500mg/dose)		ID consult recommended for consideration of adjunctive therapies Surgical consult recommended Refer to Guidelines for Management of *C. difficile* Infection (idmp.ucsf.edu) for more information

UCSF Benioff Children's Hospital San Francisco
2016 Empiric Antimicrobial Therapy Guidelines

Condition	Major Pathogens	First Choice Therapy	Alternative Therapy	Comments
Clostridium difficile associated diarrhea – recurrence[xv] Definition: Re-appearance of symptoms and signs of CDI within 8 weeks after completion of therapy for prior episode for which symptoms and signs had resolved	Same	**First Recurrence:** Repeat course of first choice therapy, stratified by illness severity – e.g. if recurrent episode is severe, treat with Vancomycin, but if recurrent episode is mild-moderate, treat with Metronidazole **Second Recurrence:** Vancomycin taper and pulse per the following regimen: 10mg/kg/dose (max 125mg/dose) PO 4 times daily x 14 days THEN BID x 7 days THEN daily x 7 days THEN every other day x 8 days (4 doses) THEN every 3 days x 2 weeks (5 doses)		ID and GI consults recommended for second recurrence Refer to Guidelines for Management of *C. difficile* Infection (idmp.ucsf.edu) for more information
Helicobacter pylori infection[v]	*Helicobacter pylori* **Options for proton pump inhibitor (PPI):** Omeprazole (Prilosec) 0.5-1mg/kg/dose PO BID (max 20mg/dose) OR Lansoprazole (Prevacid) 0.5-1mg/kg/dose PO BID (max 30mg/dose) OR Esomeprazole (Nexium) 0.5-1mg/kg/dose PO BID (max 20mg/dose)	PPI (from second column) AND Amoxicillin 25mg/kg/dose PO BID (max 1000mg/dose) AND *One of the following:* Clarithromycin* 10mg/kg/dose PO BID (max 500mg/dose) OR Metronidazole 10mg/kg/dose PO BID (max 500mg/dose) **Duration:** 10-14 days	**Sequential therapy:** PPI (from second column) AND Amoxicillin 25mg/kg/dose PO BID (max 1000mg/dose) **For 5 days, THEN:** Stop Amoxicillin Continue PPI AND Clarithromycin* 10mg/kg/dose PO BID (max 500mg/dose) AND Metronidazole 10mg/kg/dose PO BID (max 500mg/dose) **For 5 days (total duration 10 days for entire regimen)**	GI consult recommended. Current guidelines for *H. pylori* in children recommend that the initial diagnosis be established based on 1) positive histopathology from gastric biopsy and a positive rapid urease test OR 2) a positive culture. Testing of patients with functional abdominal pain is not recommended. Serology is not considered a reliable diagnostic test due to low sensitivity and specificity. Stool antigen test may be used to reliably determine whether *H. pylori* has been eradicated. Testing to confirm eradication is recommended 4-8 weeks after completion of therapy. *Check for Clarithromycin-based drug interactions before initiating treatment
FEVER IN ONCOLOGY AND BMT PATIENTS	*High-Risk Fever and Neutropenia = patients with ANY of the following: hematologic malignancy in induction, consolidation or delayed intensification phase of therapy, hematologic malignancy with relapsed or persistent disease, neutropenia anticipated to last > 7 days, significant mucositis, BMT patients before neutrophil engraftment, focus of serious bacterial infection identified (e.g. pneumonia, abscess)* *Low-Risk Fever and Neutropenia = patients with NO High Risk criteria AND ALL of the following: neutropenia anticipated to last < 7 days, appears clinically well, no focus of serious bacterial infection* *Clinically unstable = ANY of the following: any of the following: shaking chills or rigors, hypotension, hypothermia, abnormal pulses or capillary refill, respiratory distress or hypoxia, altered mental status, tachycardia out of proportion to fever* *These guidelines are specific to patients whose neutropenia is related to chemotherapy or BMT conditioning and may not be appropriate for patients with neutropenia due to other causes* *Refer to Guideline for Inpatient Management of Pediatric Oncology and BMT Patients with Fever and Pediatric Oncology and BMT Patients with Fever: Emergency Department Management for more information. Both available at idmp.ucsf.edu.*			
Fever and neutropenia, High-Risk, clinically stable[i]	Gram positive: *Viridans* group streptococcus, coagulase-negative staphylococci, *Staphylococcus aureus* Gram negative: enteric Gram negatives, hospital-acquired Gram negatives including *Pseudomonas*	Cefepime 50mg/kg/dose IV q8h (max 2g/dose) ADD Vancomycin 15mg/kg/dose IV q6-8h (initial max 1g/dose) if concern for infection at central line site or other Gram positive infection Consider Metronidazole 10mg/kg/dose IV q8h (max 500mg/dose) for suspected intra-abdominal infection	**Non-severe cephalosporin allergy:** Piperacillin-tazobactam (Zosyn) 100mg/kg/dose piperacillin IV q6h (max 4g piperacillin/dose) **Severe beta lactam allergy:** Aztreonam 30mg/kg/dose IV q8h (max 2g/dose) AND Vancomycin 15mg/kg/dose IV q6-8h (initial max 1g/dose)	Refer to Guideline for Inpatient Management of Pediatric Oncology and BMT Patients with Fever for modification of therapy

UCSF Benioff Children's Hospital San Francisco
2016 Empiric Antimicrobial Therapy Guidelines

Condition	Major Pathogens	First Choice Therapy	Alternative Therapy	Comments
Fever and neutropenia, High-Risk, clinically unstable but not with severe sepsis	Similar	Cefepime 50mg/kg/dose IV q8h (max 2g/dose) AND Vancomycin 15mg/kg/dose IV q6-8h (initial max 1g/dose) AND Ciprofloxacin 15mg/kg/dose IV q12h (max 400mg/dose IV q8h) Consider: Metronidazole 10mg/kg/dose IV q8h (max 500mg/dose) for suspected intra-abdominal infection	**Non-severe cephalosporin allergy:** Substitute Piperacillin-tazobactam (Zosyn) 100mg/kg/dose piperacillin IV q6h (max 4g piperacillin/dose) for cefepime Piperacillin-tazobactam has anaerobic activity so do not need concurrent metronidazole for anaerobic infection **Severe beta lactam allergy:** Substitute Aztreonam 30mg/kg/dose IV q8h (max 2g/dose) for cefepime ADD Vancomycin 15mg/kg/dose IV q6-8h (initial max 1g/dose) AND Ciprofloxacin 15mg/kg IV q12h (max 400mg/dose IV q8h) for both regimens	Vancomycin and Ciprofloxacin may be discontinued if cultures are negative for resistant Gram positive or Gram negative organisms Refer to Guideline for Inpatient Management of Pediatric Oncology and BMT Patients with Fever for modification of therapy Refer to Severe Sepsis Section for patients with fever and neutropenia who develop severe sepsis
Fever and neutropenia, Low-Risk	Similar – lower risk of bacteremia	**Inpatient:** Ceftazidime 50mg/kg/dose IV q8h (max 2g/dose) **ED:** Cefepime or Ceftriaxone (follow ED Pathway for Oncology and BMT Patients with Fever)	**Non-severe cephalosporin allergy:** Piperacillin-tazobactam (Zosyn) 100mg/kg/dose piperacillin IV q6h (max 4g piperacillin/dose) **Severe beta lactam allergy:** Aztreonam 30mg/kg/dose IV q8h (max 2g/dose)	If patient is clinically unstable or has identified serious infectious source, use High-Risk guidelines Refer to Guideline for Inpatient Management of Pediatric Oncology and BMT Patients with Fever for modification of therapy
Fever in oncology/BMT patient with central line, non-neutropenic, clinically stable	Varies based on patient risk factors	**Inpatient:** Consider monitoring without empiric treatment for clinically stable patients, especially with alternative explanation for fever **Outpatient:** Ceftriaxone 50mg/kg IV x 1 dose (max 1g/dose)	**Cephalosporin allergy or severe beta lactam allergy:** Levofloxacin 10mg/kg/dose PO/IV x 1 dose if ≥ 5 years old, q12h x 2 doses if < 5 years old (max 750mg/day)	Clinically *unstable* patients with non-neutropenic fever should be managed similarly to clinically unstable patients with neutropenic fever (see above) Avoid ordering standing dose of antibiotic for inpatients with non-neutropenic fever and low suspicion for bacterial infection - order one time dose and re-assess if fever continues beyond 24 hours
FEVER WITHOUT A SOURCE, YOUNG INFANT	*Definition: Any temperature ≥ 38.0°C/100.4°F in infant from age groups below* *Blood, urine and CSF cultures are recommended before antibiotic administration* *Modification of therapy is indicated if a focal source is identified or suspected:* *Refer to Severe Sepsis Section for infants who meet criteria for severe sepsis.* *Refer to CNS Infections Section if meningitis is suspected.* *Refer to Neonatal Herpes Simplex Section if neonatal HSV is suspected.* *Refer to Skin & Soft Tissue Infections Section if signs of skin & soft tissue infection are present. Consult ID for suspected bone or joint infection.*			
Fever without a source, < 28 days old, community-onset, previously healthy (admitted from home)	Enteric Gram negatives Group B streptococcus Less Common: *Staphylococcus aureus* *Listeria monocytogenes* Herpes simplex virus	Ampicillin AND Gentamicin Note: Acyclovir should not be routinely added based on fever alone – refer to Neonatal Herpes Simplex section for indications	Cefotaxime in place of Ampicillin and Gentamicin	Refer to Neonatal Dosing Guideline for antibiotic doses and intervals Note: Therapy should not be broadened based on ongoing fever alone. Many infections in this age group are viral. Consider evaluation and testing for viral infection based on clinical presentation.

UCSF Benioff Children's Hospital San Francisco
2016 Empiric Antimicrobial Therapy Guidelines

Condition	Major Pathogens	First Choice Therapy	Alternative Therapy	Comments
Fever without a source, 28-90 days old, community-onset, previously healthy (presenting from home)	*Streptococcus pneumoniae* Enteric Gram negatives Group B streptococcus *Neisseria meningitidis*	**If infant meets Low-Risk Criteria** (well-appearing, no apparent focal infection, WBC 5,000-15,000 cells/mm^3, band count ≤ 1500 cells/mm^3, urine WBC ≤ 5/HPF), then antibiotic treatment is not indicated. **If infant does not meet Low-Risk Criteria:** Ceftriaxone 50mg/kg/dose IV q24h Note: Acyclovir should not be routinely added based on fever alone – refer to Neonatal Herpes Simplex section for indications	**Corrected gestational age <44 weeks:** Use Cefotaxime per Neonatal Dosing Guideline in place of ceftriaxone	Note: Therapy should not be broadened based on ongoing fever alone. Many infections in this age group are viral. Consider evaluation and testing for viral infection based on clinical presentation.
HEAD AND NECK INFECTIONS	*For most head and neck infections, need for drainage/source control should be evaluated carefully in consultation with Pediatric Otolaryngology, Head and Neck Surgery, and Ophthalmology when orbit is involved. If initial non-operative management is chosen, a narrow spectrum regimen is encouraged to facilitate transition to oral therapy.* ***Maximum Dosing for Amoxicillin and Amoxicillin-Clavulanate (Augmentin):** - although the absolute maximum Amoxicillin dose is 4000mg/day, we recommend the following for usual maximum dosing when targeting a high dose (80-90 mg/kg/day): --Amoxicillin suspension – usual maximum 2000mg/day = 1000mg/dose --Amoxicillin tablet – usual maximum 875mg/dose or 1000mg/dose (2 of the 500mg tablets) --Amoxicillin-clavulanate (Augmentin) suspension – usual maximum 2000mg/day based on amoxicillin component ---If patient weight < 40 kg, use Augmentin ES-600 formulation ---If patient weight ≥ 40 kg, use regular Augmentin 400mg/ml formulation --Amoxicillin-clavulanate (Augmentin) tablet ---Usual maximum 875mg amoxicillin/dose BID ---For acute bacterial sinusitis with high-risk features such as systemic illness, fever 39°C, immunocompromised host, use maximum dose of 2000mg amoxicillin/dose BID			
Dental infection	Oral aerobes and anaerobes (including beta-lactamase producing anaerobes)	Amoxicillin-clavulanate (Augmentin) 22.5 mg amoxicillin/kg/dose PO BID (45 mg amoxicillin/kg/day, max 875mg amoxicillin/dose)	**Penicillin allergy:** Clindamycin 10mg/kg/dose PO TID (max 600mg/dose)	Patient should see a dentist
Peritonsillar /retropharyngeal abscess	Group A streptococcus *Staphylococcus aureus* Oral anaerobes	**Inpatient:** Ampicillin-sulbactam (Unasyn) 50mg/kg/dose ampicillin IV q6h (max 2g ampicillin/dose) ADD Vancomycin 15mg/kg/dose IV q6-8h (initial max 1g/dose) for severe infection (i.e. with airway compromise, extensive abscess, systemically ill), or suspicion of MRSA **Outpatient/step down therapy:** Amoxicillin-clavulanate (Augmentin) 45mg/kg/dose amoxicillin PO BID (max 1000mg amoxicillin/dose*)	**Penicillin allergy:** Clindamycin 10mg/kg/dose PO/IV q8h (max 600mg/dose PO, 900mg/dose IV) for non-severe infection	OHNS consult recommended. Consider ID consultation **Duration:** 10 days for non-severe infection, individualized for severe infection
Lymphadenitis – acute suppurative bacterial, usually unilateral	*Staphylococcus aureus* Group A streptococcus Occasional anaerobes	Clindamycin 10mg/kg/dose PO/IV q8h (max 600mg/dose PO, 900mg/dose IV)		If lack of response to empiric therapy, consider need for drainage, or alternative etiology besides typical bacteria – consider ID consult
Mastoiditis – acute (< 1 month duration), immunocompetent patient	*Streptococcus pneumoniae* Group A streptococcus *Staphylococcus aureus*	Ampicillin-sulbactam (Unasyn) 50mg/kg/dose ampicillin IV q6h (max 2g ampicillin/dose) ADD Vancomycin 15mg/kg/dose IV q6-8h (initial max 1g/dose) for severe infection with adjacent complications, or suspicion of MRSA	**Severe beta lactam allergy:** Consult ID/ASP	OHNS consult recommended. Consider ID consult For intra-cranial extension, refer to Brain Abscess section for empiric therapy Therapy may be tailored based on cultures from I&D
Mastoiditis – chronic (≥1 month duration, usually non-intact tympanic membrane), immunocompetent patient	*Pseudomonas aeruginosa* *Staphylococcus aureus* Anaerobes	Piperacillin-tazobactam (Zosyn) 100mg/kg/dose piperacillin IV q6h (max 4g piperacillin/dose) AND Ofloxacin Otic Solution 10 drops to affected ear BID ADD Vancomycin 15mg/kg/dose IV q6-8h (initial max 1g/dose) for severe infection with adjacent complications, or suspicion of MRSA	**Severe beta lactam allergy:** Consult ID/ASP	OHNS and ID consults recommended Therapy may be tailored based on cultures from I&D

UCSF Benioff Children's Hospital San Francisco
2016 Empiric Antimicrobial Therapy Guidelines

Condition	Major Pathogens	First Choice Therapy	Alternative Therapy	Comments
Conjunctivitis	Often viral *Streptococcus pneumoniae* *Haemophilus influenza* *Moraxella catarrhalis* *Staphylococcus aureus*	Trimethoprim-Polymyxin B 0.1%-10,000 units/ml ophthalmic drops 1-2 drops 4 times daily for 5-7 days	Topical therapy not necessary if patient is on concurrent systemic therapy with coverage against likely causative organisms	Commonly caused by viruses, consider supportive treatment such as warm compresses or cold saline drops
Orbital Cellulitis/Abscess	*Staphylococcus aureus* Streptococci *Haemophilus influenza* Anaerobes	Ampicillin-sulbactam (Unasyn) 50mg/kg/dose ampicillin IV q6h (max 2g ampicillin/dose) ADD Vancomycin 15mg/kg/dose IV q6-8h (initial max 1g/dose) for severe infection or suspicion of MRSA	**Severe beta lactam allergy:** Consult ID/ASP	OHNS, Ophthalmology and ID consults recommended For intracranial extension, refer to Brain Abscess section for empiric therapy Therapy may be tailored based on cultures from I&D
Periorbital/Preseptal Cellulitis	Group A streptococcus *Staphylococcus aureus* *Streptococcus pneumoniae* *Haemophilus influenza* Anaerobes	**Oral/Outpatient:** Clindamycin 10mg/kg/dose PO TID (max 600mg/dose) **IV/Inpatient (if unable to take PO):** Clindamycin 10mg/kg/dose IV q8h (max 900mg/dose)	**If suspected sinus origin and low suspicion for MRSA, Oral/Outpatient:** Amoxicillin-clavulanate (Augmentin) 45mg/kg/dose amoxicillin PO BID (max 1000mg amoxicillin/dose*) **If suspected sinus origin and low suspicion for MRSA, IV/Inpatient:** Ampicillin-sulbactam (Unasyn) 50mg/kg/dose ampicillin IV q6h (max 2g ampicillin/dose)	If inpatient, consider evaluation for Orbital Cellulitis/Abscess, consider Ophthalmology consult
Head and neck infection in immunocompromised patient or with atypical features, chronic course or lack of response to first line therapy	Variable depending on risk factors	Consult ID for guidance		ID consult recommended
INTRA-ABDOMINAL INFECTIONS				
Appendicitis, other community-onset intra-abdominal infection	Enteric Gram negatives Anaerobes	Ceftriaxone 50mg/kg/dose IV q24h (max 2g/dose) AND Metronidazole 10mg/kg/dose IV q8h (max 500mg/dose)	**Beta lactam allergy:** Ciprofloxacin 15mg/kg/dose IV q12h (max 400mg/dose) AND Metronidazole 10mg/kg/dose IV q8h (max 500mg/dose)	**Duration:** For **uncomplicated appendicitis**, only perioperative prophylaxis is needed For **complicated appendicitis or other community-onset intra-abdominal infection**, if *adequate source control*, treat until resolution of abdominal signs & symptoms, usually ≤ 7 days
Intra-abdominal infection, healthcare-associated	Enteric Gram negatives *Pseudomonas aeruginosa,* other resistant Gram negatives	Piperacillin-tazobactam (Zosyn) 100 mg/kg/dose piperacillin q6h (max 4g piperacillin/dose)	**Non-severe penicillin allergy:** Cefepime 50mg/kg/dose IV q8h (max 2g/dose) AND Metronidazole 10mg/kg/dose IV q8h (max 500mg/dose) **Severe beta lactam allergy:** Ciprofloxacin 15mg/kg/dose IV q12h (max 400mg/dose) AND Metronidazole 10mg/kg/dose IV q8h (max 500mg/dose)	Consider ID consult especially if additional patient risk factors, immunocompromised patient or severe infection **Duration:** If *adequate source control*, treat until resolution of abdominal signs & symptoms, usually ≤ 7 days
Necrotizing enterocolitis, definite	Enteric Gram negatives Anaerobes	Ampicillin AND Gentamicin AND if perforation, critical illness, or worsening on Ampicillin and Gentamicin, ADD: Metronidazole	Piperacillin-tazobactam (Zosyn) may be used in the setting of impaired renal function or persistent hypotension	Refer to Neonatal Dosing Guideline for antibiotic doses and intervals Refer to Guideline for Necrotizing Enterocolitis: Antibiotic Selection and Duration of Therapy (idmp.ucsf.edu) for additional guidance **Duration**: Usual duration 7 days, may be extended up to 14 days if prolonged time to resolution of clinical and radiographic signs

UCSF Benioff Children's Hospital San Francisco
2016 Empiric Antimicrobial Therapy Guidelines

Condition	Major Pathogens	First Choice Therapy	Alternative Therapy	Comments
RESPIRATORY INFECTIONS	*__Maximum Dosing for Amoxicillin and Amoxicillin-Clavulanate:__ - although the absolute maximum Amoxicillin dose is 4000mg/day, we recommend the following for usual maximum dosing when targeting a high dose (80-90 mg/kg/day): --Amoxicillin suspension – usual maximum 2000mg/day = 1000mg/dose --Amoxicillin tablet – usual maximum 875mg/dose or 1000mg/dose (2 of the 500mg tablets) --Amoxicillin-clavulanate suspension – usual maximum 2000mg/day ---If patient weight < 40 kg, use Augmentin ES-600 formulation ---If patient weight ≥ 40 kg, use regular Augmentin 400mg/ml formulation --Amoxicillin-clavulanate tablet ---Usual maximum 875mg/dose BID ---For acute bacterial sinusitis with high-risk features such as systemic illness, fever 39°C, immunocompromised host, use maximum dose of 2000mg amoxicillin/dose BID			
Community-acquired pneumonia, 3 months-5 years old, outpatient therapy[1]	Majority: respiratory viruses *Streptococcus pneumoniae,* *Haemophilus influenzae*	Antimicrobial therapy is not routinely indicated unless suspected bacterial etiology If suspected typical bacterial etiology: Amoxicillin 45mg/kg/dose PO BID (max 1000mg/dose*) Note: Atypical pneumonia is rare in this age group	**Non-severe penicillin allergy:** Cefdinir 7mg/kg/dose PO BID (max 600mg/day) **Severe penicillin allergy:** Azithromycin 10mg/kg/dose PO x 1 on day 1 then 5mg/kg/dose PO daily on days 2-5	**Duration for beta lactam therapy (not Azithromycin):** 7 days
Community-acquired pneumonia, > 5 years old, outpatient therapy[1]	Typical, lobar: *Streptococcus pneumoniae* Atypical, bilateral interstitial infiltrates: Respiratory viruses *Mycoplasma pneumoniae*	**If typical bacterial etiology suspected:** Amoxicillin 45mg/kg/dose PO BID (max 1000 mg/dose*) **If atypical bacterial etiology suspected:** Azithromycin 10mg/kg/dose PO on day 1 (max 500mg/dose) then 5mg/kg/dose PO daily on days 2-5 (max 250mg/dose)	**Non-severe penicillin allergy:** Replace Amoxicillin with Cefdinir 7mg/kg/dose PO BID (max 600mg/day) **Severe penicillin allergy:** Replace Amoxicillin with Azithromycin 10mg/kg/dose PO on day 1 (max 500mg/dose) then 5mg/kg/dose PO daily on days 2-5 (max 250mg/dose)	**Duration for beta lactam therapy (not Azithromycin):** 7 days Blood cultures are not usually indicated for outpatients with community-acquired pneumonia
Community-acquired pneumonia, < 3 months old	*Streptococcus pneumoniae* *Haemophilus influenzae* Respiratory viruses Also consider: *Bordetella pertussis* *Chlamydia trachomatis*	Ceftriaxone 50mg/kg/dose IV q24h if corrected gestational age > 44 weeks	**Corrected gestational age <44 weeks:** Use Cefotaxime per Neonatal Dosing Guideline in place of ceftriaxone	Initial inpatient therapy is recommended Blood culture is recommended Consider evaluation and empiric therapy for pertussis especially for infants with apnea, significant post-tussive emesis, lymphocytosis or older contacts with prolonged cough
Community-acquired pneumonia, > 3 months old and up, inpatient therapy but not complicated (empyema/necrotizing pneumonia)[1]	Similar to outpatient etiologies	**Suspected typical bacterial etiology:** Ampicillin 50mg/kg/dose IV q6h (max 2g/dose) **Strong suspicion for atypical etiology:** Azithromycin 10mg/kg/dose PO on day 1 (max 500mg/dose) then 5mg/kg/dose PO daily on days 2-5 (max 250mg/dose) Note: Atypical pneumonia is rare in children < 5 years old **If no distinguishing features for typical vs. atypical bacterial etiology and especially if > 5 years old**: Consider combination of Ampicillin + Azithromycin (doses as above)	**Non-severe penicillin allergy:** Replace Ampicillin with Ceftriaxone 50mg/kg/dose IV q24h (max 2g/dose) **Severe beta lactam allergy:** Levofloxacin 10mg/kg/dose IV q24h if ≥ 5 years old, q12h if < 5 years old (max 750mg/day) (provides both typical and atypical bacterial activity) OR Azithromycin 10mg/kg/dose PO on day 1 (max 500mg/dose) then 5mg/kg/dose PO daily on days 2-5 (max 250mg/dose) if strong suspicion for atypical etiology with low suspicion for typical bacterial etiology	**Duration for beta lactam therapy (not Azithromycin or Levofloxacin):** Mild: 7 days Moderate: 10 days Consider blood culture for patients with moderate to severe illness, young age, incomplete vaccines, or immunocompromised Consider therapy for Influenza if patient admitted during active Influenza season

UCSF Benioff Children's Hospital San Francisco
2016 Empiric Antimicrobial Therapy Guidelines

Condition	Major Pathogens	First Choice Therapy	Alternative Therapy	Comments
Community-acquired pneumonia, complicated (empyema, necrotizing pneumonia)[1]	*Streptococcus pneumoniae* *Staphylococcus aureus*	Ceftriaxone 50mg/kg/dose IV q24h (max 2g/dose) AND ***One of the following agents with MRSA activity:*** Clindamycin 10mg/kg/dose IV q8h (max 900mg/dose) for clinically stable patients OR Vancomycin 15mg/kg/dose IV q6-8h (initial max 1g/dose) for critically ill/clinically unstable patients	**Severe beta lactam allergy:** Replace ceftriaxone with levofloxacin 10mg/kg/dose IV q24h if ≥ 5 years old, q12h if < 5 years old (max 750mg/day)	ID consult recommended Blood cultures are recommended for patients with complicated pneumonia Consider therapy for Influenza if patient admitted during active Influenza season
Aspiration pneumonia	Often similar organisms to community-acquired pneumonia but also oral flora (aerobic and anaerobic) Note: Anaerobic flora are not established until after teeth erupt	**Inpatient:** Ampicillin-sulbactam (Unasyn) 50mg/kg/dose ampicillin IV q6h (max 2g ampicillin/dose) **Oral/step-down therapy:** Amoxicillin-clavulanate (Augmentin) 45mg/kg/dose amoxicillin PO BID (max 1000 mg amoxicillin/dose*)	**Severe beta lactam allergy:** Clindamycin 10mg/kg/dose IV/PO q8h (max 600mg/dose PO, 900mg/dose IV)	Consider possibility of aspiration pneumonitis rather than pneumonia if respiratory distress immediately follows aspiration event and resolves within 24h
Healthcare-associated or ventilator-associated pneumonia	*Pseudomonas aeruginosa,* Other resistant Gram negatives *Staphylococcus aureus*	Piperacillin-tazobactam (Zosyn) 100 mg/kg/dose piperacillin q6h (max 4g piperacillin/dose) ADD Vancomycin 15mg/kg/dose IV q6-8h (initial max 1g/dose) for patients with severe disease or patients with non-severe disease who have history of MRSA infection or colonization	**Non-severe penicillin allergy:** Replace Piperacillin-tazobactam with Cefepime 50mg/kg/dose IV q8h (max 2g/dose) **Severe penicillin allergy:** Consult ID/ASP	Consider ID consultation especially for patients with prior antimicrobial exposure or drug-resistant infections Mini-BAL recommended if able to obtain, tailor therapy to identified organism
Pertussis[2]	*Bordetella pertussis*	**Age < 6 months:** Azithromycin 10mg/kg/dose PO/IV daily x 5 days **Age ≥ 6 months:** Azithromycin 10mg/kg/dose PO on day 1 (max 500mg/dose) then 5mg/kg/dose PO daily on days 2-5 (max 250mg/dose)		Provided regimens can also be used for post-exposure prophylaxis CDC guidelines on post-exposure prophylaxis: www.cdc.gov/pertussis/outbreaks/pep.html
Acute otitis media[3]	*Streptococcus pneumoniae* *Haemophilus influenzae* *Moraxella catarrhalis*	Consider initial observation without antibiotic therapy for 48-72 hours in immunocompetent patients with the following criteria: --6 months-2 years old: unilateral, no otorrhea, non-severe infection -->= 2 years old: no otorrhea, non-severe infection Amoxicillin 45 mg/kg/dose PO BID (max 1000 mg/dose*)	**If patient has received amoxicillin within preceding 30 days, has purulent conjunctivitis, history of recurrent AOM not responsive to amoxicillin, or does not respond to initial therapy with amoxicillin x 48-72 hours:** Amoxicillin-clavulanate (Augmentin) 45mg/kg/dose amoxicillin PO BID (max 1000 mg amoxicillin/dose*) **Non-severe penicillin allergy:** Cefdinir 7mg/kg/dose PO BID (max 600mg/day) **Severe beta lactam allergy:** Azithromycin 10mg/kg/dose PO x 1 on day 1 (max 500mg/dose) then 5mg/kg/dose PO daily on days 2-5 (max 250mg/dose) **Failed oral therapy:** Ceftriaxone 50mg/kg IM/IV q24h (max 1g/dose) Single dose may be sufficient if clinical improvement within 48h, but up to 3 doses may be necessary	**Duration for beta lactam therapy (not Azithromycin):** < 2 years or severe infection: 10 days 2-5 years: 7 days > 5 years: 5 days Pain control recommended for all patients

UCSF Benioff Children's Hospital San Francisco
2016 Empiric Antimicrobial Therapy Guidelines

Condition	Major Pathogens	First Choice Therapy	Alternative Therapy	Comments
Streptococcal pharyngitis[2,3]	Group A streptococcus	**Able to take tablets:** <= 27 kg: Penicillin VK 250mg/dose PO BID > 27 kg: Penicillin VK 500mg/dose PO BID **Unable to take tablets:** Amoxicillin 50mg/kg/dose PO daily (max 1000mg/dose) **Unable to tolerate oral therapy or adherence of concern:** <= 27 kg: Benzathine Penicillin G 600,000 units IM x 1 > 27kg: Benzathine Penicillin G 1.2 million units IM x 1	**Non-severe penicillin allergy:** Cephalexin 25mg/kg/dose PO BID (max 500mg/dose) **Severe penicillin allergy:** Azithromycin 12 mg/kg/dose PO x 1 on day 1 (max 500mg/dose) then 6mg/kg/dose daily on days 2-5 (max 250mg/dose)	**Duration for oral beta lactam therapy (not Azithromycin or Benzathine Penicillin):** 10 days
Acute bacterial sinusitis[1] Diagnosis based on acute upper respiratory illness with: --persistent rhinorrhea or daytime cough lasting ≥10 days and not improving, OR --substantially worsening course after initial improvement, OR --severe onset	*Streptococcus pneumoniae* *Haemophilus influenzae* *Moraxella catarrhalis*	Consider initial observation without antibiotic therapy for 72 hours if diagnosis is made only based on persistence of rhinorrhea or cough – many of these patients improve without antibiotic therapy **Non-severe infection:** Amoxicillin 45mg/kg/dose PO BID (max 1000mg/dose*) **Severe infection:** Amoxicillin-clavulanate (Augmentin) 45mg/kg/dose amoxicillin PO BID (max 2000mg amoxicillin/dose*)	**Non-severe penicillin allergy:** Cefdinir 7mg/kg/dose PO BID (max 600mg/day) **Severe penicillin allergy:** Consult ID/ASP	**Duration of beta lactam therapy:** 10-14 days depending on symptom severity and course *See note above regarding maximum dosing of Amoxicillin and Amoxicillin-Clavulanate (Augmentin)
SEVERE SEPSIS	*For patients who meet criteria for severe sepsis i.e. probable or documented infection with systemic inflammatory response criteria and specific evidence of hypo-perfusion or organ dysfunction not explained by an alternative process; these guidelines are not intended for "rule out" scenarios*			
Severe sepsis, < 28 days old, community-onset, **previously healthy (admitted from home)**	Enteric Gram negatives Group B streptococcus Less Common: *Staphylococcus aureus* *Listeria monocytogenes* Herpes simplex virus	Cefotaxime AND Ampicillin REPLACE Ampicillin with Vancomycin if suspected skin, soft tissue, bone or joint source ADD: Acyclovir if infant has cutaneous vesicles, seizure, focal neurologic signs, CSF pleocytosis, thrombocytopenia or hepatitis		Refer to Neonatal Dosing Guideline for antibiotic doses and intervals ID consult recommended *Refer to Fever Without a Source section if well-appearing*
Severe sepsis, neonate 0-7 days old **during birth hospitalization (ICN/Pedi-Med, has not gone home)**	Enteric Gram negatives Group B streptococcus Less Common: *Listeria monocytogenes*	Gentamicin AND Ampicillin Consider: Acyclovir for infants > 48h of life with ongoing sepsis and unexplained thrombocytopenia or hepatitis	Cefotaxime is preferred in place of Gentamicin in neonates with impaired renal function, persistent hypotension, or high suspicion for meningitis	Refer to Neonatal Dosing Guideline for antibiotic doses and intervals ID consult recommended if not responsive to empiric regimen

UCSF Benioff Children's Hospital San Francisco
2016 Empiric Antimicrobial Therapy Guidelines

Condition	Major Pathogens	First Choice Therapy	Alternative Therapy	Comments
Severe sepsis, infant > 7 days old during birth hospitalization (ICN)	Coagulase-negative staphylococci *Staphylococcus aureus* Gram negatives including *Enterobacter*, other MDR organisms *Enterococcus* spp *Candida* spp	Gentamicin AND Vancomycin ADD: Acyclovir if infant has cutaneous vesicles, seizure, CSF pleocytosis, thrombocytopenia or hepatitis ADD Metronidazole for suspected NEC or other intra-abdominal infection (unless patient on piperacillin/tazobactam or meropenem)	Cefotaxime is preferred in place of Gentamicin in neonates with impaired renal function, persistent hypotension, or high suspicion for meningitis **If patient develops sepsis while on antibiotics or does not respond to initial regimen within 24h:** CHANGE Gentamicin to Meropenem AND ADD Fluconazole	Refer to Neonatal Dosing Guideline for antibiotic doses and intervals ID consult recommended if not responsive to empiric regimen If treating empirically without organism isolated at 48+ hours, consider change to Ampicillin and Gentamicin (see "Neonate 0-7 Days" regimen)
Severe sepsis, > 28 days old, community-onset, no preexisting comorbidities or recent healthcare exposure	*Staphylococcus aureus* *Streptococcus pneumoniae* Group A streptococcus *Neisseria meningitidis* Enteric Gram negatives	Ceftriaxone 50mg/kg/dose IV q24h (max 2g/dose) AND Vancomycin 15 mg/kg/dose IV q6-8h (initial max 1g/dose) ADD Metronidazole 10mg/kg/dose IV q8h (max 500mg/dose) for suspected intra-abdominal infection	**Severe penicillin or cephalosporin allergy:** Aztreonam 30mg/kg/dose IV q8h (max 2g/dose) in place of ceftriaxone **Corrected gestational age <44 weeks:** Cefotaxime per Neonatal Dosing Guideline [	ID consult recommended *Refer to CNS Infections section if meningitis is suspected*
Severe sepsis, > 28 days old, preexisting medical comorbidities* or healthcare exposure *central line, solid organ transplant, immunodeficiency or immunosuppressive medications – refer to specific categories for Oncology/BMT and ICN patients	*Staphylococcus aureus* Gram negatives including *Pseudomonas, Enterobacter,* other MDR organisms *Enterococcus* species *Candida* species in certain risk groups May also have community-acquired pathogens	Cefepime 50mg/kg/dose IV q8h (max 2g/dose) AND Vancomycin 15 mg/kg/dose IV q6-8h (initial max 1g/dose) ADD Metronidazole 10mg/kg/dose IV q8h (max 500mg/dose) for suspected intra-abdominal infection Consider: Caspofungin 70mg/m2 *first dose* (max 70mg/dose) then 50mg/m2 /dose IV q24h (max 50mg/dose) if patient on TPN, high dose steroids, already on broad spectrum antibiotics (note: Caspofungin dosing differs in age < 3 months – please consult ID/ASP for guidance)	**If patient develops sepsis while on broad spectrum antibiotics:** Replace Cefepime with Meropenem 20mg/kg/dose IV q8h (max 1g/dose) **Severe penicillin or cephalosporin allergy:** Aztreonam 30mg/kg/dose IV q8h (max 2g/dose) AND Ciprofloxacin 15mg/kg/dose IV q12h (max 400mg/dose q8h) in place of Cefepime	ID consult recommended ID/ASP approval required for Caspofungin
Severe sepsis, Oncology or BMT patient	*Staphylococcus aureus* *Viridans* group Streptococci *Enterococcus* spp Gram negatives including *Pseudomonas, Enterobacter,* other MDR organisms, *Candida* spp May also have community-acquired pathogens	Meropenem 20mg/kg/dose IV q8h (max 1g/dose) AND Vancomycin 15mg/kg/dose IV q6-8h (initial max 1g/dose) AND Ciprofloxacin 15mg/kg/dose IV q12h (max 400mg/dose IV q8h) Consider: Caspofungin 70mg/m2 *first dose* (max 70mg/dose) then 50mg/m2/dose IV q24h if patient on TPN, high dose steroids, or already on broad spectrum antibiotics (note: Caspofungin dosing differs in age < 3 months – please consult ID/ASP for guidance)	**Severe beta lactam allergy:** Use Aztreonam 30mg/kg/dose IV q8h (max 2g/dose) in place of Meropenem **ED:** Give Cefepime 50mg/kg IV x 1 dose (max 2g/dose) in place of Meropenem (per ED Oncology/BMT Fever Pathway – at idmp.ucsf.edu)	ID consult recommended ID/ASP approval required for Caspofungin

UCSF Benioff Children's Hospital San Francisco
2016 Empiric Antimicrobial Therapy Guidelines

Condition	Major Pathogens	First Choice Therapy	Alternative Therapy	Comments
SKIN & SOFT TISSUE INFECTIONS				
Abscess with or without surrounding celluitis[1,2] Surrounding cellulitis = marked erythema larger than the extent of overlying induration OR extending > 5 cm from abscess for adult-sized patient	*Staphylococcus aureus* Other pathogens depending on specific exposures/risk factors	Consider drainage alone if isolated abscess or minor surrounding cellulitis; antibiotic therapy recommended if significant surrounding cellulitis, unable to drain, severe infection, or immunocompromised patient **Outpatient/non-severe infection, > 1 month old:** Trimethoprim-sulfamethoxazole (Bactrim/Septra) 4-6 mg/kg/dose trimethoprim PO BID (max 160mg/dose) **Severe infection:** Vancomycin 15mg/kg/dose IV q6-8h (initial max 1g/dose)	Clindamycin 10mg/kg/dose IV/PO q8h (max 600mg/dose PO, 900mg/dose IV) OR Doxycycline 2mg/kg/dose PO BID (max 100mg/dose) if ≥ 8 years old	**Duration:** 5-7 days for non-severe infection
Non-purulent cellulitis[1,2]	Group A streptococcus *Staphylococcus aureus*	**Outpatient/non-severe infection:** Cephalexin 25mg/kg/dose PO TID (max 500mg/dose) **Inpatient/Need for IV Therapy:** Cefazolin 25mg/kg/dose IV q8h (max 2g/dose) **Severe infection:** Vancomycin 15mg/kg/dose IV q6-8h (initial max 1g/dose)	**If suspected MRSA or failure of prior non-MRSA therapy:** Clindamycin 10mg/kg/dose PO/IV q8h (max 600mg/dose PO, 900mg/dose IV)	**Duration:** 5-7 days for non-severe infection
Necrotizing fasciitis or other necrotizing soft tissue infection	Group A streptococcus Can be polymicrobial including anaerobes, *Clostridium* species, skin flora	Vancomycin 15 mg/kg/dose q6-8h (initial max 1g/dose) AND Piperacillin-tazobactam 100mg/kg/dose IV q6h (max 4g/dose) AND Clindamycin 10mg/kg/dose IV q8h (max 900mg/dose)	**Beta lactam allergy:** Call ID/ASP for guidance on alternative therapy	ID and Surgery consults recommended
Bite wound	*Pasteurella multocida* (animal) *Eikenella corrodens* (human) *Staphylococcus* species *Streptococcus* species Oral anaerobes	**Oral (prophylaxis or treatment):** Amoxicillin-clavulanate (Augmentin) 22.5mg/kg/dose amoxicillin PO BID (max 875 mg amoxicillin/dose) **IV (if needed for established infection):** Ampicillin-sulbactam 50mg/kg/dose ampicillin IV q6h (max 2g ampicillin/dose)	**Penicillin allergy:** Trimethoprim-sulfamethoxazole (Bactrim/Septra) 4-6 mg/kg/dose trimethoprim PO BID (max 160mg/dose) AND Clindamycin 10mg/kg/dose PO TID (max 600mg/dose)	**Duration:** 3-5 days for prophylaxis of high risk bite wounds Longer duration for treatment of established infection, guided by severity and clinical course Also consider need for tetanus and/or rabies prophylaxis
SEXUALLY TRANSMITTED INFECTIONS (ADOLESCENT)	*Refer to Herpes Simplex Virus Infection, Mucocutaneous section under Viral Infections*			
Chlamydia[7]	*Chlamydia trachomatis*	Azithromycin 1g PO x 1	Doxycycline 100mg PO BID x 7 days	Sexual partners should be treated
Gonorrhea (uncomplicated)[7]	*Neisseria gonorrhoeae*	Ceftriaxone 250mg IM x 1 AND Azithromycin 1g PO x 1		Sexual partners should be treated Obtain culture with treatment failure or alternative regimens

UCSF Benioff Children's Hospital San Francisco
2016 Empiric Antimicrobial Therapy Guidelines

Condition	Major Pathogens	First Choice Therapy	Alternative Therapy	Comments
Pelvic inflammatory disease, inpatient therapy[v]	*Chlamydia trachomatis* *Neisseria gonorrhoeae* Enteric Gram negatives and anaerobes	Cefoxitin 2g/dose IV q6h AND Doxycycline 100mg/dose IV/PO q12h (PO preferred if tolerated) 24-48 hours after clinical improvement, can transition to Doxycycline monotherapy for completion of 14 day course **If tubo-ovarian abscess is present:** Initial therapy as above. Upon discontinuing Cefoxitin, continue Doxycycline and ADD Metronidazole 500mg/dose PO BID for 14 day total course	**Beta lactam allergy:** Clindamycin 900mg/dose IV q8h AND Gentamicin 2 mg/kg/dose IV x1 followed by 1.5mg/kg IV q8h 24-48 hours after clinical improvement, can transition to Doxycycline 100mg/dose PO BID for completion of 14 day course **If tubo-ovarian abscess is present:** Initial therapy as above. Complete course with combination of Doxycycline and Metronidazole 500mg/dose PO BID for 14 day total course	
Pelvic inflammatory disease, outpatient therapy[v]	Same	Ceftriaxone 250mg IM x 1 AND Doxycycline 100mg/dose PO BID x 14 days Consider Metronidazole 500mg/dose PO BID x 14 days	**If adherence is a concern** the following regimen may be considered: Ceftriaxone 250mg IM x 1 AND Azithromycin 1g PO qweek x 2 doses Contact ASP/Pediatric ID for guidance on alternatives for patients with beta lactam allergy	
Syphilis[v]	*Treponema pallidum*	**Primary, secondary or early latent:** Benzathine Penicillin G 50,000 units/kg up to 2.4 million units IM x 1 **Late latent, or latent of unknown duration:** Benzathine Penicillin G 50,000 units/kg up to 2.4 million units IM qweek x 3 doses	Contact ASP/Pediatric ID for guidance on alternatives for patients with penicillin allergy	Sexual partners should be treated
Trichomoniasis[v]	*Trichomonas vaginalis*	Metronidazole 2g PO x 1		Sexual partners should be treated
URINARY TRACT INFECTIONS	*Diagnosis of UTI in most patients requires positive U/A and culture with compatible urinary tract symptoms* *Asymptomatic bacteriuria is common in hospitalized patients and in most cases should not be treated* *Ensure appropriate collection methods (catheterization or clean catch)* *Therapy should be modified according to culture and susceptibilities* *For patients with prior UTIs, consider prior causative organisms when selecting empiric therapy*			
Urinary tract infection, community-onset, 2 months-12 years old, outpatient therapy[v]	Enteric Gram negatives	**Patient without significant recent antibiotic exposure or known urinary tract abnormalities:** Cephalexin 25mg/kg/dose PO TID (max 500mg/dose) **If significant prior antibiotic exposure or urinary tract abnormalities:** Cefdinir 14mg/kg/dose PO daily (max 600mg/day)	**Beta lactam allergy:** Trimethoprim-sulfamethoxazole (Bactrim/Septra) 4mg/kg/dose trimethoprim PO BID (max 160mg/dose)	For infants < 2 months, refer to Fever Without a Source section for initial therapy then narrow based on organism and susceptibilities **Duration:** UTI without fever: 7 days UTI with fever in younger child: 10 days
Uncomplicated cystitis, > 12 years old, outpatient therapy[v]	Enteric Gram negatives	Nitrofurantoin monohydrate/macrocrystals (Macrobid) 100mg/dose PO BID	Cephalexin 25mg/kg/dose PO BID (max 500mg/dose)	**Duration:** 5 days
Febrile urinary tract infection/pyelonephritis, community-onset, inpatient therapy[v]	Enteric Gram negatives	**Inpatient:** Ceftriaxone 50mg/kg/dose IV q24h (max 1g/dose) **If candidate for PO therapy:** Cefdinir 14 mg/kg/dose PO daily (max 600mg/day)	**Beta lactam allergy:** Ciprofloxacin 15mg/kg/dose IV/PO BID (max 400mg/dose IV, 500mg/dose PO)	ID consult recommended for complicated infection or concurrent bacteremia **Duration:** Beta lactams: 10-14 days Ciprofloxacin: 7 days

UCSF Benioff Children's Hospital San Francisco
2016 Empiric Antimicrobial Therapy Guidelines

Condition	Major Pathogens	First Choice Therapy	Alternative Therapy	Comments
Urinary tract infection, hospital-onset This category is intended for catheter-associated infection, or patients with significant prior antibiotic exposure – for patients at low-risk for drug-resistant organism, refer to community-onset guidelines	Enteric and hospital-acquired Gram negatives including *Pseudomonas aeruginosa* *Enterococcus* species and *Candida* species are more likely to represent colonization than true infection	Ceftazidime 50mg/kg/dose IV q8h (max 2g/dose)	**Non-severe cephalosporin allergy:** Piperacillin-tazobactam (Zosyn) 100mg/kg/dose piperacillin IV q6h (max 4g piperacillin/dose) **Severe beta lactam allergy:** Ciprofloxacin 15mg/kg/dose IV/PO q12h (max 400mg/dose IV, 500mg/dose PO)	**Duration:** 7-14 days based on severity Modify therapy based on culture and susceptibility of isolated organism
VIRAL INFECTIONS				
Influenza[w] Refer to Influenza Guidelines (idmp.ucsf.edu) for treatment indications	Influenza virus	Oseltamivir according to body weight: Preterm infants: Contact Pediatric ID/ASP Term infants 0-8 months: 3mg/kg/dose PO BID Infants 9-11 months: 3.5mg/kg/dose PO BID Children >= 12 months: <=15kg: 30mg/dose PO BID >15-23kg: 45mg/dose PO BID >23-40kg: 60mg/dose PO BID >40kg: 75mg/dose PO BID **Duration:** 5 days for most patients 10 days for immunocompromised patients	Zanamivir can be used for children age >= 7 years old for treatment or >= 5 years old for prophylaxis – consider in patients unable to tolerate PO but able to use dry powder inhaler: Zanamivir 10mg/dose (2 inhalations) INH BID **Duration:** Treatment, most patients: 5 days Treatment, immunocompromised patients: 10 days Prophylaxis: 7 days Consult Pediatric ID for use of Peramivir in critically ill patients unable to take PO or dry powder inhaler	Oseltamivir Dosing for Prophylaxis (most effective if initiated within 48-72 hours of exposure: Age < 3 months: not recommended Infants 3-8 months: 3mg/kg/dose PO daily Infants 9-11 months: 3.5mg/kg/dose PO daily Children >= 12 months: <=15kg: 30mg/dose PO daily >15-23kg: 45mg/dose PO daily >23-40kg: 60mg/dose PO daily >40kg: 75mg/dose PO daily **Duration:** 7 days
Neonatal herpes simplex Consider diagnosis in infants < 6 weeks old with cutaneous vesicles, seizure, focal neurologic signs, CSF pleocytosis with non-bacterial profile, thrombocytopenia or hepatitis	Herpes simplex virus	Acyclovir 20mg/kg/dose IV q8h		ID consult recommended Full evaluation with LP, CSF HSV PCR, blood HSV PCR and surface cultures is recommended for *all* forms of neonatal HSV disease Suppressive therapy with oral acyclovir 300mg/m2/dose PO q8h is now recommended for *all* forms of neonatal HSV disease, for at least 6 months after treatment course completed – consult Pediatric ID for guidance on duration and monitoring
Herpes simplex encephalitis or other disseminated disease (non-neonatal)	Herpes simplex virus	**Age 3 months to < 12 years:** Acyclovir 10-15mg/kg/dose IV q8h **Age ≥ 12 years:** Acyclovir 10mg/kg/dose IV q8h		ID consult recommended
Herpes simplex: mucocutaneous: (non-neonatal)	Herpes simplex virus	**IV Therapy:** **Immunocompetent:** Acyclovir 5-10mg/kg/dose IV q8h **Immunocompromised:** Acyclovir 10mg/kg/dose IV q8h	**Oral therapy:** Acyclovir 20 mg/kg/dose (max 400mg/dose) PO TID OR Valacyclovir 20 mg/kg/dose (max 1000mg/dose) PO BID	Treatment most likely to be beneficial if initiated within 72 hours of onset. Oral therapy preferred if feasible due to lower risk for nephrotoxicity **Duration:** Dependent on clinical resolution, generally 5-7 days
Varicella (primary infection) or herpes zoster (reactivation) in immunocompromised hosts	Varicella zoster virus	**IV therapy (initial treatment):** Acyclovir 10mg/kg/dose IV q8h **Oral therapy (step-down):** Acyclovir 20 mg/kg/dose (max 800mg/dose) PO – 4x/day for children < 12 years; 5x/day for adolescents >=12 years OR Valacyclovir 20 mg/kg/dose (max 1000mg/dose) TID		Consider ID consultation **Duration:** Dependent on clinical resolution

ASSESSMENT OF ANTIBIOTIC ALLERGIES[21]

- Patients who report antibiotic allergies often receive antibiotics that are less effective against the infections they may have, or are associated with higher toxicity risk and/or cost than the standard therapy.
- The majority of patients who report antibiotic allergies do not have true IgE-mediated allergic reactions to those drugs. Therefore, careful assessment of the reported reaction is needed to determine the risk for cross-reactivity and inform appropriate selection of therapy.
- An IgE-mediated reaction consists of urticaria (hives), angioedema (swelling), respiratory distress, vomiting, hypotension, or other findings of anaphylaxis.
- True IgE-mediated penicillin allergy is estimated to occur in 1% to 10% of the population; the rate of cephalosporin allergy is estimated to be 10-fold lower (0.1% to 1%).
- Amoxicillin and Ampicillin are associated with development of a delayed maculopapular rash in ~5-10% of patients who receive these drugs. These reactions are not IgE mediated; careful history should be obtained to differentiate from an IgE-mediated reaction.
- Cross-reactivity between penicillins and cephalosporins is estimated to be 0.1% to 1%; cross-reactivity with carbapenems is believed to be even lower.
- In patients with non-life threatening allergy to penicillins (i.e. not anaphylaxis, Stevens-Johnson syndrome or similar), cephalosporins and carbapenems should generally be considered safe to administer, with the following exceptions:
    - Patients with IgE-mediated allergy to Ampicillin (specific to Ampicillin, does not apply to Amoxicillin) should not receive Cephalexin, and vice versa.
    - Patients with IgE-mediated allergy to Ceftriaxone, Cefotaxime or Cefpodoxime should not receive any of these three drugs.
    - Patients with IgE-mediated allergy to Ceftazidime should not receive Aztreonam, and vice versa.
- Generally speaking, patients with life-threatening allergy (e.g. anaphylaxis, Stevens-Johnson syndrome or similar) to penicillins should not receive any beta-lactam, with the exception of Aztreonam, which has no cross-reactivity to any beta-lactam except Ceftazidime.
- For recommendations on alternative therapy for patients with antibiotic allergies, please consult the Pediatric Antimicrobial Stewardship Program by calling 514-1275. In cases where an antibiotic is needed to treat infection but there is risk for IgE-mediated reaction, drug desensitization can be attempted. Generally, patients with suspected drug allergy should be evaluated by an allergist, who can assist with testing and possible drug challenge.

REFERENCES

1. Tunkel, A. R. *et al.* Practice guidelines for the management of bacterial meningitis. *Clin.Infect.Dis.* **39,** 1267–1284 (2004).
2. Guerrant, R. L. *et al.* Practice guidelines for the management of infectious diarrhea. **22908,** 331–351 (2001).
3. Weinberg, N., Weinberg, M. S. & Maloney, S. A. in *CDC Yellow Book* (2016).
4. Cohen, S. H. *et al.* Clinical practice guidelines for *Clostridium difficile* infection in adults: 2010 update by the Society for Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA). *Infect. Control Hosp. Epidemiol.* **31,** 431–455 (2010).
5. Schutze, G. E. & Willoughby, R. E. *Clostridium difficile* infection in infants and children. *Pediatrics* **131,** 196–200 (2013).
6. Koletzko, S. *et al.* Evidence-based guidelines from ESPGHAN and NASPGHAN for *Helicobacter pylori* infection in children. *J. Pediatr. Gastroenterol. Nutr.* **53,** 230–243 (2011).
7. Lehrnbecher, T. *et al.* Guideline for the management of fever and neutropenia in children with cancer and/or undergoing hematopoietic stem-cell transplantation. *J. Clin. Oncol.* **30,** 4427–4438 (2012).
8. Solomkin, J. S. *et al.* Diagnosis and management of complicated intra-abdominal infection in adults and children: guidelines by the Surgical Infection Society and the Infectious Diseases Society of America. *Clin. Infect. Dis.* **50,** 133–164 (2010).
9. Bradley, J. S. *et al.* The management of community-acquired pneumonia in infants and children older than 3 months of age: clinical practice guidelines by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America. *Clin. Infect. Dis.* **53,** e25–e76 (2011).
10. Tiwari, T., Murphy, T. V & Moran, J. Recommended antimicrobial agents for the treatment and postexposure prophylaxis of pertussis: 2005 Centers for Disease Control guidelines. *Morb. Mortal. Wkly. Rep.* (2005).
11. Lieberthal, A. S. *et al.* The diagnosis and management of acute otitis media. *Pediatrics* **131,** e964–e999 (2013).
12. Gerber, M. A. *et al.* Prevention of rheumatic fever and diagnosis and treatment of acute streptococcal pharyngitis: a scientific statement from the American Heart Association Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee of the Council on Cardiovascular Disease. *Circulation* **119,** 1541–1551 (2009).
13. Shulman, S. T. *et al.* Clinical practice guideline for the diagnosis and management of group A streptococcal pharyngitis: 2012 update by the Infectious Diseases Society of America. *Clin. Infect. Dis.* **55,** e86–e102 (2012).
14. Wald, E. R. *et al.* Clinical practice guideline for the diagnosis and management of acute bacterial sinusitis in children aged 1 to 18 years. *Pediatrics* **132,** e262–e280 (2013).
15. Stevens, D. L. *et al.* Practice guidelines for the diagnosis and management of skin and soft tissue infections: 2014 update by the Infectious Diseases Society of America. *Clin. Infect. Dis.* **59,** e10–e52 (2014).
16. Liu, C. *et al.* Clinical practice guidelines by the Infectious Diseases Society of America for the treatment of methicillin-resistant *Staphylococcus aureus* infections in adults and children. *Clin. Infect. Dis.* **52,** (2011).
17. Centers for Disease Control and Prevention. Sexually transmitted diseases treatment guidelines , 2015. *Morb. Mortal. Wkly. Rep.* **64,** (2015).
18. AAP Subcommittee on Urinary Tract Infection. Urinary tract infection: clinical practice guideline for the diagnosis and management of the initial UTI in febrile infants and children 2 to 24 months. *Pediatrics* **128,** 595–610 (2011).
19. Gupta, K. *et al.* International clinical practice guidelines for the treatment of acute uncomplicated cystitis and pyelonephritis in women: A 2010 update by the Infectious Diseases Society of America and the European Society for Microbiology and Infectious Diseases. *Clin. Infect. Dis.* **52,** e103–20 (2011).
20. American Academy of Pediatrics, Committee on Infectious Diseases. Recommendations for prevention and control of influenza in children , 2011 – 2012. *Pediatrics* **128,** (2012).
21. Weiss, M. E. *et al.* Drug allergy: an updated practice parameter. *Ann. Allergy, Asthma Immunol.* **105,** 259–273.e78 (2010).