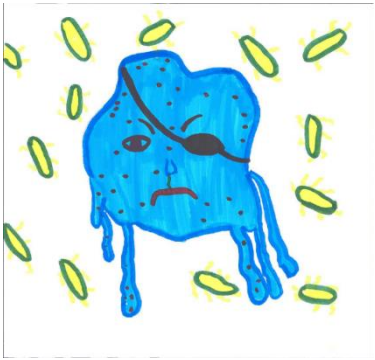
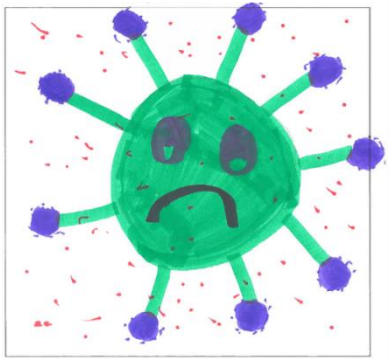
Children's Mercy Hospital
Antimicrobial Stewardship Program Empirogram
Empirical Guidelines for Common Infections

Version 16; Updated 10.2025



"Sickly Slimey Seth" by Tori, Age 14



"Mean Face" by Lyla, Age 12

Children's Mercy Hospital Empirogram

Intended for primarily healthy, immunocompetent host unless otherwise noted.

Children's Mercy Antimicrobial Stewardship Program (ASP) Overview

The CM ASP was developed in 2008 with a goal of optimizing the use of antibiotics while minimizing unintended consequences of use, including adverse effects, unnecessary cost/waste, selection of pathogenic organisms, and the emergence of resistance. The ASP is a multidisciplinary team, separate from the Infectious Diseases team, which performs many functions including but not limited to:

- Antibiotic review for inpatients at 48 hours after ordering to provide recommendations to optimize use
- Development of resources such as the Empirical Guidelines for Common Infections and the Outpatient Antibiotic Handbook. Refer to the Children's Mercy ASP Website for more resources.
- Informal/formal education as necessary
- Share valuable antibiotic use data to improve prescribing
- Collaborate with other divisions and disciplines to develop antibiotic use protocols, improve microbiologic testing, and engage in quality improvement work

ASP providers are available for antimicrobial-related questions Monday - Friday 08:00 - 16:00. Non-urgent questions may be directed to AntimicrobialStewards@cmh.edu.

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Gram Positive Antibiogram for Children's Mercy- 2024 (All Sources)

Children's Mercy Hospitals & Clinics - 2024 Antibiogram
Department of Pathology & Laboratory Medicine- Microbiology Laboratory
2024 Gram Positive Antibiogram (% Susceptible)

Organism	# of isolates tested	Ampicillin	Cefotaxime	Clindamycin	Erythromycin	Linezolid	Meropenem	Nitrofurantoin[4]	Oxacillin	Penicillin	Penicillin (Oral)	Rifampin[3]	Tetracycline	Trim/Sulfa	Vancomycin
Enterococcus faecalis	213	100	-	-	-	-	-	100	-	99	-	-	-	-	100
All Staphylococcus aureus	1358	-	-	80	55	100	-	100	72	0	-	100	94	93	100
MSSA	981	-	-	78	67	100	-	100	100	0	-	100	95	96	100
MRSA	377	-	-	87	23	100	-	100	0	0	-	100	90	87	100
Staphylococcus epidermidis	150	-	-	52	24	100	-	98	33	0	-	98	92	55	100
S. pneumoniae *	89	-	-	93	60	-	84[2]	-	-	-	66§	-	-	-	100[2]
Meningitis breakpoint		-	96†	-	-	-	-	-	-	65†	-	-	-	-	-
Non-meningitis breakpoint		-	100‡	-	-	-	-	-	-	99‡	-	-	-	-	-

of *S.pneumoniae* isolates tested: Penicillin=89, Cefotaxime=89, Erythromycin=68, Clindamycin=81, Meropenem=19, Vancomycin=18

† Susceptible breakpoint for *S. pneumoniae* in patients with meningitis is ≤ 0.5 µg/mL for cefotaxime and ≤ 0.06 µg/mL for penicillin

‡ Susceptible breakpoint for *S. pneumoniae* in patients with non-meningitis infections is ≤ 1µg/mL for cefotaxime and ≤ 2 µg/mL for penicillin

§ Susceptible breakpoint for *S. pneumoniae* is ≤ 0.06 µg/mL for penicillin when penicillin V is administered by the oral route

[4] Antibiotics tested on UTI isolates only: *E. faecalis* (185), *S. aureus* (45), *S. epidermidis* (79)

(-) =No data available

Gram Negative Antibiogram for Children's Mercy- 2024 (All Sources)

Children's Mercy Hospitals & Clinics - 2024 Antibiogram
Department of Pathology & Laboratory Medicine- Microbiology Laboratory

2024 Gram Negative Antibiogram (% susceptible)

Organism	# of isolates tested	Amikacin [1]	Ampicillin	Amp/sulbactam [1]	Cefazolin	Cefepime	Ceftazidime	Ceftriaxone	Ciprofloxacin	Gentamicin	Meropenem [1]	Pip/tazo	Tobramycin	Trimeth/Sulfa
Acinetobacter baumannii complex (includes **ALL** sources)	16 [2]	-	-	93	-	-	54	15	77	85	80	-	85	92
Citrobacter freundii (includes **ALL** sources)	39	100	IR	IR	IR	-	-	-	93	100	100	-	96	79
Klebsiella aerogenes^ (includes **ALL** sources)	34	100	IR	IR	IR	100	-	-	100	100	100	-	100	100
Serratia marcescens (includes **ALL** sources)	72	98	IR	IR	IR	100	100	100	100	100	100	-	93	100
Enterobacter cloacae (Non-urine sources **ONLY**)	68	100	IR	IR	IR	98[b]	-	-	100	98	100	-	95	95
Pseudomonas aeruginosa (Non-Urine sources **ONLY**)	236	-	-	-	-	97	97	-	92	-	96	96	97	-
Escherichia coli* (Non-Urine sources **ONLY)	94	100	49	58	66[a]	90[b]	84	82	78	90	100	93	89	72
Klebsiella oxytoca (Non-Urine sources **ONLY**)	16 [2]	100	IR	62	33[a]	89[b]	89	89	100	78	100	-	86	89
Klebsiella pneumoniae* (Non-Urine sources **ONLY)	47	100	IR	85	85 [a]	100[b]	97	97	97	100	100	100	100	97
Proteus mirabilis* (Non-Urine sources **ONLY)	9 [2]	100	86	92	14[a]	86[b]	86	86	85	71	100	100	75	86

ESBL positive isolates: *E. coli* (12), *K. pneumoniae* (3), *K. oxytoca* (2)

^ *Klebsiella aerogenes,* formerly named *Enterobacter aerogenes.*

[1] Antibiotics tested on Non-Urine isolates only: *A. baumannii* complex (14), *C. freundii* (7), *K. aerogenes* (14), *S. marcescens* (54).

[2] Please exercise discretion when data are reviewed for species with fewer that 30 isolates.

* Cefazolin and Cefepime susceptibility based off Kirby Bauer disc diffusion results.

IR = Intrinsic Resistance, (-) = No data available

**E. coli, K. pneumoniae and P. mirabilis* breakpoints differ for urine vs. all other sources.

Gram Negative Antibiogram for Children's Mercy- 2024 (URINE ISOLATES ONLY)

Children's Mercy Hospitals & Clinics - 2024 Antibiogram
Department of Pathology & Laboratory Medicine- Microbiology Laboratory

2024 Gram Negative - URINE ONLY- Antibiogram (% susceptible)

Organism	# of isolates tested	Ampicillin	Amox/clav	Cefazolin	Cefepime	Ceftazidime	Ceftriaxone	Ciprofloxacin	Gentamicin	Nitrofurantoin	Tobramycin	Trimeth/Sulfa
Enterobacter cloacae	46	IR	IR	IR	-	-	-	100	98	36	98	80
Pseudomonas aeruginosa	64	-	-	-	96	98	-	95	-	-	98	-
**Escherichia coli*	1413	54	85	91	-	95	95	91	91	97	92	73
Klebsiella oxytoca	47	IR	91	18	-	91	91	100	100	89	100	94
**Klebsiella pneumoniae*	116	IR	91	90	-	92	92	94	94	18	92	84
**Proteus mirabilis*	110	85	91	97	-	96	96	98	96	IR	96	90

ESBL positive isolates: *E. coli* (85), *K. pneumoniae* (9), *K. oxytoca* (3)

IR = Intrinsic Resistance, (-) = No data available

**E. coli, K. pneumoniae and P. mirabilis* breakpoints differ for urine vs. all other sources.

BioFire FilmArray Blood Culture Identification (BCID) Panel

BCID is a multiplex PCR test that is performed with a positive blood culture; results are typically available within an hour of the culture becoming positive. The following table provides suggested antimicrobials to optimize therapy until final identification and susceptibilities are available.

Organism Detected	Empirical Antimicrobial	Notes
Gram-Positive Organisms		
Staphylococcus aureus, **MecA/C gene and MREJ not detected (MSSA)**	Cefazolin/oxacillin	**ID consult required**
Staphylococcus aureus, **MecA/C gene and MREJ detected (MRSA)**	Vancomycin	**ID consult required**
Staphylococcus epidermidis OR *Staphylococcus lugdunensis* and **MecA/C gene not detected**	Cefazolin/oxacillin	**ID consult required for *S. lugdunensis***
Staphylococcus epidermidis OR *Staphylococcus lugdunensis* and **MecA/C gene detected**	Vancomycin	**ID consult required for *S. lugdunensis***
Staphylococcus species	Vancomycin	
Streptococcus agalactiae (Group B Strep)	Penicillin/ampicillin	ID consult recommended
Streptococcus pneumoniae	Ceftriaxone ± vancomycin	
Streptococcus pyogenes (Group A Strep)	Penicillin/ampicillin	ID consult recommended
Streptococcus species	Ceftriaxone	Add vancomycin for immunocompromised pts
Enterococcus faecalis	Ampicillin	**ID consult required**
Enterococcus faecium	Vancomycin	
Listeria monocytogenes	Ampicillin	ID consult recommended

BCID Empiric Antimicrobial Recommendations Continued		
Organism Detected	**Empirical Antimicrobial**	**Notes**
Gram-Negative Organisms		
Acinetobacter calcoaceticus-baumanii complex	Cefepime or meropenem	ID consult recommended for *A. calcoaceticus-baumanii* complex, *Salmonella* spp., and *P. aeruginosa*. If "**CTX-M"** detected, this organism produces an extended-spectrum beta-lactamase (ESBL). Meropenem should be utilized empirically. If "**KPC, VIM, NDM, OXA-48-like, or IMP**" detected, contact ID for treatment options as this organism may be resistant to most beta-lactams, including meropenem.
Escherichia coli	Ceftriaxone	
Enterobacter cloacae complex	Cefepime	
Enterobacterales species	Cefepime	
Klebsiella aerogenes	Cefepime	
Klebsiella pneumoniae	Ceftriaxone	
Klebsiella oxytoca	Ceftriaxone	
Proteus species	Ceftriaxone	
Pseudomonas aeruginosa	Cefepime or meropenem	
Salmonella spp.	Ceftriaxone	
Serratia marcescens	Ceftriaxone	
Haemophilus influenzae	Ceftriaxone	ID Consult recommended for *Haemophilus* type A-F
Neisseria meningitis	Ceftriaxone	ID consult recommended
Stenotrophomonas maltophilia	Sulfamethoxazole/trimethoprim + 2nd Agent	**ID consult required**

Organism Detected	Empirical Antimicrobial	Notes
Fungal Organisms#		
Candida albicans	Fluconazole or micafungin (if critically ill or fluconazole use within the past 3 months – use micafungin)	**ID consult required**
Candida auris	Call ID	
Candida glabrata	Micafungin	
Candida krusei	Micafungin	
Candida parapsilosis	Micafungin or fluconazole	
Candida tropicalis	Micafungin	
Cryptococcus neoformans/gattii	Call ID	

[#] Refer to IDSA Candida Guidelines for treatment options in neonatal patients

Microbiology Pearls

- **Blood Cultures/BCID**
  - Blood cultures obtained at CMH are monitored 24/7 by microbiology staff
  - BCID results are located at the bottom of the specimen information for the positive blood culture
  - BCID identifies genes in bacterial families (e.g., *Streptococcus spp.)* and for individual species (e.g, *Streptococcus pyogenes)*
    - If results are indeterminate, it is possible an organism that is not detected by the BCID is present
  - BCID becomes less accurate if multiple organisms are identified on a blood culture
  - If BCID is not run on a positive blood culture, an organism may be only growing from an anaerobic bottle – call micro
- **Minimum Inhibitory Concentration (MIC) Value Interpretation**
  - MICs are the lowest concentration of an antimicrobial at which microorganism growth is inhibited
  - MIC interpretation of susceptible, intermediate, or resistant is unique for each bug-drug combination
    - We cannot compare MIC numbers between bacteria or antibiotics when deciding on treatment
    - The lowest MIC does not always mean that antibiotic is the best
  - Consider the susceptibility pattern, infection type, and patient factors when selecting treatment

DIAGNOSES FOR WHICH FORMAL ID CONSULTATION IS RECOMMENDED

ID consultation should be considered for patients requiring prolonged antimicrobial therapy, a more individualized treatment regimen, outpatient parenteral therapy, or ID follow up once discharged. Additional diagnoses are recommended below.

Category	Specific Diagnoses
Bacteremia or fungemia	*Staphylococcus aureus*; Salmonella* sp.; *Enterococcus* sp.*, *Staphylococcus lugdunensis**, *Candida* sp.*, Multi-drug resistant or unusual organism; Persistent bacteremia/fungemia (≥3 days); antibiotic locks (outside of dialysis)*
Bone/Joint	Osteomyelitis; Pyogenic arthritis
Cardiovascular	Endocarditis or endovascular infection; Myo- or pericarditis; Mediastinitis
Congenital	CMV; Toxoplasmosis; HSV; Rubella; HIV; Varicella; Suspected congenital infection w/o known cause
CNS	Bacterial/fungal meningitis; Brain (sub/epidural) abscess; Contaminated penetrating injury; Encephalitis
Device associated	VP shunt; Baclofen pump; Other hardware infection
Eye, Head, Neck	Endophthalmitis; Orbital cellulitis; Retropharyngeal abscess; Mastoiditis; Lemierre's Syndrome; dental abscesses requiring surgical debridement
Gastrointestinal	Intra-abdominal abscess not responsive to initial therapy
Genitourinary	Renal abscess/lobar nephronia
Organisms	Invasive fungal infection; TB and Non-tuberculous mycobacteria; *Actinomyces;* Any unfamiliar organism; Lyme Disease; Malaria; HIV
Pulmonary	Empyema; Lung abscess or necrosis; Lung nodules
Skin/soft tissue	Necrotizing soft tissue infections; Pyomyositis
Systemic	Kawasaki disease; Multisystem inflammatory syndrome in children (MIS-C); Acute rheumatic fever; Sepsis/shock & purpura fulminans; Toxic shock syndrome
Trauma	Complicated bites with tendon/joint/bone involvement; Contaminated wounds/fractures w/ concern for infection

*** Mandatory ID consult**

Restricted Antimicrobials and Immunizations at Children's Mercy

The following agents are restricted or have criteria for use in certain populations as noted. For approval outside of these populations, an ID consult is required prior to inpatient use.

Antimicrobials (approved populations)

- Amikacin (Cystic Fibrosis **or** ID Consult)
- Aztreonam Inhaled (Pulmonology)
- Baloxavir (Outpatient treatment for ≥ 12 y.o. & previously healthy 5-11 y.o. **or** prophylaxis for ≥ 5 y.o. **or** ID consult)
- Ceftaroline (Cystic Fibrosis **or** ID Consult)
- Ceftazidime-avibactam (ID Consult)
- Ceftolozane-tazobactam (Cystic Fibrosis **or** ID Consult)
- Colistimethate IV (Cystic Fibrosis **or** ID Consult)
- Daptomycin (ID Consult)
- Fidaxomicin (Pts with Cdiff who are: ≥ 16 years **or** BMT/IBD patients **or** ID consult)
- Levofloxacin (ID consult **or** Cystic fibrosis **or** Documented MDR *S. pneumoniae* infection **or** bacterial prophylaxis for oncologic indications – refer to Lexi-Comp **or** low-risk febrile neutropenia criteria for ED and clinics)
- Linezolid (ID Consult)
- Moxifloxacin (ID Consult)
- Remdesivir (Pts w/ mild-mod COVID-19 and risk factors for severe disease **or** severe COVID-19 **or** ID Consult)
- Other non-formulary antimicrobials (e.g. tigecycline, etc.)

Immunizations (approved populations)

- Cholera, Japanese Encephalitis Virus, Typhoid, Yellow Fever Vaccines (ID Travel Clinic)
- Pneumococcal Polysaccharide Vaccine – 23 Valent (PPSV23) (Immunodeficiency testing)
- Rotateq (Pts with latex allergy or myelomeningocele)
- Recombinant Zoster Vaccine (Shingrix) (≥19 years and immunocompromised with evidence of immunity to varicella)

ANTIMICROBIAL DOSING RECOMMENDATIONS FOR GENERAL PATIENTS (Neonates Excluded)					
Antimicrobial	**General Dosing** (Indication-specific dosing may exist)	**Monitoring/ ADR**	**Notes**	**Cost**	**PO Conversion**
Penicillins					
Penicillin G aqueous	75,000 units/kg/dose IV q4-6h (max: 4 million units/ dose) *May be given as continuous infusion	CBC, BMP, LFT Qweek, rash, GI upset	Multiple dosage forms	$	Penicillin VK
Oxacillin	50 mg/kg/dose IV q6h (max: 3 g/dose) *May be given as continuous infusion	CBC, BMP, LFT Qweek, rash, phlebitis		$$	Cephalexin
Ampicillin	50 mg/kg/dose IV q6h (max: 2 g/dose) Severe Infections (e.g. CNS, endocarditis): 75-100 mg/kg/dose IV q6h (max: 2 g/dose)	CBC, BMP, LFT Qweek, rash, GI upset		$$	Amoxicillin
Amoxicillin	25 mg/kg/dose PO BID (max: 500-1000 mg/dose) High dose: 45 mg/kg/dose PO BID (max: 2 g/dose BID or 1 g/dose TID)	Rash, GI upset	May dose TID	$	
Ampicillin/ sulbactam	50 mg/kg/dose IV q6h (max: 2 g/dose)	CBC, BMP, LFT Qweek, rash, GI	Dose on amp component	$$	Amox/clav
Amoxicillin/ clavulanate	25 mg/kg/dose PO BID (max: 500-875 mg/dose) High dose: 45 mg/kg/dose PO BID (max: 2 g/dose)	Rash, GI upset	Avoid dosing clavulanate > 10 mg/kg/day; May dose TID	$	Refer to Amox/clav Formulation Table below
Piperacillin/ tazobactam	75 mg/kg/dose IV q6h (max:4 g/dose) *May be given as continuous or extended infusion	CBC, BMP, LFT Qweek, rash, GI upset	Dose on piperacillin component	$$	

Antimicrobial	General Dosing (Indication-specific dosing may exist)	Monitoring/ADR	Notes	Cost	PO Conversion
Cephalosporins					
Cefazolin (1st gen)	50 mg/kg/dose IV q8h (max: 2 g/dose) *May be given as continuous infusion	CBC, BMP Qweek, rash, GI upset		$	Cephalexin
Cephalexin (1st gen)	Mild Infections (e.g. cellulitis, cystitis): 15-25 mg/kg/dose PO q8hr (max: 500-1000 mg/dose) Severe Infections (e.g. MSK infections): 33-50 mg/kg/dose PO q8hr (max: 1500 mg/dose)	Rash, GI upset		$	
Cefuroxime (2nd gen)	250 – 500 mg PO BID 50 mg/kg/dose IV q8hr (max: 2 g/dose)	CBC Qweek, rash, GI upset	PO ceph w/ better *S. pneumo* activity	$	Available as tablets & IV
Ceftriaxone (3rd gen)	50 mg/kg/dose IV q24h (max: 2 g/dose) Meningitis: 50 mg/kg/dose IV q12h (max: 2 g/dose)	CBC, BMP, LFTs Qweek, biliary sludging, rash, GI upset	Avoid in hyperbili and Ca^{2+}-receiving neonates	$	Dependent on indication
Cefdinir (3rd gen)	7 mg/kg/dose PO q12h (max: 300 mg/dose)	Rash, GI upset	Avoid use for CAP or UTI	$	
Cefpodoxime (3rd gen)	5 mg/kg/dose PO q12h (max: 200 mg/dose)	Rash, GI upset	Non-form agent	$	
Cefixime (3rd gen)	8 mg/kg/dose PO q24 hours (max: 400 mg/dose)	Rash, GI upset		$$	
Ceftazidime (3rd gen)	50 mg/kg/dose IV q8h (max: 2 g/dose)	CBC, BMP Qweek, rash, GI upset		$$	
Cefepime (4th gen)	50 mg/kg/dose IV q8h (max: 2 g/dose) *May be given as continuous or extended infusion	CBC, BMP Qweek, rash; seizures in renal dysfunction, GI upset		$$	

Antimicrobial	General Dosing (Indication-specific dosing may exist)	Monitoring/ADR	Notes	Cost	PO Conversion
Carbapenems					
Meropenem	20 mg/kg/dose IV q8h (max: 1-2 g/dose) Meningitis: 40 mg/kg/dose IV q8h (max: 2 g/dose) *May be given as extended infusion	CBC, BMP, LFT Qweek, rash, GI		$$	
Ertapenem	<12 yrs: 15mg/kg/dose IV q12hr (max: 500 mg/dose) >12 yrs: 1000 mg IV once daily	CBC, BMP, LFT Qweek, rash, GI		$$	
Aminoglycosides					
Gentamicin, tobramycin	Conventional: 2.5 mg/kg/dose IV q8h Extended interval: 5-10 mg/kg/dose IV q24h Gram Positive Synergy (gent): 1 mg/kg/dose IV q8hr (See ICN Helpful Hints for neonatal dosing)	TDM, CBC Qweek, BMP, ototoxicity	Use adjusted body weight if obese	$	
Fluoroquinolones					
Ciprofloxacin	PO: 20 mg/kg/dose PO q12h (max: 750 mg/dose) IV: 10 mg/kg/dose IV q8-12h (max: 400 mg/dose)	↑QTc, photosensitivity, arthralgias, neuropsych effects, hypoglycemia		$	IV=PO; Avoid concomitant divalent cations
Levofloxacin	< 5 years: 10 mg/kg/dose IV/PO q12h (max: 750 mg/dose) ≥ 5 years: 10 mg/kg/dose IV/PO q24h (max: 750 mg/dose)		Restricted to ID, CF, select oncology indications	$	
Miscellaneous Antimicrobials					
Azithromycin	10 mg/kg/dose IV/PO once (max: 500 mg/dose) on Day 1; 5 mg/kg/dose IV/PO once daily (max: 250 mg/dose) on Days 2-5	GI upset, ↑QTc, neonate: pyloric stenosis		$	IV=PO

Antimicrobial	General Dosing (Indication-specific dosing may exist)	Monitoring/ADR	Notes	Cost	PO Conversion
Clindamycin	IV: 10 mg/kg/dose IV q6-8hr (Max: 900 mg/dose) PO: 10-13 mg/kg/dose PO TID (Max:600 mg/dose)	GI upset, *C.diff*		$	IV=PO
Daptomycin	6-12 mg/kg/dose IV q24h (dependent upon age/indication)	CK, CBC, BMP Qweek	Restricted to ID; Avoid for lung infect.	$$$$	
Doxycycline	2.2 mg/kg/dose IV/PO q12h (max: 100 mg/dose)	Phlebitis (IV); photosensitivity, esophagitis		$	IV=PO;Avoid divalent cations
Fidaxomicin	16 mg/kg/dose PO BID (max: 200 mg/dose)	Nausea, fever	Restricted to ≥ 16 years, BMT, IBD, ID	$$$	
Linezolid	<12 years: 10 mg/kg/dose IV/PO q8h (max: 600 mg/dose) ≥ 12 years: 600 mg IV/PO q12h	CBC, LFTs Qweek; neuropathy, 5HT syndrome	Restricted to ID	$$$	IV=PO
Metronidazole	10 mg/kg/dose IV/PO q8h (max: 500 mg/dose) Appendicitis: 30 mg/kg/dose IV once daily (max: 1500 mg/dose)	Disulfuram reaction, neuropathy		$	IV=PO
Rifampin	10 mg/kg/dose IV/PO q12h (max: 300 mg/dose)	Red-orange secretions, hepatotoxicity	Check for drug interactions	$	IV=PO
Trimethoprim/ sulfamethox-azole (TMP/SMX)	6 mg/kg/dose of TMP PO q12h (max: 160 mg TMP/dose) High dose: 5 mg/kg/dose IV/PO of TMP q6-8h	Crystalluria; photosensitivity	High dose for PCP	IV: $$ PO:$	IV=PO (IV = large volume)
Vancomycin	15-20 mg/kg/dose IV q6-8h (adjust w/ TDM) Consider q8hr interval in post-pubescent patients (See ICN Helpful Hints for neonatal dosing)	Troughs or AUC (see below),BMP, flushing	Increased AKI risk w/ doses > 4 gm/day	$$	

Antimicrobial	General Dosing (Indication-specific dosing may exist)	Monitoring/ADR	Notes	Cost	PO Conversion
Antivirals					
Acyclovir	Neonatal HSV: 20 mg/kg/dose IV q8h Neonatal Suppression: 300 mg/m^2/dose PO TID < 12 years: 10-15 mg/kg/dose IV q8h ≥ 12 years: 5-10 mg/kg/dose IV q8h Refer to Lexi-comp for PO dosing	IV: CBC, BMP Qweek, crystalluria	Use ideal or adjusted body weight if > 2 years & obese	$	Acyclovir or Valacyclovir
Baloxavir marboxil	Prophylaxis and Treatment: < 20 kg: 2 mg/kg/dose once 20-80 kg: 40 mg/dose once ≥ 80 kg: 80 mg/dose once		See Lexi for restricted criteria	$$	
Oseltamivir	Treatment: ≤8 months: 3 mg/kg/dose PO BID; ≥9 months: 3.5 mg/kg/dose PO BID (max: 75 mg/dose) Prophylaxis: ≤8 months: 3 mg/kg/dose PO Qday; ≥9 months: 3.5 mg/kg/dose PO Qday (max: 75 mg/dose)	GI upset	Refer to AAP Influenza Guidelines	$	
Remdesivir	Loading: 5 mg/kg/dose IV once (max: 200 mg/dose) Maintenance: 2.5 mg/kg/dose IV q24h (max: 100 mg/dose)	CBC, BMP, LFTs, PT as indicated		$$$$	
ValACYclovir	Treatment: 20 mg/kg/dose PO BID or TID (max: 1000 mg/dose Prophylaxis: 20 mg/kg/dose PO Qday or BID (max: 500-1000 mg/dose)	GI upset, neutropenia, headache	Dosing depends on type of infection and immune status	$	

Antimicrobial	General Dosing (Indication-specific dosing may exist)	Monitoring/ADR	Notes	Cost	PO Conversion
Antifungals					
Fluconazole	Treatment: 6-12 mg/kg/dose IV/PO q24h Prophylaxis: 3-6 mg/kg/dose IV/PO q24h Max dose varies per indication	CBC, BMP, LFTs ↑QTc		$	IV = PO
Itraconazole	Loading: 2-5 mg/kg/dose PO TID x 3 days (max: 200 mg/dose) Maintenance: 2-5 mg/kg/dose PO BID (max: 200 mg/dose)	TDM (see table below); GI, Headache, BMP, LFTs, ↑QTc	Liquid is absorbed better than capsules	$	
Micafungin	Treatment: 2-4 mg/kg/dose IV Q24h (max: 100-150 mg/dose) Prophylaxis: 1-2 mg/kg/dose IV q24h (max: 50 mg/dose)	LFTs, histamine infusion reaction		$$$	
Posaconazole	DR Tablets (adolescents): 300 mg PO BID x 1 day, then 300 mg PO Qday (contact ID for dosing in younger) Immediate Release Suspension: 6-8 mg/kg/dose PO TID-QID (max: 200 mg/dose) IV: 6-10 mg/kg/dose IV q12h x 1 day, then q24h (max: 300 mg/dose)	TDM required (see table below), BMP, LFTs, ↑QTc	Dosage formulations are **not** interchangeable	$$$	IR Suspension is poorly absorbed
Voriconazole	<12 years and less than 50 kg: - 9 mg/kg/dose IV q12h x 2 doses, then 8 mg/kg/dose IV q12hr - 9 mg/kg/dose PO BID (max: 350 mg/dose) ≥ 12 years and ≥50 kg: - 6 mg/kg/dose IV q12h x 2 doses then 4 mg/kg/dose IV q12h - 200 mg-300 mg PO BID	TDM required (see table below), ↑QTc, Visual hallucinations, BMP, LFTs	Used ideal or adjusted body weight in obese patients	$$$	PO bio-availability is reduced in children

Empiric Antimicrobials for Common Infections					
Diagnosis	**Pathogens**	**Empiric Drug(s)**	**Allergy Alt.**	**Duration**	**Comments**
CNS Infections					
Patient ≤28 days	*E. coli* *S. agalactiae* (GBS) *L. monocytogenes*	Ampicillin PLUS ceftazidime		Varies	
Patient 28 - 60 days	*S. pneumoniae* *N. meningitides* *H. influenzae* *S. agalactiae* (GBS)	Ceftriaxone ± vancomycin		Varies	
Patient > 60 days	*S. pneumoniae* *N. meningitides* *H. influenzae*	Ceftriaxone PLUS vancomycin		Varies	
Herpes Simplex Virus Meningoencephalitis	*HSV1* or *HSV2*	Acyclovir		Varies	Dosing adjustments for renal and obesity
Pulmonary, Eye, Head, & Neck					
Community acquired pneumonia (CAP) (uncomplicated)	*S. pneumoniae* *Mycoplasma*	Refer to Clinical Pathway Ampicillin High dose Amoxicillin	Ceftriaxone or Clindamycin	3-7 days	Use azithromycin for atypical CAP
CAP (complicated)	*S. pneumoniae* *S. pyogenes* MSSA or MRSA (less common)	Refer to Clinical Pathway Ampicillin/sulbactam If MRSA concern or unstable, add vancomycin	Ceftriaxone PLUS clindamycin	Depends on response	
Hospital/Ventilator associated pneumonia	Gram negatives *S. aureus*	Cefepime		7 days	Consider adding vancomycin if clinically deteriorating

Empiric Antimicrobials for Common Infections					
Diagnosis	**Pathogens**	**Empiric Drug(s)**	**Allergy Alt.**	**Duration**	**Comments**
Aspiration pneumonia	Oral flora	Ampicillin *(anaerobic coverage may not be needed)* OR Ampicillin/sulbactam	Clindamycin ± ceftriaxone	5 days	Aspiration may cause a non-infectious chemical pneumonitis; antibiotics may not be needed
Acute COVID-19 Infection	SARS-CoV-2 virus	Refer to the Clinical Pathway Severe Illness: remdesivir +/- dexamethasone Critical illness: dexamethasone		Up to 5 days	Antiviral therapy may not be indicated for every patient. Refer to EBP summary on remdesivir in children with COVID-19.
Influenza Infection	Influenza virus	Oseltamivir* **recommended for any child hospitalized with suspected or confirmed influenza disease*		5 days	Contact ID for alternatives for hospitalized patients with influenza
Acute Sinusitis	*S. pneumoniae* *M. catarrhalis* *H. influenzae* *S. pyogenes*	Refer to the Clinical Pathway Mild-mod disease: High dose amoxicillin Severe disease or mild-mod disease AND: < 2 years old, attends daycare, OR abx use in the past 30 days: High dose amox/clav	Mild-Mod: -Cefuroxime or cefixime PLUS clindamycin Severe: Levofloxacin	5-7 days	

Empiric Antimicrobials for Common Infections					
Diagnosis	**Pathogens**	**Empiric Drug(s)**	**Allergy Alt.**	**Duration**	**Comments**
Acute otitis media	*S. pneumoniae* *M. catarrhalis* *H. influenzae* *S. pyogenes*	Refer to Clinical Pathway High dose amoxicillin High dose amox/clav (if amox in the past 30 days or concomitant conjunctivitis) Consider Watchful Waiting in eligible patients	Mild-Mod: -Cefuroxime -Cefdinir -Ceftriaxone Severe: Clindamycin	5-10 days (Based on age or severity)	Non-formulary antibiotic alternatives or guidance on treatment in patients not improving on 48-72h of empiric antibiotics available in Outpatient Antibiotic Handbook
Acute Mastoiditis	*S. pneumoniae* *H. influenzae* MRSA or MSSA *S. pyogenes*	Ampicillin/sulbactam	Ceftriaxone PLUS clindamycin	≥ 4 weeks	
Orbital cellulitis (post-septal)	*S. pneumoniae* *H. influenzae* *S. pyogenes* MRSA or MSSA Anaerobes	Ampicillin/sulbactam	Ceftriaxone PLUS clindamycin	≥ 2 weeks	Consider vancomycin PLUS ceftriaxone PLUS metronidazole for sight-threatening or CNS infections
Periorbital cellulitis (pre-septal)	MRSA or MSSA *S. pyogenes*	Cefazolin/cephalexin Clindamycin (if MRSA concern) Amp/sulb or amox/clav	Vancomycin	5-7 days	Consider source of infection (skin vs. sinuses) when selecting antibiotics
Tonsillar or peritonsillar abscess	*S. pyogenes* Oral anaerobes	Ampicillin/sulbactam	Clindamycin	10-14 days	

Empiric Antimicrobials for Common Infections					
Diagnosis	**Pathogens**	**Empiric Drug(s)**	**Allergy Alt.**	**Duration**	**Comments**
Retro- or para-pharyngeal abscess	*S. pyogenes* Oral anaerobes MRSA or MSSA	Ampicillin/sulbactam	Clindamycin	Depends on response	
Skin/Soft Tissue and Bone/Joint					
Cellulitis or Erysipelas	*S. pyogenes* (GAS) MSSA or MRSA	Refer to Clinical Pathway Cefazolin/ cephalexin Clindamycin (if MRSA history)	Amox/clav Clindamycin	7 days	
Abscess	MSSA or MRSA *S. pyogenes* (GAS)	Refer to Clinical Pathway Clindamycin	TMP/SMX	5 days	If MSSA, use cephalexin
Necrotizing fasciitis	*S. pyogenes* MRSA or MSSA Polymicrobial	Consult ID for antibiotic recommendations		Depends on response	Obtain Surgery Consult
Infected bite (animal or human)	*P. multocida* *E. corrodens* *Capnocytophaga* Oral anaerobes Polymicrobial	Refer to Clinical Pathway Ampicillin/sulbactam or amoxicillin/clavulanate	Clindamycin PLUS TMP/SMX OR Clindamycin PLUS doxycycline	Tx : 5-7 days Ppx: 3 days	Verify tetanus vaccine status Assess rabies risk if animal Use standard dose amox/clav
Suppurative lymphadenitis	MSSA or MRSA Group A strep	Ampicillin/sulbactam	Clindamycin (if MRSA history) Cefazolin	7-10 days	

Empiric Antimicrobials for Common Infections					
Diagnosis	**Pathogens**	**Empiric Drug(s)**	**Allergy Alt.**	**Duration**	**Comments**
Pyomyositis	MSSA or MRSA	Refer to Clinical Pathway Cefazolin or Clindamycin	Vancomycin	Depends on response	
Septic arthritis	MSSA or MRSA *S. pyogenes* *S. pneumoniae* *N. gonorrhoeae* *K. kingae* (patients 3 months – 4 years)	Refer to Clinical Pathway Cefazolin or Clindamycin (consider for MRSA, no *K. kingae* coverage) -Discuss w/ ID prior to abx	Vancomycin	≥ 3 weeks	Consider using cefepime or adding ceftriaxone if Gram negatives seen on Gram stain
Acute osteomyelitis	MSSA or MRSA *K. kingae* (patients 3 months – 4 years)	Refer to Clinical Pathway Cefazolin or Clindamycin (consider for MRSA, no *K. Kingae* coverage) -Discuss with ID prior to abx	Vancomycin	≥ 3-4 weeks	Consider using cefepime or adding ceftriaxone for patients with sickle cell (*Salmonella spp*)
Genitourinary Tract					
Cystitis	Enteric Gram negative bacilli	Refer to Clinical Pathway Cephalexin or cefazolin	Ceftriaxone Cefixime SMX/TMP Nitrofurantoin Ciprofloxacin	3-5 days	Consider previous cultures and susceptibilities

Empiric Antimicrobials for Common Infections					
Diagnosis	**Pathogens**	**Empiric Drug(s)**	**Allergy Alt.**	**Duration**	**Comments**
Pyelonephritis	Enteric Gram negative bacilli	Refer to Clinical Pathway Cefazolin or cephalexin	Ceftriaxone Cefixime SMX/TMP Ciprofloxacin	7-10 days	Consider previous cultures and susceptibilities
Sexually Transmitted Infections (STIs)	*N. gonorrhoeae* *C. trachomatis* Others	Refer to Clinical Pathway OR CDC STI Guidelines		Depends on infection	
Gastrointestinal/Abdominal					
Appendicitis	Enteric Gram negative bacilli Anaerobes	Ceftriaxone PLUS metronidazole	Ciprofloxacin PLUS Metro Pip/tazo	Depends on response	Refer to Clinical Pathway
Intra-abdominal Abscess	Enteric Gram negative bacilli Anaerobes	Ceftriaxone PLUS metronidazole	Ciprofloxacin PLUS Metro Pip/tazo	Depends on response	Consider enterococcal coverage if hospital acquired
Salmonellosis <3 months old	*Salmonella spp*.	Ceftriaxone	Cipro SMX/TMP Azithro	7-10 days	Routine tx for enteritis not indicated for healthy children >3 mo
***C. difficile*-associated diarrhea**	*C. difficile*	Vancomycin (PO) or fidaxomicin (adult sized pts) -Usual dose PO vanco = 125 mg/dose	Metronidazole	10 days	Refer to IDSA treatment guidelines
Ascending cholangitis	Gram Negatives *Enterococcus spp.* Anaerobes	Piperacillin/tazobactam	Ceftriaxone PLUS Metro	Depends on response	

Empiric Antimicrobials for Common Infections					
Diagnosis	**Pathogens**	**Empiric Drug(s)**	**Allergy Alt.**	**Duration**	**Comments**
Device Related Infections					
CSF shunt infection	CoNS MSSA or MRSA Gram-negatives	Vancomycin PLUS cefepime		Varies with organism	
Catheter-associated blood stream infection (CLABSI)	MSSA or MRSA Coagulase Negative Staphylococcus (CoNS) Enteric Gram negative bacilli	Ceftriaxone or Cefepime ± vancomycin Consider cefepime if history of resistant gram negatives	Dependent on specific allergy	Varies with organism	See BCID table ID consult required for *S. aureus*, *Enterococcus spp, Candida spp.,* & *S. lugdenensis* Obtain peripheral & central cultures simultaneously
Miscellaneous Infections					
Fever and neutropenia	Enteric Gram negative bacilli *P. aeruginosa* CoNS	Cefepime	Aztreonam PLUS vancomycin Pip/ tazo	Depends on response	If unstable, add vanco Refer to oncology algorithm for tx of low-risk patients
Toxic Shock Syndrome	MRSA or MSSA *S. pyogenes*	Cefazolin PLUS clindamycin PLUS vancomycin		Depends on response	If broader gram-negative coverage desired, consider cefepime instead of cefazolin
Neonatal Infections					

Empiric Antimicrobials for Common Infections					
Diagnosis	**Pathogens**	**Empiric Drug(s)**	**Allergy Alt.**	**Duration**	**Comments**
Febrile Infant 0-60 days	*E. coli* Group B strep *L. monocytogenes*	Refer to Clinical Pathway for diagnosis and management			
NEC	Enteric Gram-negative bacilli Polymicrobial CoNS (very premature infants)	Ampicillin PLUS gentamicin ± metronidazole	Ceftazidime or Ceftriaxone PLUS Metro	Depends on patient response	Vancomycin or oxacillin may be used in place of ampicillin until cultures negative at 48 hours Add metro if perforation suspected Refer to specific protocols (ICN and CICU)

Antimicrobial Drug Levels				
Antimicrobial		**When to Obtain**	**Timing of Level**	**General Goal Ranges**
Vancomycin	**Non-MRSA infections**	Before 4th dose	Trough only: Trough (immediately prior to next dose)	Dependent on organism and infection Refer to CMH Pharmacy Pharmacokinetics Handbook
	MRSA infections	After 3rd or 4th dose	AUC monitoring: Two levels at 1 hour after end of infusion and a trough (immediately prior to next dose)	
Gentamicin Tobramycin Amikacin	**Conventional**	After 3rd or 4th dose	Peak (30 minutes after the end of 30-minute infusion) Trough (immediately prior to next dose)	
	Extended Interval	N/A	Random levels (2 and 8 hours after the end of 30-minute infusion)	
Voriconazole		After 3-7 days	Trough (immediately prior to next dose)	1-2 to 5.5 mcg/mL
Posaconazole		After 7 days	Trough (immediately prior to next dose)	≥ 0.7-1 mcg/mL
Itraconazole		After ≥ 14 days	Random level due to prolonged half-life	≥ 1 to 10 mcg/mL (itraconazole + hydroxyitraconazole)

General Guidance for Selecting Amoxicillin-Clavulanate (Augmentin™) Dosage Formulations		
Patient Population	**Formulation**	**Typical Dose**
Standard Dose – consider for most uncomplicated infections not caused by *Streptococcus pneumoniae*		
< 3 months	Suspension: 250mg-62.5mg/5mL **OR** 125mg-31.25mg/5mL	30 mg/kg/**DAY** divided twice daily
≥ 3 months **AND** < 40 kg	Suspension: 400mg-57mg/5mL	25 – 45 mg/kg/**DAY** divided twice daily
Children ≥ 40 kg	Suspension: 400 mg-57mg/5mL	880 mg twice daily **OR** 520 mg three times daily
	Tablet: 500 mg-125 mg **OR** 875mg-125 mg	500 mg three time daily **OR** 875 mg twice daily
High Dose – consider when covering for *S. pneumoniae* (e.g. pneumonia, sinusitis); sometimes used for complicated or severe infections		
< 3 months old **AND** ≥ 2 kg	**ES** Suspension*: 600mg-42.9mg/5mL	75 mg/kg/**DAY** divided three times daily
≥ 3 months old **AND** < 40 kg	**ES** Suspension: 600mg-42.9mg/5mL	80 – 100 mg/kg/**DAY** divided twice or three times daily
Children ≥ 40 kg	XR Tablet^: 1000 mg-62.5 mg	2000 mg twice daily
	ES Suspension: 600mg-42.9mg/5mL (tablet preferred)	1980 mg twice daily **OR** 1080 – 1200 mg three times daily

*Study in neonates used the 4:1 formulation, which resulted in daily clavulanate doses of 18.75 mg/kg/day. Depending on the indication, an alternative formulation may be indicated.
^If unable to get insurance coverage of XR tablets, can consider sending two prescriptions for Amoxicillin 500 mg PO q8h **AND** amoxicillin-clavulanate 500-125 mg PO q8h to be taken simultaneously.

Antimicrobial IV to PO

- IV to PO antimicrobial transition can reduce risks associated with IV lines (e.g., CLABSI, IV infiltrate), reduce hospital length of stay, and decrease overall medical costs
- Certain antimicrobials achieve the same concentrations in the body when given PO compared with when given IV, these are considered highly bioavailable
    - The following antimicrobials are highly bioavailable and should be given PO if possible:
        - Azithromycin
        - Ciprofloxacin
        - Clindamycin
        - Doxycycline
        - Fluconazole
        - Linezolid
        - Levofloxacin
        - Metronidazole
        - Rifampin
        - Sulfamethoxazole/trimethoprim
- Consider changing from IV to PO if:
    - Clinically stable/clinically improving
    - Tolerating enteral nutrition or other PO medications by oral or enteral route
        - Note: ciprofloxacin, levofloxacin, and doxycycline must be spaced apart from enteral feeds
- Consider keeping IV therapy if:
    - Unable to absorb PO medications (e.g., malabsorption syndrome, ileus, short bowel)
    - Excessive vomiting or diarrhea
    - Infectious diagnosis may require prolonged IV therapy (e.g., endocarditis, CNS infection, bacteremia)
- Refer to Children's Mercy Pharmacist-Initiated IV to PO Therapeutic Interchange Policy for more detail

Notes: