Outpatient Antibiotic Handbook

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Last updated: November 12, 2024

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This handbook is meant to serve as a guide for antimicrobial selection in the outpatient setting.

NOTE: This *Outpatient Antimicrobial Stewardship Handbook* ("Handbook") was developed to assist clinicians in the management of various common pediatric infections they may face and to provide a centralized resource and delineation of administrative processes to facilitate the delivery of care of the patients for whom they are caring.

This Handbook is provided for your education and is not a substitute for appropriate clinical judgment in each clinical scenario, nor is it intended to be applied uniformly to all patients. Flexibility in specific cases may require deviations from the Handbook's recommendations. Clinical research and practice can quickly change as new information that can impact the provision of clinical care is created.

The information in this Handbook is intended to assist physicians and other health care providers in clinical decision-making by describing a range of generally acceptable approaches for the diagnosis, management, or prevention of specific diseases or conditions. This Handbook should not be considered inclusive of all proper methods of care or exclusive of other methods of care reasonably directed at obtaining the same results. The ultimate judgment regarding care of a particular patient must be made by the physician or licensed provider in light of the individual circumstances presented by the patient.

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Jan-Dec 2023 TCH Antibiogram –Snapshots & ASP Comments/Updates

GRAM NEGATIVE

ORGANISMS	#	Total Isolates	Ampicillin	Amoxicillin Clavulanic Acid	Ceftazidime	Ceftriaxone	Cefepime	Piperacillin/ Tazobactam	Ertapenem	Meropenem	Ciprofloxacin	Levofloxacin	Amikacin	Gentamicin	Tobramycin	Tetracycline ◊	Trimethoprim/ Sulfamethoxazole	Nitrofurantoin Urine Isolates Only <	Cefazolin Urine Isolates Only **
		% SUSCEPTIBILITY																	
Enterobacter Cloacae Complex	34						94	88	100	100	85	88	94	88	88	88	79	56	
Escherichia Coli	1454	40	74	95	91		98	92	100	100	77	67	100	86	86	66	63	98	84
Klebsiella Oxytoca	34		88	97	91		97	88	100	100	88	79	100	91	91	88	85	91	
Klebsiella Pneumoniae	157		85	89	87		94	92	100	100	84	83	100	89	87	76	75	17	85
Proteus Mirabilis	109	80	97	99	98		100	100	100	100	98	97	100	94	95		83		94
Pseudomonas Aeruginosa	145			94			96	94		98	96	86	97	94	97				
Salmonella Species Not Typhi	34	97		100	100						91	88					97		

GRAM POSITIVE

ORGANISMS	#	Total Isolates	Ampicillin	Ceftriaxone	Ceftriaxone Meningitis	Ceftriaxone Nonmeningitis	Clindamycin	Doxycycline	Levofloxacin	Linezolid	Meropenem	Oxacillin	Penicillin	Penicillin Meningitis	Penicillin Nonmeningitis	TetracyclineO	Tigecycline	Trimeth Sulfa	Vancomycin	Gentamicin High Level
		% SUSCEPTIBILITY																		
Enterococcus Faecalis	207	100							99	100			100			21	100		100	80
Staphylococcus Aureus, Methicillin Resistant	209						78	100		100		0				92	100	90	100	
Staphylococcus Aureus, Methicillin Sensitive	402						80	100		100		100				92	100	95	100	
Staphylococcus Epidermidis	48						46			100		38				88		58	100	
Streptococcus Pneumoniae	68				89	98	77		100	100	83			69	97	76		70	100	
Streptococcus Pyogenes [Group A Streptococcus]													TOC*							

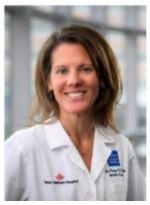
The EC antibiogram includes Main Campus, West Campus, and The Woodlands campus emergency centers.

(For pathogens not listed, please see the complete TCH 2023 antibiogram on the TCH Connect Page)

Notes from the TCH ASP Team Re 2023 Antibiogram-Houston

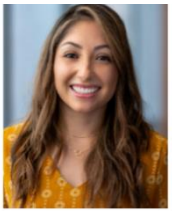
- *E coli* isolates from the urine only showed an 84% susceptibility to cefazolin (compared to 91% for ceftriaxone and 98% for nitrofurantoin). Based on these data, our team recommends oral third generation cephalosporins as empiric therapy for febrile infants. Oral first generation cephalosporins and nitrofurantoin may be considered in well-appearing adolescents without concern for pyelonephritis or in TCP/TCUC satellite campuses where local susceptibility data may be more favorable (>90%).
- MSSA is nearly twice as prevalent in the community compared to MRSA. Clindamycin susceptibility remains 78-80% for *Staph aureus*.
- *Strep pneumoniae* susceptibility to penicillin (non-meningitis) remains high (97%). Amoxicillin is the drug of choice.
- Penicillin/amoxicillin remains the drug of choice for Group A *Strep*. There are growing reports of macrolide resistance among Group A *Strep* isolates.
- The diagnostic test of choice for *Mycoplasma pneumoniae* infections is PCR testing from the nasopharynx. Serum IgM against *M. pneumoniae* is non-specific and is not recommended.


Maggie Danner, MD


Debra Palazzi, MD, MEd


Diana Nguyen, DO


Grant Stimes, PharmD, MPA, BCIDP


Brittany Rodriguez, PharmD, BCIDP

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Antibiotic Selection for the Treatment of Pediatric Streptococcal Pharyngitis

Key Points Regarding Recurrent Group A Streptococcal Pharyngitis:

- Group A strep pharyngitis is uncommon in children <3 years age
- Group A strep is universally susceptible to penicillin/amoxicillin, which remains the treatment of choice. Macrolide resistance among community isolates of *Strep pyogenes* is growing and may result in treatment failure.
- Most children with recurrent positive rapid Group A strep tests or cultures despite completing appropriate therapy are colonized with Group A strep and have intercurrent viral illnesses. Additional viral symptoms (nasal congestion, cough) may not be present until days after strep testing results finalize, so additional history may be needed to elicit these symptoms.
- Treatment for Group A strep colonization is not recommended unless specific risk factors are present (see algorithm)
- Oral third generation cephalosporins are **not** advised for the treatment of group A strep pharyngitis (unnecessarily broad-spectrum)

Drug	Dose	Duration (Days)
First Line Therapy		
Amoxicillin, PO	25 mg/kg/dose twice daily (Max: 500 mg/dose) **OR** 50 mg/kg/dose once daily (Max: 1000 mg/dose)	10
Penicillin VK, PO	<27 kg: 250 mg/dose twice daily >27 kg, adolescents: 500 mg twice daily	10
Alternative if does not tolerate oral therapy		
Benzathine Penicillin G, IM*	<27 kg: 600,000 units >27 kg, adolescents: 1.2 million units	Single Dose
Penicillin Allergy – Non-Anaphylactic**		
Cephalexin, PO	20 mg/kg/dose twice daily (Max: 500 mg/dose)	10
Penicillin Allergy- Anaphylactic or Severe Cutaneous Reaction OR Penicillin PLUS Cephalosporin Allergy**		
Clindamycin, PO	7 mg/kg/dose three times daily (Max: 300 mg/dose)	10
Azithromycin, PO***	12 mg/kg/dose once daily (Max: 500 mg/dose)	5

*Single dose IM ceftriaxone is **not** considered equivalent to single dose IM benzathine penicillin G for the treatment of streptococcal pharyngitis.

**Place referral to one of the penicillin allergy clinics at TCH (Infectious Diseases WC- Dr. Taylor in comments box OR Allergy & Immunology)

***Azithromycin resistance among Group A streptococcus isolates is increasing, and treatment failure may occur. Counseling for families to monitor for signs of treatment failure or recurrence is advised. Use is not recommended unless the child has a severe allergy to penicillin and cephalosporins.

References: Shulman ST, Bisno AL, Clegg HW, Gerber MA, Kaplan EL, Lee G, Martin JM, Van Beneden C; Infectious Diseases Society of America. **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. 2012 Nov 15;55(10):e86-102.

Symptom Relief for Viral Illnesses

BE ANTIBIOTICS AWARE
SMART USE, BEST CARE

1. DIAGNOSIS

- ☐ Cold or cough
- ☐ Middle ear fluid (Otitis Media with Effusion, OME)
- ☐ Flu
- ☐ Viral sore throat
- ☐ Bronchitis
- ☐ Other:

You have been diagnosed with an illness caused by a virus. Antibiotics do not work on viruses. When antibiotics aren't needed, they won't help you, and the side effects could still hurt you. The treatments prescribed below will help you feel better while your body fights off the virus.

2. GENERAL INSTRUCTIONS

- ☐ Drink extra water and fluids.
- ☐ Use a cool mist vaporizer or saline nasal spray to relieve congestion.
- ☐ For sore throats in older children and adults, use ice chips, sore throat spray, or lozenges.
- ☐ Use honey to relieve cough. Do not give honey to an infant younger than 1.

3. SPECIFIC MEDICINES

- ☐ Fever or aches:
- ☐ Ear pain:
- ☐ Sore throat and congestion:

Use medicines according to the package instructions or as directed by your healthcare professional. Stop the medication when the symptoms get better.

4. FOLLOW UP

- ☐ If not improved in _____ days/hours, if new symptoms occur, or if you have other concerns, please call or return to the office for a recheck.
- ☐ Phone:
- ☐ Other:

Signed: _____

To learn more about antibiotic prescribing and use, visit **www.cdc.gov/antibiotic-use.**

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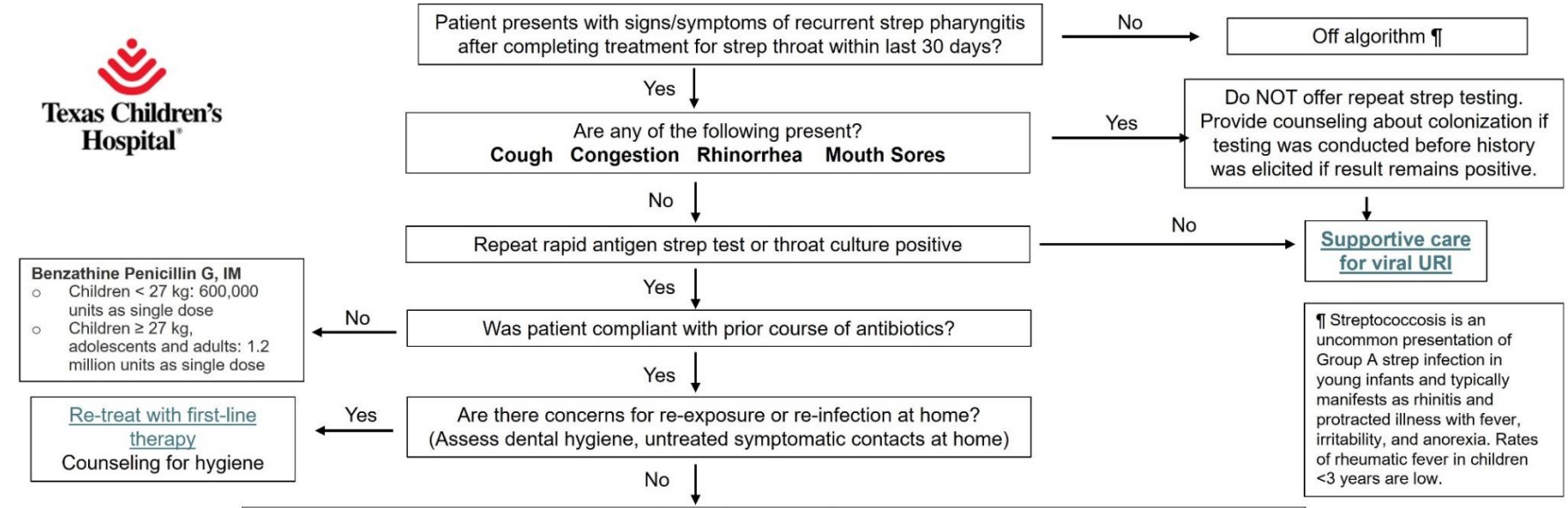
Recurrent Strep Pharyngitis Algorithm



¶ Streptococcosis is an uncommon presentation of Group A strep infection in young infants and typically manifests as rhinitis and protracted illness with fever, irritability, and anorexia. Rates of rheumatic fever in children <3 years are low.

Family Discussion Points:

1. Findings likely represent intercurrent viral illness in individual colonized with strep pharyngitis*, antimicrobial therapy typically unnecessary, recommend supportive care for viral URI

- If trial of re-treatment is desired, recommend first-line therapy
- Measurement of serologic response to GAS extracellular antigens (eg, ASO) is discouraged [1]
- Treatment of asymptomatic household contacts is NOT recommended unless risk factors (see below).[1]
- Tonsillectomy not recommended to avoid recurrent strep pharyngitis.[2]

2. Antimicrobial therapy NOT indicated for most group A strep pharyngeal carriers.

Exceptions: (1) a local outbreak of acute rheumatic fever (ARF) or post-strep glomerulonephritis; (2) an outbreak of GAS pharyngitis in a closed or semi-closed community; (3) a family history of ARF; (4) multiple ("ping-pong") episodes of documented symptomatic GAS pharyngitis occurring within a family for many weeks despite appropriate therapy; or (5) when a patient is being seriously considered for tonsillectomy solely because of frequent GAS isolations.

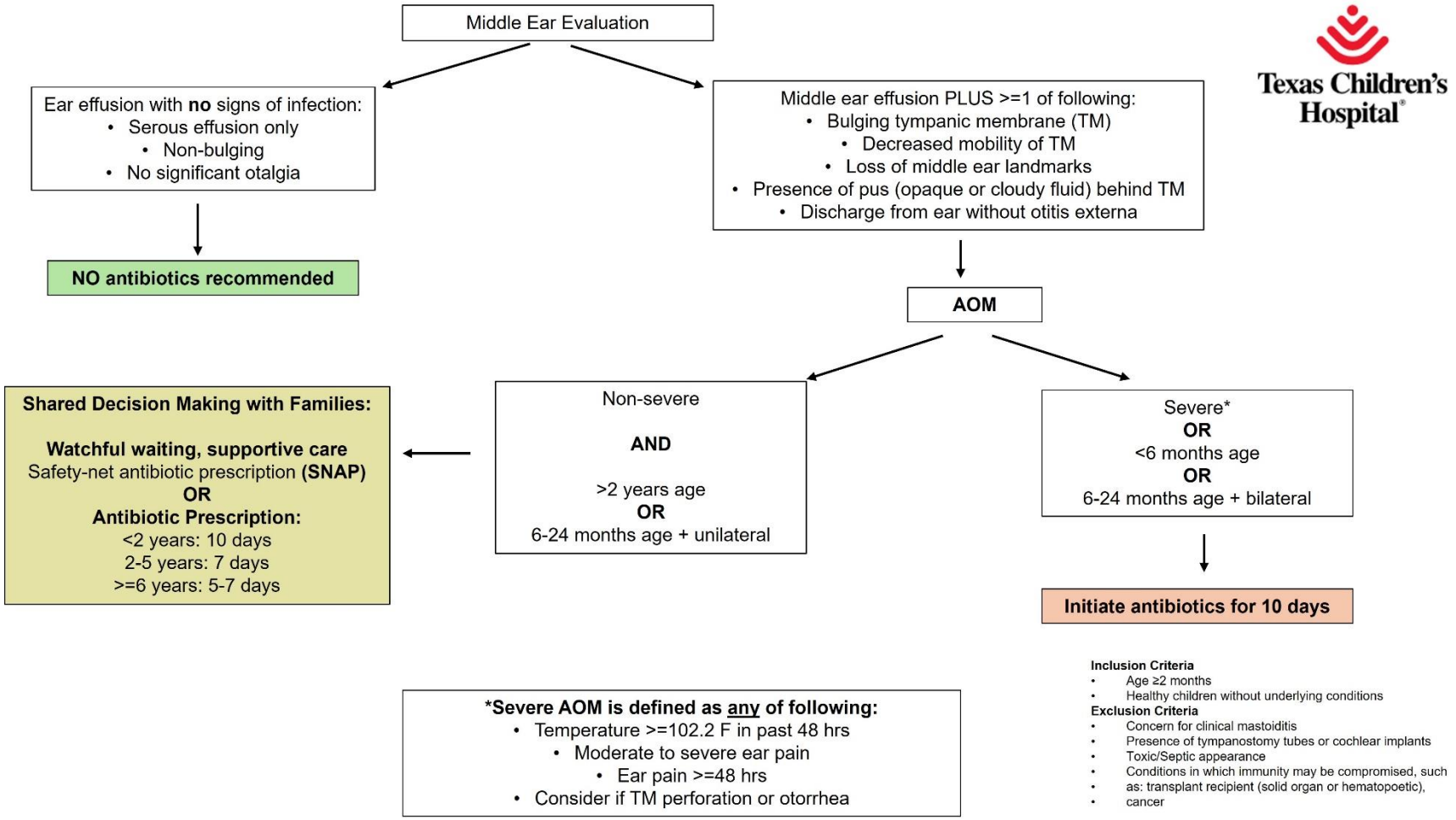
- If GAS carriage eradication is desired, recommend clindamycin 10 mg/kg/dose three times daily (max 300 mg/dose) for 10 days
- OR
- Penicillin V 50 mg/kg/day in 4 divided doses (max 500 mg/dose) for 10 days PLUS rifampin 20 mg/kg/dose once daily on the last 4 days.

***Throat culture surveys of healthy asymptomatic children during the streptococcal season and during school outbreaks of pharyngitis yield GAS infection prevalence rates as high as 25%. GAS carriage can persist for many months, but the risk of transmission is low.[1]**

References

1. Redbook: 2021-2024 Report of the Committee on Infectious Diseases. Group A Streptococcal Infections. Pg 694-707.
2. Shulman ST, Bisno AL, Clegg HW, Gerber MA, Kaplan EL, Lee G, Martin JM, Van Beneden C; Infectious Diseases Society of America. 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. 2012 Nov 15;55(10):e86-102.

Acute Otitis Media Algorithm



Inclusion Criteria
- Age ≥2 months
- Healthy children without underlying conditions

Exclusion Criteria
- Concern for clinical mastoiditis
- Presence of tympanostomy tubes or cochlear implants
- Toxic/Septic appearance
- Conditions in which immunity may be compromised, such
- as: transplant recipient (solid organ or hematopoetic),
- cancer

Antibiotic Selection for the Treatment of Pediatric Acute Otitis Media (AOM)

Oral Antibiotic Duration of Therapy by Age & Severity

<2 years OR severe any age = **10 days** 2-5 years with non-severe symptoms = **7 days**

>=6 years with non-severe symptoms = **5-7 days**

Clinical Scenario	Drug & Dose
	First Line Therapy
No amoxicillin in last 30 days	**Amoxicillin, PO** <3 months: 20 mg/kg/**dose** twice daily >3 months: 45 mg/kg/**dose** twice daily (Max: 2,000 mg/dose)
HAS received amoxicillin in last 30 days OR concurrent conjunctivitis (suggesting beta lactamase-producing organism) OR or treatment failure 48-72 hours on amoxicillin therapy OR Severe disease	**Amoxicillin/clavulanate, PO*** < 3 months: 20 mg/kg/**dose** of amoxicillin component twice daily (use 250 mg/5 mL oral suspension) ≥ 3 months: 45 mg/kg/**dose** of amoxicillin component twice daily (Max: 2,000 mg/dose amoxicillin component) If patient ≤ 40 kg or cannot swallow tablet, use ES oral suspension [600 mg/5mL] If patient >40 kg, can use XR tablet [1000 mg] but may require prior authorization
Amoxicillin/ clavulanate failure**	**Ceftriaxone, IV or IM** 50 mg/kg/**dose** daily for **3 days** (Max: 1000 mg/dose)
	Penicillin Allergy – Non-Anaphylactic***
No oral cephalosporin in last 30 days	**Cefdinir, PO****** ≥ 6 months: 7 mg/kg/dose **twice** daily (Max: 300 mg/dose) **OR** **Ceftriaxone, IV or IM** 50 mg/kg in a **single dose** (Max: 1000 mg/dose)
Oral cephalosporin therapy failure in last 30 days	**Ceftriaxone**, IV or IM 50 mg/kg daily for **3 days** (Max: 1,000 mg/dose)
	Penicillin Allergy- Anaphylactic or Severe Cutaneous Reaction OR Penicillin PLUS Oral Third Generation Cephalosporin Allergy***
Any scenario	**Levofloxacin, PO** ≥ 6 months and < 5 years: 10 mg/kg/dose twice daily (Max: 375 mg/dose) ≥ 5 years: 10 mg/kg/dose daily (Max: 750 mg/dose) Macrolides are **NOT** recommended due to high rates of *Strep pneumoniae* and *H influenzae* macrolide resistance. Clindamycin offers no coverage for *H. influenzae* or *Moraxella.* Clindamycin resistance in 2023 among *Strep pneumoniae* isolates was 20% in the Houston area but may be as low as 10% in other areas, including Austin, TX.

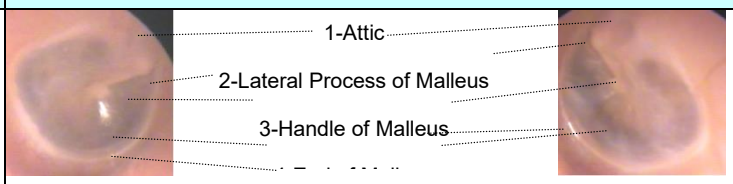
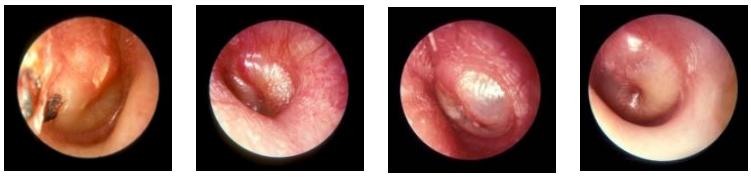
*The total daily clavulanate dose should not exceed 10 mg/kg/day.

**Consider ENT referral if recurrent failures.

***Place referral to one of the penicillin allergy clinics at TCH (Infectious Diseases WC- Dr. Taylor in comments box OR Allergy & Immunology)

******To improve efficacy, twice daily dosing is recommended for cefdinir for acute otitis media.**

Reference: Lieberthal A, Carroll A, Chonmaitree T, et al. The Diagnosis and Management of Acute Otitis Media. *Pediatrics* March 2013; 131 (3): e964–e999.

Condition	Definition	Example
Normal Tympanic Membrane (TM)	Clear, pearl-gray appearance	 Right TM Left TM
Myringitis	Redness of the tympanic membrane without MEE	
Middle Ear Effusion (MEE)	Presence of fluid in the middle ear space	Includes ear infection. See AOM & OME.
Acute Otitis Media (AOM)	Rapid onset of MEE accompanied by ≥1 of the following: Otalgia, fever, ear pulling; Bulging tympanic membrane, decreased mobility of TM, loss of middle ear landmarks, presence of pus behind TM, otorrhea	
Bullous Myringitis	Characterized by severe ear pain accompanied by blisters on the tympanic membrane and the adjacent skin of the external auditory canal.	
Sporadic AOM	Occurrence of AOM >3 months after a prior episode of AOM	
Recurrent AOM	6 episodes of AOM within past 12 consecutive months	
Otitis Media with Effusion (OME)	Presence of MEE without signs & symptoms of infection (may be serous or mucoid)	
Chronic OME	Duration of OME for ≥3 months	
Myringosclerosis	A fibroblastic invasion of the submucosal layers followed by thickening and fusion of the collagen fibers into a plaque	

Antibiotic Selection for the Treatment of Pediatric Acute Bacterial Rhinosinusitis*

Presumptive Diagnosis

- Persistent symptoms (ie nasal drainage, daytime cough) lasting >10 days without improvement
- Worsening symptoms after initial improvement
- Severe onset (concurrent fever >102.2 F) and purulent nasal discharge for at least 3 days

Note: Savage, et al. (2023) recently found **no** differences in outcomes between children receiving amoxicillin versus amoxicillin-clavulanate for the treatment of acute bacterial sinusitis but did find slightly increased adverse drug events (gastrointestinal symptoms and yeast infections) among those receiving amoxicillin-clavulanate

Clinical Scenario	Drug & Dose (Duration: 10 days)
	First Line Therapy
Mild to Moderate Severity and No Risk Factors**	**Amoxicillin, PO** >3 months: 45 mg/kg/**dose** twice daily (Max: 2000 mg/dose)
Mild to Moderate Severity and Risk Factors**	**Amoxicillin/clavulanate, PO** ≥ 3 months: 45 mg/kg/**dose** of amoxicillin component twice daily (Max: 2,000 mg/dose amoxicillin component)
Severe	If patient ≤ 40 kg or cannot swallow tablet, use ES oral suspension [600 mg/5mL] If patient >40 kg, can use XR tablet [1000 mg] but may require prior authorization
	Penicillin Allergy – Non-Anaphylactic* **
Any scenario	**Cefdinir or Cefpodoxime** **PLUS** **Clindamycin** Cefdinir: ≥ 6 months: 7 mg/kg/dose **twice daily** (Max: 300 mg/dose) Cefpodoxime: >2 months: 5 mg/kg/dose **twice daily** (Max: 200 mg/dose) Clindamycin: Infants PMA > 44 weeks, children, and adolescents: 13 mg/kg/dose three times daily (Max: 600 mg/dose)
	Penicillin Allergy- Anaphylactic or Severe Cutaneous Reaction OR Penicillin PLUS Cephalosporin Allergy* **
Any scenario	**Levofloxacin, PO** ≥ 6 months and < 5 years: 10 mg/kg/dose twice daily (Max: 375 mg/dose) ≥ 5 years: 10 mg/kg/dose daily (Max: 750 mg/dose) **OR** **Adolescents: Doxycycline 100 mg PO BID**

*Uncommon in children <2 years of age

**Risk factors (at least 1 of 3 present): Attends Daycare, Received Antibiotics in Last 30 days, Age <2 years

***Place referral to one of the penicillin allergy clinics at TCH (Infectious Diseases WC- Dr. Taylor in comments box OR Allergy & Immunology)

Note: Consider ID consult if patient is immunocompromised. Macrolides and trimethoprim-sulfamethoxazole are **NOT** recommended for empiric therapy due to high rates of resistance *among S. pneumoniae* and *Haemophilus influenzae.*

References:

1. Chow AW, Benninger MS, Brook I, et al. IDSA clinical practice guideline for acute bacterial rhinosinusitis in children and adults. *Clin Infect Dis*. 2012;54(8):e72-e112.
2. Ellen R. Wald, Kimberly E. Applegate, et al; Clinical Practice Guideline for the Diagnosis and Management of Acute Bacterial Sinusitis in Children Aged 1 to 18 Years. *Pediatrics* July 2013; 132 (1): e262–e280.
3. Savage, T. J., Kronman, M. P., Sreedhara, S. K, et al. (2023). Treatment Failure and Adverse Events After Amoxicillin-Clavulanate vs Amoxicillin for Pediatric Acute Sinusitis. *JAMA*, *330*(11), 1064–1073.

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Antibiotic Selection for the Treatment of Pediatric Community Acquired Pneumonia

Clinical Scenario	Drug & Dose (Duration: 5 days)
	First Line Therapy
Vaccinated* AND no recent high-dose amoxicillin failure	**Amoxicillin, PO** <3 months: 20 mg/kg/**dose** twice daily >3 months: 45 mg/kg/**dose** twice daily (Max: 2000 mg/dose)
Unvaccinated* OR recent high-dose amoxicillin failure	**Amoxicillin/clavulanate, PO** < 3 months: 20 mg/kg/**dose** of amoxicillin component twice daily (use 250 mg/5 mL oral suspension) ≥ 3 months: 45 mg/kg/**dose** of amoxicillin component twice daily (Max: 2,000 mg/dose amoxicillin component) If patient ≤ 40 kg or cannot swallow tablet, use ES oral suspension [600 mg/5mL] If patient >40 kg, can use XR tablet [1000 mg] but may require prior authorization
	Penicillin Allergy – Non-Anaphylactic**
Any scenario	**Cefpodoxime, PO** >2 months: 5 mg/kg/dose **twice daily** (Max: 200 mg/dose) **OR** **Cefdinir, PO***** ≥ 6 months: 7 mg/kg/dose **twice** daily (Max: 300 mg/dose) **OR** **Clindamycin, PO** Infants PMA > 44 weeks, children, and adolescents: 13 mg/kg/**dose** three times daily (Max: 600 mg/dose) ***Clindamycin susceptibility in 2023 among Strep pneumoniae isolates was 80% in the Houston area but may be as high as 90% in other areas, including Austin, TX.***
	Penicillin Allergy- Anaphylactic or Severe Cutaneous Reaction OR Penicillin PLUS Cephalosporin Allergy**
Any scenario	**Levofloxacin, PO** ≥ 6 months and < 5 years: 10 mg/kg/dose twice daily (Max: 375 mg/dose) ≥ 5 years: 10 mg/kg/dose daily (Max: 750 mg/dose)
Any penicillin allergy status	
Concern for atypical pathogens (rare in children <5 years) (Consider in adolescents with bilateral disease or infants <3 months age)	**Azithromycin, PO** 10 mg/kg/**dose** on day #1 (Max dose: 500 mg/**dose**) then 5 mg/kg/**dose** daily on days 2-5 (Max: 250 mg/dose) ***Macrolides provide poor coverage for *Strep pneumoniae* and should not be used as monotherapy for community acquired pneumonia** Azithromycin for chronic cough or anti-inflammatory purposes is **NOT recommended**

Amanda I. Messinger, Oren Kupfer, Amanda Hurst, Sarah Parker; Management of Pediatric Community-acquired Bacterial Pneumonia. *Pediatr Rev* September 2017; 38 (9): 394–409.

*At least two doses of pneumococcal and Hib vaccinations

**Place referral to one of the penicillin allergy clinics at TCH (Infectious Diseases WC- Dr. Taylor in comments box OR Allergy & Immunology)

***To improve efficacy, we recommend twice daily dosing for cefdinir for community acquired pneumonia.

NOTE: Cefdinir should **NOT** be considered first-line therapy for children with community acquired pneumonia and should be restricted to children with confirmed penicillin allergies. **If prescribed, provide counseling to families that efficacy of oral cefdinir for pneumococcal pneumonia is unknown and instruct to return to clinic for re-evaluation if no improvement in 48 hrs.**

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Urinary Tract Infections: Definitions & Treatment Options

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Category	Definition	Treatment Considerations	Typical Duration of Therapy (days)*
Uncomplicated UTI	Cystitis (with or without fever**) without any evidence of complicated UTI or pyelonephritis (see below)	Consider narrow-spectrum agents (cephalexin, nitrofurantoin) if well-appearing and/or adolescent Recommend oral third generation cephalosporins if ill-appearing or febrile infants	5
Complicated UTI	UTIs in association with a structural or functional abnormality of the genitourinary tract **OR** in an adolescent male	Recommend empiric oral third generation cephalosporins AVOID cephalexin and nitrofurantoin	7-10***
Pyelonephritis	Flank pain, may appear systemically ill		

Duration of appropriate therapy should not differ for infections caused by organisms with resistant phenotypes compared with infections caused by more susceptible phenotypes.

**For more information on the care of children with first febrile UTI, please see EBOC Guideline on Clinical Care Site

***Prolonged (10-day) therapy could be considered in systemically ill-appearing children or young infants

Admission considerations: age <2 months, ill-appearing, unable to tolerate oral medications, immunocompromised, lack of oral options by type of infection and susceptibility results, consider if concern for urinary tract obstruction

Bacteriuria without pyuria:

Pyuria may be absent in approximately 10-20 % of children with UTI (particularly with certain pathogens, including *Enterococcus, Klebsiella,* and *Pseudomonas*). In symptomatic children with bacteriuria without pyuria, we recommend antibiotic therapy for those with any of the following characteristics:

- *Age <2 years*
- *Fever >38°C (100.4°F)*
- *History of febrile UTI or urinary tract abnormality*
- *Clinical worsening or lack of improvement*

Empiric Antibiotic Options	Dose	Treatment Considerations
Cepodoxime (preferred & currently on preferred list for Medicaid)	<12 years: 5 mg/kg/dose every 12 hrs (Max 200 mg/dose) >12 years: 200 mg every 12 hrs	Cystitis or pyelonephritis
Cefixime (preferred if available)	4 mg/kg/dose PO every 12 hrs (Max 200 mg/dose)	Cystitis or pyelonephritis
Cefdinir (less preferred due to poor urinary concentration):	>6 months-12 years: 7 mg/kg/dose PO BID (Max: 300 mg/dose) >12 years: 300 mg PO twice daily	Cystitis or pyelonephritis
Nitrofurantoin	Macrodantin: 5-7 mg/kg/day divided q6 hrs (Max: 100 mg/dose) Macrobid (adolescents): 100 mg BID	Uncomplicated cystitis NOT for pyelonephritis or febrile UTI in infants
Cephalexin	17 mg/kg/dose PO **TID** (Max 500 mg/dose) (TID dosing preferred based on MIC of current organisms in community)	Uncomplicated cystitis where *E coli* susceptibility in the urine >90% (Austin based on recent data; not Houston based on 2023 antibiogram). NOT for pyelonephritis

Management of UTI caused by ESBL-producing organisms

- Organisms that produce enzymes that inactivate most penicillins, cephalosporins, and aztreonam
    - Escherichia coli, Klebsiella pneumoniae, Klebsiella oxytoca, and Proteus mirabilis
- Do not inactivate non–β-lactam agents (ex, cipro, trimethoprim-sulfamethoxazole [TMP-SMX])
    - However, organisms carrying ESBL genes often harbor additional genes or mutations that mediate resistance to a broad range of antibiotics!
    - Routine EBSL testing is **not** performed by most clinical microbiology laboratories
        - Rather, **nonsusceptibility to ceftriaxone** is often used as a proxy for ESBL production

Treatment Options

- Treat complicated UTI (UTIs in association with a structural or functional abnormality of the genitourinary tract OR in an adolescent male) caused by ESBL-producing organisms **like pyelonephritis**
- **Guidelines[1] DO NOT suggest prescribing amoxicillin-clavulanic acid for the treatment of urinary tract infection caused by ESBL-producing organisms**
    - Higher failure rates demonstrated (up to 50% in women with uncomplicated cystitis!)
    - If amoxicillin-clavulanate was initiated as empiric therapy for uncomplicated cystitis caused by an organism later identified as an ESBL-E **AND** clinical improvement occurs = no change or extension of antibiotic therapy is necessary.
    - Oral alternative choices for cystitis include TMP-SMX, fluoroquinolones (for complicated or uncomplicated), or nitrofurantoin (uncomplicated only) if susceptible

ESBL Organism	Uncomplicated Cystitis	Complicated UTI or Pyelonephritis	Invasive Infections
First-Line Agents	TMP-SMX* Nitrofurantoin*	TMP-SMX* Fluoroquinolones* Carbapenems	Carbapenems
Alternative Agents	Fluoroquinolones* Carbapenems Aminoglycosides	Aminoglycosides	

*Oral option

If you have questions about treatment choices based on urine culture results, please place E-consult order to Infectious Diseases into Epic (patient/parental consent required).

Reference: [1]Pranita D Tamma, Samuel L Aitken, Robert A Bonomo, Amy J Mathers, David van Duin, Cornelius J Clancy, Infectious Diseases Society of America 2023 Guidance on the Treatment of Antimicrobial Resistant Gram-Negative Infections, *Clinical Infectious Diseases*, 2023;, ciad428.

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Skin and Soft Tissue Infection – Treatment Table

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***If personal or family history of MRSA, consider starting with clindamycin or trimethoprim-sulfamethoxazole therapy.** Consider cultures if drainable abscess or lack of clinical improvement > 48 hours on first-line therapy.

Skin & Soft Tissue Infection Diagnosis	First-Line Treatment*	Alternative Oral Antibiotics (Treatment Failure or Allergy to First Line Treatment)	Duration of oral therapy (days)
Paronychia or Folliculitis without Cellulitis (if cellulitis, see below)	Warm soaks & compresses Incision & Drainage Topical Mupirocin x 5 days	n/a	n/a
Cellulitis or Erysipelas	**Cephalexin**, 17 mg/kg/**dose** PO TID (Max 500 mg/dose)*	**Amoxicillin-clavulanate**, 22.5 mg/kg/dose (amoxicillin component) PO BID (Max: 875 mg/dose)** **Clindamycin**, 10 mg/kg/dose PO TID (Max: 450-600 mg/dose)	5
Impetigo	<5 lesions AND not near mouth AND small surface area: Topical Mupirocin x 5 days	**Clindamycin**, 10 mg/kg/dose PO TID (Max: 450-600 mg/dose) **Trimethoprim-sulfamethoxazole*****, 4 mg/kg/dose PO BID (Max 160 mg TMP/dose)	7
	>5 lesions OR near mouth OR large surface area: **Cephalexin**, 17 mg/kg/dose PO TID (Max 500 mg/dose) **PLUS** Topical Mupirocin x 5 days		
Abscess Consider systemic antibiotics if concern for overlying cellulitis, size >3 cm, or systemic symptoms	**Warm compresses, I&D if large** **Clindamycin**, 10-13 mg/kg/dose PO TID (Max 450-600 mg/dose) **OR** **Trimethoprim-sulfamethoxazole***, 4-6 mg/kg/dose PO BID (Max 160 mg TMP/dose)	**Doxycycline** (consider in children >8 years of age): <45 kg: 2 mg/kg/dose PO BID (Max 100 mg/dose) >45 kg: 100 mg PO BID **OR** **Cephalexin** (no MRSA coverage), 17 mg/kg/dose PO TID (Max 500 mg/dose)	5

** If needing to use liquid amoxicillin-clavulanate, recommend the 400 mg/5 mL product. Do NOT use the 600 mg/5 mL product due to insufficient amount of clavulanate present to kill MSSA

***Little-to-no coverage of group A *Streptococcus*, only for children age >2 months

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General Antibiotic Information Table

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Antibiotic	Storage & Administration Facts	Taste 1: good 5: bad	Notable Side Effects*	Cost**
Amoxicillin, PO	Shake suspension well before use, preferred refrigeration. Rapid absorption with or without food; delayed absorption may be seen in some infants <60 days old.	1	GI upset	$
Amoxicillin-clavulanate, PO*	Shake suspension well before use, refrigerate. Administer at start of meal to increase absorption and decrease GI upset. Take ER tablets with food.	2	GI upset, diarrhea, vomiting (reduced by using ES-600 suspensions) Diaper rash	$$ ER tablets will need prior authorization
Azithromycin, PO	Can give with or without food. Administer at least 2 hours before or after antacids containing aluminum or magnesium. Shake suspension well before use.	3	Diarrhea Pyloric stenosis in infants QT prolonged with prolonged use and in combination with other QT prolonging meds	$$
Cefdinir, PO*	Can give with or without food; administer with food if stomach upset occurs Administer at least 2 hours before or after antacids or iron supplements. Shake suspension well before use; do not refrigerate	3	GI upset, diarrhea Can cause red-brick colored stools	$$
Cefpodoxime, PO*	Suspension - can give with or without food. Administer tablet with food.	3	GI upset, diarrhea	$$
Ceftriaxone, IV/IM	Do not use in infants <2 months (may displace bilirubin from protein binding sites)		Pain at injection site	$$$
Cephalexin, PO	Can give with or without food. Shake suspension well before use	2	GI upset	$$
Clindamycin, PO*	Shake oral solution well before use; do not refrigerate. Capsules should be taken with full glass of water to avoid esophageal irritation. Capsules can be opened and mixed with applesauce or chocolate syrup and consumed immediately after mixing.	3	Diarrhea	$$

This clinical standard is owned and updated by the pediatric infectious diseases division at Baylor College of Medicine. Please contact Dr. Margaret Danner, MD for questions related to this clinical standard and associated documents.

	Can give with or without food.			
Doxycycline, PO	Keep upright for 30 min after dose, administer with full glass of water. Can open capsules if needed and mix with small amount of liquid or soft food.	2	Abdominal pain, esophagitis, photosensitivity	$$
Levofloxacin, PO*	Maintain adequate hydration to prevent crystalluria. Administer at least 2 hours before or after antacids or multivitamins. Oral solution should be given 1 hour before or 2 hours after meals. Tablets may be given without regard to meals. Solution can be administered through feeding tube.	3	Headache QT prolongation with prolonged use and in combination with other QT prolonging meds Tendinopathy – rare in children	$$$
Trimethoprim-sulfamethoxazole, PO	Can give with or without food. Shake suspension well before use; depending on the suspension concentration, the dose volume (mL) may be high. Take with full glass of water. Do not use in infants <2 months (may displace bilirubin from protein binding sites).	2	SJS/TEN like rash Hyperkalemia Myelosuppression	$

*Note: The highest rates of *C difficile* colitis have been reported with clindamycin, third generation cephalosporins, fluoroquinolones, and amoxicillin-clavulanate use (References: 1. Shirley DA, Tornel W, Warren CA, Moonah S. *Clostridioides difficile* Infection in Children: Recent Updates on Epidemiology, Diagnosis, Therapy. *Pediatrics*. 2023;152(3):e2023062307. 2. Miller AC, Arakkal AT, Sewell DK, et al. Comparison of Different Antibiotics and the Risk for Community-Associated *Clostridioides difficile* Infection: A Case-Control Study. *Open Forum Infect Dis*. 2023;10(8):ofad413)

**Prices are only an estimate and are subject to change based on insurance coverage
Pricing Reference:
$ 0-30 dollars
$$ 31-100 dollars
$$$ >100 dollars