Community Acquired Pneumonia – Pediatric
Ages 3 month to 18 years
Clinical Practice Guideline
MedStar Health
Antibiotic Stewardship

"These guidelines are provided to assist physicians and other clinicians to make decisions regarding the care of their patients. They are not a substitute for individual judgment brought to each clinical situation by the patient's primary care provider in collaboration with the patient. As with all clinical reference resources, they reflect the best understanding of the science of medicine at the time of publication but should be used with the clear understanding that continued research may result in new knowledge and recommendations."

These guidelines are intended to assist clinicians in treating community acquired pneumonia in otherwise healthy infants and children older than 3 months of age. These guidelines do not pertain to infants ≤ 3 months of age, immunocompromised children, children with chronic lung disease (ex: cystic fibrosis), or ventilator dependent children.

Community-acquired pneumonia (CAP) is an acute lung infection contracted outside of a hospital setting. Pneumonia is the most common cause of hospitalizations for children in the United States[1].

I. INITIAL PRESENTATION

- Fever (temperature ≥ 38.0 C or 100.4 F)
- Cough
- Wheezing
- Retractions
- Tachypnea
- Dyspnea
- Anorexia
- Lethargy

II. GENERAL RISK FACTORS

- Age < 5 years
- Male
- Prematurity
- Malnutrition
- Exposure to tobacco smoke
- Childcare attendance
- Low socioeconomic status
- Pre-existing illnesses[1]

III. SELECTION OF CARE SETTING

A. Conditions that favor **Outpatient management:**

- Absence of respiratory distress
- Sustained SpO2 ≥ 90%
- Adequate outpatient caregiver support and ability to be compliant with outpatient therapy.

B. Conditions that favor **Inpatient management**:

- Respiratory distress (tachypnea, dyspnea, retractions, grunting, nasal flaring, apnea, altered mental status).
- Sustained SpO2 < 90%
- < 3 months of age with suspected bacterial pneumonia
- Children who are Immunocompromised or ventilator dependent or with neuromuscular or chronic pulmonary disease (such as cystic fibrosis).
- Suspected pathogen with increased virulence (ex: MRSA).
- Poor outpatient support with concerns about the ability to be compliant with outpatient therapy.
- Failed outpatient therapy of presumed bacterial pneumonia (with worsening symptoms or no response in 48-72 hours).
- Toxic appearance
- Complications such as pleural effusion, empyema, or abscess

IV. AGE GROUP AND MOST COMMON PATHOGENS

A. < 2 years of age – Approximately 80% of CAP is caused by a viral etiology--usually evidenced by gradual onset, preceding upper respiratory tract symptoms, and lack of toxic appearance.

B. > 5 years of age - Viruses are responsible in only 1/3 of cases.

Viruses

The incidence of a viral etiology decreases with age. Common viruses:

- *Respiratory syncytial virus (RSV)* (found in up to 40% of children <2 years of age)
- *Human Rhinovirus* (found in up to 29% of children <2 years of age)
- *Adenovirus*
- *Human metapneumovirus*
- *Coronaviruses including SARS-CoV-2*
- *Influenza A, B*
- *Parainfluenza viruses 1, 2, and 3*

Bacteria (In order of prevalence)

- *Streptococcus pneumoniae* ***(most common cause of bacterial pneumonia in children of all***

ages)

- *Staphylococcus aureus, including MRSA*
- *Streptococcal pyogenes (Group A strep)*
- *Haemophilus influenza, non-typable*
- *Moraxella catarrhalis*

Atypical bacteria

- *Mycoplasma pneumoniae (causes 'walking pneumonia')*
    - More common in older children and adolescents.
    - Course is classically slowly progressive and is associated with malaise, cough, and absence of fever.
- *Chlamydia trachomatis* and *Chlamydia pneumoniae*
    - More often found in infants < 3 months age.
    - Transmitted vertically from the mother.
    - May be preceded by Chlamydial conjunctivitis in the neonatal period.

V. DIAGNOSTIC TESTING ROUTINELY RECOMMEDED

- **Pulse oximetry** should be performed in all children with pneumonia and suspected hypoxemia. The presence of hypoxemia should guide decisions regarding site of care and further diagnostic testing. Pulse oximetry of less than 90% should be transferred to an ED or hospital and 90-93% while awake should warrant consideration of further evaluation.
- **Rapid testing for influenza** is recommended when seasonally appropriate and available. A positive test would guide appropriate antiviral therapy.
- **Rapid testing for RSV**.
- **Rapid testing for *SARS-CoV-2***. If rapid COVID test is negative, it is recommended that a confirmatory PCR test follow.

NOT ROUTINELY RECOMMENDED

- **Chest x-ray** is not necessary to confirm CAP in patients in the outpatient setting. Chest x-

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ray is a consideration for patients with a non-specific exam but persistent clinical symptoms consistent with pneumonia, (signs of respiratory distress), patients with hypoxemia, and with no clinical improvement 48 -72 hours after initiation of therapy[2].

- **Blood cultures** are not routinely recommended for non-toxic, fully immunized children.
- **Acute phase reactants (ESR, CRP, procalcitonin)** should not routinely be obtained.
- ***Mycoplasma and Chlamydia* testing for pneumonia** is not routinely recommended.
- **Complete blood cell count** is not routinely recommended**.** However, it may provide useful information in patients with an unclear diagnosis or with concern for increasing systemic infection.
- **Sputum cultures** not routinely recommended as they are difficult to obtain and are of low diagnostic yield.

VI. DRUG THERAPY – Table 1 lists preferred antibiotic regimens.

Antibacterial therapy is not necessary for viral pneumonia. However, be alert for clinical symptoms consistent with a bacterial super-infection after a viral illness. **Staphylococcal (MRSA) pneumonia is a frequent complication after influenza infection.**

- **Amoxicillin should be used as first-line therapy** for previously healthy, appropriately immunized children (< 5 years of age) with mild to moderate CAP suspected to be of bacterial origin. Amoxicillin provides appropriate coverage for *Streptococcus pneumoniae,* the most prominent invasive bacterial pathogen. High-dose amoxicillin is recommended due to concerns about antibiotic-resistant Streptococcus pneumoniae identified in pediatric community acquired pneumonia.

- **Macrolide antibiotics** should be prescribed for initial treatment of children (primarily school-aged children and adolescents) with findings compatible with **CAP caused by atypical pathogens. (40-50% of *S. pneumoniae* is resistant to macrolide antibiotics).**

- **In children with moderate to severe CAP consistent with influenza virus infection, antiviral therapy should be administered as soon as possible** during widespread local circulation of influenza viruses. Antiviral treatment provides maximal benefit when started early (< 48-72 hours). Treatment with antiviral therapy should not be delayed if influenza is suspected but influenza testing is not available. Negative influenza diagnostic tests, especially rapid antigen tests, do not conclusively exclude influenza disease.

VII. MINMIZING ANTIMICROBIAL RESISTANCE

A. Antibiotic exposure selects for antibiotic resistance; therefore, limiting exposure to any antibiotic, whenever possible, is preferred.

B. Limiting the spectrum of activity of antimicrobials to that specifically required to treat the identified pathogen is preferred.

C. Using the proper dosage of antimicrobial to be able to achieve a minimal effective concentration at the site of infection is important to decrease the development of resistance.

D. Treatment for the shortest effective duration will minimize exposure of both pathogens and normal microbiota to antimicrobials and minimize antimicrobial resistance.

Table 1.
Empiric Therapy for Outpatient Pediatric Community-Acquired Pneumonia (CAP)

Category	Antibiotic	Comments
Outpatient **(presumed typical bacterial pathogens)**	**Amoxicillin:** 90mg/kg/day PO divided q8-12h (max 1000mg/dose) **Alternative:** **Amoxicillin/clavulanate** <40kg: 90mg/kg/day of Amoxicillin PO divided q8-12h using the Augmentin ES-600 suspension. ≥40kg: 2000mg of Amoxicillin PO q12h using Augmentin 1000mg XR tablets. **Non-severe Penicillin Allergy:** **Cefdinir** 7mg/kg/dose PO q12h (max 300mg/dose) **Severe Penicillin allergy:** **Levofloxacin** 6months to 5 years: 10mg/kg/dose PO q12h (max 750mg/day) ≥5years: 10mg/kg/dose PO q24h (max750mg/day)	-Consider Amoxicillin/clavulanate if patient received Amoxicillin within 30 days -Oral cephalosporins are less active against *S.pneumoniae* compared to high-dose Amoxicillin (70% vs. 98%) -Doxycycline and TMP/SMX have < 50% activity again *S.pneumoniae*
Outpatient **(presumed atypical pathogens)**	**Azithromycin:** 10mg/kg/dose PO X1 (max 500mg/dose) on day 1, then 5mg/kg/dose PO q24h (max 250mg/dose) on days 2-5	-Only ~60% of *S.pneumoniae* isolates are susceptible to macrolides

VIII. AMOXICILLIN OR PENICILLIN ALLERGY:

For children with a history of non-anaphylactic allergic reactions to amoxicillin, treatment is not well defined and should be individualized.

Options include: 1) A trial of amoxicillin under medical observation.
2) 2nd or 3rd generation cephalosporin (such as cefdinir)
3) Clindamycin or a macrolide

Patients with history of anaphylactic or life-threatening reactions to penicillin:

Options include: 1) Levofloxacin
2) Clindamycin
3) Azithromycin

Levofloxacin is now recognized as the preferred oral agent for children as young as 6 months of age with highly penicillin-resistant isolates (minimum inhibitory concentration of ≥4 µg/mL).[3,5] Prescribing clinicians should verbally review common, anticipated, potential adverse events, such as rash, diarrhea, and potential musculoskeletal or neurologic events, and indicate why a fluoroquinolone is the most appropriate antibiotic agent for a child's infection.[3]

Azithromycin is only partly effective for pneumonia. It has limited action against resistant S.pneumoniae, which causes 25% or more cases of pneumonia in children.

IX. DURATION OF TREATMENT

- **5 days** of therapy recommended for previously healthy children with CAP improvement by day 3 of therapy.
- **7-10** days of therapy recommended for children who are immunocompromised, have chronic lung disease (not including asthma (, or if poor clinical response to initial therapy.
- Complicated CAP and infections caused by certain pathogens, notably CA-MRSA, may require longer treatment than those caused by S. pneumoniae.
- Azithromycin is dosed for 5 days due to different tissue-site pharmacokinetics.
- Follow-up chest radiograph is only recommended for children not clinically improving or worsening after 2-3 days of initiating antibiotics. Consideration of further investigation or adjustment of antibiotics coverage should be performed.
- Clinical deterioration at any time should receive a higher level of care.

X. RECOMMENDED VACCINATIONS

- COVID-19 Vaccination (if eligible)
- *HIB (Haemophilus influenza b)*
- Influenza (seasonal flu)
- Measles (MMR)
- Pertussis (whooping cough; in DTaP or Tdap)
- Pneumococcal Conjugate Vaccine (Prevnar 13 valent)
- Pneumococcal Polysaccharide Vaccine (Pneumovax 23 valent) if eligible.
- Varicella (chicken pox)

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- RSV monoclonal antibody, nirsevimab-alip (Beyfortus)

- **See CDC Vaccination website Special Situations with link below:** https://www.cdc.gov/vaccines/schedules/hcp/imz/child-adolescent.html

XI. PATIENT EDUCATION

Please review the information below with your patients.

A. Pneumonia is an infection of the lungs. Bacterial pneumonia is treated with antibiotics. Influenza may be treated with antiviral drugs such as Oseltamivir, if diagnosed early. Viral pneumonia does not get better with antibiotics.

B. Catching illnesses such as pneumonia, upper respiratory infections (colds), and other respiratory infections can be decreased by following good hygiene practices. Wash your hands regularly and disinfect frequently touched surfaces.

C. If you smoke and/or vape, stop.

D. Avoid exposure to cigarette and/or vape smoke.

E. Make sure the child and all family members are up to date on their vaccines including influenza and COVID-19 vaccinations.

F. Call your physician if your child shows any of the following warning signs that the pneumonia is getting worse:

- Fever lasting more than 3 days after starting antibiotics.
- Increasing breathing difficulties.
- Signs of dehydration, not drinking, repeated vomiting, and decreased urination.
- Evidence of an infection elsewhere in the body: red swollen joints, bone pain, severe headache, stiff neck, vomiting, or other new signs or symptoms.
- Skin around mouth or fingers looks blue or dusky.

G. Parents should follow these home care guidelines for children:

- Encourage rest.
- Increase fluid intake.
- No cough suppressants (such as codeine or dextromethorphan [DM]). Coughing is necessary to clear the excessive secretions caused by the infection and open the airways.
- Use over the counter drugs such as acetaminophen or ibuprofen to relieve fever or pain.

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