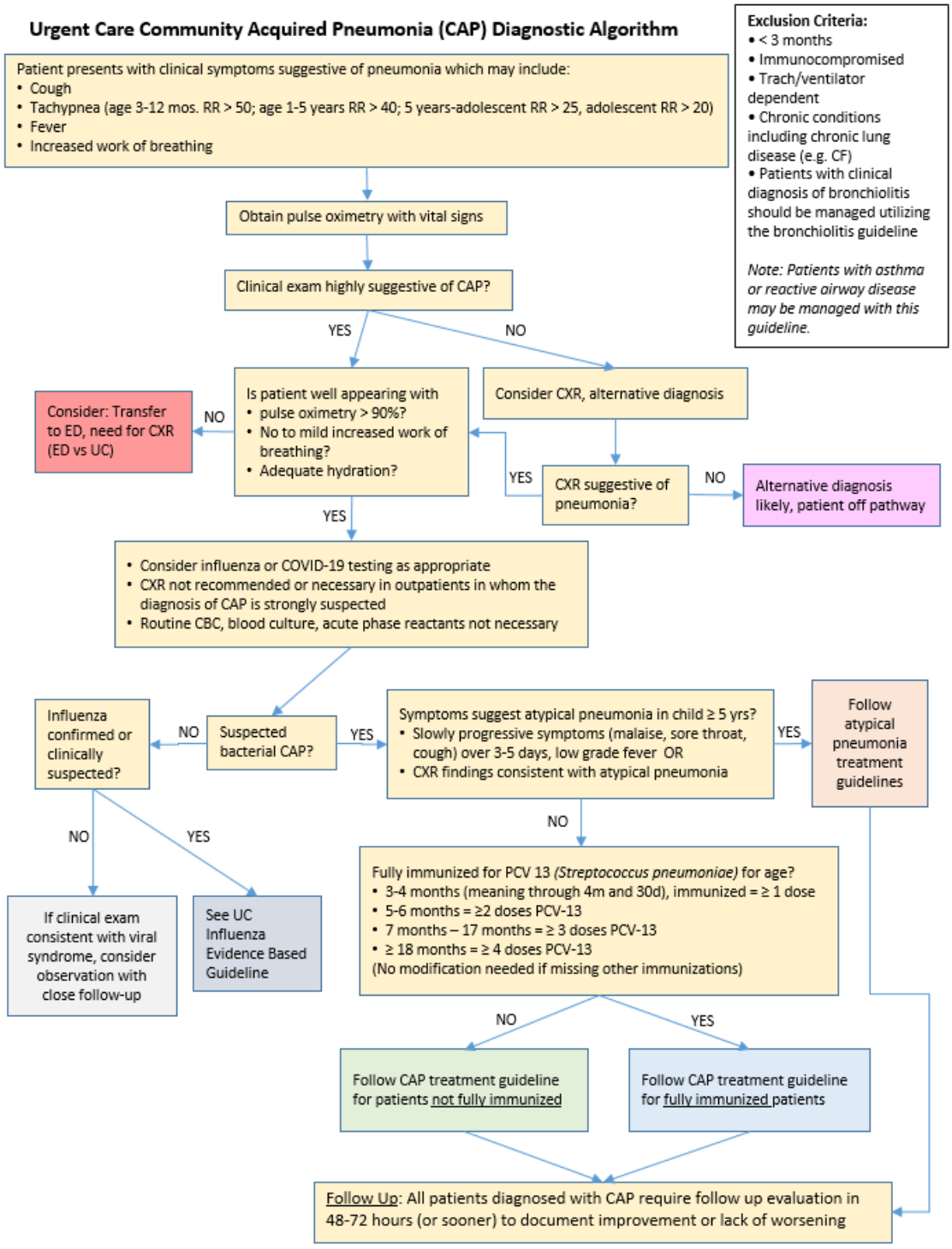
Children's Hospital and Health System, Inc.
Patient Care Evidence Based Guideline
CW Urgent Care

Subject: Community Acquired Pneumonia



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Community Acquired Pneumonia (CAP) Treatment Guideline

Duration of treatment for CAP:
- 5 days of treatment is appropriate for previously healthy patients diagnosed with CAP who do not require hospitalization.
- Providers should consider longer (7-10 day) duration of antibiotics for patients with underlying health conditions or uncertain ability to follow up for reassessment in 48-72 hours.

Follow up: recommended for all patients with suspected bacterial CAP 48-72 hours after diagnosis to ensure improvement on current treatment plan (or sooner based on provider discretion)

Fully immunized, all ages:
- For preschool aged children, most pneumonia is viral in origin. If bacterial CAP strongly suspected, use guideline below.
- For "typical" CAP
  - Amoxicillin 90 mg/kg/day divided TID, max dose 1000 mg TID
  - Low-risk PCN allergy:
    - Cefprozil 30 mg/kg/day divided BID, max dose 500 mg BID (least expensive option for suspension)
      OR
    - Cefpodoxime 10 mg/kg/day divided BID, max dose 200 mg BID (cost and taste may limit use of suspension, tablets inexpensive)
      OR
    - Cefuroxime 30 mg/kg/day divided BID, max dose 500 mg BID (cost may limit use of suspension, tablets inexpensive)
      OR
    - Alternate: cefdinir
      - 14 mg/kg/day divided BID, max dose 300 mg BID
      - Not recommended for ill-appearing patients due to suboptimal pharmacokinetic profile:
  - High-risk PCN allergy
    - Includes: anaphylaxis, mouth blisters, hypotension, seizure, peeling skin, syncope, swelling (face, lips, throat), wheezing
    - Preferred: Clindamycin 40 mg/kg/day divided TID, max dose 600 mg TID
      OR
    - Alternate: Levofloxacin
      - < 5 years age: Levofloxacin 20 mg/kg/day divided BID, max dose 375 mg BID
      - ≥ 5 years age: Levofloxacin 10 mg/kg/day once daily, max dose 750 mg once daily

- Not fully immunized for age with PCV-13**, all ages:
  - Preferred: cefpodoxime, cefuroxime, cefprozil (see dosing recommendation above)
    OR
  - Clindamycin (see dosing recommendation above)
  - Do NOT use cefdinir for patients un-immunized/under-immunized with PCV-13 due to suboptimal pharmacokinetic profile

**Fully immunized with PCV-13 for *Streptococcus pneumoniae* for age.
- 3-4 months (meaning through 4m and 30d) ≥ 1 dose
- 5-6 months ≥ 2 doses
- 7-17 months ≥ 3 doses
- ≥ 18 months ≥ 4 doses

- No modification needed if missing other immunizations

- Atypical CAP:
  - Consider in patients ≥ 5 years with slowly progressive symptoms (malaise, sore throat, cough) over 3-5 days, low grade fever, CXR findings consistent with atypical pneumonia.
  - Azithromycin 10 mg/kg/day once daily on day 1, then 5 mg/kg/day once daily on days 2-5. Max dose 500 mg once daily on day 1, then dose of 250 mg once daily on days 2-5.
    OR
  - Doxycycline 2-4 mg/kg/day divided BID for 10 days (max dose 100 mg BID)

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Purpose: To evaluate and initiate treatment of community acquired pneumonia (CAP). The focus of this treatment guideline is children ages 3 months-18 years of age.

Definition: Community-acquired pneumonia is an acute infection of the pulmonary parenchyma acquired by a previously healthy child that is acquired in the community.

Pneumonia is a leading cause of mortality and morbidity in children worldwide. Although the majority of pediatric deaths caused by pneumonia occur in developing countries, developed countries such as the U.S. experience considerable burden of disease and related healthcare costs. In the pediatric urgent care setting, providing healthcare for children with pneumonia is common.

Etiology: Many microorganisms have been identified as causative agents of pediatric pneumonia, primarily viruses and bacteria. Pathogens vary by patient age and other factors, including immunization status and special health conditions.

Most common etiologies by age:

- *Streptococcus pneumoniae* is the most common bacterial pathogen in all age groups.
- Neonates: Neonates less than three months of age are at risk of bacterial pathogens present in the birth canal. (Not discussed in this guideline.)
- Infants ≥ 3 months of age:
    - Viruses (most common etiology for age group)
    - Bacterial pathogens (*Streptococcus pneumoniae* most common)
    - Afebrile pneumonia of infancy: typically seen in young infants, ages 2 weeks-4 months
        - *Chlamydia trachomatis*
        - Cytomegalovirus
        - *Mycoplasma hominis*
        - *Ureaplasma urealyticum*
    - Infants with severe *Bordetella pertussis* infection also may develop pneumonia
- Children < 5 years:
    - Viruses (most common etiology)
        - Respiratory syncytial virus (RSV) most common virus
    - Bacterial pathogens:
        - *Streptococcus pneumoniae* (most common bacterial etiology)
        - *Staphylococcus aureus*
        - *Streptococcus pyogenes*
- Children ≥ 5 years:
    - *Streptococcus pneumoniae*
    - *Mycoplasma pneumoniae*
    - *Chlamydia pneumoniae*
    - Viruses

Special populations: See Appendix

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Differential Diagnosis:

- Aspiration of gastric contents
- Bronchiolitis
- Asthma
- Pulmonary infarction
- Neoplasm
- Foreign body aspiration/mucus plug
- Drug exposures
- Sepsis
- Heart failure
- Metabolic acidosis
- Vaping-associated pulmonary disease

Guideline

Subjective Data / History:

The clinical presentation of CAP varies depending upon the pathogen, host, and severity. Presenting signs and symptoms are nonspecific, and no single symptom is indicative of pneumonia in children. While symptoms may be subtle, especially in infants and young children, fever and cough are suggestive of pneumonia. Increased work of breathing and tachypnea may precede cough.

- Common symptoms across all ages:
    - Ill-appearing
    - Fever
    - Cough
    - Labored breathing
    - Chest pain
    - Abdominal pain
    - Vomiting
- Infants:
    - Difficulty feeding
    - Fussiness
    - Fever (note: fever may be absent in young infants)
- Older Children and Adolescents:
    - Pleural chest pain
    - Neck pain or nuchal rigidity

Objective Data / Physical Exam:

- Common physical exam findings across all ages (highest predictive of pneumonia in bold):
    - **Tachypnea**
        - Lack of tachypnea helpful in excluding pneumonia

        - Age 3-12 mos RR> 50; age 1-5 years RR> 40; 5 years-adolescent RR>25; adolescent RR>20
    - **Hypoxia**
    - **Nasal flaring**
    - Other signs of increased work of breathing such as grunting or retractions (hypoxia and increased WOB highly predictive of pneumonia)
    - Cough
    - Ill-appearing or fussy
    - Fever
    - Breath field auscultation findings may include:
        - Crackles
        - Decreased breath sounds
        - Focal findings
        - Wheezing: more common in atypical and viral pneumonia
        - Bronchial breath sounds
        - Egophony: increased resonance of vocal sounds when auscultating the chest
        - Bronchophony: increased intensity and clarity of the patient's spoken voice when auscultating the chest

Diagnostic Studies:

- **Radiographs: Routine chest x-rays are not necessary to confirm clinically suspected pneumonia in children who are well enough to be treated as outpatients.**
    - Indications for radiographs in children with clinical evidence of pneumonia include:
        - Confirmation or exclusion of the diagnosis when clinical findings are inconclusive
        - Exclusion of alternate explanations for respiratory distress / symptoms
        - Exclusion of pneumonia in young children (3-36 months) with fever > 102.2°F of unknown origin that is persistent well beyond a typical viral syndrome (> 72 hours)
        - Severe disease (may be done by ER or as inpatient)
        - Assessment for complications, particularly in children whose pneumonia is prolonged and unresponsive to antimicrobial therapy
        - History of recurrent pneumonia
- **Laboratory Studies:** The laboratory evaluation of the child with CAP depends on the clinical scenario, including the age of the child, severity of illness, complications, and whether the child requires hospitalization.
        - **Laboratory studies are usually not necessary for children with mild lower respiratory tract infection who will be treated as outpatients**
        - When suspicion of influenza or COVID-19 exists, it is appropriate to test as the result would impact treatment and counseling.
        - Routine testing for *mycoplasma pneumoniae* is not recommended for patients with suspected atypical bacterial pneumonia who do not have severe enough illness to require admission.

        - CBC and acute phase reactants (CRP, procalcitonin) may be used in certain settings (ED, hospitalized patient) to aid in determining diagnosis and treatment plan for certain patients with uncertain diagnosis or severe disease.

Diagnosis: See page 1: "Urgent Care Community Acquired Pneumonia (CAP) Diagnostic Algorithm"

The evaluation of the child with cough and potential lower respiratory tract disease has three goals: Identification of the clinical syndrome, consideration of etiologic agent, and assessment of disease severity.

- **Identification of the clinical syndrome** (pneumonia vs. bronchiolitis, asthma exacerbation, etc.)
- **Consideration of the etiologic agent.** Features of each etiology frequently overlap and may reflect a mixed bacterial/viral infection.
    - Bacterial:
        - Children of all ages
        - Abrupt onset
        - Ill-appearing, sometimes toxic
        - Fever/chills
        - Respiratory distress is moderate to severe
        - Focal auscultatory findings
        - Localized chest pain
        - Radiologic findings (if obtained):
            - Alveolar infiltrates
            - Segmental consolidation
            - Lobar consolidation
        - WBC count > 15,000 (if obtained)
        - Elevated acute phase reactants (if obtained)
    - Viral:
        - Usually children < 5 years
        - Gradual onset
        - Preceding upper airway symptoms
        - Nontoxic appearance
        - Diffuse, bilateral auscultatory findings
        - Wheezing may be present
        - Radiologic findings (if obtained): interstitial infiltrates
    - Atypical Bacterial:
        - Children of all ages, but most common in children ≥ 5 years
        - Fever tends to be low grade as compared to "typical" CAP
        - Patients generally do not appear as ill as in "typical" bacterial CAP
        - Gradual worsening of nonproductive cough and other symptoms typically over 3-5 days or longer
        - Prominent constitutional findings (malaise, sore throat, headache, myalgias, conjunctivitis, photophobia) may be present
        - Wheezing may be present

- Extrapulmonary manifestations/complications may occur, including rash and mucositis; rarely Stevens Johnson syndrome, hemolytic anemia or hepatitis may occur.
- Radiologic findings (if obtained): Classically, diffuse, bilateral interstitial infiltrates are seen. Lobar or segmental consolidation can be seen, especially in children sick enough to be hospitalized, parahilar or peribronchial infiltrates, localized reticulonodular infiltrates, or patchy infiltrates can all be seen with atypical pneumonia

- **Assessment of the severity of illness: Severe pneumonia warrants transfer to ER**

Mild to moderate pneumonia	Severe pneumonia
No to minimal respiratory distress • RR may be elevated, but less than what meets severe criteria • No to mild retractions • No nasal flaring, grunting • Mild shortness of breath	Severe respiratory distress • RR>70 (infants) or RR > 50 (children) • Moderate to severe retractions • Nasal flaring, grunting, severe difficulty breathing • Significant shortness of breath
Normal color	Cyanosis
Normal mental status	Altered mental status (lethargy, confusion)
Normal pulse oximetry (≥ 92%)* *use clinical judgment for patients with borderline pulse oximetry	Pulse oximetry < 90% sustained
Normal feeding, no vomiting	Not feeding (infants) or signs of dehydration
Normal heart rate for age	Tachycardia as defined for age
Normal perfusion (capillary refill < 2 seconds)	Prolonged capillary refill ≥ 2 seconds
Well to mildly ill appearing	Toxic appearance

- **Additional indications for hospitalization beyond severe disease:**
  - Inability to maintain hydration orally
  - Underlying conditions that may predispose to a more serious course of pneumonia
  - Suspicion that CAP is due to a pathogen with increased virulence, such as *S. aureus* or group A strep
  - Infants less than 3-6 months of age should be considered for admission if bacterial etiology of their pneumonia is strongly suspected.

Treatment:

- **See Page 2: "Community Acquired Pneumonia (CAP) Treatment Guideline" for specific antibiotic selection, dose and duration of therapy**
- CAP is typically treated empirically, determined by age, immunization status, and suspected etiology.
- **Bacterial**

  - *S. pneumoniae* is the most common bacterial etiology of CAP.
  - A 5 day duration of antibiotic therapy is appropriate for previously healthy children with bacterial CAP who do not require hospitalization (for all antibiotics and immunization status). See SAFER study link for details.
  - All patients who are diagnosed with CAP should be seen in follow up in 48-72 hours to document improvement. Patients should be advised that antibiotic duration may be extended or different antibiotic selected at that time if the healthcare provider feels that there has not been adequate improvement.
  - Patients with underlying health conditions or uncertain ability to follow up in 48-72 hours should receive 7-10 days of antibiotics (instead of 5 days).
  - Immunization status: **See CAP Treatment Guideline (second page of algorithm)**

- **Atypical Pneumonia**
  - If ≥ 5 years, consider treatment for atypical pneumonia if suspected based on clinical history, exam findings, and CXR (if obtained).
- **Viral Pneumonia**
  - Viral pneumonia does not benefit from antibiotic therapy except in certain circumstances (Influenza).
  - Influenza pneumonia: Consult the Urgent Care Influenza Evidence Based Guideline for recommendations on treatment of influenza

Follow up: all patients with suspected CAP should be reassessed in 48-72 hours by a health care provider (PCP or Urgent Care if PCP not available) to document improvement on current treatment regimen.

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This guideline is designed to serve as a reference for clinical practice and does not represent an exclusive course of treatment nor does it serve as a standard of medical care. Providers should apply their professional judgment to the management of individual patient conditions and circumstances. Children's Hospital and Health System (CHHS) does not make any representation with respect to any sort of industry recognized standard of care for the particular subject matter of this clinical guideline. Additionally, CHHS form documents are subject to change, revision, alteration, and/or revocation without notice.

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References

Barson, WJ et al. Community-acquired pneumonia in children: Outpatient treatment. Up To Date, revised April 13, 202.

Biondi E, McCulloh R, Alverson B, et al. Treatment of mycoplasma pneumonia: a systematic review. Pediatrics 2014; 133:1081.

Bradley JS, Byington CL, Shah SS, 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 2011; 53e25.

Florin TA, Ambroggio L, Brokamp C, et al. Reliability of Examination Findings in Suspected Community-Acquired Pneumonia. Pediatrics 2017:140.

McCracken GU Jr. Diagnosis and management of pneumonia in children. Pediatr Infect Dis J 2000; 19:924.

American Academy of Pediatrics. Tables of antibacterial drug dosages. In: Red Book 2021 Report of the Committee on Infectious Diseases, 32 ed,) Editor: David W. Kimberlin, MD, FAAP; Associate Editors: Elizabeth D. Barnett, MD, FAAP; Ruth Lynfield, MD, FAAP; and Mark H. Sawyer, MD, FAAP , American Academy of Pediatrics, 2021, p. 876-897.

Messinger AI, Kupfer O, Hurst A, Parker S. Management of Pediatric Community-acquired Bacterial Pneumonia. Pediatrics in Review 2017, 38:9.

Pernica, JM, Harman, S, Kam, A et al. Short-Course Antimicrobial Therapy for Pediatric Community-Acquired Pneumonia: The SAFER Randomized Clinical Trial. JAMA Pediatr. 2021;175(5):475-482.

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Shah SN, Bachur RG, Simel DL, Neuman MI. Does This Child Have Pneumonia? The Rational Clinical Examination Systematic Review. JAMA 2017; 318:462.

Treatment information also provided by: Dr. Michelle Mitchell, Infectious Disease, Antimicrobial Stewardship, Children's Wisconsin, Tracy Zembles, PharmD, Antimicrobial Stewardship, Children's Wisconsin, Katie Ray, PharmD, Antimicrobial Stewardship, Children's Wisconsin (personal communications, 2021).

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Appendix: Special Populations

- Un-immunized/under-immunized
  - Patients not fully immunized with PCV-13 are at risk for infection with strains of *S. pneumoniae* that have higher rates of antimicrobial resistance
  - Unlike resistant strains of *S. pneumoniae*, which continue to circulate, *Haemophilus influenzae* type b infections are exceedingly rare, and *H. influenzae* type b is now felt to be an extremely rare/nonexistent cause of community acquired pneumonia
  - Children not fully immunized against varicella or measles could develop viral pneumonia due to either of these pathogens
- Immunocompromised
  - At risk for usual etiologies of pneumonia, as well as gram negative bacilli, *S. aureus,* opportunistic fungi, and viral infections
  - Subspecialty phone consultation is appropriate for immunocompromised patients with community acquired pneumonia, as diagnostic and treatment recommendations will vary depending on the type of immunodeficiency present
- Sickle Cell Anemia
  - Pneumonia prevalence is increased, and atypical pneumonia may be the etiology of acute chest syndrome in patients with sickle cell anemia
  - *S. pneumoniae*, *S. aureus,* and *H. influenzae* can also cause pneumonia in patients with sickle cell anemia
- Cystic Fibrosis
  - Patients with CF are at higher risk for pneumonia due to *S. aureus*, *H. influenzae*, and *Pseudomonas aeruginosa*, as well as multidrug resistant organisms
- Aspiration-prone
  - Patients with known or possible swallowing dysfunction (such as those with underlying neurologic disorders that impair swallow or gag reflex) are at risk for pneumonia caused by oropharyngeal flora
- Residence or travel to the following geographic areas should increase suspicion of endemic pathogens.
  - Southwestern United States, northern Mexico, and parts of Central and South America: *Coccidioides immitis*
  - Great Lakes states, southeastern and central United States: *Blastomyces dermatitidis*
  - Ohio, Mississippi, and Missouri River valleys: *Histoplasma capsulatum*
  - "Four Corners" region (New Mexico, Arizona, Colorado and Utah): Hantavirus
  - Tuberculosis: immigrants from countries with a high prevalence of infection (e.g., countries throughout Asia, Africa, Latin America, and Eastern Europe
- Animal exposures:
  - Bird droppings and bat guano: *Histoplasma capsulatum*
  - Domestic or wild birds exposure: *Chlamydia psittaci*
  - Livestock (Cattle, goats and sheep): *Coxiella burnetii* (Q Fever)

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