

Community-Acquired Pneumonia ED Algorithm

Evidence Based Outcome Center

Exclusion Criteria

- Children \leq 3 months
- Cystic Fibrosis
- Chronic lung disease
- Immunodeficiency
- Immunosuppression (e.g., children undergoing chemo or chronic steroid use)
- Moderate to large or complex effusions, lung abscess or pneumatocele
- Sickle Cell Disease
- History of feeding difficulties or aspiration
- Recent history of thoracic trauma
- Extensive comorbidities
- Tracheostomy tube presence
- If Suspected Viral Etiology and no suspicion of bacterial coinfection
- Pneumonia suspected to be from fungal disease or mycobacterial infection

Mild Pneumonia Criteria 1

- Normal to Mild WOB
- Oxygen Saturations \geq 90% RT

Moderate/Severe Pneumonia Criteria 2

- Moderate-to-severe retractions
- Grunting or nasal flaring
- Altered mental status or lethargy
- Oxygen saturations persistently $<$ 90% on room air
- Known moderate-to-large effusion, empyema, or necrotizing changes
- Failure of outpatient antibiotic therapy (No improvement in 48-72 hours on appropriate therapy OR significant worsening on appropriate therapy)

Severe/ PICU Criteria 3

- FiO₂ \geq 0.5
- Sepsis
- Impending respiratory failure
- Altered mental status

Inclusion Criteria
Suspected community-acquired pneumonia in children greater than 3 months to 18 years of age.

Provider Assessment

Sepsis Pathway

Mild Pneumonia 1

Moderate-Severe Pneumonia 2

Testing

- Consider Chest X-Ray when diagnosis uncertain

Testing

- Obtain 2-view Chest X-ray (if not previously performed)
- PIV + NS Bolus
- Blood culture, CRP, ESR, CBC with diff if toxic appearing or concern for complicated pneumonia.

Meets Criteria for Outpatient Management?
Criteria:

- Able to tolerate oral antibiotics
- *Close outpatient follow-up ensured*
- Normal hydration

Moderate/Large Effusions or Empyema Identified?

Complicated Pneumonia Guideline

Oral Antibiotic Management:
First Line Antibiotic:
High-Dose Amoxicillin for TOTAL 5 days
90 mg/kg/day divided BID or TID | Max dose 1 gram/dose (or 3 grams/day)
(Refer to Addendum 1 for antibiotic guidance)

Follow-up:
48-72 hours (sooner if worsening condition)

Initiate Empiric Antibiotic Therapy:
First-Line Antibiotic: Ampicillin
(Refer to Addendum 1 for antibiotic guidance)

Obtain 2-view Chest X-ray (if not previously performed)

Meets PICU Criteria? 3

DISCHARGE

ADMIT to Floor

PICU consult;
Manage **OFF PATHWAY**
(Refer to Addendum 1 for antibiotic guidance)

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- Pneumonia suspected to be from fungal disease or mycobacterial infection

Inclusion Criteria
 Suspected community-acquired pneumonia in children greater than 3 months to 18 years of age.

Assessment of Respiratory Severity
 Are any of the following signs or symptoms present?

- Moderate-to-severe retractions
- Grunting or nasal flaring
- Known moderate-to-large effusion, empyema, or necrotizing changes
- Altered mental status or lethargy
- Oxygen saturations persistently < 90% on room air
- Sepsis

Yes → Refer to DCMC ER for immediate evaluation

If suspected viral etiology and no suspicion of bacterial coinfection consider Managing OFF-Pathway
 Refer to CDC guidelines if concern for influenza

NO → Consider rapid testing for RSV & Influenza if it will change medical management

No initial blood work required
 Consider Chest X-Ray to confirm clinical diagnosis

Meets Criteria for Outpatient Management?
 Criteria:

- Able to tolerate oral antibiotics
- Mildly increased to normal work of breathing
- Close outpatient follow-up ensured
- Improvement in clinical symptoms, including fever and respiratory rate, if indicated

Consider admission for infants < 6 months of age

NO → Refer for direct admission to DCMC

Continue antimicrobial therapy for 5-day total course

Responding? ¹

Outpatient Oral Antibiotic Management:
First-Line Antibiotic:
 High Dose Amoxicillin for 5 days
 90 mg/kg/day divided BID or TID | Max dose 1 gram/dose (or 3 grams/day)
 (Refer to the Addendum 1: for antibiotic guidance)
Follow-up:
 48-72 hours (sooner if worsening condition)

Chest X-ray

Effusion?

• **Re-evaluate diagnosis** (consider additional testing if indicated)
 • **Broaden antibiotic coverage:**
 Change to high-dose Amoxicillin-clavulanate(1) w/w Azithromycin(2)
 (1) 90 mg/kg/day divided BID | Max dose 875 mg/dose (tablet), 1 grams/dose (ES Suspension)
 (2) 10 mg/kg once daily x3 doses | Max dose 500 mg
 (Refer to Addendum 1 for antibiotic guidance, allergy alternatives)
 • **Follow-up in 24 – 48 hours**

Responding? ¹

Continue antimicrobial therapy an additional 5 days

1 Responding
 Improvement in clinical signs including fever, oxygen saturation, and respiratory rate within 48-72 hours

Community-Acquired Pneumonia Inpatient Algorithm

Evidence Based Outcome Center

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 - If Suspected Viral Etiology and no suspicion of bacterial coinfection
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Inclusion Criteria
Suspected community-acquired pneumonia in children greater than 3 months to 18 years of age.

! ALERT

Patients with clinical deterioration should be **Managed OFF-Pathway** using clinical judgment.

Deterioration is defined as decline in cardiovascular status, increase in fever pattern, or increase in oxygen requirement.

- Assessment of Respiratory Severity**
- Are any of the following signs or symptoms present?
- Moderate-to-severe retractions
 - Grunting or nasal flaring
 - Altered mental status or lethargy
 - Oxygen saturations persistently $<$ 90% on room air
 - Known moderate-to-large effusion, empyema, or necrotizing changes
 - Failure of outpatient antibiotic therapy **1**
 - Sepsis

Sepsis
YES → Sepsis Pathway

Consider rapid testing for RSV & Influenza if it will change medical management

- If not recently obtained CONSIDER testing:**
- 2-view Chest X-ray
 - Rapid testing for RSV & Influenza
 - Blood culture, CBC with diff, sputum cx (if able), CRP, ESR
 - Additional blood work as indicated by patient condition

Initiate Empiric Antibiotic Therapy:

First Line Antibiotic: Ampicillin
(Refer to Addendum 2 for antibiotic guidance)

- Administer oxygen to keep O₂ saturations \geq 90%
- IVF as needed (isotonic preferred)

PICU consult;
Manage **OFF PATHWAY**
(Refer to Addendum 2 for antibiotic guidance)

Continue current therapy; transition to oral therapy as able

Responding? **2**

Order Chest X-ray
Consider US to evaluate effusion

Pleural Effusion? Moderate to Large → Complicated Pneumonia Guideline

- Small but not complicated
- Reassess diagnosis
 - Perform additional diagnostic testing as indicated
 - Broaden antimicrobial therapy (Consider coverage for resistant *S. pneumoniae*, *H. influenzae*, atypicals, or *S. aureus*)
(Refer to addendum 2 for antibiotic guidance)
 - Consider consultation with an Infectious Disease specialist

Meets Criteria for Outpatient Management?

Criteria:

- Oxygen saturations $>$ 90% on room air for **at least 8 hours**
- Able to tolerate oral antibiotics
- Mildly increased to normal work of breathing
- Close outpatient follow-up ensured
- Improvement in clinical symptoms, including fever and respiratory rate, if indicated

Responding? **2** NO → Consider Infectious Disease consult; Manage **OFF PATHWAY**

Provide prescription for antimicrobial therapy to complete **TOTAL 5 day course**
(Refer to Addendum 3 for additional antibiotic guidance/selection)

Instruct to follow-up in 48-72 hours

DISCHARGE

1 Treatment Failure
No improvement in 48-72 hours on appropriate therapy OR significant worsening on appropriate therapy

2 Responding
Improvement in clinical signs including fever, oxygen saturation, and respiratory rate within 48-72 hours

3 PICU Criteria

- FiO₂ \geq 0.5
- Sepsis
- Impending respiratory failure
- Altered mental status

COMPLICATED BACTERIAL PNEUMONIA ALGORITHM

EVIDENCE BASED OUTCOME CENTER

EXCLUSION CRITERIA

- Children \leq 3 months
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- Sickle Cell Disease
- Tracheostomy tube presence
- Recent history of thoracic trauma
- Extensive co-morbidities

INCLUSION CRITERIA

Chest radiograph with suspected bacterial effusion of moderate to large size, or meeting criteria for inpatient admission in children 3 months to 18 years.

! ALERT

Patients with clinical deterioration should be **Managed OFF-Pathway** using clinical judgment.

Deterioration is defined as decline in cardiovascular status, increase in fever pattern, or increase in oxygen requirement.

Laboratory Assessment:
Blood Culture, CBC w/ differential, BMP, CRP, ESR, & Nasal PCR

Ceftriaxone and Clindamycin

Toxic Appearance

Ceftriaxone
(Consider stopping coverage for MRSA)

Ceftriaxone and Vancomycin

Positive Nasal PCR

(Refer to dosing in Addendum 2)

Early Surgical Consultation preferred in patients requiring a chest tube / drain, as well as patients not responding rapidly to medical management

Small effusion:
 $< \frac{1}{4}$ hemi-thorax

Effusion Size

Moderate effusion:
 $\frac{1}{4}$ to $\frac{1}{2}$ hemi-thorax
Or
Large effusion:
 $> \frac{1}{2}$ hemi-thorax

Continue IV antibiotics alone

Responding¹

Consider Laboratory Assessments (CRP) & Antibiotic Regimen (Worsening pleural disease may not be shown via ultrasound)

Consult surgery & obtain Chest Ultrasound (consider repeat daily as necessary to evaluate pleural quality)

- Option: Chest CT with contrast

Complex effusion

Primary Treatment: Chest tube with fibrinolytics
Secondary Treatment: VATS

Responding¹

Develop plan of care for duration* and mode of antibiotic therapy

Recommendations:

1. Ultrasound preferred over Chest CT to evaluate quality of pleural fluid. (I.e. loculations)
2. Chest CT indicated for atypical clinical or radiological features. (I.e. parenchymal abscess)
4. Consider ID consult for diagnostic testing, antibiotic selection, as well as length of treatment.
5. Consider Pulmonology consult for those with necrotizing pneumonias which requires long-term follow-up.
6. Outpatient follow-up with a chest radiograph one month post completion of the antibiotic course is recommended.

*there is no set duration of antibiotics, and it is based on clinical improvement

Responding
Improvement in clinical signs including fever, respiratory rate, FiO2 within 48-72 hours. **1**

Lateral decubitus films not generally indicated.