**Definition:** The presence of signs and symptoms of pneumonia in a previously healthy child, due to an infection of the pulmonary parenchyma that has been acquired outside of the hospital.

**Etiology:** The exact etiology of pneumonia is often unidentified due to the difficulty of obtaining a direct culture of infected lung tissue. Following the introduction of pneumococcal vaccine, the burden of invasive pneumococcal disease has declined. (1) Currently, mixed etiologies account for 30 to 50% of the children with community-acquired pneumonia. (2-4) Mycoplasma pneumoniae and Chlamydia pneumoniae are more common in school-age children. Viruses are most often identified in children <5 years of age, with respiratory syncytial virus (RSV) being the most common viral etiology in children <3 years of age. (2-7) In the Southwestern United States, data confirm the importance of Streptococcus pneumoniae and atypical pathogens (M. pneumoniae, C. pneumoniae), and the frequent occurrence of mixed infections in children with community-acquired pneumonia. (8) In children with parapneumonic effusion at Texas Children's Hospital, Staphylococcus aureus has become the most common organism actually isolated. (9)

**Inclusion Criteria**
- Age ≥60 days to 17 years
- Healthy without underlying conditions

**Exclusion Criteria**
- Aspiration
- Recent hospitalization (<7 days before the onset of illness)

**Differential Diagnosis**
Viral bronchiolitis Pertussis
Tuberculosis (TB) Foreign body

**Diagnostic Evaluation:** Pneumonia-related pathogens vary in incidence throughout the year but peak during January through April in the Southwestern United States. (8) Pathogens currently circulating in the local community should be considered in the diagnostic evaluation. Children with community-acquired pneumonia have a risk of progressing to septic shock.

**Table 1. Vital Sign Changes of Sepsis** (10)

<table>
<thead>
<tr>
<th>Age</th>
<th>Heart Rate</th>
<th>Resp Rate</th>
<th>Systolic BP</th>
<th>Temp (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0d - 1m</td>
<td>&gt;205</td>
<td>&gt;60</td>
<td>&lt;60</td>
<td>&lt;36 or &gt;38</td>
</tr>
<tr>
<td>&gt;1m - 3m</td>
<td>&gt;205</td>
<td>&gt;60</td>
<td>&lt;70</td>
<td>&lt;36 or &gt;38</td>
</tr>
<tr>
<td>&gt;3m - 1y</td>
<td>&gt;190</td>
<td>&gt;60</td>
<td>&lt;70</td>
<td>&lt;36 or &gt;38.5</td>
</tr>
<tr>
<td>&gt;1y - 2y</td>
<td>&gt;190</td>
<td>&gt;40</td>
<td>&lt;70 + (age in yr x 2)</td>
<td>&lt;36 or &gt;38.5</td>
</tr>
<tr>
<td>&gt;2y - 4y</td>
<td>&gt;140</td>
<td>&gt;40</td>
<td>&lt;70 + (age in yr x 2)</td>
<td>&lt;36 or &gt;38.5</td>
</tr>
<tr>
<td>&gt;4y - 6y</td>
<td>&gt;140</td>
<td>&gt;34</td>
<td>&lt;70 + (age in yr x 2)</td>
<td>&lt;36 or &gt;38.5</td>
</tr>
<tr>
<td>&gt;6y - 10y</td>
<td>&gt;140</td>
<td>&gt;30</td>
<td>&lt;70 + (age in yr x 2)</td>
<td>&lt;36 or &gt;38.5</td>
</tr>
<tr>
<td>&gt;10y - 13y</td>
<td>&gt;100</td>
<td>&gt;30</td>
<td>&lt;90</td>
<td>&lt;36 or &gt;38.5</td>
</tr>
<tr>
<td>&gt;13y</td>
<td>&gt;100</td>
<td>&gt;20</td>
<td>&lt;90</td>
<td>&lt;36 or &gt;38.5</td>
</tr>
</tbody>
</table>

**Table 2. Signs and Symptoms of Shock** (10)

<table>
<thead>
<tr>
<th>Exam Abnormalities</th>
<th>Cold Shock</th>
<th>Warm Shock</th>
<th>Non-Specific</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peripheral Pulses</td>
<td>Decreased or weak</td>
<td>Bounding</td>
<td></td>
</tr>
<tr>
<td>Capillary Refill</td>
<td>≥3 sec</td>
<td>Flash (&lt;1 sec)</td>
<td></td>
</tr>
<tr>
<td>Skin</td>
<td>Mottled, cool</td>
<td>Flushed, ruddy erythroderma (other than face)</td>
<td>Petechiae below the nipple, any purpura</td>
</tr>
<tr>
<td>Mental Status</td>
<td>Decreased, irritability, confusion, inappropriate crying or drowsiness, poor interaction with parents, lethargy, diminished arousability, obtunded</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**History:** Assess for
- Age of child
- Immunization status, especially S. pneumoniae, pertussis, and influenza
- Exposure to tuberculosis (TB)

**Physical Examination**
The severity assessment of pneumonia is based on overall clinical appearance and behavior, including a child’s alertness, respiratory effort, and ability to take oral fluids. A small percentage of children <5 years of age may present with abdominal pain or with fever and no signs of respiratory illness. (11) Although wheezing is more common in children with asthma, it can be a manifestation of viral or Mycoplasma pneumonia.

A complete physical examination should be performed. A combination of clinical findings, including vital signs and pulse oximetry, is most predictive in determining CAP:
- Infants <12 months: Nasal flaring, O₂ sat <96%, tachypnea (RR >50) and retractions
- Children 1 to 5 years: O₂ sat <96%, tachypnea (RR >40)
- Children >5 years: O₂ sat <96%, tachypnea (RR >30)

NOTE: O₂ sat ≤92% is a strong predictor of CAP. (12)
Evaluate the severity of symptoms using the Clinical Respiratory Score (CRS).

<table>
<thead>
<tr>
<th>Clinical Respiratory Score (CRS)</th>
<th>Assess</th>
<th>Score 0</th>
<th>Score 1</th>
<th>Score 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory Rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;2 mos: &lt;50</td>
<td>&lt;2 mos: 50-60</td>
<td>&lt;2 mos: &gt;60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-12 mos: &lt;40</td>
<td>2-12 mos: 40-50</td>
<td>2-12 mos: &gt;50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;5 yrs: &lt;20</td>
<td>&gt;5 yrs: 30-40</td>
<td>&gt;5 yrs: &gt;40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auscultation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good air movement, scattered</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>expiratory wheezing, loose</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>rales/crackles</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of Accessory Muscles</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild to no use of accessory</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>muscles, mild to no</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>retractions, no nasal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>flaring on inspiration</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mental Status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal to mildly irritable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspiratory and expiratory</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>rales/crackles, nasal flaring</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diminished or absent breath</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sounds, severe wheezing, or</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>rales/crackles, or marked</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>prolonged expiration</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Room Air SpO₂</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;95%</td>
<td>90-95%</td>
<td>&lt;90%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Color</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pale to normal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cyanotic, dusky</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Add score from all rows to calculate total CRS score)

Consider the presence of parapneumonic effusion or empyema in children with pneumonia who present severely ill. Signs of pleural effusion include dyspnea, dry cough, and pain over the chest wall, exaggerated by deep breathing or coughing. Auscultatory findings may include a friction rub (leathery, rough inspiratory and expiratory breath sounds). Breath sounds may also be diminished or absent over the affected areas. (13,14)

Critical Points of Evidence*

Evidence Supports
- Administer high-dose amoxicillin for 7 days for mild severity CAP to cover *S. pneumoniae*. (22,29,30,33–54) – Strong recommendation, moderate quality evidence
  Remarks: The recommended duration of antibiotic therapy was primarily guided by the 2016 IDSA guideline on the management of hospital-acquired and ventilator-associated pneumonia in adults. This guideline recommends 7 days of antimicrobial therapy for hospital-acquired and ventilator-associated pneumonia, based on studies demonstrating equivalence between shorter and longer courses of therapy in patients with ventilator-associated pneumonia (moderate quality evidence).
- Administer ampicillin for 7 days for moderate severity CAP to cover *S. pneumoniae*. (22,29,30,33–54) – Strong recommendation, moderate quality evidence
  Remarks: The recommended duration of antibiotic therapy was primarily guided by the 2016 IDSA guideline on the management of hospital-acquired and ventilator-associated pneumonia in adults. This guideline recommends 7 days of antimicrobial therapy for hospital-acquired and ventilator-associated pneumonia, based on studies demonstrating equivalence between shorter and longer courses of therapy in patients with ventilator-associated pneumonia (moderate quality evidence).
- Treat children with small, simple effusions with ampicillin to cover *S. pneumoniae*. (22,29,30,33–54) – Strong recommendation, low quality evidence
- Administer cefTRIAXone and vancomycin for severe bacterial CAP to cover *S. pneumoniae* and *S. aureus*. (22,29,30,43,45,51,52,54–56) – Strong recommendation, moderate quality evidence
- Treat ill-appearing children or those with clinical deterioration with cefTRIAXone and vancomycin. (22,29,30,43,45,51,52,54–56) – Strong recommendation, low quality evidence
- Consider chest thoracostomy tube drainage with or without fibrinolytics or VATS as treatment options for complicated pleural effusion. (22,29,57–81) – Strong recommendation, moderate quality evidence

Evidence Against
- Do not routinely use macrolides. Consider adding a macrolide (e.g., 5 days of azithromycin) only if an atypical pathogen is suspected in infants ≤3 months (e.g., *Chlamydia trachomatis*) and children ≥6 years (e.g., *Mycoplasma pneumoniae*). (22,29,30,33–54) Atypical pneumonia is unlikely for the following: consolidated lobar pneumonia, necrotizing pneumonia, cavitary pneumonia, large empyema, unilateral pneumonia, infant ≤3 months without a known exposure, or child is not school-aged. Consider atypical pneumonia for the following scenarios: antibiotic failure; diffuse, bilateral, interstitial infiltrate on X-ray (if obtained); maternal history of recent Chlamydia infection (for infants ≤3 months). (2,22,30,63,82–94) – Weak recommendation, low quality evidence
- Do not utilize procalcitonin levels to determine whether to initiate antibiotic therapy. (22,29,30,51,53,85–92) – Strong recommendation, low quality evidence

*NOTE: The references cited represent the entire body of evidence reviewed to make each recommendation.
Condition-Specific Elements of Clinical Management

**General:**
The clinical picture of children with community-acquired pneumonia (CAP) is highly variable making the determination of etiology difficult. The child’s age and severity of illness are important factors to consider in diagnosing and managing this disease. (14)

**Admission Criteria**
- Unable to tolerate oral fluids and medications; severely dehydrated
- Moderate or severe respiratory distress
- Failed outpatient antibiotic treatment
- Altered mental status
- Oxygen saturation consistently <90%
- Unsafe to send home/poor follow-up

**Discharge Criteria**
- No oxygen requirement
- Tolerating PO
- Appropriate mental status for age
- Signs of clinical improvement and decreasing fever for at least 12 hours
- Appropriate support system (e.g., PCP, caregivers)

**Consults/Referrals:**
- Consultation with an ID specialist should be considered when allergies or prior antibiotic non-responsiveness confound the choice of therapy.
- Consultation with pulmonary, surgery, ID, and/or IR is appropriate when uncertain about management of an effusion or persistent pneumonia.

**Follow-Up Care:**
- Children diagnosed with CAP who are not hospitalized should follow up with their PCP within 24 to 48 hours regardless of initiating antibiotic therapy.
- Follow-up care is recommended for all children hospitalized with CAP.
- For the child who is not following the expected clinical course, consider complications, viral etiology, TB, an alternative diagnosis, or ineffective antibiotic treatment due to lack of antibiotic coverage or resistance patterns.

**Measures**

**Process**
- Percentage of patients on protocol
- Length of stay (inpatient, ICU)
- # of patients receiving vancomycin

**Outcome**
- Time to initiation of O₂ wean
- Time to O₂ wean completion
- Mortality rate
- Failure to respond to antibiotic treatment
  - Unplanned readmission within 48 hours and type of antibiotic
  - Unplanned clinic revisit within 48 hours and type of antibiotic
- Need for surgery following fibrinolytic therapy and thoracostomy tube
- Direct variable costs
Clinical Algorithm for Community-Acquired Pneumonia (CAP)

Begin

Initial clinical findings suggestive of CAP

No

Manage as appropriate to clinical findings (OFF algorithm)

Yes

Suspect infectious pleural effusion

No

Follow Infectious Pleural Effusion Algorithm

Yes

Calculate a CRS for CAP severity only, excluding CRS contributions from other concurrent pulmonary disease, e.g., asthma

Mild/Moderate CRS 0-6

Bacterial CAP suspected

Diagnostic Tests

- initiate antibiotic therapy

- Admit for IV antibiotics

- Consider following the Infectious Pleural Effusion Algorithm if concerned for infectious pleural effusion

- Manage as appropriate to clinical findings

- Observation OR admit for IV antibiotics

Viral CAP suspected

Consider Flu & RSV admission panel if planning for admission (based on time of year, and epidemiology)

Initiate antiviral treatment if symptoms <48 hours and influenza season

If planning for admission:

- Obtain CXR

- Obtain blood culture only if patient requires ICU admission or is progressing to severe or complicated pneumonia

- Consider CBC diff, other tests (e.g., TB if history of exposure, pertussis)

If not planning for admission:

- Consider CXR, CBC diff, other tests (e.g., TB if history of exposure, pertussis)

Severe CRS ≥7

Diagnostic Tests

- Obtain CXR, CBC diff, Chem 7, blood culture

- Consider Flu & RSV admission panel (based on time of year and epidemiology) or other tests (e.g., TB if history of exposure, pertussis)

- Admit for IV antibiotics

- Consider following the Infectious Pleural Effusion Algorithm if concerned for infectious pleural effusion

- Manage as appropriate to clinical findings

- Observation OR admit for IV antibiotics

Inclusion Criteria

- Age ≥60 days to 17 years

- Healthy without underlying conditions

Exclusion Criteria

- Aspiration

- Recent hospitalization

Septic Shock Criteria

Immediately refer to the Septic Shock guideline and intervene rapidly if patient has toxic appearance, ill appearance, altered mental status, and/or compromised perfusion with abnormal vital signs

Antibiotics for Mild or Moderate Severity Bacterial CAP

- High-dose amoxicillin (if tolerating PO) or ampicillin (if not tolerating PO) for 7 days to cover S. pneumoniae.

- Routine use of macrolides is not recommended; consider adding a macrolide (e.g., 5 days of azithromycin) only if an atypical pathogen is suspected in infants ≤3 months (e.g., Chlamydia trachomatis) and children ≥6 years (e.g., Mycoplasma pneumoniae).

- Ampicillin to cover S. pneumoniae in children with small, simple effusions.

--------------------------------------------------------------------

Antibiotics for Severe Bacterial CAP

- cefTRIAXone and vancomycin to cover S. pneumoniae and S. aureus.

- Routine use of macrolides is not recommended; consider adding a macrolide (e.g., 5 days of azithromycin) only if an atypical pathogen is suspected in infants ≤3 months (e.g., Chlamydia trachomatis) and children ≥6 years (e.g., Mycoplasma pneumoniae).
Clinical Algorithm for Infectious Pleural Effusions

Suspect Infectious Pleural Effusion

CXR

CXR demonstrates pleural effusion

Off algorithm/Return to CAP algorithm

Prepares for admission

Suspect complicated pleural effusion:
- Large effusion
- Ill-appearing
- Worsening symptoms
- Loculation on CXR*

Chest US

Need for intervention

- CBC diff/plt
- Chem 7
- Blood culture
- Pleural fluid Gram stain & culture
- Initiate antibiotic therapy

CXR demonstrates pleural effusion

- Administer appropriate antibiotic(s) based on severity^ 
- Return to CAP algorithm

Simple
- Consider ID, IR, and/or surgery consultation
- Thoracentesis
- Thoracostomy tube

Complex
- Consider ID, IR, and/or surgery consultation
- Thoracostomy tube w/ fibrinolytics*

Clinical improvement

Simple
- ID and surgery consultation
- Consider IR and/or pulmonary consultation
- Repeat imaging (chest US or CT of chest)
- Thoracostomy tube w/ fibrinolytics* (if not already done)

Complex
- ID and surgery consultation
- Consider IR and/or pulmonary consultation
- Repeat imaging (chest US or CT of chest)
- Thoracostomy tube w/ fibrinolytics* (if not already done)

Septic Shock Criteria
Immediately refer to the Septic Shock guideline and intervene rapidly if patient has toxic appearance, ill appearance, altered mental status, and/or compromised perfusion with abnormal vital signs

To determine if an effusion is loculated, consider obtaining a decubitus film.

^Antibiotics for Small, Simple Pleural Effusions
Ampicillin

*Antibiotics for Complicated Pleural Effusions
- Vancomycin and cefTRIAXone for ill-appearing children AND/OR children who have complicated effusions AND/OR clinical deterioration

For fibrinolysis
Fibrinolytic: tPA (alteplase)
Concentration: 1 mg of tPA to every 10 mL of saline (e.g., 4 mg of tPA in 40 mL of saline; mixed by Pharmacy)
Dose

<table>
<thead>
<tr>
<th>Weight (kg)</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤15</td>
<td>10 mL</td>
</tr>
<tr>
<td>&gt;15 to ≤20</td>
<td>20 mL</td>
</tr>
<tr>
<td>&gt;25 to ≤35</td>
<td>30 mL</td>
</tr>
<tr>
<td>&gt;35</td>
<td>40 mL</td>
</tr>
</tbody>
</table>

Dwell time: Each dose to dwell for 1 h
Frequency: 1st dose at time of chest tube insertion with subsequent doses every 24 h for a total of 3 doses
Instructions: Clamp the chest tube when inserting the tPA
Other
- "Ownership" of the thoracostomy/pleural catheter, including fibrinolytic administration, is the responsibility of the service that inserted the tube
- CCM may place a thoracostomy/pleural catheter and administer fibrinolytics for patients in critical care
- Consult surgery or IR for patients on acute care floors

Manage as appropriate to clinical findings
References


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Texas Children's Hospital
Appendix A

We did not critically evaluate the evidence for infants <60 days. In an effort to provide guidance for these children, Infectious Disease has provided the antibiotic recommendations below.

- Infants <60 days with mild severity bacterial CAP (outpatient) should be treated with high-dose amoxicillin to cover *S. pneumoniae*.
- Neonates <28 days with moderate severity bacterial CAP should initially be treated with ampicillin and gentamicin.
- Infants ≥28 days to 60 days with moderate severity bacterial CAP should be treated with ampicillin ± macrolide to cover *S. pneumoniae* and atypical pathogens.
- Infants <60 days with severe bacterial CAP should be treated with cefTRIAXone and vancomycin to cover *S. pneumoniae* and *S. aureus*.
- Do not routinely use macrolides. Consider adding a macrolide (e.g., 5 days of azithromycin) only if an atypical pathogen is suspected in infants ≤3 months (e.g., *Chlamydia trachomatis*). Atypical pneumonia is unlikely for the following: consolidated lobar pneumonia, necrotizing pneumonia, cavitary pneumonia, large empyema, unilateral pneumonia, infant ≤3 months without a known exposure, or child is not school-aged. Consider atypical pneumonia for the following scenarios: antibiotic failure; diffuse, bilateral, interstitial infiltrate on X-ray (if obtained); maternal history of recent *Chlamydia* infection (for infants ≤3 months).
## Appendix B

### Pneumonia Without Effusion/Empyema Pathway

#### Acute Care Floor

**Target Length of Stay:** 2.5 Days

<table>
<thead>
<tr>
<th>Admission Criteria</th>
<th>PCU</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANY of the following:</td>
<td>ANY of the following:</td>
</tr>
<tr>
<td>☐ Oxygen therapy</td>
<td>☐ CPAP or BiPAP initiation</td>
</tr>
<tr>
<td>☐ Frequent suctioning or respiratory treatments (no more frequently than every 2 hours; if every 2 hours, then can continue for at most 12 hours)</td>
<td>☐ High flow oxygen that does not meet acute care criteria</td>
</tr>
<tr>
<td>☐ Respiratory distress</td>
<td>☐ Moderate-severe respiratory distress</td>
</tr>
<tr>
<td>☐ Need for IV antibiotics (failed outpatient oral therapy)</td>
<td>☐ Respiratory distress requiring extended frequent observation, respiratory treatments, or suctioning every 1 hour for more than 4 hours or every 2 hours for more than 12 hours</td>
</tr>
<tr>
<td>☐ IV fluids for inadequate oral intake</td>
<td>☐ Moderate-severe dehydration</td>
</tr>
</tbody>
</table>

#### Goals for Transfer to Lower Level of Care

<table>
<thead>
<tr>
<th>Goals for Transfer to Lower Level of Care</th>
<th>PCU</th>
<th>PICU</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Decreased respiratory support (oxygen and suctioning) to meet acute care floor criteria</td>
<td>☐ Decreased respiratory support to meet PCU or acute care floor criteria</td>
<td></td>
</tr>
<tr>
<td>• Off CPAP or BiPAP</td>
<td>• Extubated</td>
<td></td>
</tr>
</tbody>
</table>

#### Discharge Criteria

<table>
<thead>
<tr>
<th>Discharge Criteria</th>
<th>PCU</th>
<th>PICU</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL of the following:</td>
<td>☐ Decreased respiratory support to meet PCU or acute care floor criteria</td>
<td></td>
</tr>
<tr>
<td>☐ O₂ sat ≥90% without supplemental O₂</td>
<td>• Extubated</td>
<td></td>
</tr>
<tr>
<td>☐ Improved work of breathing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Fever curve stable or trending down (need not be afebrile)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Maintaining hydration status without supplemental IV fluids</td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Age-appropriate or baseline mental status for age</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Discharge Preparation

<table>
<thead>
<tr>
<th>Discharge Preparation</th>
<th>PCU</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL of the following:</td>
<td></td>
</tr>
<tr>
<td>☐ Appropriate medication regimen prescribed and patient’s ability to obtain medication confirmed</td>
<td></td>
</tr>
<tr>
<td>☐ Evaluate support system (caregiver, PCP, funding, etc.) and address identified needs</td>
<td></td>
</tr>
<tr>
<td>☐ Pending consults completed</td>
<td></td>
</tr>
<tr>
<td>☐ Prepare patient/caregiver for transition to self-care (transportation arrangements confirmed, care management needs met, PCP confirmed)</td>
<td></td>
</tr>
<tr>
<td>☐ Patient/caregiver education</td>
<td></td>
</tr>
</tbody>
</table>
## Pneumonia without Effusion/Empyema Pathway

### Recommendations for Inpatient Care:

<table>
<thead>
<tr>
<th>Assessment &amp; Testing</th>
<th>PCU</th>
<th>PICU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bloodwork not routinely indicated</td>
<td>Bloodwork not routinely indicated</td>
<td>Mini-BAL if indicated</td>
</tr>
<tr>
<td>Repeat chest x-ray not routinely indicated</td>
<td>Repeat chest x-ray not routinely indicated</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Consults</th>
<th>Acute Care Floor</th>
<th>PCU</th>
<th>PICU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child Life consult if needed for coping techniques, procedural teaching, psychosocial support</td>
<td>Target Length of Stay: 2.5 Days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Work consult if needed; Case Manager consult if home care needs identified; Financial Counselor consult if patient unfunded</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For complicated pneumonia, take patient off pathway and consider Surgery, IR, ID, and/or Pulmonary consult(s)</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>O₂</th>
<th>Acute Care Floor</th>
<th>PCU</th>
<th>PICU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse oximetry per oxygen weaning protocol</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wean oxygen per oxygen weaning protocol to maintain $O_2$ sat ≥90%</td>
<td>Per PCU orders</td>
<td>Per PICU orders</td>
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</table>

<table>
<thead>
<tr>
<th>Medications</th>
<th>Acute Care Floor</th>
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<th>PICU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antibiotics per CAP Guidelines: Use oral antibiotics unless indication for IV therapy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain medication per protocol</td>
<td>Antibiotics per CAP Guidelines: Transition to oral antibiotics when signs of clinical improvement</td>
<td></td>
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<tr>
<td>IV fluids if indicated</td>
<td>Pain medication per protocol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Additional medications as indicated</td>
<td>IV fluids if indicated</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Additional medications as indicated</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Antibiotics per CAP Guidelines: Transition to oral antibiotics when signs of clinical improvement</td>
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<td></td>
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<tr>
<td></td>
<td>Pain medication per protocol</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>IV fluids if indicated</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Additional medications as indicated</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Other</th>
<th>Acute Care Floor</th>
<th>PCU</th>
<th>PICU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other orders: vital signs, ins/outs, age appropriate diet, activity as tolerated, isolation precautions if needed</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

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Texas Children's Hospital

DATE: August 2018
Clinical Standards Preparation
This clinical standard was prepared by the Evidence-Based Outcomes Center (EBOC) team in collaboration with content experts at Texas Children’s Hospital. Development of this clinical standard supports the TCH Quality and Patient Safety Program initiative to promote clinical standards and outcomes that build a culture of quality and safety within the organization.

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Kathy Carberry, MPH, RN, Director

No relevant financial or intellectual conflicts to report.

Development Process
This clinical standard was developed using the process outlined in the EBOC Manual. The literature appraisal documents the following steps:

1. Review Preparation
   - PICO questions established
   - Evidence search confirmed with content experts

2. Review of Existing External Guidelines
   - Infectious Diseases Society of America and American Thoracic Society 2016; Pediatric Infectious Diseases Society and Infectious Diseases Society of America (IDSA) 2011; British Thoracic Society (BTS) 2011; World Health Organization 2014; European Association for Cardio-Thoracic Surgery 2015; Children’s Hospital of Philadelphia 2012, Revised 2016; Seattle Children's Hospital 2012, Revised 2016; Cincinnati Children’s Hospital 2012

3. Literature Review of Relevant Evidence
   - Searched: PubMed, Cochrane, AHRQ, CINAHL, Trip, BestBETs, AAP, BMJ Clinical Evidence, Google Scholar

4. Critically Analyze the Evidence
   - 7 meta-analyses, 12 randomized controlled trials, and 33 nonrandomized studies

5. Summarize the Evidence
   - Materials used in the development of the clinical standard, literature appraisal, and any order sets are maintained in a

Evaluating the Quality of the Evidence
Published clinical guidelines were evaluated for this review using the AGREE II criteria. The summary of these guidelines are included in the literature appraisal. AGREE II criteria evaluate Guideline Scope and Purpose, Stakeholder Involvement, Rigor of Development, Clarity and Presentation, Applicability, and Editorial Independence using a 4-point Likert scale. The higher the score, the more comprehensive the guideline.

This clinical standard specifically summarizes the evidence in support of or against specific interventions and identifies where evidence is lacking/inconclusive. The following categories describe how research findings provide support for treatment interventions.

- **Evidence Supports** provides evidence to support an intervention
- **Evidence Against** provides evidence against an intervention
- **Evidence Lacking/Inconclusive** indicates there is insufficient evidence to support or refute an intervention and no conclusion can be drawn from the evidence.

The GRADE criteria were utilized to evaluate the body of evidence used to make practice recommendations. The table below defines how the quality of the evidence is rated and how a strong versus weak recommendation is established. The literature appraisal reflects the critical points of evidence.

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Quality</th>
<th>Type of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRONG</td>
<td>High</td>
<td>Consistent evidence from well-performed RCTs or exceptionally strong evidence from unbiased observational studies</td>
</tr>
<tr>
<td>WEAK</td>
<td>Moderate</td>
<td>Evidence from RCTs with important limitations (e.g., inconsistent results, methodological flaws, indirect evidence, or imprecise results) or unusually strong evidence from unbiased observational studies</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>Evidence for at least 1 critical outcome from observational studies, RCTs with serious flaws or indirect evidence</td>
</tr>
<tr>
<td></td>
<td>Very Low</td>
<td>Evidence for at least 1 critical outcome from unsystematic clinical observations or very indirect evidence</td>
</tr>
</tbody>
</table>

Recommendations
Practice recommendations were directed by the existing evidence and consensus amongst the content experts. Patient and family preferences were included when possible. The Content Expert Team and EBOC team remain aware of the controversies in the diagnosis and management of community-acquired pneumonia in children. When evidence is lacking, options in care are provided in the clinical standard and the accompanying order sets (if applicable).

Approval Process
Clinical standards are reviewed and approved by hospital committees as deemed appropriate for its intended use. Clinical standards are reviewed as necessary within EBOC at Texas Children’s Hospital. Content Expert Teams are involved with every review and update.

Disclaimer
Practice recommendations are based upon the evidence available at the time the clinical standard was developed. Clinical standards (guidelines, summaries, or pathways) do not set out the standard of care and are not intended to be used to dictate a course of care. Each physician/practitioner must use his or her independent judgment in the management of any specific patient and is responsible, in consultation with the patient and/or the patient’s family, to make the ultimate judgment regarding care.
## Version History

<table>
<thead>
<tr>
<th>Date</th>
<th>Comments</th>
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<td>Oct 2008</td>
<td>Originally completed</td>
</tr>
<tr>
<td>Jan 2013</td>
<td>Updated</td>
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<tr>
<td>Aug 2018</td>
<td>Updated</td>
</tr>
<tr>
<td>Jan 2019</td>
<td>Revised the ‘Vital Sign Changes of Sepsis’ table</td>
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