### Community Acquired Pneumonia Guidelines (Part 1 of 3)

#### Site-of-Care Decisions
- **Determine if patient should be treated inpatient or outpatient**
  - **Outpatient care:** able to take oral medications and have adequate outpatient care
  - **Inpatient care:** based on severity-of-illness scores (e.g., CURB-65 criteria [confusion, uremia, respiratory rate, low blood pressure, 65 years or older]) or prognostic models (e.g., Pneumonia Severity Index [PSI]) and professional judgment
- Patients with CURB-65 score ≥2 require hospitalization or aggressive outpatient care
- If inpatient treatment required, determine if patient should be admitted to ICU or general ward
  - **ICU admission required:** septic shock necessitating vasopressors, or acute respiratory failure requiring intubation and mechanical ventilation
  - **ICU admission recommended:** 1 major criteria or 3 minor criteria are present

#### Severe CAP Criteria

<table>
<thead>
<tr>
<th>Minor Criteria:</th>
<th>Major Criteria:</th>
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<tbody>
<tr>
<td>- Hypothermia (&lt;36°C)</td>
<td>- Invasive mechanical ventilation</td>
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<tr>
<td>- PaO₂/FiO₂ ratio ≤250</td>
<td>- Septic shock requiring vasopressors</td>
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<tr>
<td>- Leukopenia (WBC &lt;4000 cells/mm³)</td>
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<td>- Multilobar infiltrates</td>
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<td>- Confusion/disorientation</td>
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<td>- Respiratory rate ≥30 breaths/min</td>
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<td>- Uremia (BUN ≥20mg/dL)</td>
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<tr>
<td>- Thrombocytopenia (platelets &lt;100000 cells/mm³)</td>
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<tr>
<td>- Hypotension requiring aggressive fluid resuscitation</td>
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<tr>
<td>- Other considerations: hypoglycemia, acute alcoholism/alcoholic withdrawal, hyponatremia, unexplained metabolic acidosis, elevated lactate, cirrhosis, asplenia</td>
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#### Diagnostic Tests
- **Physical exam:**
  - Crackles or rales, bronchial breath sounds, hypoxemia, tachypnic
  - Signs/symptoms of cough, fever, sputum production, pleuritic chest pain
- **Chest radiograph:**
  - Observe apparent lobar or bilateral infiltrates with or without microbiological evidence
  - Hospitalized for suspected pneumonia but negative chest radiograph: may receive empiric antibiotics with repeat chest radiograph 24–48 hrs later
- **Lab tests:**
  - Pretreatment blood culture and/or expectorated sputum samples for culture and gram stain should be taken if: ICU admission, outpatient antibiotic therapy failure, cavitary infiltrates, leukopenia, active alcohol abuse, chronic severe liver and lung disease, asplenia, positive Legionella or pneumococcal UAT result, pleural effusion; optional for other indications
  - Tests mentioned above are optional in patients without these conditions
- **Pulse oximetry**
- **Severe CAP:** should obtain blood culture, expectorated sputum culture, urinary antigen tests for Legionella pneumophila and S. pneumoniae; endotracheal aspirate sample for intubated patients
- **Nonresponsive to antibiotics:** chest CT, thoracentesis, bronchoscopy with BAL and transbronchial biopsies to rule out other reasons for antibiotic failure
- Diagnostic tests to determine etiology are optional for outpatients

#### Outpatient Empirical Treatment

<table>
<thead>
<tr>
<th>Previously healthy with no risk factors for drug-resistant S. pneumoniae (DRSP) infection or no use of antimicrobials within previous 3 months</th>
<th>Macrolide:</th>
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<tbody>
<tr>
<td>Macrolide:</td>
<td>azithromycin, clarithromycin, or erythromycin</td>
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<tr>
<td>Alternative:</td>
<td>doxycycline</td>
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<tr>
<td>Comorbid conditions: Diabetes, chronic heart, lung, liver, or renal disease, alcoholism, malignancies, asplenia, immunosuppressive conditions or drugs, use of antimicrobials in the previous 3 months, or other risks for DRSP infection</td>
<td>Respiratory Fluoroquinolone:</td>
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<tr>
<td>Respiratory Fluoroquinolone:</td>
<td>moxifloxacin, gemifloxacin, or levofloxacin (750mg)</td>
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<td>OR</td>
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<tr>
<td>β-Lactam PLUS Macrolide:</td>
<td>amoxicillin (1g three times daily) or</td>
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<td></td>
<td>amoxicillin/clavulanate (2g twice daily) or</td>
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<td></td>
<td>cefpodoxime, ceftriaxone, or cefuroxime (500mg twice daily) plus</td>
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<tr>
<td></td>
<td>azithromycin, clarithromycin, or erythromycin</td>
</tr>
<tr>
<td>Alternative to the Macrolide:</td>
<td>doxycycline</td>
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<tr>
<th>Regions with high rate (&gt;25%) of macrolide-resistant S. pneumoniae</th>
<th>Consider alternative agents:</th>
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(continued)
### INPATIENT EMPIRICAL TREATMENT

#### Non-ICU

**Recommendations:**  
Respiratory Fluoroquinolone  
OR  
\(\beta\)-Lactam PLUS Macrolide:  
- cefotaxime, ceftriaxone, or ampicillin plus  
- ertapenem (selected patients)  
**Alternative to the Macrolide:** doxycycline  
**\*Penicillin Allergy\***: use Respiratory Fluoroquinolone

#### ICU

**Minimal Recommendations:**  
\(\beta\)-Lactam PLUS Azithromycin OR Fluoroquinolone:  
- cefotaxime, ceftriaxone, ampicillin/sublactam

**\*Penicillin Allergy\***: a Respiratory Fluoroquinolone AND Aztreonam are recommended

#### Additional Recommendations or Modifications:

- If *Pseudomonas* Infection
  - Antipneumococcal Antipseudomonal \(\beta\)-Lactam* PLUS Ciprofloxacin OR Levofloxacin (750mg):  
    - piperacillin-tazobactam, cefepime, imipenem, meropenem  
    *Above \(\beta\)-Lactam PLUS Aminoglycoside AND Azithromycin  
    *Above \(\beta\)-Lactam PLUS Aminoglycoside AND Antipneumococcal Fluoroquinolone

**\*Penicillin Allergy\***: substitute Aztreonam for above \(\beta\)-Lactam

- If Community-Acquired Methicillin-Resistant *S. aureus* (CA-MRSA)
  - Add vancomycin or linezolid

### PATHOGEN SPECIFIC TREATMENT

- **S. pneumoniae** PCN susceptible (MIC <2µg/mL)
  - Preferred: penicillin G, amoxicillin  
  - Alternative: macrolide, cephalosporins (cefodoxime, cefprozil, cefuroxime, cefdinir, ceftriaxone, cefotaxime), clindamycin, doxycycline, respiratory fluoroquinolone

- **S. pneumoniae** PCN resistant (MIC ≥2µg/mL)
  - Preferred: based on susceptibility including cefotaxime, ceftriaxone, fluoroquinolone  
  - Alternative: vancomycin, linezolid, high-dose amoxicillin (3g/day with PCN MIC ≤4µg/mL)

- **H. influenzae** non-\(\beta\)-lactamase producing  
  - Preferred: amoxicillin  
  - Alternative: fluoroquinolone, doxycycline, azithromycin, clarithromycin

- **H. influenzae** \(\beta\)-lactamase producing  
  - Preferred: 2nd or 3rd generation cephalosporin, amoxicillin/clavulanate  
  - Alternative: fluoroquinolone, doxycycline, azithromycin, clarithromycin

- **Legionella species**  
  - Preferred: fluoroquinolone, azithromycin  
  - Alternative: doxycycline

- **Mycoplasma pneumoniae**, **Chlamydia pneumoniae**  
  - Preferred: macrolide, tetracycline  
  - Alternative: fluoroquinolone

- **Influenza A**  
  - Preferred: initiate oseltamivir or zanamivir within 48hrs if influenza A identified. Not recommended if uncomplicated influenza and symptoms ongoing for >48hrs.

- **H5N1 Influenza**  
  - Preferred: oseltamivir 75mg twice daily for 5 days

### OTHER TREATMENTS

- Consider local resistance patterns, previous antibiotic use, and comorbidities when choosing empirical antibiotics

- Administer noninvasive ventilation in cases of hypoxemia or respiratory distress unless immediate intubation necessary due to severe hypoxemia or bilateral alveolar infiltrates

- Low-tidal-volume ventilation (6cm\(^3\)/kg of IBW) for patients with diffuse bilateral pneumonia or acute respiratory distress syndrome

- Screen for occult adrenal insufficiency in hypotensive fluid-restricted patients with severe CAP

### TREATMENT DURATION

- **Admission through Emergency department:** administer 1st antibiotic dose in the ED  
- **Initiate treatment within 6–8hrs of presentation**  
- **Duration:** minimum 5 days of treatment, should be afebrile 48–72hrs, and no more than 1 CAP associated sign of clinical instability before discontinuing therapy

- Longer duration of therapy may be warranted in certain circumstances (eg, initial therapy did not target identified pathogen, extrapulmonary infections such as meningitis or endocarditis)
IV TO ORAL SWITCH

- Switch once hemodynamically stable, notable clinical improvement, normal functioning GI tract, and can ingest oral therapy
- Usually switch to oral form of same antibiotic or same pharmacological class
- Discharge once clinically stable, no other active medical problems, and have a safe environment for continued care as an outpatient
- Criteria for Clinical Stability:
  - Temp \( \leq 37.8^\circ C \)
  - Systolic blood pressure \( \geq 90 \text{mmHg} \)
  - Heart rate \( \leq 100 \text{ beats per min} \)
  - Arterial \( O_2 \) saturation \( \geq 90\% \) or \( pO_2 \) \( \geq 60 \text{mmHg} \)
  - Respiratory rate \( \leq 24 \text{ breaths per min} \)
  - Maintain oral intake and normal mental status

PREVENTION

- Smoking cessation should be advised in hospitalized patients
- Assess vaccination status at time of hospital admission
- Inactivated influenza vaccine recommended for all children 6–23 months and \( \geq 50 \) years of age, high risk persons
  - 6 months–49 years of age, household contacts of high-risk persons, healthcare workers, pregnancy, diabetes, asthma
- Pneumococcal vaccine recommended for persons \( \geq 65 \) years of age, high-risk persons 2–64 years of age, smokers, diabetes, asplenia, alcoholism, chronic cardiovascular, pulmonary, renal, or liver disease
- Offer influenza vaccine administration during discharge or outpatient treatment; vaccines can be given during either time

REFERENCES