

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 (eg, CURB-65 criteria [confusion, uremia, respiratory rate, low blood pressure, 65 years or older]) or prognostic models (eg, 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

Minor Criteria:

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| <ul style="list-style-type: none"> • Hypothermia (<36°C) • PaO₂/FIO₂ ratio ≤ 250 • Leukopenia (WBC <4000 cells/mm³) • Multilobar infiltrates • Confusion/disorientation • Respiratory rate ≥ 30 breaths/min | <ul style="list-style-type: none"> • Uremia (BUN ≥ 20mg/dL) • Thrombocytopenia (platelets <100000 cells/mm³) • Hypotension requiring aggressive fluid resuscitation • Other considerations: hypoglycemia, acute alcoholism/alcoholic withdrawal, hyponatremia, unexplained metabolic acidosis, elevated lactate, cirrhosis, asplenia |
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Major Criteria

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| <ul style="list-style-type: none"> • Invasive mechanical ventilation | <ul style="list-style-type: none"> • Septic shock requiring vasopressors |
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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 24–48hrs 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, cavity 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

<p>Previously healthy with no risk factors for drug-resistant <i>S. pneumoniae</i> (DRSP) infection or no use of antimicrobials within previous 3 months</p>	<p>Macrolide:</p> <ul style="list-style-type: none"> • azithromycin, clarithromycin, or erythromycin <p>Alternative: doxycycline</p>
<p>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</p>	<p>Respiratory Fluoroquinolone:</p> <ul style="list-style-type: none"> • moxifloxacin, gemifloxacin, or levofloxacin (750mg) <p align="center">OR</p> <p>β-Lactam PLUS Macrolide:</p> <ul style="list-style-type: none"> • amoxicillin (1g three times daily) or • amoxicillin/clavulanate (2g twice daily) or • cefepodoxime, ceftriaxone, or cefuroxime (500mg twice daily) plus • azithromycin, clarithromycin, or erythromycin <p>Alternative to the Macrolide: doxycycline</p>
<p>Regions with high rate (>25%) of macrolide-resistant <i>S. pneumoniae</i></p>	<p>Consider alternative agents:</p> <ul style="list-style-type: none"> • eg, β-Lactam or Respiratory Fluoroquinolone

Inpatient Empirical Treatment

Non-ICU

<p>Recommendations:</p>	<p>Respiratory Fluoroquinolone</p> <p align="center">OR</p> <p>β-Lactam PLUS Macrolide:</p> <ul style="list-style-type: none"> • cefotaxime, ceftriaxone, or ampicillin plus • ertapenem (selected patients) <p>Alternative to the Macrolide: doxycycline</p> <p>**Penicillin Allergy**: use Respiratory Fluoroquinolone</p>
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Inpatient Empirical Treatment (continued)**ICU**

Minimal Recommendations:	β-Lactam PLUS Azithromycin OR Fluoroquinolone: • cefotaxime, ceftriaxone, ampicillin/sulbactam **Penicillin Allergy**: a Respiratory Fluoroquinolone AND Aztreonam are recommended
Additional Recommendations or Modifications: If <i>Pseudomonas</i> Infection	Antipseudomoccal Antipseudomonal β-Lactam* PLUS Ciprofloxacin OR Levofloxacin (750mg): • piperacillin-tazobactam, ceftepime, imipenem, meropenem OR *Above β-Lactam PLUS Aminoglycoside AND Azithromycin OR *Above β-Lactam PLUS Aminoglycoside AND Antipseudomoccal Fluoroquinolone **Penicillin Allergy**: substitute Aztreonam for above β -Lactam
If Community-Acquired Methicillin-Resistant <i>S. aureus</i> (CA-MRSA)	Add vancomycin or linezolid

Pathogen Specific Treatment

<i>S. pneumoniae</i> PCN susceptible (MIC <2 μ g/mL)	Preferred: penicillin G, amoxicillin Alternative: macrolide, cephalosporins (cefepodoxime, ceftazidime, cefuroxime, cefdinir, cefditoren, ceftriaxone, cefotaxime), clindamycin, doxycycline, respiratory fluoroquinolone
<i>S. pneumoniae</i> PCN resistant (MIC \geq 2 μ g/mL)	Preferred: based on susceptibility including cefotaxime, ceftriaxone, fluoroquinolone Alternative: vancomycin, linezolid, high-dose amoxicillin (3g/day with PCN MIC \leq 4 μ g/mL)
<i>H. influenzae</i> non- β -lactamase producing	Preferred: amoxicillin Alternative: fluoroquinolone, doxycycline, azithromycin, clarithromycin
<i>H. influenzae</i> β -lactamase producing	Preferred: 2nd or 3rd generation cephalosporin, amoxicillin/clavulanate Alternative: fluoroquinolone, doxycycline, azithromycin, clarithromycin
<i>Legionella</i> species	Preferred: fluoroquinolone, azithromycin Alternative: doxycycline
<i>Mycoplasma pneumoniae</i> , <i>Chlamydia pneumoniae</i>	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 (6cm³/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°C
 - Heart rate \leq 100 beats per min
 - Respiratory rate \leq 24 breaths per min
 - Systolic blood pressure \geq 90mmHg
 - Arterial O₂ saturation \geq 90% or pO₂ \geq 60mmHg
 - 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
- Intranasal live influenza vaccine recommended for persons 5–49 years of age without chronic diseases (eg, asthma, immunodeficiency, chronic medical conditions)
- 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

Mandell LA, Wunderink RG, Anzueto A, et al. Infectious Disease Society of America/American Thoracic Society Consensus Guidelines on the Management of Community-Acquired Pneumonia in Adults. *IDSA/ATS*. 2007; 44 Suppl 2: S27–S63.

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