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Community Acquired Pneumonia in Adults

Clinical Practice Guideline
Antibiotic Stewardship

These guidelines are provided to assist physicians and other clinicians in making decisions regarding the care of their patients. They are not a substitute for individual judgment brought to each clinical situation by the patient's primary care provider-in collaboration with the patient. As with all clinical reference resources, they reflect the best understanding of the science of medicine at the time of publication, but should be used with the clear understanding that continued research may result in new knowledge and recommendations.

Introduction: Community Acquired Pneumonia (CAP) remains one of the leading causes of death in the United States. According to one estimate, almost 1 million episodes of CAP occur in adults age 65 and older each year in the United States. There is considerable variability in rates of hospitalization, in part because there are several different severity rating tools available for determining which patients should be treated in the hospital or treated as outpatients. Physicians often overestimate severity and hospitalize a significant number of patients at low risk for death. Points where evaluation and management differ for HIV-infected patients are noted in this document.

I. Initial Presentation

A. Patient may present with the following signs and symptoms below:

• Cough with or without sputum	• Cough with or without sputum	• Hemoptysis
• Gastrointestinal symptoms	• Pleuritic chest pain	• Myalgias
• Rales, rhonchi, wheezing	• Dyspnea	• Malaise, fatigue
• Temperature > 38°C (100.4°F)	• Egophony, bronchial breath sounds, dullness to percussion	• Atypical symptoms in older patients (confusion, delirium)

B. Chest X-ray is necessary to confirm the diagnosis. In older patients and individuals with co-existing illness the x-ray can help exclude other diseases that can mimic pneumonia i.e. CHF, bronchial obstruction, or suggest other specific diagnoses i.e. lung tumors or pleural effusions or assess severity of illness by locating infiltrates in more than one lobe.

A negative chest X-ray does not completely rule out pneumonia. False negative chest xrays may be seen in very early pneumonia, neutropenia, dehydration or *Pneumocystis Jirovecii* Pneumonia.

Routine follow up chest x- ray is not recommended on every patient. However, follow-up chest x-rays are indicated in selected patients, i.e. > 50 years of age and/or smokers.

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The recommended time interval for follow up chest x-ray is between 7-12 weeks since radiographic abnormalities clear more slowly than clinical manifestations.

II. Risk factors associated with a possible complicated course of CAP

A. Coexisting illness/conditions:

• Age >60 years	• Use of antibiotics within past 3 months	• Malnutrition
• COPD	• Suspicion of aspiration	• Immunosuppression/HIV
• Diabetes Mellitus	• Altered mental status	• Asplenia
• Chronic renal failure, liver disease and/or heart disease	• Hospitalization within the past year for CAP	• Malignancies

B. Indicators of severe CAP on presentation:

• Respiratory rate 30/min or greater	• Temperature < 36^{o}C (96.8^{o}F)
• Diastolic blood pressure < 60 mmHg	• Confusion/disorientation
• Systolic blood pressure < 90 mmHg	

C. Chest x-ray findings:

• Multilobar infiltrates	• Pleural effusions
• Cavitation	• Necrosis

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III. Severity of Illness Scoring and Prognostic Models

Every patient should be assessed for admission versus outpatient treatment using a severity scale. The two most commonly used are the Pneumonia Severity Index (PSI) and the CURB-65. The PSI has been more widely studied and validated but is more cumbersome than the CURB-65.

A. Pneumonia Severity Index (PSI)

This is a prediction model that assigns points based on age, coexisting disease and initial presentation. The PSI risk class, which correlates directly with mortality rate, ranges from I to V. Risk class I has the lowest mortality rate while risk class V has the highest mortality rate. The PSI risk class determination is a two step process. The first step is to determine if the patient is in risk category I. This is based solely on the history and physical examination. If the patient is <50 years of age, has no history of co-morbidity and the physical exam reveals normal mental status, pulse <125, RR<30, SBP>90 and temperature >35°C but ≤ 40°C, then the patient is risk category I and no further workup is required. If the patient is not a risk category I, the next step utilizes blood tests (chemistry and ABG) and a CXR. These results determine which risk category (II-V) the patient is placed. Utilizing the mortality rates, risk class I and II can generally be treated as outpatients, risk class III can be treated with a short hospitalization, and risk class IV and V require hospitalization.
Note that the PSI scoring system has not been formally validated for HIV-infected patients and does not include specific variables related to HIV infection (such as CD4 count). Studies that have utilized the PSI score in HIV patients have shown its utility, particularly in patients with high CD4 counts. However, up to 20% of HIV- infected patients have bacteremic disease despite low PSI scores.

PSI Scoring System

Demographic Factor	**Score**
Age: Men	Age in years
Women	Age –10
Nursing Home Resident	Age + 10
Coexisting Illnesses	
Neoplastic disease	+30
Liver Disease	+20
Congestive heart failure	+10
Cerebrovascular Disease	+10
Renal Disease	+10
Physical Examination Findings	
Altered Mental Status	+20
Respiratory Rate >30	+20
Systolic Blood Pressure <90 mmHg	+20
Temperature < 35 or > 40° C	+15
Pulse > 125/min	+10
Laboratory and Radiographic Findings	
Arterial pH < 7.35	+30
BUN > 30 mg/dl	+20

Sodium <130 mEq/L	+20
Glucose >250 mg/dl	+10
Hematocrit < 30%	+10
Partial pressure of arterial oxygen < 60mmHg	+10
Pleural effusion	+10
TOTAL SCORE	

Treatment setting decision based on PSI score

Patient Score	Class	Treatment Setting
Age < 50y, no coexisting illness, negative physical exam findings.	Class I	Outpatient
51- 70	Class II	Outpatient
71-90	Class III	Overnight admission
91-130	Class IV	Hospital Unit
>130	Class V	ICU

Fine MJ et al. *Prediction Rule to Identify Low-Risk Patients with Community-Acquired Pneumonia.* N Engl. J. Med., 1997; 336 (4): 243-247.)

B. CURB-65 Score

One point is assigned for the presence of each of the following:

*C*onfusion
*U*remia (BUN greater than 20 mg/dL)
*R*espiratory rate ≥30 breaths/minute
*B*lood pressure (systolic < 90 or diastolic ≤60 mmHg)
Age greater than or equal to *65*

Treatment setting decision based on CURB-65 score

CURB-65 Score	Treatment Setting
0-1	**Outpatient**
2	**Inpatient**
3-5	**Inpatient-ICU**

C. Note that scoring systems are not intended to replace clinical judgment.
Certain patients with low PSI or CURB-65 scores may require hospitalization, whereas other patients with high PSI scores due to advanced age and multiple stable chronic illnesses may be managed successfully as outpatients in some instances. Other

considerations not taken into account by this guideline may influence a clinician's decision to admit a patient.

D. HIV-infected patients, particularly those with advanced disease (CD4 count less than 200 cells/mm^3) typically require blood cultures to rule out bacteremia as well as sputum and urinary antigen testing. If these tests cannot be performed as an outpatient, the patient may need admission.

IV. Primary Pathogens

A. Common etiologies of outpatient CAP include: *Streptococcus pneumoniae, Mycoplasma pneumoniae, Haemophilus influenza, Chlamydophila* (formerly *Chlamydia) pneumoniae,* and respiratory viruses (Influenza A and B, adenovirus, respiratory syncytial virus, and parainfluenza).

B. "Atypical" organisms, so called because they are not detectable on Gram stain or culturable on standard bacteriologic media, include *Mycoplasma pneumoniae*, *Chlamydophila pneumoniae*, *Legionella pneumophila*, and respiratory viruses. With the exception of Legionella, these are common causes of CAP.

C. Epidemiologic conditions and risk factors related to specific pathogens in community acquired pneumonia are listed in the table below. Note that empiric therapy for CAP does not necessarily cover all of these organisms and further work-up may be necessary.

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CAP pathogens associated with certain conditions

Condition	Commonly encountered pathogens
Alcoholism	*Streptococcus pneumoniae,* oral anaerobes, *Klebsiella pneumoniae, Acinetobacter* species, *Mycobacterium*
COPD and/or smoking	*Haemophilus influenzae, Pseudomonas aeruginosa, Legionella* species, *S. pneumoniae, Moraxella cararrhalis, Chlamydophila pneumoniae*
Aspiration*	Gram-negative enteric pathogens, oral anaerobes
Lung abscess	CA-MRSA, oral anaerobes, endemic fungal pneumonia, *M. tuberculosis*, atypical mycobacteria
Exposure to bat or bird droppings	*Histoplasma capsulatum*
Exposure to birds	*Chlamydophila psittaci* (if poultry: avian influenza)
Exposure to rabbits	*Francisella tularensis*
Exposure to farm animals or parturient cats	*Coxiella burnetti* (Q fever)
HIV infection (early)	*S. pneumoniae, H. influenzae, M. tuberculosis*
HIV infection (late)	*S. pneumoniae, H. influenzae, M. tuberculosis, Pneumocystis jirovecii, Cryptococcus, Histoplasma, Aspergillus,* atypical mycobacteria (especially *Mycobacterium kansasii*), *P. aeruginosa*
Hotel or cruise ship stay in previous 2 weeks	*Legionella* species
Travel to or residence in southwestern United States	*Coccidioides* species, *Hantavirus*
Travel to or residence in Southeast and East Asia	*Burkholderia pseudomallei,* avian influenza, SARS
Travel to or residence in the Middle East	*MERS-CoV*
Influenza active in community	Influenza, *S. pneumoniae, Staphylococcus aureus, H. influenzae*
Cough 12 weeks with whoop or posttussive vomiting	*Bordetella pertussis*
Structural lung disease (e.g., bronchiectasis)	*Pseudomonas aeruginosa, Burkholderia cepacia, S. aureus*
Injection drug use	*S. aureus*, anaerobes, *M. tuberculosis, S. pneumoniae*
Endobronchial obstruction	Anaerobes, *S. pneumoniae, H. influenzae, S. aureus*
In context of bioterrorism	*Bacillus anthracis* (anthrax), *Yersinia pestis* (plague), *Francisella tularensis* (tularemia)

**Anaerobic coverage is clearly indicated only in the classic aspiration pleuropulmonary syndrome in patients with a history of loss of consciousness as a result of alcohol/drug overdose or after seizures in patients with concomitant gingival disease or esophogeal motility disorders*

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D. Drug-resistant *S. pneumoniae* (DRSP)

1. Risk factors for infection with b-lactam–resistant *S. pneumoniae* include age less than 2 years or greater than 65 years, beta-lactam therapy within the previous 3 months, alcoholism, multiple comorbidities, immunosuppressive illness or therapy, and exposure to a child in a day care center.

2. Recent treatment with antimicrobials is likely the most significant risk factor. Recent therapy or repeated courses of therapy with beta-lactams, macrolides, or fluoroquinolones are risk factors for pneumococcal resistance to the same class of antibiotic.

V. Management Course

A. Chest X-ray (CXR) should be performed to confirm diagnosis of CAP.

1. See CXR findings section II.C. above
2. Rule-out *Pneumocystis jiroveci pneumonia* (formerly known as *Pneumocystis carinii pneumonia* (PCP)) in HIV patients (CD4 count less than or equal to 200 cells/mm^3) with absence of infiltrate on CXR, non-productive cough, and high clinical suspicion of pneumonia.

B. Patients should be screened by pulse oximetry to rule out unsuspected hypoxemia.

C. Routine diagnostic tests to identify an etiologic diagnosis (i.e. sputum culture) are usually not indicated for outpatients with CAP as most patients respond well to empiric therapy.

D. Clinical indications for more extensive diagnostic testing are listed below.

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Clinical indications for additional diagnostic testing for CAP

Indication	Blood Culture	Sputum Culture	Legionella Urinary Antigen Test	Pneumococcal Urinary Antigen Test	Multiplex PCR (limited by cost and availability)	Other
Failure of outpatient antibiotic therapy		☆	☆	☆	☆	
Cavitary infiltrates	☆	☆				Fungal & Tuberculosis cultures
Leukopenia	☆			☆	☆	
Active alcohol abuse	☆	☆	☆	☆	☆	
Severe chronic liver disease	☆			☆	☆	
Asplenia (functional or anatomic)	☆			☆	☆	
Recent travel (within past 2 weeks)			☆		☆	Common respiratory pathogens in area of
Pleural effusion	☆	☆	☆	☆		Thoracentesis and pleural fluid cultures
Severe structural lung disease		☆			☆	Common respiratory pathogens in area of travel

E. HIV patients experience a high proportion (up to 20%) of bacteremic forms of pneumococcal pneumonia, therefore urine pneumococcal antigen test should be performed in all HIV patients with CAP (this is consistent with recommendations for leukopenic patients in above table).

F. Rule out pulmonary tuberculosis (TB) in HIV patients (any CD4 count) presenting with acough> 2 wks, fever, night sweats, weight loss, hemoptysis, shortness of breath, chest pain; consult infectious disease physician

G. Blood cultures are indicated for patients with severe CAP.

H. Procalcitonin levels may be a useful adjunct in distinguishing viral infection from bacterial, leading to reduced antibiotic use without an increase in treatment failure or mortality.

VI. Drug Therapy:

The prevalence of macrolide resistance in the United States is high enough that macrolides cannot be recommended as empiric mono-therapy for uncomplicated CAP. For patients in whom doxycyline is contraindicated (pregnancy, allergy), agents recommended for patients with co-morbidities or risk factors for drug resistant strep pneumo should be used.

A. Recommended antibiotics in previously healthy outpatients (including HIV patients with CD4 count greater than 200cells/mm3):

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Outpatient empiric drug therapy for uncomplicated CAP

Cl	Agent	Dosing
Tetracycline	doxycycline	100 mg PO twice daily x 7-10 days ($33-120 based on supply and formulation)

B. Recommended antibiotics for patients with the presence of co-morbidities such as chronic heart, lung, liver, or renal disease; diabetes mellitus; alcoholism; malignancies; asplenia; immunosuppressing conditions** (including HIV with CD4 count less than or equal to 200 cells/mm^3) or use of immunosuppressant drugs;** use of antimicrobials within the previous 3 months[§]; or other risks for DRSP infection.

Drug therapy for CAP patients with comorbidities or risk factors for DRSP

Cl	Agent	Dosing
Respiratory fluoroquinolone	Moxifloxacin Levofloxacin	400 mg PO once daily x 5 days ($190) 750 mg PO once daily x 5 days ($180)
Beta-lactam **plus** macrolide[≠**]	*Preferred:* Amoxicillin (high dose), or Amoxicillin-clavulanate (high dose) or *Alternatives:* Cefpodoxime or Cefuroxime **PLUS** Azithromycin, or Clarithromycin	 1 g PO three times daily x 7-10 days ($21-30) 1000/62.5mg: 2 tabs PO twice daily x 7-10 days ($187-268) 200 mg PO twice daily x 14 days[±] ($236) 500 mg PO twice daily x 7-10 days[±] ($112-$160) 500 mg PO once daily x1day, then 250mg once daily x 4 days ($47) 500 mg PO twice daily x 7 days ($32) OR 1 g (extended-release) PO daily x 7 days ($70)

§ Use agent from a different class than previous antibiotic

*** Rule out PCP in immunosuppressed patients, consult infectious disease physician*

± Shorter course of 5-10 days acceptable if patient afebrile for 48 hours on treatment

≠ Doxycycline may be used as alternative to macrolide; dosing and duration as in previous table

Fluoroquinolone Warnings/ Precautions:

Fluoroquinolone use may cause peripheral neuropathy or QT prolongation. Risk factors include advanced age, hypokalemia, hypomagnesemia, clinically significant bradycardia, and the use of other agents that prolong the QT interval. Tendon inflammation and/or rupture have also been reported. Risk may be increased with concurrent corticosteroids, organ transplant recipients, and in patients >60 years if age. In patients with myasthenia gravis, use may exacerbate muscle weakness. Patients should promptly report any symptoms. The drug should be discontinued.

***Macrolides can cause QT prolongation. Risk factors include advanced age, hypokalemia, hypomagnesemia, clinically significant bradycardia, and the use of other agents that prolong the QT interval.*

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VII. Duration of treatment:

A. Most patients with CAP have traditionally been treated for 7-10 days or longer. However, there are very few well-controlled studies that have evaluated the optimal duration of therapy.
B. Patients should be treated for a minimum of 5 days, should be afebrile for 48 hours, and have no more than 1 CAP-associated sign of clinical instability before discontinuation of therapy.

VIII. Patient Education:

Patient information can be obtained through the Clinical Reference System:

Adult Health Advisor, Pneumonia or via Medline Health topics a
http://www.nlm.nih.gov/medlineplus/pneumonia.html

Please review below information with your patients.

1. Bacterial pneumonia is treated with antibiotics.
2. Most cases of pneumonia can be treated without hospitalization.
3. The need for hospitalization depends on:
   The extent of the illness
   Whether you live alone and how well you can take care of yourself
   How old you are
   Whether you live in a nursing home and what health care is available there
   Whether pneumonia is a complication of another disease.
4. Pneumonia isn't usually contagious and can normally be cured in 1 or 2 weeks with treatment. Recovery may take longer for adults over age 60, and people with other illnesses. Your body helps to fight the infection in addition to antibiotics.
5. Patients should follow these self-care treatment guidelines:
   Rest in bed until fever disappears and pain and shortness of breath decrease
   Increase the amount of water, tea, or fruit juice you drink to about 2 to 3 quarts each day. The extra fluid will help you cough up lung secretions more easily.
   Cough up lung secretions as much as possible
   Use a cool-mist humidifier to increase moisture in the air
   Use cough medicine only if your cough is dry and the doctor agrees
   Use a heating pad on a low setting to reduce chest pain
   Use over-the-counter drugs such as acetaminophen (Tylenol®) to relieve minor discomfort
6. **Offer Influenza (October-March) and Pneumococcal vaccinations to at-risk patients. Encourage patients meeting criteria to obtain annual influenza vaccination.**
7. Call physician if:

• Symptoms do not improve in 72 hours	• Coughing up blood	• Become mentally confused
• Chest pain is not relieved by heat or prescribed medication	• Beginning to be nauseous, vomit, or have diarrhea	• Skin, fingernails, or toenails turning blue
• Temperature > than 102° F (39° C)	• Shortness of breath increases	• Any new symptoms appear

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VII. References

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Outpatient Management of Patients with Community Acquired Pneumonia Guideline initiated 1996. Clinical Guidelines are reviewed every two years by a committee of experts in the field. Updates to guidelines occur more frequently as needed when new scientific evidence or national standards are published.