

**Clinical Practice Guideline
for the**

**Treatment of Community-Acquired
Pneumonia in Adults**

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Limitations

This document is a guideline. The synthesis of the enclosed recommendation is not meant to replace any practices based on personal training, clinical judgment, experience or specific aspects of individual patient situations.

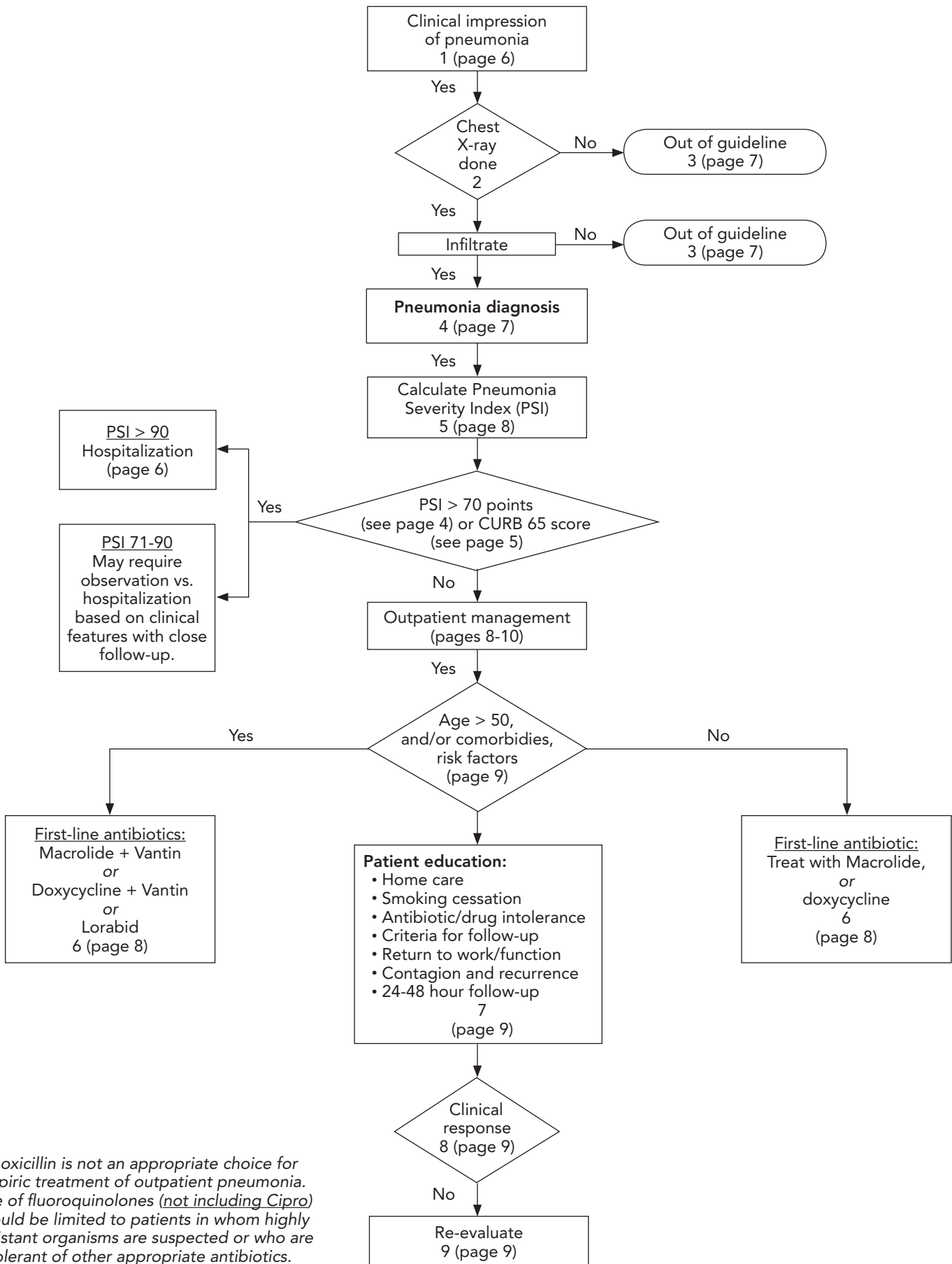
Goals

- Improve the assessment of the need for hospitalization for patients with community-acquired pneumonia (CAP).
- Improve the appropriate selection of antibiotics for patients with CAP based on risk factors.
- Increase the appropriate use of chest X-ray to improve the accuracy of diagnosis of CAP.

Timetable

CPGC proposed panel formation:	April 1992
Original guideline disseminated:	December 1993
First revision:	January 2001
Second revision:	November 2004
Third revision:	August 2008

Algorithm 1: Treatment of Community-Acquired Pneumonia



Amoxicillin is not an appropriate choice for empiric treatment of outpatient pneumonia. Use of fluoroquinolones (not including Cipro) should be limited to patients in whom highly resistant organisms are suspected or who are intolerant of other appropriate antibiotics.

Table 1: Pneumonia Severity Risk Index (PSI) Assessment

The Pneumonia Severity Index (PSI) can identify low-risk patients for outpatient and/or observational treatment.

<p>Demographic factors Age: Males Females Admitted from Nursing Home</p> <p>Comorbid illness Neoplastic disease Congestive heart failure Cerebrovascular disease Renal disease Liver disease</p> <p>Physical examination findings Resp rate (≥ 30/min) Systolic BP (< 90mm HG) Altered mental status Temp ($\leq 95^\circ\text{F}$ (35°C) or $\geq 104^\circ\text{F}$ (40°C)) Pulse (> 125/min)</p> <p>If > 50 and has any comorbid illness/ PE findings, complete following: Laboratory findings: pH (< 7.35) BUN (≥ 30 mg/dL) Sodium (≤ 130 mEq/L) Glucose (≥ 250mg/dL) Hematocrit ($< 30\%$) PO₂ (< 60mmHg) Pleural effusion</p>	Age (years)	_____
	Age (years) –10 (+10)	_____
	<i>Subtotal</i>	<input type="text"/>
	(+30)	_____
	(+20)	_____
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<i>Subtotal</i>	<input type="text"/>	

PSI total score: _____

Assigned patient risk class: _____

Risk Class	PSI Score	Considered Treatment Options	Pneumonia PORT Mortality Rate
I	No score	Empiric outpatient Rx	0.1 %
II	≤ 70	Empiric outpatient Rx	0.6 %
III	71-90	23-hr observation	0.9 %
IV	91-130	Inpatient admission	9.3* %
V	> 130	Inpatient admission	27* %

* See "Calculate Pneumonia Severity Index (PSI)," page 8.

Table 2: CURB-65 and CRB-65 Severity Scores for CAP

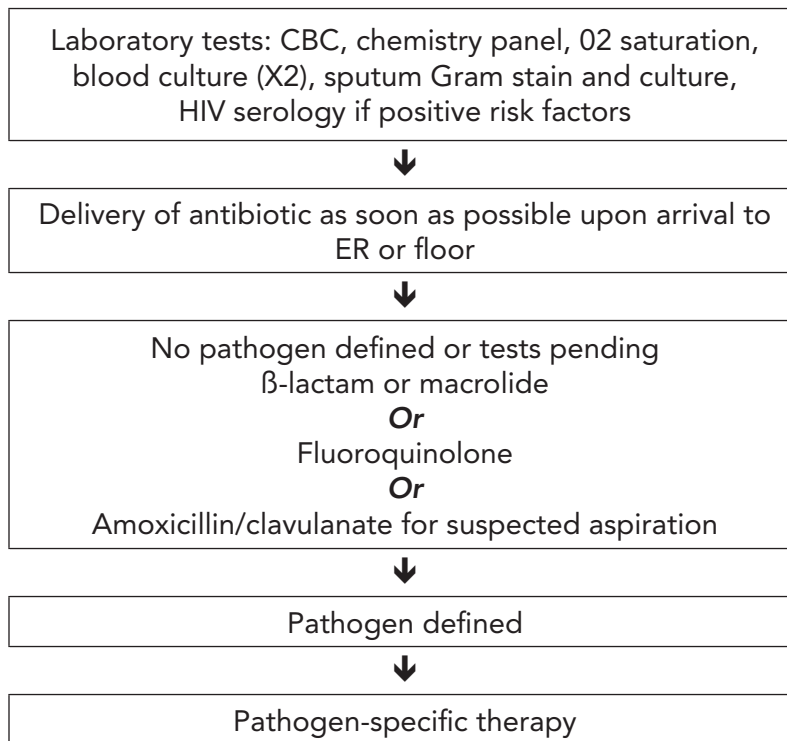
The CURB-65 score is an algorithm based on five easily measurable factors from which its name is derived (Confusion, Urea >20 mg/dl, Respiratory rate > 30, Blood pressure systolic < 90 and diastolic < 60 and Age > 65).

Clinical factor	Points
Confusion	1
Blood urea nitrogen > 19 mg per dL	1
Respiratory rate \geq 30 breaths per minute	1
Systolic blood pressure < 90 mm Hg or Diastolic blood pressure \leq 60 mm Hg	1
Age \geq 65 years	1
Total points:	

CURB-65 score	Mortality (%)	Recommendation
0	0.6	Low risk; consider home treatment
1	2.7	
2	6.8	Short inpatient hospitalization or closely supervised outpatient treatment
3	14.0	Severe pneumonia; hospitalize and consider admitting to intensive care
4 or 5	27.8	

CRB-65 score	Mortality (%)	Recommendation
0	0.9	Very low risk of death; usually does not require hospitalization
1	5.2	Increased risk of death; consider hospitalization
2	12.0	
3 or 4	31.2	High risk of death; urgent hospitalization

Algorithm 2: Treatment of CAP in the Hospitalized Patient



General medical ward

Generally preferred antibiotics:

- A. Extended-spectrum cephalosporin combined with a macrolide
- B. β -lactam/ β -lactamase inhibitor combined with a macrolide
- C. Fluoroquinolone (alone)

Intensive care unit

- Generally preferred: an extended-spectrum cephalosporin or β -lactam/ β -lactamase inhibitor plus either fluoroquinolone or macrolide
- Structural lung disease: antipseudomonal agents plus a fluoroquinolone
- β -lactam allergy: fluoroquinolone \pm clindamycin.
- Suspected aspiration: fluoroquinolone with or without clindamycin, metronidazole or a β -lactam/ β -lactamase inhibitor

Algorithm 1 annotations

1) Clinical impression of pneumonia

An urgent visit should be scheduled if patient presents with two or more of the following symptoms of lower respiratory tract infection:

- Rigors*
- Pleuritic chest pain*
- Shortness of breath*
- Chest tightness*
- Deep cough
- Sputum production
- Fever over 100°F or lasting more than 72 hours
- Night sweats
- Wheezing

* Consider emergency visit.

2) Obtain chest X-ray

A chest X-ray (CXR) is necessary in confirming the diagnosis of pneumonia. A CXR is required for the routine evaluation of patients who are likely to have pneumonia. It is also helpful in assessing prognosis. Because of bacterial resistance and the need to avoid unnecessary use of antibiotics, it is important to confirm a diagnosis wherever possible. At a minimum, it is prudent to obtain a CXR in patients over 40 years old, patients with COPD, asthma and other comorbid illnesses, and in smokers. Unnecessary X-rays can be avoided by using clinical findings to guide the decision for a CXR in patients with suspected lower respiratory tract infection.

The absence of any vital sign abnormalities makes a diagnosis of pneumonia less likely and suggests that a CXR is not necessary. It may be prudent to consider a CXR in patients over age 40, in patients with COPD, asthma and other comorbid illnesses, and in smokers.

There may be circumstances in which a CXR is not obtained, but a presumptive diagnosis of pneumonia is made based on clinical judgment. In this instance, the recommendations following "Pneumonia diagnosis" (Algorithm Annotations #4) still apply.

3) Comorbidities or clinical status suggest treatment of lower respiratory tract infection (LRTI)

If the CXR reveals no infiltrate or is not obtained, other etiologies for symptoms should be considered as well. If clinical features suggest respiratory infection, then treatment of LRTI should be considered. Although no combination of clinical findings clearly establishes a diagnosis of pneumonia or LRTI, the following signs may suggest the presence of a significant LRTI requiring treatment:

- Temperature > 100°F (37.8°C)
- Pulse > 100
- Decreased breath sounds
- Rales
- Respiratory rate > 20

If there are signs of acute bacterial infection such as fever, treatment may be warranted for patients who:

- Have chronic obstructive pulmonary disease (COPD)
- Are immunosuppressed
- Are asthmatic
- Are elderly
- Are smokers
- Have illness of suspected nosocomial origin
- Have acute exacerbation of chronic bronchitis

4) Pneumonia diagnosis

Sputum for Gram stain and culture is optional. Certain epidemiological factors are associated with unusual organisms not effectively treated with the antibiotics recommended in this guideline. CBC with differential and blood cultures should be obtained. Sputum for Gram stain and culture should be considered with a productive cough based on clinical status, age, and comorbid factors (see note below). Immigrants from areas endemic for tuberculosis should be evaluated for that possible agent.

Note: The utility of the Gram stain and culture will depend upon the ability of the medical facility to obtain a deep cough specimen, transport it to the lab promptly and have it properly processed within 1-2 hours of collection. After that period of time, yield of various microbial agents (including *Streptococcus pneumoniae*) decreases. The interpretation of the Gram stain will also depend on the experience of the person reading the stain. Minimum criteria for acceptance of a sputum specimen should be set by the lab (usually < 25 epithelial cells/hpf and > 10 PMN's/hpf).

5) Calculate Pneumonia Severity Index (PSI)

PSI is a clinical tool that is validated for use to assess morbidity and mortality. There is a prediction rule that can help the clinician identify patients with CAP who are at low risk for morbidity and mortality, and who may be candidates for outpatient treatment.

Patients with PSI scores of ≤ 91 total points are at significant increased risk for morbidity and mortality such that inpatient therapy should be considered. See Algorithm 2, page 6.

Patients with a PSI score of < 91 (Class I through III) are at low risk for morbidity and mortality; many of these patients may be candidates for outpatient treatment. However, the clinician is cautioned that other factors should be considered prior to the decision to use outpatient treatment: physician judgment, ability to maintain oral intake, history of substance abuse, cognitive impairment, ability to carry out activities of daily living, patient preference.

Patients who are deemed unsuitable for outpatient management could be considered for management with:

- Short stay observation hospitalization (< 24 hours), especially if PSI > 71
- Traditional inpatient care
- IV antibiotics through office or infusion center

If a pleural effusion is present on the initial CXR, then a lateral decubitus film should be considered to determine the amount of the effusion. Pleural effusions in patients with CAP should be followed. Thoracentesis should be considered if clinically indicated, especially when the effusion layers out to more than 2 cm on a lateral decubitus film.

6) Antibiotics

In otherwise healthy patients with no infiltrate and few of the signs indicative of pneumonia, antibiotic treatment for acute bronchitis is not indicated because most cases of bronchitis in healthy adults are of viral origin.

Doxycycline remains an appropriate first-line choice due to its effectiveness for atypical agents, as well as its enhanced activity against *S. pneumoniae*.

Amoxicillin is not an appropriate choice for empiric treatment of outpatient pneumonia.

< 50 years of age: Macrolide (erythromycin) or doxycycline is the drug of choice for expected pathogens in patients who are < 50 years of age and have no comorbidities or any of the physical exam findings listed in the algorithm, except in the cases of GI intolerance. For those patients, another macrolide, such as azithromycin or clarithromycin, is recommended. A full 14-day treatment course is recommended; azithromycin, however, can be used for a shorter course of therapy because of its very long half-life.

> 50 years of age or comorbidities: Combination treatment is recommended (see Algorithm 1, page 3). If high degree of penicillin resistance is suspected, a broad-spectrum fluoroquinolone may be used; it is not necessary to add a macrolide to this agent. **Cipro is not an appropriate choice of fluoroquinolone.** Amoxicillin/clavulanate is a reasonable choice for community-acquired aspiration.

Antibiotic intolerance: A broad-spectrum fluoroquinolone is recommended for patients who do not tolerate any of the first-line drugs. **Cipro is not an appropriate choice of fluoroquinolone.**

7) Patient education

Much of the information can be provided directly by the physician. However, a discussion should be supplemented with written materials.

Key educational messages to patients:

- CAP is caused by a number of different pathogens and is usually treated with antibiotics.
- Although CAP is a potentially serious disease, most episodes can be safely treated at home.
- There are a number of measures that a patient can take to speed recovery and relieve symptoms: diet, fluids, acetaminophen or NSAIDs, and a full course of antibiotics. (Additional over-the-counter medications may provide additional relief, but the most important measure is to take the antibiotics as prescribed.)
- Criteria for follow-up: difficulty breathing, worsening cough, worsening or onset of rigors, fever persisting > 48 hours, medication intolerance.
- Recovery time varies from patient to patient. The provider can help the patient decide when to return to work/function. In general, this is possible 48 hours after fever has subsided and cough has begun to improve. Cough may persist for 8 weeks or so, but there should be a trend towards improvement. It is not uncommon for 2 to 3 months to elapse before the patient returns to his/her previous state of health.
- Secondary prevention: Pneumovax recommendation, tobacco cessation. There is no contraindication for use of Pneumovax immediately after an episode of pneumonia.
- Other important issues of concern to patients, e.g., risk of recurrent pneumonia, severity of recurrence, issues regarding contagion.

8) Follow-up

Criteria for follow-up include:

- Difficulty breathing
- Worsening cough
- Worsening or onset of rigors
- Fever persisting > 48 hours
- Medication intolerance

Common clinical practice is to obtain a follow-up CXR in patients with pneumonia to ensure resolution of the infiltrate, especially in patients who are > 40 years old and/ or smokers. Barring complications, we recommend follow-up CXR at 6-8 weeks; earlier CXR will often fail to show improvement. Patients with multilobar involvement should at least show improvement, if not resolution, by then. A non-resolving infiltrate at 6-8 weeks requires further evaluation. Lung cancer is often suspected with non-resolving infiltrates.

It is suggested that those treated as outpatients should be contacted or examined by the health care team within 24-48 hours after commencing therapy to assess their progress and clinical response.

Lack of clinical improvement should not be a reason to automatically change antibiotics.

9) Re-evaluate

Follow-up office visit for the patient failing to respond to treatment or worsening symptoms. Failure to improve should prompt an investigation. Include a review of:

- Available microbiology
- Obstructive process (i.e., smoking, aspiration)

10) Pneumococcal polysaccharide vaccine

1-2 doses ages 19-64 years; 1 dose \geq 65 years

Medical indications: Chronic pulmonary disease (excluding asthma); chronic cardiovascular diseases; diabetes mellitus; chronic liver diseases, including liver disease as a result of alcohol abuse (e.g., cirrhosis); chronic alcoholism, chronic renal failure, or nephrotic syndrome; functional or anatomic asplenia (e.g., sickle cell disease or splenectomy [if elective splenectomy is planned, vaccinate at least 2 weeks before surgery]); immunosuppressive conditions; and cochlear implants and cerebrospinal fluid leaks. Vaccinate as close to HIV diagnosis as possible.

Other indications: Alaska Natives and certain American Indian populations and residents of nursing homes or other long-term-care facilities.

One-time revaccination after 5 years for persons with chronic renal failure or nephrotic syndrome; functional or anatomic asplenia (e.g., sickle cell disease or splenectomy); or immunosuppressive conditions. For persons aged $>$ 65 years, one-time revaccination if they were vaccinated $>$ 5 years previously and were aged $<$ 65 years at the time of primary vaccination.

Table 1: Pneumonia Antibiotics

	Tetracycline	Macrolides		
Pathogens	Doxycycline (e.g., Vibramycin®)	Erythromycin (e.g., EES®)	Clarithromycin (e.g., Biaxin®)	Azithromycin (e.g., Zithromax®)
<i>Streptococcus pneumoniae</i>	+++	+++	+++	+++
<i>Haemophilus influenzae</i>	++	+	++	+++
<i>Moraxella catarrhalis</i>	++++	+++	++++	++++
<i>Staphylococcus aureus</i> (methicillin sensitive)	++	++	+++	+++
<i>Mycoplasma pneumoniae</i>	+++	+++	+++	+++
<i>Chlamydia pneumoniae</i>	+++	+++	+++	+++
<i>Legionella</i> spp.	+++	+++	+++	+++
Drug characteristics	Doxycycline	Erythromycin	Clarithromycin	Azithromycin
Typical PO dose	100 mg	500 mg	500 mg	500 mg day 1, then 250 mg QD x 4 days
Frequency PO	BID	TID-QID	BID	QD
Typical days therapy PO	7-14	7-14	7-14	5
Typical cost/treatment	\$5.00 (10 days)	\$12.80 (10 days QID)	\$102.20 (10 days)	\$41.20 (Z-pak®)
Tier		1	3	2
Adverse effects	GI distress, photosensitivity, increased BUN	Abdominal cramping, anorexia, diarrhea, nausea, vomiting, hepatic dysfunction	Abnormal taste, headache, abdominal pain/ discomfort, diar- rhea, dyspepsia, nausea	Abdominal pain, diarrhea, nausea, vomiting
+ Poor antimicrobial activity ++ Moderate antimicrobial activity +++ Good antimicrobial activity ++++ Excellent antimicrobial activity				

Table 1: Pneumonia Antibiotics (cont.)

	β-lactams			Fluoroquinolone
Pathogens	Cefuroxime (e.g., Ceftin®)	Cefpodoxime (e.g., Vantin®)	Amoxicillin/ clavulanate (e.g., Augmentin®)	Fluoroquinolone (e.g., Levaquin®)
<i>S. pneumoniae</i>	+++*	+++*	+++*	++++
<i>H. influenzae</i>	+++	+++	++++	++++
<i>M. catarrhalis</i>	++++	++++	++++	++++
<i>S. aureus</i> (methicillin sensitive)	+++	+++	+++	++++
<i>M. pneumoniae</i>	N/A	N/A	N/A	+++
<i>C. pneumoniae</i>	N/A	N/A	N/A	+++
<i>Legionella</i> spp.	N/A	N/A	N/A	+++
Drug characteristics	Cefuroxime	Cefpodoxime	Amoxicillin/ clavulanate	Fluoroquinolone
Typical PO dose	500 mg	200 mg administer with food	875/125 mg	500 mg
Frequency PO	BID	BID	BID	QD
Typical days therapy PO	7-14	14	7-14	7-14
Typical cost/treatment	\$114.80 (10 days)	\$88.40 (10 days)	\$83.00 (10 days)	\$111.50 (10 days)
Tier	3	3	3	3
Adverse effects	Diarrhea, nausea, vomiting	Diarrhea, nausea	Diarrhea, nausea, vomiting, rash, urticaria	Diarrhea, nausea, headache
N/A Not applicable + Poor antimicrobial activity ++ Moderate antimicrobial activity +++ Good antimicrobial activity ++++ Excellent antimicrobial activity * Caution regarding antimicrobial activity against <i>S. pneumoniae</i> with penicillin MIC ≥ 0.12 mg/L.				

References

1. Institute for Clinical Systems Improvement. "Community-Acquired Pneumonia." May 2006. http://www.icsi.org/pneumonia_community-acquired/community-acquired_pneumonia_2.html.
2. Infectious Diseases Society of America/American Thoracic Society. "Consensus Guidelines on the Management of Community-Acquired Pneumonia, 2007."
3. Daneman N, McGeer A, Green K et al. "Macrolide resistance in bacteremic pneumococcal disease: implications for patient management." CID 2006;43:432-8.
4. Department of Health and Human Services, Center for Disease Control and Prevention's Advisory Committee on Immunization Practices, et al. "Recommended Adult Immunization Schedule United States, October 2007-September 2008." <http://www.cdc.gov/vaccines/recs/schedules/adult-schedule.htm>.