

Clinical Practice Guideline for the Diagnosis and Management of **Community-Acquired Pneumonia – Adult**

This clinical practice guideline (CPG) was adapted from the Alberta Medical Association Clinical Practice Guideline for the Diagnosis and Management of Community-Acquired Pneumonia: Adult (February 2002,) The Alberta Clinical Practice Guidelines Program, and other articles as referenced.

Exclusions

- Patients less than 16 years old
- Immunocompromised patients
- Hospital acquired pneumonia (onset after 4 days hospitalization)
- Aspiration pneumonia
- Patients with cystic fibrosis or tuberculosis
- Pregnant women
- Residents of long term care facilities

Definitions

Pneumonia:

Acute infection of the pulmonary parenchyma that is associated with:

At least two of the following symptoms:

Fever, rigors, new cough with or without sputum production or chronic cough with change in colour of sputum, pleuritic chest pain, shortness of breath

AND

Auscultatory findings consistent with pneumonia (localized crackles, bronchial breath sounds)

AND

The presence of a new opacity on chest X-ray²

Community-Acquired Pneumonia (CAP):

Pneumonia that has been acquired in a patient who:

Has not been hospitalized within 14 days prior to onset of symptoms²

OR

Has been hospitalized less than 4 days prior to onset of symptoms

Issues

- Microbiologic diagnosis of CAP has significant limitations and as such, treatment of CAP is usually empiric
- Chest radiography is underutilized in both the diagnosis and follow up of CAP
- The overuse of antibiotics for ill-defined respiratory tract infections has led to the emergence of antibiotic resistant organisms
- Inappropriate choice and delay in administration of antibiotics for the treatment of CAP may lead to increased patient morbidity and mortality

Goals

- To increase the accuracy of the clinical diagnosis of pneumonia
- To optimize the appropriate use of laboratory and diagnostic imaging services
- To optimize the use of antibiotics in the treatment of CAP in adults

Prevention

- Smoking cessation and avoidance of environmental tobacco smoke
- Limit the spread of viral infections (e.g. hand washing)
- Influenza vaccine is recommended annually for high risk patients (see Appendix 1)
- Pneumococcal vaccine is recommended for high risk patients (see Appendix 2)
- Rehabilitation and nutritional programs where appropriate

Etiology

See Tables 1 and 2

Table 1	
Usual Pathogens	
Outpatients	
No comorbid factors	<i>S. pneumoniae</i> <i>M. pneumoniae</i> <i>C. pneumoniae</i>
Smokers, chronic lung disease	<i>S. pneumoniae</i> <i>H. influenzae</i> <i>M. pneumoniae</i> <i>C. pneumoniae</i>
Older patients + comorbid factors	<i>S. pneumoniae</i> <i>H. influenzae</i> <i>S. aureus</i> <i>M. catarrhalis</i> <i>C. pneumoniae</i> <i>enterobacteriaceae</i>
Hospitalized	
Moderate/Severe patients	<i>S. pneumoniae</i> <i>H. influenzae</i> <i>S. aureus</i> <i>Group A streptococci</i> <i>enterobacteriaceae</i> <i>C. pneumoniae</i> <i>legionella spp (rare)</i>

Table 2¹

Clues to the epidemiology and etiology of pneumonia based on the medical history

Feature	Possible Etiologic Agent or Associated Condition
Environmental	
Exposure to contaminated air conditioning, cooling towers; hot tub; recent travel and stay in a hotel; grocery store mist machine; visit to or recent stay in a hospital with drinking water contaminated by <i>L. pneumophila</i>	<i>Legionella pneumophila</i>
Exposure to infected parturient cats, cattle, sheep, goats	<i>Coxiella burnetii</i>
Pneumonia develops after windstorm in an area of endemnicity	<i>Coccidioides immitis</i>
Outbreak of pneumonia in shelter for homeless men or jail	<i>S. pneumoniae</i> , <i>Mycobacterium tuberculosis</i>
Outbreak of pneumonia in military training camp	<i>S. pneumoniae</i> , <i>C. pneumoniae</i> , adenovirus, <i>M. pneumoniae</i>
Outbreak of pneumonia in nursing home	<i>C. pneumoniae</i> , <i>S. pneumoniae</i> , respiratory syncytial virus, influenza A virus
Exposure to contaminated bat caves; excavation in areas of endemnicity	<i>Histoplasma capsulatum</i>
Exposure to turkeys, chickens, ducks, or psittacine birds	<i>Chlamydia psittaci</i>
Exposure to mice or mice droppings	Hantavirus
Exposure to rabbits	<i>Francisella tularensis</i>
Exposure to suspicious white powder (in the setting of bio-terrorist activity)	<i>Bacillus anthracis</i>
Travel History	
Travel to Thailand or other countries in Southeast Asia	<i>Burkholderia pseudomallei</i> (melioidosis)
Immigration from countries with high endemic prevalence of tuberculosis	<i>M. tuberculosis</i>
Occupational History	
Health Care work	<i>M. tuberculosis</i> , acute HIV seroconversion with pneumonia
Tick bite (<i>Dermacentor variabilis</i> or <i>Ixodes dommini</i> [scapularis])	Rocky mountain spotted fever (rarely complicated by pneumonia), <i>Ehrlichia species</i>
Host Factor	
Diabetic ketoacidosis	<i>S. pneumoniae</i> , <i>Staphylococcus aureus</i>
Alcoholism	<i>S. pneumoniae</i> , <i>Klebsiella pneumoniae</i> , <i>S. aureus</i> , anaerobes
Chronic Obstructive Lung Disease	<i>S. pneumoniae</i> , <i>Haemophilus influenzae</i> , <i>Moraxella catarrhalis</i>
Solid organ transplantation (pneumonia occurring > 3 months after transplantation)	<i>S. pneumoniae</i> , <i>H. influenzae</i> , <i>Legionella species</i> , <i>Pneumocystis carinii</i> (rarely CMV), <i>Strongyloides stercoralis</i>
Sickle cell disease	<i>S. pneumoniae</i>
HIV infection and CD4 count <200/μL	<i>P. carinii</i> , <i>S. pneumoniae</i> , <i>H. influenzae</i> , <i>Cryptococcus neoformans</i> , <i>M. tuberculosis</i> , <i>rhodococcus equi</i>
B cell defects (e.g. multiple myeloma, Hodgkin's Disease)	<i>S. pneumoniae</i>
Granulocytopenia	Aerobic gram-negative bacilli (e.g. <i>Escherichia coli</i> or <i>K. pneumoniae</i>)
Bronchiectasis	<i>Pseudomonas aeruginosa</i>

Adapted from: Mandell L et al. Canadian guidelines for the initial management of community-acquired pneumonia: an evidence based update by the Canadian Infectious Diseases Society and the Canadian Thoracic Society. Clin. Infect. Dis. 2000; 31: 383-421

Diagnosis

Clinical Assessment

History:

- Fever +/- chills
- New onset of cough which may or may not be productive
- Pleuritic chest pain
- Constitutional symptoms such as fatigue, headache, nausea and vomiting, abdominal pain, myalgias

Identification of risk factors:

- Smoking
- Comorbid conditions: asthma, lung cancer, chronic obstructive pulmonary disease (COPD), diabetes, alcoholism, chronic renal or liver failure, congestive heart failure (CHF), chronic corticosteroid use, malnutrition or acute weight loss, HIV
- Recent (3 months) antibiotic history*
- Hospitalization in the past 3 months

*Note: See Background

Physical Examination:

- Temperature > 37.8 degrees Celsius

Note: Basal temperature in the frail elderly is often lower

- Tachypnea (respiratory rate \geq 25/minute)

Note: Respiratory rate must be counted for a full minute

Signs of consolidation: diminished chest expansion, increased tactile vocal fremitus, dullness on percussion, diminished air entry, bronchial breath sounds, whispering pectoriloquy, localized crackles, pleural rub

Investigations

All Patients:

- Chest X-ray, PA and lateral
- CBC with differential
- Sputum gram stain and culture only if productive cough
- Blood cultures* for those who present to ER with history of chills/rigors

Additional Tests for Hospitalized Patients:

- Blood cultures*
- Chemistry – glucose, electrolytes, creatinine, ALT
- Pulse oximetry
- Arterial blood gas if patient:
 - O₂ sat < 90%
 - Has COPD
 - Receiving chronic oxygen (do on baseline O₂)
- Thoracentesis should be considered in patients with significant pleural effusion
- Serology is not routinely recommended

*Note: 1 set blood culture = 3 vials: 1 vial aerobic/1vial anaerobic from one site/1 vial aerobic from a second site AT THE SAME TIME

Management

Up to 80% of patients with CAP are treated as outpatients¹.

General

- Ensure adequate hydration
- Adequate analgesics/antipyretics for pain and fever
- Cough suppressants are not routinely recommended
- For patients who may require admission to hospital, calculation of Pneumonia Severity of Illness (PSI) score is recommended to guide determination of site of care (See Appendix 3 and 4).

Note: the pneumonia severity of illness score is a guide and should never replace a physician's judgment as to the admission decision.

- Significant pleural effusion (> 10 mm on lateral decubitus) should be drained
- Empyema should be drained

Oxygen

- Oxygen therapy is indicated for hypoxemia

Antibiotic Therapy

Due to morbidity and mortality of bacterial pneumonia, and limitations of microbiologic diagnosis, empiric therapy is recommended for all patients with physical findings of pneumonia and new infiltrate on chest x-ray.

Residents of Long Term Care facilities should be considered a special subset of Community-Acquired Pneumonia. These residents often show atypical pneumonia, and have more comorbidities, and thus should be treated on an individual basis. The recommended first line of treatment is a “respiratory” fluoroquinolone, with a second-, third, or fourth generation cephalosporin plus a macrolide as an alternative¹. These patients may require IV antibiotics for a longer period of time than other patients.

- See Tables 3 and 4 for antibiotic therapy recommendations

Antibiotics NOT routinely recommended in adult CAP

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|--|
| <ul style="list-style-type: none"> • Amoxicillin – unless culture proven <i>Streptococcus pneumoniae</i> sensitive to amoxicillin • Cephalexin – no activity against Pen I/R <i>Streptococcus pneumoniae</i>, or <i>Chlamydia pneumoniae</i> • Ciprofloxacin – poor activity against <i>Streptococcus pneumoniae</i> • TMP/SMX – increased resistance to <i>Streptococcus pneumoniae</i>. No coverage of <i>Mycoplasma pneumoniae</i> or <i>Chlamydia pneumoniae</i> |
|--|

Critical Indicators

To aid the measurement of quality improvement activities, the following patient outcome and performance indicators can be used:

Performance Indicators*

- A combination of antibiotics for routine care
- Switch to oral antibiotics when vital signs are stable (target 24 hours)

Patient Outcome Indicators*

- Vital signs stable
- Afebrile (< 38 degrees Celsius for 24 hours)
- Normal Mental Status (or usual mental status if chronically altered)
- Respiratory rate 24/min or less
- Systolic Blood Pressure >90
- Heart rate < 120 BPM
- On oral antibiotics and tolerating well
- Understands diagnosis and discharge plan

*Note: From Critical Indicators from Evidence-Based Practice: Process and Outcomes, Centre for Case Management, 2002; and References 1 and 2

Follow Up

Follow up for outpatients should occur at 48 to 72 hours

Follow up chest X-ray recommended at 6 weeks to ensure resolution and exclude underlying diseases such as empyema, lung abscess, and malignancy if:

- Extensive/necrotizing pneumonia
- Smoker
- Alcoholism
- COPD
- >5% weight loss in the past month
- >50 years old

Failure of Therapy

Definition:

- Hemodynamic compromise

OR

- Clinical deterioration after 72 hours of antibiotic therapy

OR

- No improvement after completion of antibiotic therapy

Consider:

- Host-related factors:
 - Noninfectious pulmonary pathology
 - Immunosuppressed
- Pathogen-related factors:
 - Antibiotic resistance

- Non-bacterial etiology
 - Viruses
 - Mycobacterium spp
 - Fungi
- Drug-related factors:
 - Compliance
 - Malabsorption
 - Drug-drug interactions
 - Drug fever

Table 3

Antibiotic Agents in OUTPATIENT Treatment of CAP in Adult Patients			
Recommended Therapy and Dose	Duration	Comments	
No Comorbid Factors*			
Azithromycin (G, H, S) 500mg PO first day then 250mg PO daily	5 days	*Comorbid/risk factors include: asthma, lung cancer, COPD, diabetes, alcoholism, chronic renal failure or liver failure, CHF, chronic corticosteroid use, malnutrition or acute weight loss(>5%), hospitalization in past 3 months, HIV, smoking	
<i>Or</i>			
Clarithromycin 250 to 500mg PO bid	10 days		
<i>Or</i>			
Erythromycin (S) 500mg PO qid	10 days		
<i>Or</i>			
Doxycycline (G, H) 200 mg PO first day then 100mg PO daily	10 days		
Comorbid factors*			
Azithromycin (G, H, S) 500mg PO first day then 250mg PO daily	5 days		
<i>Or</i>			
Clarithromycin 250 to 500 mg PO bid	10 days		
<i>Or</i>			
Doxycycline (G, H) 200mg PO first day then 100 mg PO daily	10 days		
Failure of First Line Agents**			
Gatifloxacin (G) 400mg PO daily	10 days	**Failure of Therapy: Hemodynamic compromise <i>Or</i> Clinical deterioration after 72 hours of antibiotic therapy <i>Or</i> No improvement after completion of antibiotic therapy	
<i>Or</i>			
Levofloxacin (H, S) 500 mg PO daily	10 days		
<i>Or</i>			
Moxifloxacin 400mg PO daily	10 days		
<i>Or</i>			
Cefuroxime Axetil (G, H, S) 500 mg PO bid PLUS Erythromycin (S) 500 mg PO qid	10 days		

Formulary Coverage:

- G - Grey Bruce Health Services
- H - Hanover and District Hospital
- S - South Bruce Grey Health Centre

Table 4			
Antibiotic Treatment for Adults Admitted to Hospital with CAP			
Recommended Therapy and Dose	Duration	Comments	
No Comorbid Factors*			
Azithromycin (G, H, S) 500mg PO first day then 250mg PO daily	5 days	* Comorbid/risk factors include: asthma, lung cancer, COPD, diabetes, alcoholism, chronic renal failure or liver failure, CHF, chronic corticosteroid use, malnutrition or acute weight loss (>5%), hospitalization in past 3 months, HIV, smoking	
<i>Or</i>			
Clarithromycin 500 mg PO bid	10 to 14 days		
<i>Or</i>			
Doxycycline (G, H) 200mg Po first day then 100mg PO daily	10 to 14 days		
Comorbid Factors*			
Gatifloxacin (G) 400mg PO daily	10 days		
<i>Or</i>			
Levofloxacin (H, S) 500mg PO daily	10 days		
<i>Or</i>			
Moxifloxacin 400mg PO daily	10 days		
<i>Or</i>			
Cefuroxime (G, H, S) 750mh IV q8h PLUS Macrolide**	10 days	** Macrolide: Azithromycin (G, H, S) – 500mg IV/PO first day then 250mg PO daily x 4 days Clarithromycin – 500mg PO bid Erythromycin (S) – 0.5-1g IV q6h/500mg PO qid	
Severe***			
Cefotaxime (H) / Ceftriaxone (G, S) 1g IV q8h/1g IV daily PLUS Macrolide**	10 to 14 days	*** Severe: <ul style="list-style-type: none"> • PaO₂ <60mmHg • Resp. rate >30/minute • Sepsis with end organ dysfunction • Extra pulmonary septic complications • Cavitation • Multilobar involvement 	
Alternative****			
Cefotaxime (H) / Ceftriaxone (G, S) 1g IV q8h/1g IV daily PLUS Quinolone*****	10 to 14 days	**** Alternative: <ul style="list-style-type: none"> • The standard of care is with beta-lactam plus a macrolide • This combination should be effective but clinical data is lacking • Quinolone monotherapy is not adequate in severe pneumonia 	
Cephalosporin Allergy			
Quinolone***** PLUS Another antibiotic (clindamycin, macrolide, vancomycin)		***** Quinolone: Gatifloxacin (G) – 400mg IV/PO daily Levofloxacin (H, S) – 500mg IV/PO daily Moxifloxacin – 400mg PO daily	

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Background

Incidence

Pneumonia is the leading cause of death from infection and the sixth leading cause of death overall². In the United States, the annual incidence is 12 cases per 1000 adults¹. Incidence of CAP is increased in the winter months². Up to 80% of cases of CAP are treated in an outpatient setting⁴. Mortality cases are less than 1% for outpatients, but rises to an average of 14% for hospitalized patients with CAP². Fifty percent of pneumonia cases and 90% of mortality from pneumonia are found in patients over the age of 65.

Etiology (see Tables 1 and 2)

In almost one-half of cases of pneumonia an etiologic agent is not found.

Streptococcus pneumoniae (*S. pneumoniae*) is the most common bacterial pathogen causing CAP and may account for up to 50% of CAP¹. Risk factors for antibiotic resistant *S. pneumoniae* include:

- Beta-lactam/macrolide/quinolone use within the past 3 months
- Alcoholism
- Age >65 years
- Immunosuppression
- Exposure to child(ren) attending childcare facility
- Resident of a long-term care facility^{5,6}

Previous beta-lactam and macrolide therapy are risk factors for penicillin resistant *S. pneumoniae*. Penicillin resistant *S. pneumoniae* often exhibits multiple resistances especially to oral cephalosporins, macrolides, and TMP/SMX. Prior quinolone therapy, especially with ciprofloxacin, is a risk factor for quinolone resistant *S. pneumoniae*.

Other pathogens causing CAP include: *Mycoplasma pneumoniae*, *Chlamydia pneumoniae*, *Haemophilus influenzae* (mostly nontypeable), *Moraxella catarrhalis*, Group A *Streptococcus*, *Staphylococcus aureus*. *Klebsiella pneumoniae* and other gram-negative bacilli may cause pneumonia in patients with comorbid factors. *M.*

pneumoniae accounts for 20% of CAP in outpatients and is more prevalent in younger age groups. *C. pneumoniae* accounts for 10% of pneumonia in outpatients and may be a co-pathogen in the elderly and may vary in incidence according to geographic location.

Elderly patients are more likely to be colonized with Gram-negative organisms (especially if decreased functional status, institutionalized and multiple co-morbid illnesses).

Viruses (e.g. influenza virus A and B, parainfluenza, adenovirus) account for only 2 to 15% of adult cases. Influenza should be considered during the appropriate session. Respiratory syncytial virus, a significant pathogen in young children, is also emerging as an important respiratory pathogen in adults¹.

Tuberculosis (TB) should be considered (especially in the elderly). There is a 10 to 30 times increased incidence of TB in long term care residents then in the elderly living at home and long term care residents account for 20% of cases in older people⁷.

Although anaerobes are not common pathogens in CAP, they may play a role in polymicrobial aspiration syndromes in the elderly or debilitated (alcoholism, intravenous drug use, neurologically impaired, poor oral hygiene). In this setting, correlation with Gram stain (presence of multiple bacterial morphotypes phagocytosed with WBCs) is important.

Pathogenesis

In up to 50% of cases, a viral infection precedes the development of pneumonia and undoubtedly plays a role in the pathogenesis of pneumonia^{1,4}. Viruses may inhibit important host defenses, including ciliary activity, neutrophil function, and other lung defense mechanisms⁴. Cigarette smoke compromises mucociliary function and macrophage activity. Alcohol impairs the cough reflex, increases oropharyngeal colonization with gram-negative bacilli, and may inhibit immune mechanisms⁴. Elderly patients are at increased risk of developing pneumonia due to multiple factors: increased number and severity of

comorbidities, decreased mucociliary clearance, diminished cough reflex, increased aspiration, increased colonization with gram-negative organisms, and depressed immune systems⁴.

Diagnosis

Diagnosis of pneumonia is based on a patient's history, comorbidities, physical findings, and chest x-ray. Symptoms of CAP most commonly include fever, chills, dyspnea, pleuritic chest pain, and cough. With increasing age, symptoms of infections may not be as apparent and physical signs may be diminished. Fever may be less commonly observed but delirium and confusion may be more common in this population.

Clinical Assessment

Normal respiratory rate in the elderly is 16 to 25 breaths per minute¹⁰. A respiratory rate >25 breaths per minute has a sensitivity of 90% and a specificity of 95% for the diagnosis of pneumonia.

A single temperature or 38.3 degrees Celsius has a sensitivity of only 40% for predicting infection. Lowering the threshold to 37.8 degrees Celsius increases the sensitivity to 70%. Basal body temperature in the frail elderly is lower than 37% however^{1,5}. An increase of 1.1 degrees Celsius over baseline on at least two occasions may be a better temperature criterion in the elderly¹¹.

Delirium or acute confusion is found in 44.5% of elderly patients with pneumonia¹².

Investigations

Chest x-ray is the gold standard for diagnosis of CAP and should be done in all patients with findings consistent with pneumonia.

Some radiographic patterns suggest certain infections and may help to support a diagnosis of pneumonia versus an alternate cause. Comorbid lung or cardiovascular disease can be identified and the severity of the illness may be judged by the extent to lung involvement on chest x-ray.

CBC with differential is recommended for all patients. In the elderly, the total WBC count and number of bands are one of the best indicators of bacterial infection¹³. In addition, the following laboratory values should be determined for patients who are hospitalized: glucose, electrolytes, creatinine, ALT.

Collection of sputum for Gram stain and culture is recommended if the patient has a productive cough. Although sputum cultures may be of limited value, special attention should be paid to the Gram stain, especially if intra-cellular organisms are seen. This may provide some information on the etiological agent.

Patients being managed as outpatients should have a blood culture if they give a history of chills/rigors associated with fever. Blood cultures should be done in all hospitalized patients, preferably before antibiotic treatment. Obtaining a blood culture within 24 hours of presentation has been associated with improved 30 day survival in patients with CAP¹⁴.

Oxygen saturation should be assessed by pulse oximetry. If O₂ sat <90% or patient has COPD, arterial blood gas should be drawn on room air, or on baseline O₂ if patient is receiving chronic oxygen. Hypoxemia is one of the important indicators of acute severity and short-term mortality in CAP¹⁵.

Thoracentesis is indicated in patients with significant pleural effusion defined as fluid collection >10mm in thickness on the lateral decubitus view.

Serology is NOT routinely recommended.

Legionella urinary antigen testing is not recommended routinely as Legionella is rare locally, but should be considered in patients with severe CAP with travel history to endemic areas.

Routine use of invasive testing (bronchoscopy, bronchoalveolar lavage, etc.) is not recommended.

The presence of recurrent pneumonia should lead to investigation for immune system disorders or structural abnormalities.

Management

General

Adequate hydration of patients with CAP is essential. Many patients with pneumonia are dehydrated due to increased insensible water loss.

Nutritional status, especially in the elderly, is a very important factor. Weight loss of > 5 to 10% can result in increased mortality⁵.

Antibiotic Therapy

The choice of empiric therapy should be based on the severity of illness, patient age, comorbidities, treatment setting (outpatient or hospital), local susceptibility patterns where available, and patient's recent (3 months) antibiotic history.

Empiric therapy of outpatient CAP should always cover *S. pneumoniae*, and intracellular pathogens such as *M. pneumoniae* and *C. pneumoniae*. Antibiotics of choice for outpatient therapy of CAP are doxycycline or a macrolide (erythromycin, azithromycin, clarithromycin).

Macrolide resistance of *S. pneumoniae* exceeds 10% and coverage of *Haemophilus* spp may not be optimal. Azithromycin has no appreciable serum concentrations and should be avoided in patients who present with rigors/chills as this is an indicator of bacteremia.

Levofloxacin, moxifloxacin and gatifloxacin provide excellent coverage of the pathogens involved, but because of their broad spectrum and potential for increasing resistance in *S. pneumoniae*, they should be reserved for those patients who 1) have failed first line therapy or 2) are elderly and have significant comorbidities, including those who are residents of long-term care facilities.

Ciprofloxacin does not have adequate coverage of *S. pneumoniae* and should not be used in the management of CAP. Additionally, ciprofloxacin (a hydrophilic

molecule in comparison to the hydrophobic nature of most other quinolones) has been shown to activate efflux pumps, which may be the initial step in the development of quinolone resistance¹⁶.

Penicillin	15.8%
Amoxicillin	4.7%
Cefuroxime	9.8%
Cefotaxime/ceftriaxone	3.9%
Macrolide	13%
Clindamycin	4%
Tetracycline	7%
TMP-SMX	21%
Levofloxacin	<1%
Vancomycin	0%

* Based on 971 clinically significant isolates in 2001 (Bugs and Drugs, Edmonton, Alberta)

In severe pneumonia, combination therapy with a beta-lactam plus a macrolide is recommended¹⁷⁻¹⁹.

Hospitalization

Fine et al devised and validated a scoring system for predicting mortality in CAP that is also useful for identifying patients who should be admitted to hospital. For patients who may require admission to hospital, calculation of this Pneumonia Severity of Illness (PSI) score is recommended (Appendix 3 & 4). The pneumonia severity of illness score is a guide and should never replace a physician's judgment as to the admission decision.

All patients who required admission to hospital for treatment should receive antibiotics within 4 to 8 hours of arrival to hospital. If antibiotic therapy is delayed for more than 8 hours, the mortality is much higher than if antibiotics are given within 8 hours²⁰.

Recovery is often prolonged in the elderly and may take up to several months. Hospitalization of this population may often hasten functional decline.

Follow up

Post-treatment chest x-ray is recommended as 2% of patients with pneumonia will have underlying cancer and 1% will only be visible on follow up x-ray.

Poor outcome risk factors:

- Respiratory rate ≥ 30 per minute
- Systolic blood pressure ≤ 90 mmHg, diastolic blood pressure ≤ 60 mmHg
- Acute renal dysfunction
- Malnutrition or $> 5\%$ weight loss in past month (nutritional consult recommended)
- Functional impairment (occupational therapy and/or physiotherapy consult recommended)
- Age and comorbid factors are also contributors to outcome^{15, 21}

Prevention

- Smoking cessation and avoidance of environmental tobacco smoke. Smoking is the strongest independent risk factor for invasive pneumococcal disease in adults²².
- Limit the spread of viral infections (e.g. hand washing). Hand washing can prevent up to 80% of the most common infectious diseases (mostly viral) that may predispose to pneumonia.
- Influenza vaccine is recommended annually for high risk patients (See Appendix 1)
- Pneumococcal vaccine is recommended for high risk patients (See Appendix 2)
- Rehabilitation (occupational therapy and/or physiotherapy) and nutritional programs where appropriate.

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APPENDIX 1

INFLUENZA VACCINE²³

Vaccine should be given annually to:

High Risk:

- Adults and children with chronic cardiac or pulmonary disorders (bronchopulmonary dysplasia cystic fibrosis, asthma)
- Adults and children with chronic conditions: diabetes and other metabolic diseases, cancer, immunodeficiency (including HIV), immunosuppression (including renal transplants), renal disease, anemia, hemoglobinopathy
- Residents of nursing homes or long term care facilities
- People >65 years of age
- Children and adolescents treated with long term ASA
- People at high risk of influenza complications traveling to foreign destinations where influenza is likely to be circulating

People capable of transmitting influenza to those at high risk:

- Health care workers and other personnel who have continuous, direct care contact with people in high risk groups (above)
- Household contacts (including children) of people at high risk who cannot be immunized or are immunosuppressed or elderly/frail

Others:

- People who provide essential community services and other adults who wish to reduce their chances of acquiring infection and consequently missing work
- Pregnant women in high risk groups (vaccine is considered safe for pregnant women, regardless of stage of pregnancy)

Protection begins 2 weeks post vaccination and lasts up to 6 months (may be less in the elderly).

APPENDIX 2

PNEUMOCOCCAL POLYSACCHARIDE VACCINE^{24,25}

Strongly Recommended – High Risk*:

- Asplenia (traumatic/surgical/congenital)
- Splenic dysfunction
- Sickle-cell disease

NB: Where possible give vaccine 10 to 14 days prior to splenectomy or at beginning of chemotherapy for Hodgkin's disease.

* Vaccine failures may occur in this group – advise counselling
(re: fulminant pneumococcal sepsis and need to seek early medical advice with fever).

Recommended:

- All persons >65 years old
- All residents of long term care facilities
- Patients with chronic cardiovascular/pulmonary disease, cirrhosis, alcoholism, chronic renal disease, diabetes mellitus, HIV infection, and other conditions associated with immunosuppression, chronic cerebrospinal fluid leak

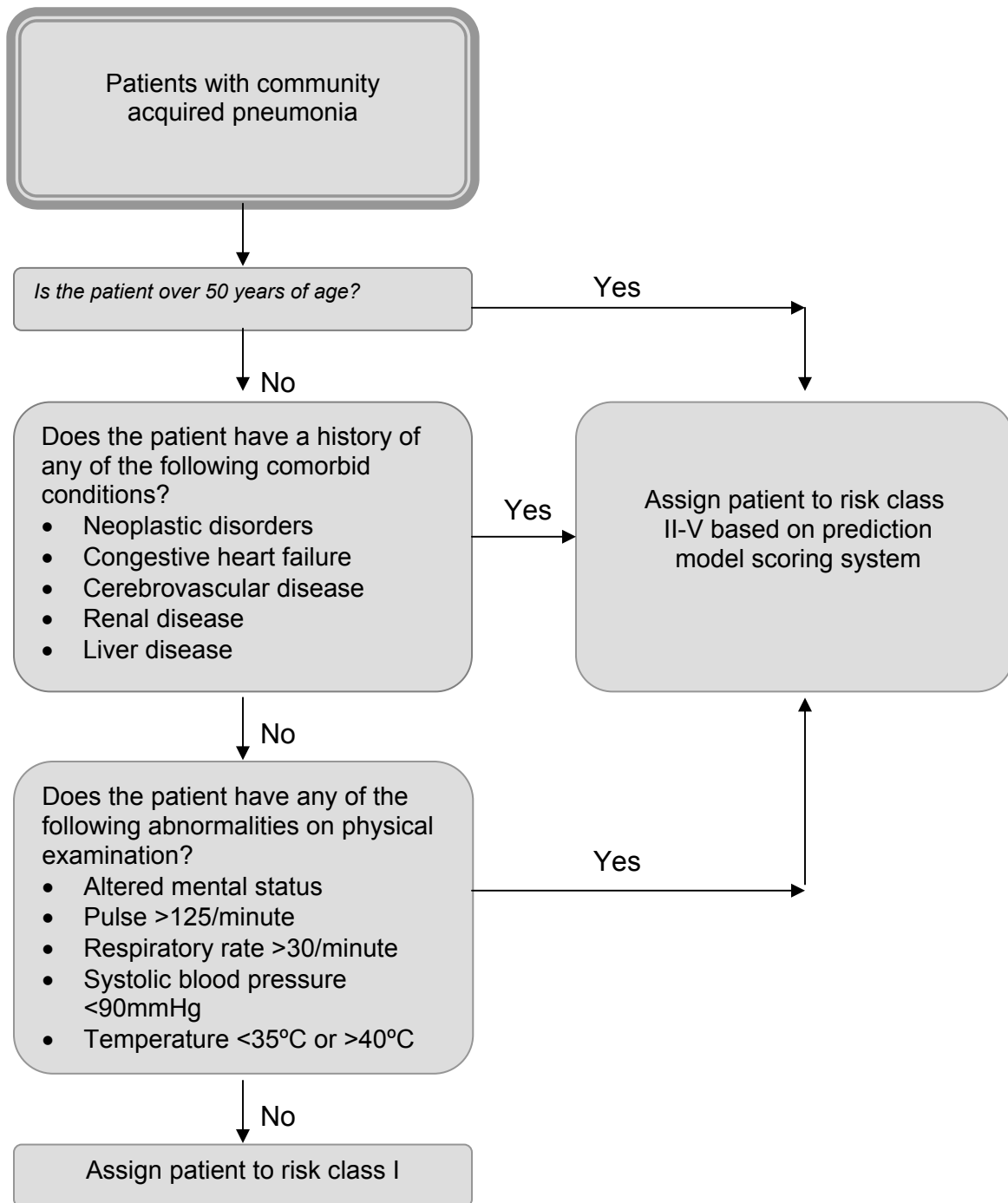
NB: Vaccine may be administered simultaneously with influenza vaccine (separate injection site).

Not Recommended:

- Children <2 years of age
- Asthma (as the single underlying condition)
- Otitis media (as the single underlying condition)

APPENDIX 3 PREDICTION MODEL FOR IDENTIFICATION OF PATIENT RISK FOR PERSONS WITH COMMUNITY-ACQUIRED PNEUMONA

See appendix 4 for Pneumonia Specific Severity of Illness (PSI) scoring system



Reprinted from: Fine MJ, Auble TE, Yearly DM, et. Al. A Prediction rule to identify low-risk patients with community-acquired pneumonia. *New England Journal of Medicine*, 1997; 336: 243-250

APPENDIX 4 PNEUMONIA SEVERITY OF ILLNESS (PSI) SCORING SYSTEM

PATIENT CHARACTERISTICS	POINTS ASSIGNED	PATIENT'S POINTS
Demographic Factors		
• Age (in years)		
- Males	Age (in years)	
- Females	Age (in years) -10	
• Nursing Home Resident	+10	
Comorbid Illness		
• Neoplastic Disease	+30	
• Liver Disease	+20	
• Congestive Heart Failure	+10	
• Cerebrovascular Disease	+10	
• Renal Disease	+10	
Physical Exam Findings		
• Altered Mental Status	+20	
• Respiratory Rate >30/minute	+20	
• Systolic BP <90 mmHg	+20	
• Temperature <35°C or >40°C	+15	
• Pulse >125/minute	+10	
Laboratory Findings		
• pH <7.35	+30	
• BUN >10.7 mmol/L or creatinine >120 mmol/L	+20	
• Sodium <130 mmol/L	+20	
• Glucose >13.9 mmol/L	+10	
• Hematocrit <30%	+10	
• PO <60 mmHg or O ₂ sat <90%	+10	
• Pleural effusion	+10	
TOTAL SCORE		

RISK CLASS	#OF POINTS	MORTALITY (%)	RECOMMENDATION FOR SITE OF CARE
I	<50 yrs, no comorbidity, RR <24, normal BP, T <38°C, P<110	0.1	Outpatient
II	<70 points	0.6	Outpatient
III	71-90 points	2.8	Generally Outpatient
IV	91-130 points	8.2	Inpatient
V	>130 points	29.2	Inpatient

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