Community-acquired pneumonia

With accurate diagnosis, patients can be appropriately treated in and out of the hospital.

By Shari J. Lynn, MSN, RN

COMMUNITY-ACQUIRED PNEUMONIA (CAP) is exactly what it sounds like—a lung infection acquired while out and about in the world. The cause may be a virus, bacteria, or fungus. (See CAP stats.)

The estimated cost of treating CAP in the United States is about $12.2 billion a year. Inpatient treatment ranges from $7,500 to $10,227 per admission, whereas outpatient treatment ranges from $150 to $350 per patient. This difference demonstrates the need for accurate diagnosis and appropriate treatment.

Immune response

A patient’s immune response to CAP depends on the type of organism involved. Less noxious organisms typically are destroyed by macrophage engulfment, which results in a moderate immune response. If the organism is highly virulent or is present in great numbers, a series of immune responses occur, including inflammation, cellular infiltration, and activation of the immune cascade. When the patient can’t clear pulmonary secretions, a secondary infection may develop. (See Immune response.)

In response to physiologic changes, the patient’s respiratory rate may increase in an attempt to improve oxygen levels, but eventually he or she becomes exhausted from the work of tachypnea, and the respiratory rate decreases, leading to hypoxemia and hypercapnia. In addition, the patient may experience fever, pleuritic chest pain, coughing, dyspnea, and a general feeling of being unwell. In older adults, symptoms may not be as obvious; they may have a less productive cough, anorexia, or confusion.

Risk factors

Many factors contribute to an increased chance of developing CAP. (See CAP risk factors.) Antibiotic treatment, chronic steroid use, and malnutrition increase the risk for CAP as do comorbidities such as chronic renal failure. In the elderly population, comorbidities as well as the effects of aging (such as reduced mucociliary movement and clearance, decreased cough reflex, increased potential for colonization of gram-negative organisms, and decreased immune response) increase the risk for CAP. Additional risk factors include spleen removal, HIV, hypogammaglobulinemia, and sickle cell disease.

Classification and causes

CAP is just one classification of pneumonia. (See CAP vs. HAP.) The criteria for CAP include:

• patient hasn’t been hospitalized within 14 days before symptom onset
• patient’s symptoms begin within 4 days of hospital admission
• patient doesn’t live in a long-term care facility.

Bacterial pathogens and respiratory viruses are common causes of CAP. Bacterial organisms that are treatable in the outpatient setting include Chlamydia pneumoniae, Haemophilus influenzae, Moraxella catarrhalis, Mycoplasma pneumoniae, and Streptococcus pneumoniae. Respiratory viruses associated with outpatient treatment of CAP include adenovirus, influenza A and B, parainfluenza virus, and respiratory syncytial virus. However, any patient infected with these pathogens who shows severe symptoms may be admitted for inpatient care as well as those infected with anaerobes that are related to aspiration and Legionella pneumophila.

Patient assessment

Begin the patient assessment by identifying symptoms and their onset. Note symptom severity, including characteristics of cough and sputum, descriptions of pain level, factors that relieve or aggravate symptoms, treatments the patient has already tried, and how the patient describes illness severity.

Negative test results and negative symptoms can help rule out other diagnoses. Ask about abdominal pain, chest pain, hematuria, dysuria, edema, weight gain, and neurologic symptoms. In addition, gather information about the patient’s current medications (including prescription and over-the-counter med-
ications and herbal remedies); tobacco, alcohol, and illicit drug use; environmental exposure to possible lung irritants; and immunizations.

Note allergies and past medical history as well as social and family histories. Ask about any comorbidities, such as cancer, autoimmune disease, and chronic respiratory issues. Also note the patient’s residence (for example, home or long-term care facility).

Examine all body systems to determine infection severity, the probability of CAP, and other illnesses that may have contributed to CAP. A head, ears, eyes, nose, and throat exam may reveal an upper-respiratory infection related to nasal congestion, ocular discharge, mouth breathing, nasal flaring, or otitis media. Dullness and dryness of the lips, eyes, and mucosa may be signs of dehydration.

Pulmonary auscultation and physical examination may reveal dull percussion, chest tenderness, increased tactile fremitus, bronchophony, egophony, and whispered pectoriloquy. You also may hear wheezes, rhonchi, or crackles, and the patient may have pleuritic chest pain that’s more severe on deep inspiration.

Cardiovascular effects of CAP include poor perfusion, prolonged capillary refill, and tachycardia. Because of dehydration and cyanosis caused by hypoxia, the patient’s skin may tent, and he or she may experience mental status changes. Changes in mental status, loss of appetite, and falls (related to confusion and dizziness as a result of hypoxia) also can be factors that are part of a CAP diagnosis.

**Diagnostic tools**

Diagnosis of CAP includes a chest x-ray. Viral pneumonia commonly presents with interstitial infiltrates on x-ray; bacterial infection presents with alveolar infiltrates. Viral and bacterial infections can occur simultaneously.

**CAP stats**

These statistics reveal the prevalence of community-acquired pneumonia (CAP) and why outpatient treatment is preferred when possible.

- All age groups are susceptible to CAP, but the greatest morbidity and mortality can be found in young patients under 6 years old and older patients over 75 years old.
- The incidence of CAP increases exponentially in patients over age 50 in industrialized countries.
- Even with the discovery of antibiotics, pneumonia is still prevalent on a global level and remains an economic burden on the healthcare system.
- According to the World Health Organization, 1.4 million people die every year from pneumonia, and it’s a predominant cause of death in children.
- In the United States, CAP is the eighth leading cause of death and the most common cause of death from an infectious agent.
- The death rate for patients being treated in the outpatient setting is less than 5%.
- The death rate may increase to 10% and go as high as 30% for patients admitted to the intensive care unit.
- The most prevalent reasons for death related to CAP are complications, such as refractory hypoxemia, multi-organ failure, sepsis, and shock.

**Immune response**

A patient’s immune response to the organism causing community-acquired pneumonia includes vasodilation of the pulmonary capillaries, resulting in permeability and leaking of protein-rich exudate into the interstitial space and eventually reaching the alveoli. As the alveoli fill with exudate, they stick together and inhibit gas exchange.

The formation of neutrophils, as part of the inflammatory response, may damage the lung tissue and lead to fibrosis or pulmonary edema. The tissue of the alveoli is delicate and can be damaged easily by the normal inflammatory response, which can be exacerbated if the patient has underlying protective mechanism issues such as overproduction of mucous, immune deficiencies, and diminished ciliary action.

![Healthy Alveolus](image1)

![Unhealthy Alveolus](image2)

Many tools (including the pneumonia severity index, CURB-65 and CRB-65, SMART-COP, and the American Thoracic Society criteria) are available to help determine if the patient with CAP can be treated successfully as an outpatient or if hospital admission is required.

**Pneumonia severity index**

The pneumonia severity index (PSI) was developed to classify patients suspected of having CAP (goo.gl/Yk5JLH). This tool, which has been used in emergency departments, nursing homes, and community hospitals, looks at pa-
Several factors place patients at risk for community-acquired pneumonia (CAP), including comorbidities, lifestyle, and patient characteristics.

**Comorbidities**
- Altered mental state
- Asthma
- Bronchiectasis
- Chronic obstructive pulmonary disease
- Cystic fibrosis
- Diabetes
- Heart disease

**Lifestyle**
- Alcohol or substance misuse
- Homelessness
- Overcrowded living conditions
- Smoking

**Patient characteristics**
- Extremes of age
- Immunocompromised status

Tien characteristics such as:
- demographics (gender and residence)
- physical assessment findings (mental status, pulse, respiratory rate, temperature, and systolic blood pressure)
- laboratory results (pH, blood urea nitrogen [BUN], sodium, glucose, hematocrit, and partial pressure of arterial oxygen)
- comorbidities (liver disease, neoplasm, stroke, heart disease, and renal failure)
- radiology results (presence of pleural effusion).

PSI scoring places patients into one of five categories. The first three recommend outpatient treatment; the fourth and fifth recommend hospitalization.

**CURB-65 and CRB-65**
CURB-65 and CRB-65 are easier to use than the PSI. Although the PSI has 20 items, CURB-65 has only five (confusion, BUN > 19 mg/dL, respiratory rate > 30 breaths/minute, systolic blood pressure < 90 mmHg or diastolic blood pressure < 60 mmHg, and age > 65 years) and CRB-65 has only four (the same items as CURB-65, but BUN isn’t necessary if lab results aren’t available). (Visit goo.gl/qXJ76f to view the CURB-65 and CRB-65 tools.)

Both tools result in a rating that corresponds to patient care recommendations. CURB-65 rates patients with 0 or 1 as being acceptable for outpatient treatment; 2 as short inpatient stay or closely supervised outpatient treatment; and 3, 4, and 5 as hospitalization and possible ICU admission. CRB-65 rates patients as 0 (no need for hospitalization), 1 to 2 (consider hospitalization), and 3 to 4 (urgent recommendation for hospitalization).

**SMART-COP**
SMARTCOP (goo.gl/bkuDFl) is used to determine the severity of CAP in adults. The acronym represents the information needed to make the proper determination for care, and the data collected translates to a point system. Scoring for a patient who is under 50 years old is:
### CAP

#### Less common pathogens

- Enteric gram-negative bacilli
- *Pseudomonas aeruginosa*
- *Staphylococcus aureus*

*Note: Sulfisoxazole or trimethoprim-sulfamethoxazole (TMP-SMX) are commonly used for less common pathogens.*

### Diagnosis

- Chest x-ray infiltrate
- Cough
- Fever
- Precise role for microbiologic cultures is unclear.

### Empiric treatments

- Beta-lactams
- Macrolides
- Respiratory fluoroquinolone

### Prevention

- Comorbidity treatment
- Influenza vaccination
- Pneumococcal vaccination
- Smoking cessation

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### CAP

- Systolic blood pressure < 90 mmHg
  (2 points)
- Multilobar chest x-ray involvement
  (1 point)
- Albumin < 35 g/L (1 point)
- Respiratory rate ≥ 25 breaths/minute
  (1 point)
- Tachycardia ≥ 125 beats/minute (1 point)

### HAP

- Acinetobacter baumannii
- Candida sp.
- *Hemophilus influenzae*
- Influenza
- *Legionella pneumophila*
- *Stenotrophomonas*
- *Streptococcus pneumoniae* and other Strep sp.

#### Bronchoalveolar lavage or protected specimen brush with quantitative cultures

- Clinical features are unreliable (fever, leukocytosis, new chest x-ray infiltrate)
- Serial chest x-rays or CT scanning
- Suctioned/expectorated sputum

### Diagnosis

- Bronchoalveolar lavage
- Clinical features are unreliable (fever, leukocytosis, new chest x-ray infiltrate)
- Serial chest x-rays or CT scanning
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### Empiric treatments

- Aminoglycosides
- Antipseudomonal beta-lactams
- Antipseudomonal fluoroquinolones
- Vancomycin or linezolid

### Prevention

- Gastric acidity maintenance
- Head of bed elevation
- Infection prevention measures
- Invasive mechanical ventilation avoidance
- Oral and pharyngeal decontamination
- Subglottic suctioning

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Source: The Ohio State University College of Medicine. scribd.com/document/114849137/Community-Acquired-Pneumonia-CAP-Vs

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- Multilobar chest x-ray involvement
  (1 point)
- Albumin < 35 g/L (1 point)
- Respiratory rate ≥ 25 breaths/minute
  (1 point)
- Tachycardia ≥ 125 beats/minute (1 point)
- Confusion—acute (1 point)
- Oxygen—low arterial oxygen pressure
  (PaO₂) ≤ 70 mmHg or oxygen saturation
  ≤ 93% or PaO₂/FiO₂ fraction of inspired oxygen
  (FiO₂) < 333 mmHg (2 points)
- pH < 7.35 (2 points).

For patients over 50, all the factors are the same except respiratory rate (> 30 breaths/minute) and oxygen level (PaO₂ < 60 mmHg or oxygen saturation ≤ 90% or PaO₂/FiO₂ < 250 mmHg).

The total score determines the patient’s risk for needing intensive respiratory vasopressor support.

- 0-2 = low risk
- 3-4 = moderate risk
- 5-6 = high risk
- 7 = very high risk

Patients with a score of ≥ 5 are considered to have an increase risk for CAP.

#### American Thoracic Society criteria

The American Thoracic Society has created criteria for patients with severe CAP who require ICU admission.

Minor criteria include:
- respiratory rate > 30 breaths/minute and PaO₂/FiO₂ ≤ 250 mmHg (A need for noninvasive ventilation can substitute for a respiratory rate > 30 breaths/minute or PaO₂/FiO₂ mmHg < 250.)
- multilobar infiltrates
- confusion/disorientation
- uremia (BUN level ≥ 20 mg/dL)
- leukopenia as a result of the infection alone (white blood cell count < 4,000 cells/mm³)
- thrombocytopenia (platelet count < 100,000 cells/mm³)
- hypothermia (core temperature < 96.8°F [36°C])
- hypotension requiring aggressive fluid resuscitation.

Major criteria include:
- invasive mechanical ventilation
- septic shock with the need for vasopressors.

Other criteria to consider include hypoglycemia (in patients without diabetes), acute alcoholism or alcohol withdrawal, hyponatremia, unexplained metabolic acidosis or elevated lactate level, cirrhosis, and asplenia.

#### Nursing interventions and treatment

In the outpatient setting, patients with CAP are treated with antibiotics as outlined in guidelines from the American Thoracic Society and the Infectious Diseases Society of America. (See Treatment options.)

With the increase in antibiotic resistance, evidence-based prescribing is crucial. To decrease the chance of antibiotic-resistant microorganisms developing and to reduce the chances of adverse effects from antibiotic treatment, a short (5-day) course of antibiotic treatment is recommended. Research shows no difference between long- and short-course antibiotic treatment of CAP, and the short course has been shown to reduce the risk of...
Treatment options

The Infectious Diseases Society of America/American Thoracic Society collaborated to create these outpatient treatment options for those with community-acquired pneumonia.

**Patient considerations**

| Patient is healthy, with no use of antimicrobials in the past 3 months | Macrolide (azithromycin, clarithromycin, erythromycin) or Doxycycline (Note: macrolide preferred.) |
| Patient with compromised immune system or other comorbidities (chronic heart, lung, liver, or renal disease; diabetes; asplenia; alcoholism; malignancy) or use of antimicrobials within the previous 3 months | Respiratory fluoroquinolone (moxifloxacin, gemifloxacin, levofloxacin [750 mg]) or Beta-lactam (high-dose amoxicillin 1 g three times a day or amoxicillin-clavulanate 2 g twice a day by mouth* plus macrolide) |
| Patient in region with high rate (> 25%) of high-level (MIC ≥ 16 mcg/ml) macrolide-resistant *Streptococcus pneumoniae* | Respiratory fluoroquinolone (moxifloxacin, gemifloxacin, levofloxacin [750 mg]) or Beta-lactam (high-dose amoxicillin 1 g three times a day or amoxicillin-clavulanate 2 g twice a day** plus macrolide) |

*Alternative for patients unable to take the medication because of a previous allergic reaction or contraindicated medical condition: ceftriaxone, cefepoxide, and cefuroxime (500 mg two times daily); doxycycline is an alternative to the macrolide.

**High dose to cover patients with drug-resistant *Staphylococcus pneumoniae* (DRSP), patients < 2 or > 65 years old who have received beta-lactam therapy within the last 3 months, patients diagnosed with alcoholism, patients with a compromised immune system or other comorbidities, and children exposed in day care.


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*Clostridium difficile.*

To qualify for short-course antibiotic treatment, patients must be deemed clinically stable by the healthcare provider. The definition of clinically stable includes 48 to 72 hours without a fever in the last 5 days of therapy, systolic blood pressure > 90 mmHg, heart rate < 100 beats/minute, respiratory rate < 24 breaths/minute, oxygen saturation > 90%, and normal mental status. If no improvement occurs after 5 days of antibiotic use, treatment should continue for another 2 days.

Recent research provides a better understanding of CAP patients receiving current treatments as compared to health care-associated pneumonia patients, specifically related to CAP drug-resistant pathogens (CAP-DRP), including *Pseudomonas aeruginosa, Acinetobacter baumannii,* methicillin-resistant *Staphylococcus aureus* (MRSA), and extremely resistant *Enterobacteriaceae.* The goal of this research is to decrease the overuse of narrow-spectrum antibiotics, which can result in using inappropriate medications and broad-spectrum antibiotics. (Access an algorithm for treating CAP-DRPs at americannursetoday.com/?p=36506.)

Other treatments include acetaminophen for pain and fever, early ambulation, appropriate hydration, and nutritional meals. Systemic steroids (if reactive airway involvement secondary to CAP exists), bronchodilators, and cough suppressants may also be ordered.

Teach patients the expected guidelines for recovery, which include:

- fever resolved in 1 week
- notably decreased chest pain and sputum in 4 weeks
- notably decreased cough and breathlessness in 6 weeks
- resolution of symptoms (although fatigue may still be present) in 3 months
- feeling back to normal in 6 months

Patients with underlying comorbidities may follow a different or extended course of recovery.

Follow-up for outpatient treatment is usually 48 to 72 hours after the initial diagnosis, with another follow-up appointment with the healthcare provider in 2 to 3 weeks. Instruct patients to contact their provider if any unexpected complications develop. Patients who smoke should have additional follow-up at the 6- to 12-week mark for a repeat assessment and chest x-ray to rule out underlying pathology that may have been a factor in the original CAP diagnosis.

What’s in your toolkit?

Using tools to assess whether CAP patients can be treated in the community reduces care costs and protects patients with decreased immunity from being admitted to hospitals, where they may acquire other infections. The assessment tools lead to treatment designed to limit the creation of additional drug-resistant pathogens. Research regarding CAP is fluid, so stay up-to-date with the most recent evidence-based practices.

Visit americannursetoday.com/?p=36506 for a list of selected references.

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Please mark the correct answer online.

1. The body’s physiologic response to an organism causing community-acquired pneumonia (CAP) includes
   a. vasooconstriction of pulmonary capillaries.
   b. vasodilatation of pulmonary capillaries.
   c. leaking of low-protein exudate.
   d. leaking of low-carbohydrate exudate.

2. A risk factor for CAP is
   a. increased cough reflex.
   b. chronic renal failure.
   c. intermittent steroid use.
   d. hypergammaglobulinemia.

3. Which statement about mortality from CAP is correct?
   a. Older patients over age 75 are at higher risk of mortality.
   b. Patients between 20 and 40 years old are at higher risk of mortality.
   c. The mortality rate for patients treated in the outpatient setting is 15%.
   d. The mortality rate for patients treated in the intensive care unit is 5%.

4. One of the most common pathogens that causes CAP is
   a. Haemophilus influenzae.
   b. Pseudomonas aeruginosa.
   c. Staphylococcus aureus.
   d. enteric gram-negative bacilli

5. Which patient most likely has CAP rather than hospital-acquired pneumonia?
   a. Symptoms began 7 days after admission to the hospital.
   b. The patient was hospitalized 20 days before symptoms started.
   c. The patient lives in a long-term care facility.
   d. Symptoms began 3 days after admission to the hospital.

6. Signs and symptoms of CAP include
   a. whispered pectoriloquy.
   b. increased appetite.
   c. decreased tactile fremitus.
   d. lack of skin tenting.

7. Which statement about the use of chest x-rays for diagnosing CAP is correct?
   a. Viral infection presents with alveolar infiltrates.
   b. Use of computed tomography scans is preferable over serial chest x-rays.
   c. Bacterial infection presents with alveolar infiltrates.
   d. Viral and bacterial infections do not occur simultaneously.

8. Which tool used to assess whether a patient with CAP can be treated as an outpatient requires only four parameters?
   a. SMART-COP
   b. Pneumonia severity index
   c. American Thoracic Society criteria
   d. CB8-65

9. Which tool uses minor and major criteria to assess whether patients with severe CAP need to be admitted to the intensive care unit?
   a. SMART-COP
   b. Pneumonia severity index
   c. CURB-65
   d. American Thoracic Society criteria

10. What is the level of risk for needing intensive respiratory vasopressor support for a patient who scores 3 on the SMART-COP tool?
    a. Low
    b. Moderate
    c. High
    d. Very high

11. The recommended course of antibiotic treatment for CAP in a patient who is clinically stable is
    a. 3 days.
    b. 5 days.
    c. 7 days.
    d. 14 days.

12. A 55-year-old man with CAP is otherwise healthy and has not used antimicrobials in the past 3 months. An appropriate treatment choice is
    a. azithromycin.
    b. amoxicillin.
    c. levofloxacin.
    d. gemifloxacin.

13. Which of the following indicates a patient with CAP is clinically stable and can be treated with short-course antibiotic therapy?
    a. Oxygen saturation of 85%
    b. Respiratory rate of 26 breaths/minute
    c. Systolic blood pressure of 95 mmHg
    d. Heart rate of 90 beats/minute

14. A 70-year-old woman with CAP lives in a region that has a 30% rate of high-level (MIC ≥ 16 mcg/ml) macrolide-resistant Streptococcus pneumoniae. An appropriate single-treatment choice is
    a. erythromycin.
    b. doxycycline.
    c. moxifloxacin.
    d. clarithromycin.

15. Patients receiving treatment for CAP should be told which of the following is an expected guideline for recovery?
    a. Fever resolves in 2 weeks.
    b. Chest pain and sputum notably decrease in 6 weeks.
    c. Cough and breathlessness notably decrease in 6 weeks.
    d. Symptoms resolve in 2 months.
Drug-resistant pathogen algorithm

This diagnostic and treatment algorithm aids in treating patients at risk for community-acquired pneumonia drug-resistant pathogens.

CAP = community-acquired pneumonia, MRSA = methicillin-resistant *Staphylococcus aureus*