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Diagnosis and Management of Community-Acquired Pneumonia: Evidence-Based Practice

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ABSTRACT
The purpose of this article is to evaluate the new Infectious Diseases Society of America and the American Thoracic Society Guideline for Community-Acquired Pneumonia in Adults for nurse practitioner (NP) practice using evidence-based practice principles. The major recommendations for diagnosis, treatment, site of care, and prevention are also summarized. In general, the guideline meets the criteria of evaluation of practice guidelines, although the methods used for the literature search are not adequately described. The guideline was not developed with the input from primary care providers; however, it is appropriate for NPs who work in a variety of settings, including primary care.

Keywords: Adults, community-acquired pneumonia, evidenced-based practice, practice guidelines

In 1901, Osler proclaimed that the “most widespread and fatal of all acute diseases, pneumonia, is now the Captain of the Men of Death.” Today, pneumonia, along with influenza, continues to be a leading cause of death in the United States, despite advances in antimicrobial therapy, vaccines, and critical care. Pneumonia also has a significant effect on morbidity, resulting in more than 10 million outpatient visits, 600,000 hospitalizations, and 64 million days of restricted activity each year. Consequently, nurse practitioners (NPs) in a variety of settings encounter pneumonia on a regular basis, and in order to provide the most optimal care they must review and evaluate the available evidence. Given the growing amount of research on community-acquired pneumonia (CAP), this can be a daunting task for any clinician. Consequently, the purpose of this article is to summarize and evaluate the latest guideline developed by the Infectious Diseases Society of America and the American Thoracic Society (IDSA/ATS) for diagnosis and management of CAP in adults.

OVERVIEW OF CAP
Pneumonia is an infection of the lower respiratory tract caused by bacteria, viruses, fungi, protozoa, or parasites. Respiratory pathogens reach the lungs through inhalation of microorganisms, aspiration of oropharyngeal secretions, and hematogenous spread from other bodily sites of infection. CAP refers to pneumonia that is acquired outside health care organizations, including hospitals, nursing homes, and other long-term care facilities. Although antibiotic resistance has increasingly become a recognized problem in pneumonia, older age and underlying disease, not antibiotic resistance, are more important factors in mortality.

Despite advances in diagnostic testing, the causative agent in as many as 50% of clients with CAP is not identified even when extensive testing has been performed. Unfortunately, no diagnostic test exists that can identify all potential pathogens. Streptococcus pneumoniae, Mycoplasma pneumoniae, and Chlamydia pneumoniae have been the most commonly identified organisms, although their incidence depends on the type of diagnostic testing and criteria used (Table 1). Legionella spp and variable infections are also common. Infections by gram-negative bacilli may be increasing in outpatient settings because of the complexity of the clients treated outside of health care settings.

Table 1. Most Common Causes of Community-Acquired Pneumonia

| Client Type               | Cause                                      |
|--------------------------|--------------------------------------------|
| Outpatient               | Streptococcus pneumoniae                   |
|                          | Mycoplasma pneumoniae                      |
|                          | Haemophilus influenzae                     |
|                          | Chlamydia pneumoniae                       |
|                          | Respiratory viruses¹                       |
| Inpatient (nonintensive care unit) | S pneumoniae                             |
|                          | M pneumoniae                              |
|                          | C pneumoniae                              |
|                          | H influenzae                               |
|                          | Legionella species                         |
|                          | Respiratory viruses¹                       |
| Inpatient (intensive care unit) | S pneumoniae                             |
|                          | Staphylococcus aureus                      |
|                          | Legionella species                         |
|                          | Gram-negative bacilli                      |
|                          | H influenzae                               |

¹ Influenza A and B, adenovirus, respiratory syncytial virus, and parainfluenza.

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To eliminate some of the confusion arising from multiple national practice guidelines, the IDSA/ATS published a joint clinical practice guideline in 2007.4 This guideline is geared toward emergency medicine and primary care practitioners and hospitalists, and it is intended primarily for CAP.

Initial diagnosis and treatment decisions are based on assessment of severity. Site-of-care decisions and outpatient treatment versus hospitalization should be based on severity-of-illness scores, such as the CURB-65 criteria (confusion, uremia, respiratory rate, low blood pressure, age 65 years or older), or prognostic models, such as the Pneumonia Severity Index. These objective measures of severity should be supplemented by subjective factors, such as the ability to take medications safely and reliably. Clients with septic shock should be directly admitted to the intensive care unit (ICU) for vasopressors, intubation, and mechanical ventilation. In addition, any clients with three or more of the minor criteria for severe CAP (Table 2) should also be considered for admission to the ICU or high-level monitoring unit.

The diagnosis of CAP is based on presenting signs and symptoms, such as cough, fever, sputum, pleuritic chest pain, and presence of rales or bronchial breath sounds; however, a demonstrable infiltrate by chest X-ray (or other imaging technique) is required to differentiate CAP from other causes of cough and fever (e.g., acute bronchitis). Chest radiographs may also be useful in identification of causative agent, prognosis, alternative diagnoses, and associated conditions. In cases when the chest X-ray is not definitive, although the client’s toxic condition is suggestive of pneumonia, it may be prudent to treat presumptively for 24 hours and repeat the imaging in 1 to 2 days. It is important to keep in mind that some clients because of age, immune status, and hydration may not present with typical clinical features, radiograph findings, or both.

Routine diagnostic tests (e.g., cultures, Gram staining) to identify causative agents are optional in nonhospitalized clients with CAP because studies have shown that these tests are infrequently done, yet clients do well with empirical antibiotic treatment. Exceptions to this recommendation, such as influenza that can be tested using rapid point-of-care tests, do exist. Specific recommendations for additional diagnostic testing are provided in Table 3.

Table 3. Suspected severe acute respiratory syndrome (SARS), Mycobacterium tuberculosis infection, community-acquired Methicillin-resistant Staphylococcus aureus (MRSA), fungal infections, avian influenza, and disease caused by agents used in bioterrorism should be verified with further diagnostic testing. Moreover, in situations when antibiotic treatment would likely be altered, investigation for specific causative agents should be undertaken, especially when the presence of specific pathogens is suspected based on the clinical presentation. This allows the clinician to narrow or completely alter antibiotic therapy, improving the likelihood of treatment success. Clearly, extensive diagnostic testing should be indicated for critically ill clients, and the guideline provides additional information about the circumstances in which other testing, such as blood cultures, respiratory tract specimen Gram stain and culture, and antigen tests, should be done.

| Table 2. Criteria for Severe Community-Acquired Pneumonia |
|----------------------------------------------------------|
| **Minor Criteria**                                        |
| Respiratory rate ≤ 30 breaths/min                         |
| PaO<sub>2</sub>/FiO<sub>2</sub> ratio ≤ 250                |
| Multilobar infiltrates                                    |
| Confusion or disorientation                               |
| Uremia (BUN level ≥ 20 mg/dL)                             |
| Leukopenia (WBC count < 4000 cells/mm<sup>3</sup>)         |
| Thrombocytopenia (platelet count < 100,000 cells/mm<sup>3</sup>) |
| Hypothermia (core temperature < 36°C)                     |
| Hypotension requiring aggressive fluid resuscitation     |
| **Major Criteria**                                        |
| Invasive mechanical ventilation                           |
| Septic shock with the need for vasopressors               |

BUN, blood urea nitrogen; PaO<sub>2</sub>/FiO<sub>2</sub>, arterial oxygen pressure/fraction of inspired oxygen; WBC, white blood count.

* Other criteria to consider include hypoglycemia (in nondiabetic patients), acute alcoholism or alcoholic withdrawal, hyponatremia, unexplained metabolic acidosis or elevated lactate level, cirrhosis, and asplenia.

* A need for noninvasive ventilation can substitute for a respiratory rate ≥ 30 breaths/min or a PaO<sub>2</sub>/FiO<sub>2</sub> ratio ≤ 250.

* As a result of infection alone.

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The mainstay of pneumonia treatment is antimicrobial therapy. Appropriate antibiotic selection is based on prediction of most likely causative pathogen (Table 1 and Table 4) and antibiotic susceptibility. For most clients in the outpatient setting, antibiotic selection will be empirical until more rapid and accurate diagnostic tests are developed (Table 5). Other factors to consider in selection include pharmacokinetics and pharmacodynamics, compliance, safety, and cost. Local susceptibility patterns, if available from local or state health departments, should be considered in antibiotic selection. When the specific pathogen(s) is known, antimicrobial therapy should be directed toward that causative agent (Table 6). Clients should be treated with antibiotics for at least 5 days, be afebrile for 48 to 72 hours, and have no more than one sign of clinical instability (heart rate ≤ 100 beats/minute, respiratory rate ≤ 24 breaths/minute, systolic blood pressure ≥ 90 mm Hg, arterial oxygen saturation ≥ 90% or partial pressure of oxygen ≥ 60 mm Hg on room air, ability to maintain oral intake, normal mental status). Clients with persistent clinical instability may need to be hospitalized or treated for a longer duration.

Prevention of pneumonia is also addressed in the IDSA/ATS guideline (Table 7). Vaccination status should be assessed at the time of hospitalization for all persons, and vaccination can be performed at discharge or in the outpatient setting. Smoking cessation is also a critical part of prevention. Respiratory hygiene measures, including hand hygiene and masks and tissue for patients with a cough, should be used in outpatient and inpatient settings.

### APPRAISAL OF IDSA/ATS GUIDELINE

A number of criteria have been identified for the evaluation of clinical practice guidelines. According to the components in the AGREE (appraisal of guidelines for research and evaluation) instrument, appraisal should address the following: scope and purpose, stakeholder involvement, rigor of development, clarity and presentation, applicability, and editorial independence. In relation to scope and purpose, the IDSA/ATS guideline has a clear aim: diagnosis and treatment of CAP in adults. Institutionalized and immunocompromised adults are excluded. Relevant clinical questions are addressed, such as antimicrobial selection and determination of site of care.

#### Table 3. Clinical Indications for More Extensive Diagnostic Testing

| Indication                           | Blood Culture | Sputum Culture | Legionella UAT | Pneumococcal UAT | Other |
|--------------------------------------|---------------|----------------|----------------|-------------------|-------|
| ICU admission                        | X             | X              | X              | X                 | X*    |
| Failure of outpatient antibiotic therapy | X             | X              | X              | X                 |       |
| Cavitary infiltrates                 | X             | X              | X              | X                 |       |
| Leukopenia                           | X             | X              | X              | X                 | X*    |
| Active alcohol abuse                 | X             | X              | X              | X                 |       |
| Chronic severe liver disease         | X             | X              | X              | X                 |       |
| Severe obstructive or structural lung disease | X             | X              | X              | X                 |       |
| Asplenia (anatomic or functional)    | X             | X              | X              | X                 |       |
| Recent travel (within 2 wk)          | X             | X              | X              | X                 |       |
| Positive Legionella UAT result       | X             | NA             | NA             | X                 |       |
| Positive pneumococcal UAT result     | X             | X              | X              | X                 |       |
| Pleural effusion                     | X             | X              | X              | X                 | X*    |

**UAT, urinary antigen test; NA, not applicable.**

* Endotracheal aspirate if intubated, possibly bronchoscopy or nonbronchoscopic bronchoalveolar lavage.

* Fungal and tuberculosis cultures.

* For travel to or residence in southwestern United States, consider Coccidioides species, Hantavirus; for travel to Southeast and East Asia, consider Burkholderia pseudomallei, avian influenza, SARS.

* Special media for Legionella.

* Thoracentesis and pleural fluid cultures.

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Stakeholder involvement focuses on how well the guideline represents the views of those who will be using it. The investigators readily acknowledge that, although the guideline is intended for use by primary care, emergency care, and hospitalist physicians, those specialists were not involved in the development. NPs, other primary care providers, and clients were not included either. Finally, no information is available about pretesting of the guideline before dissemination for use.

Rigor refers to the process used to identify, select, and synthesize the evidence used to develop the guideline. The strategy used to search for evidence, including search terms, sources used, and the dates covered, is not provided in the guideline. Information on the inclusion or exclusion of pieces of evidence is also not available. The process for formulation and grading of each recommendation is described. The committee used a three-tier scale to grade the recommendations: high (evidence from well-conducted, randomized controlled trials), moderate (evidence from well-designed, controlled trials without randomization), and low (evidence from case studies and expert opinion). The final grading of

| Condition | Commonly Encountered Pathogen(s) |
|-----------|-----------------------------------|
| Alcoholism | *Streptococcus pneumoniae*, oral anaerobes, *Klebsiella pneumoniae*, *Acinetobacter* species, *Mycobacterium tuberculosis* |
| Chronic obstructive pulmonary disease, smoking, or both | *Haemophilus influenzae*, *Pseudomonas aeruginosa*, *Legionella* species, *S pneumoniae*, *Moraxella catarrhalis*, *Chlamydia pneumoniae* |
| Aspiration | Gram-negative enteric pathogens, oral anaerobes |
| Lung abscess | Community-acquired MRSA, oral anaerobes, endemic fungal pneumonia, *M tuberculosis*, atypical mycobacteria |
| Exposure to bat or bird droppings | *Histoplasma capsulatum* |
| Exposure to birds | *Chlamydia pneumoniae* (if poultry: avian influenza) |
| Exposure to rabbits | *Francisella tularensis* |
| Exposure to farm animals or parturient cats | *Coxiella burnetii* (Q fever) |
| Hotel or cruise ship stay in previous 2 wk | *Legionella* species |
| HIV infection (early) | *S pneumoniae*, *H influenzae*, *M tuberculosis* |
| HIV infection (late) | Pathogens listed above for early infection plus *Pneumocystis jiroveci*, *Cryptococcus*, *Histoplasma*, *Aspergillus*, atypical mycobacterium (especially *Mycobacterium kansasii*), *P aeruginosa* |
| Travel or residence in southwestern United States | *Coccidioides* species, *Hantavirus* |
| Travel or residence in Southeast or East Asia | *Burkholderia pseudomallei*, avian influenza, SARS |
| Influenza activity in community | *Influenza*, *S pneumoniae*, *Staphylococcus aureus*, *H influenzae* |
| Cough >2 wk with whoop or posttussive vomiting | *Bordetella pertussis* |
| Structural lung disease (eg, bronchiectasis) | *P 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) |

*Table 4. Epidemiologic Conditions and/or Risk Factors Related to Specific Pathogens in Community-Acquired Pneumonia*
each recommendation was a composite of each committee member’s evaluation of the evidence and his or her clinical expertise. In the discussion of each recommendation, a clear link is found between the recommendation and evidence on which it is based. It is unclear whether the guideline was externally reviewed. The guideline was reviewed by each of the societies for final approval. The guideline should reflect current research and have a procedure for updating the guideline. The guideline does include 335 references, with publication dates between 1971 and 2006. Approximately 70% were published from 2000 to the present, with 25% of the references published between 2004 and 2006. The references are from the United States, Canada, and Europe, although all the references are in English so it is unknown what effect literature from non-English journals may have on the recommendations. There is no discussion of updating of the guideline.

Clarity and presentation pertains to the language and format of the guideline. The recommendations are concrete with clear descriptions of the diagnosis and management of CAP. Options for diagnosis and treatment are provided. The recommendations are easily identified. The presentation could be enhanced by dissemination of a quick reference guide.

Applicability of the guideline refers to the organizational, behavioral, and cost implications of implementing the guideline. This guideline will potentially require some changes and will have cost implications for some clients and practices; however, these are probably not significant in most situations (see “Summary and Conclusions”).

Finally, editorial independence deals with the independence of the recommendations and acknowledgement of any possible conflicts of interest by those developing the guideline. No explicit statement acknowledges the funding source for the guideline development, although presumably it was funded by the two societies. Conflicts of interest, specifically funding by pharmaceutical companies, are acknowledged in the guideline.

**SUMMARY AND CONCLUSIONS**

The IDSA/ATS guideline for CAP provides a comprehensive overview of diagnosis and treatment, including evaluation of the severity of CAP and determination of site of treatment. The scope and purpose, clarity, and presentation and applicability are strengths of this guideline.
Table 6. Recommended Antimicrobial Therapy for Specific Pathogens

| Organism                                      | Preferred Antimicrobial                  | Alternative Antimicrobial(s)                                                                 |
|-----------------------------------------------|------------------------------------------|---------------------------------------------------------------------------------------------|
| *Streptococcus pneumoniae*                    | Penicillin G, amoxicillin                 | Macrolide, cephalosporins [oral (cefepodoxime, cefprozil, cefuroxime, cefdinir, cefditoren) or parenteral (cefuroxime, ceftriaxone, cefotaxime)], clindamycin, doxycycline, respiratory fluoroquinolone<sup>a</sup> |
| Penicillin resistant; MIC > 2 μg/mL           | Agents chosen on basis of susceptibility, including cefotaxime, ceftriaxone, fluoroquinolone | Vancomycin, linezolid, high-dose amoxicillin (3 g/d with penicillin MIC ≤ 4 μg/mL)         |
| *Haemophilus influenzae*                      |                                          | Fluidquinolone, doxycycline, azithromycin, clarithromycin<sup>a</sup>, Fluoroquinolone, doxycycline, azithromycin, clarithromycin<sup>a</sup> |
| Non-β-lactamase producing                     | Amoxicillin                              | Macrolide                                                                                  |
| β-Lactamase producing                         | Second- or third-generation cephalosporin, amoxicillin-clavulanate | Fluoroquinolone                                                                            |
| *Mycoplasma pneumoniae*                       | Macrolide, a tetracycline                | Fluidquinolone                                                                            |
| *Chlamydia pneumoniae*                        |                                          | Fluidquinolone, doxycycline, azithromycin, clarithromycin<sup>a</sup>                     |
| *Legionella species*                          | Fluoroquinolone, azithromycin            | Doxycycline                                                                                |
| *Chlamydia psittaci*                          | A tetracycline                           | Macrolide                                                                                  |
| *Coxiella burnetii*                           | A tetracycline                           | Macrolide                                                                                  |
| *Francisella tularensis*                      | Doxycycline                              | Gentamicin, streptomycin                                                                   |
| *Yersinia pestis*                             | Doyxicycline, fluoroquinolones           | Other fluoroquinolones, β-lactam, if susceptible; rifampin, clindamycin, chloramphenicol |
| *Bacillus anthracis* (inhaled)                | Ciprofloxacin, levofloxacin, doxycycline (usually with second agent) | β-Lactam/β-lactamase inhibitor<sup>a</sup>, fluoroquinolone                                |
| *Enterobacteriaceae*                          | Third-generation cephalosporin, carbapenem<sup>b</sup> (drug of choice if extended-spectrum β-lactamase producer) | Aminoglycosides plus ciprofloxacin or levofloxacin<sup>c</sup>                           |
| *Pseudomonas aeruginosa*                      | Antipseudomonal β-lactam<sup>a</sup> plus ciprofloxacin or levofloxacin<sup>b</sup> or aminoglycosides | Aminoglycosides                                                                         |
| *Burkholderia pseudomallei*                   | Carbapenem, ceftazidime                  | Fluoroquinolone, TMP-SMX                                                                   |
| *Acinetobacter species*                       | Carbapenem                               | Cephalosporin-aminoglycoside, ampicillin-subbacamt, colistin                             |
| *Staphylococcus aureus*                       |                                          | Fluidquinolone                                                                            |
| Methicillin susceptible                        | Antistaphylococcal penicillin<sup>a</sup> | Cefazolin, clindamycin                                                                     |
| Methicillin resistant                          | Vancomycin or linezold                   | TMP-SMX                                                                                   |
| *Bordetella pertussis*                        | Macrolide                                | TMP-SMX                                                                                   |
| *Anaerobe (aspiration)*                       | β-Lactam/β-lactamase inhibitor<sup>c</sup>, clindamycin | Carbapenem                                                                                 |
| *Influenza virus*                              | Oseltamivir or zanamivir                 | See TB guidelines<sup>7</sup>                                                             |
| *Mycobacterium tuberculosis*                  | Isoniazid plus rifampin plus ethambutol plus pyrazinamide | Amphotericin B                                                                             |
| *Coccidioides species*                        | For uncomplicated infection in normal host, no therapy generally recommended; for therapy, itraconazole, fluconazole | Amphotericin B                                                                             |
| *Histoplasmosis*                               | Itraconazole                             | Amphotericin B                                                                             |
| *Blastomycosis*                                | Itraconazole                             | Amphotericin B                                                                             |

Note: Choices should be modified on the basis of susceptibility test results and advice from local specialists. Refer to local references for appropriate doses. TMP-SMX, trimethoprim-sulfamethoxazole; TB, tuberculosis.

<sup>a</sup>Levofloxacin, moxifloxacin, gemifloxacin (not a first-line choice for penicillin-susceptible strains). Ciprofloxacin is appropriate for Legionella and most gram-negative bacilli (including H influenzae).

<sup>b</sup> Azithromycin is more active in vitro than clarithromycin for H influenzae.

<sup>c</sup> Imipenem-clavulanate, meropenem, ertapenem.

<sup>d</sup> Piperacillin-tazobactam for gram-negative bacilli, ticarcillin-clavulanate, ampicillin-subbacamt, or amoxicillin-clavulanate.

<sup>e</sup> Ticarcillin, pipericillin, cefazidime, cefepime, aztreonam, imipenem, meropenem.

<sup>f</sup> 750 mg daily.

<sup>g</sup> Nafcillin, oxacillin, fluocxacin.

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However, several weaknesses do exist. The investigators acknowledge that there was no input from primary care and emergency department physicians and hospitalists in the development of the guideline. In addition, although the approach to grading each recommendation is outlined, the methods for literature review need to be articulated more clearly. The investigators do not provide explicit information about how the articles used in the guideline were identified and selected. This additional information would help practitioners be able to evaluate for any potential biases in the sources used for the guideline.

The next step is for individual NPs to evaluate the guideline to (1) decide whether the strengths outweigh the weaknesses and (2) determine whether the guideline is applicable to their setting and clientele. Straus et al recommend addressing the four “Killer Bs” as a way to evaluate the appropriateness of the guideline for implementation in various settings. Is the burden of illness, or the number of clients with this disease, too low to warrant use of the guideline? Are the beliefs of the clients served about the type and value of interventions or their potential consequences incompatible with the guideline? Are the opportunity costs associated with guideline implementation a bad bargain? In other words, would the resources of the practice or community be better spent elsewhere? Are the barriers (geographic, organizational, cultural, legally, etc) so high that it is not worth using the guideline? Implementation of the guideline will be

**Table 7. Recommendation for Vaccine Prevention of Community-Acquired Pneumonia**

| Route of administration | Polyvalent Polysaccharide Vaccine | Inactivated influenza vaccine | Live Attenuated Influenza Vaccine |
|-------------------------|----------------------------------|-----------------------------|---------------------------------|
| Intramuscular injection | Inactivated influenza vaccine    | Intranasal spray             |
| Intramuscular injection | Killed virus                     | Live virus                  |

**Recommended groups**

- All persons ≥ 65 y of age
- High-risk persons
- 2–64 y of age
- Current smokers

**Specific high-risk indications for vaccination**

- Chronic cardiovascular, pulmonary, renal, or liver disease
- Diabetes mellitus
- Cerebrospinal fluid leaks
- Alcoholism
- Asplenia
- Immunocompromising conditions or medications
- Native Americans and Alaska natives
- Long-term care facility residents

**Revaccination schedule**

- One-time revaccination after 5 y for (1) adults ≥ 65 y of age, if first dose is received before age 65 y; (2) persons with asplenia, and (3) immunocompromised persons
- Annual revaccination

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Continued from page 640 Diagnosis and Management

problematic in some settings (e.g., those in which clients have financial barriers). If clients are being treated in the outpatient setting, inexpensive antibiotics (e.g., doxycycline) can be selected; however, the need for chest radiography may be problematic.

In summary, despite some weaknesses, including the acknowledged weakness that no primary care providers were involved in the development of the guideline, the CAP guideline has many strengths and in general is applicable to many NPs who work in primary care and urgent care settings. NPs are encouraged to review the guideline and determine whether it is relevant to their practice setting and clients.

References

1. Feikin DR, Schuchat A, Kolczak M, et al. Mortality from invasive pneumococcal pneumonia in the era of antibiotic resistance, 1995-1997. Am J Public Health. 2000;90(2):223-229.
2. National Center for Health Statistics. Health: United States, 2006. Available at: www.cdc.gov/nchs/data/hus/hus06.pdf#highlights. Accessed April 6, 2007.
3. Mandell LA. Epidemiology and etiology of community-acquired pneumonia. Infect Dis Clin North Am. 2004;18(4):761-776.
4. Mandell LA, Wunderink RG, Anzueto A, et al; Infectious Diseases Society of America; American Thoracic Society. Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. Clin Infect Dis. 2007;44(suppl 2):S27-S72.
5. McCance KL, Huether SE. Pathophysiology: the biological basis for disease in adults and children. 5th ed. St Louis, MO: Elsevier Mosby; 2006.
6. Niederman MS, Mandell LA, Anzueto A, et al; American Thoracic Society. Guidelines for the management of adults with community-acquired pneumonia. Diagnosis, assessment of severity, antimicrobial therapy, and prevention. Am J Respir Crit Care Med. 2001;163(7):1730-1754.
7. American Thoracic Society, Centers for Disease Control and Prevention, Infectious Diseases Society of America. American Thoracic Society/Centers for Disease Control and Prevention/Infectious Diseases Society of America: controlling tuberculosis in the United States. Am J Respir Crit Care Med. 2005;172(9):1169-1227.
8. Agree Collaboration. Appraisal of guidelines for research and evaluation (AGREE) instrument. Available at: www.agreecollaboration.org/pdf/agreeinstrumentsfinal.pdf. Accessed June 6, 2007.
9. Field MS, Lohr KN, eds. Guidelines for clinical practice: from development to use. Washington, DC: National Academies Press; 1992.
10. Gilbert TT, Taylor JS. How to evaluate and implement clinical policies. Farm Pract Manag. 1999;8(3):28-33.
11. Straus SE, Richardson WS, Glasziou P, Haynes RB. Evidence-based medicine: how to practice and teach EBM. 3rd ed. Edinburgh: Elsevier; 2005.

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