RTI RESISTANCE

BULLETIN 1

TO PRESCRIBE OR NOT: DIFFERENTIATING THE NEED FOR ANTIMICROBIALS IN RTIs

FROM THE EDITORS' DESK

Antimicrobial resistance is a significant problem in today's healthcare environment. Reports have predominantly targeted the hospital environment as the main source of resistant infections, such as those caused by methicillin-resistant *Staphylococcus aureus* (MRSA) "superbugs." Resistant hospital-acquired infections are associated with substantial morbidity, mortality, and costs. This has led to the movement towards increased transparency and reduction in reimbursement for such "preventable" conditions.[1]

What is important to note is that the concerns pertaining to antimicrobial resistance are just as important in the outpatient setting. The call for more judicious use of antimicrobials in the primary care setting began in the 1990s when resistance rates of *Streptococcus pneumoniae* to penicillin and the macrolides were rapidly increasing.[2] This was associated with a gradual reduction in the number of prescriptions by primary care physicians (PCPs) to treat upper respiratory tract infections (RTIs) in Europe.[3, 4] However, this trend has not been as obvious in the United States.

- In 1998, acute RTIs were associated with over 76 million office visits resulting in 41 million antimicrobial prescriptions–55% (22.6 million) of these prescriptions were considered unnecessary since the RTIs were likely caused by viral pathogens.[5]
- According to a 2006 study that included 52,135 RTI-associated office visits, the percentage of patients receiving antimicrobials remains high despite that only 5%–25% of these patients may actually have a bacterial infection.[6]

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IN THIS BULLETIN

Jointly sponsored by Vemco MedEd and Center for Independent Healthcare Education

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(From The Editor's Desk...)

Patients (%) receiving antimicrobial prescriptions for RTIs, 1998-2003[6]	
All URIs	65.0%
Acute Sinusitis	81.3%
Acute Bronchitis	75.7%
Acute Pharyngitis	65.0%
Nonspecific URI	33.4%

The overuse of antimicrobials has several potential consequences, including increasing the risk of resistance development and the probability of an adverse event or drug–drug interaction while inflating overall healthcare costs. Given the number of antimicrobial prescriptions for RTIs written by PCPs, this sector of healthcare can make a major impact in reducing or minimizing resistance development in the community. Education on the proper use and selection of antimicrobials for community-acquired RTIs is imperative in reducing unnecessary antimicrobial use and, thus, minimizing the selective pressure for resistance.

This bulletin, therefore, focuses on

- When an antimicrobial is appropriate for patients who present with an RTI
- How to select the appropriate agent when a bacterial infection is suspected

This bulletin discusses lower RTIs as these are associated with more serious complications and have a greater risk of mortality. Future bulletins will discuss the impact of resistance in the community on antimicrobial selection and will offer insights on how to appropriately select and dose these agents to achieve successful clinical outcomes while minimizing the risk of resistance development.

Common RTIs	
Upper RTIs	**Lower RTIs**
Acute sinusitis	Acute bronchitis
Otitis media	Acute exacerbation of chronic bronchitis (AECB)
Pharyngitis	Community-acquired pneumonia (CAP)

CME ACCREDITATION

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TARGET AUDIENCE
This educational initiative has been designed to meet the needs of physicians and other healthcare professionals involved in the diagnosis, management, and treatment of outpatients with RTIs.

PURPOSE STATEMENT
The purpose of this activity is to educate primary care physicians and other healthcare professionals on when an antimicrobial agent is needed to treat an RTI, identifying the risk factors for a resistant RTI, and optimizing antimicrobial therapy. With this knowledge, healthcare professionals involved in the diagnosis, management and treatment of outpatients with RTIs will be able to tailor therapy to achieve successful outcomes.

LEARNING OBJECTIVES
At the conclusion of this activity, learners should be able to
- Determine when an antimicrobial agent is needed to treat a respiratory tract infection (RTI)

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Physicians
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ACUTE BRONCHITIS

Acute bronchitis is among the most common causes of visits to PCPs. Data from the National Health Interview Survey indicate that 4% to 5% of the adult population will have at least one episode each year.[7] This was confirmed in a more recent study involving Oregon Medicaid patients in which approximately 5% of the population was diagnosed with acute bronchitis each year.[8]

The primary symptom of acute bronchitis is cough lasting 21 days or less in otherwise healthy patients.[9] (*Please note* that cough lasting longer than 21 days should be considered "chronic" or "persistent" and must be managed differently.) Before proceeding with the management of these patients, it is important to rule out other causes of cough, such as asthma and pneumonia.

It is important to recognize that in 90%-95% of patients, acute bronchitis is due to a viral pathogen **(Table 1)**.[9] Less than 10% of patients with acute bronchitis have a bacterial cause of infection and only a few bacteria have been identified as potential causative pathogens.[10, 11] A small proportion of patients may also have non-infectious disease causes–occult asthma and allergic or occupational exposures.[9]

In the 90%-95% of patients with viral acute bronchitis, antimicrobials are not recommended.[9] However, studies have shown 50%-80% antimicrobial prescription rates.[8, 12] Systematic reviews and meta-analyses prove no consistent effect of antimicrobials on the duration or severity of illness in these patients.[13, 14]

Antimicrobials are appropriate in

- Patients suspected with pertussis infection–those exposed to a known pertussis infection or symptomatic patients during a documented pertussis epidemic.[9]
- Patients during mycoplasma or *C. pneumoniae* outbreaks[9]

When managing patients with acute bronchitis, it may be useful to refer to the illness as a "chest cold". This will help discourage the perception that antimicrobial therapy is needed. Inhaled bronchodilators may be prescribed in some circumstances to help relieve symptoms while increase in fluid intake should be encouraged.[9] For those experiencing persistent irritative cough, a trial of a scopolamine-containing product should be considered.

Table 1. Common causative pathogens of acute bronchitis

Viral Pathogens (90%-95% of cases)[9]	Bacterial Pathogens (<10% of cases)[10, 11]
Influenza **Parainfluenza** **Respiratory syncitial virus (RSV)** **Coronavirus** **Adenovirus** **Rhinoviruses**	***Bordetella pertussis*** ***Mycoplasma pneumoniae*** ***Chlamydophila pneumoniae***

ACUTE EXACERBATION OF CHRONIC BRONCHITIS (AECB)

Chronic bronchitis (defined as cough with sputum production for most days of at least 3 months a year for two consecutive years) is present in approximately 85% of the patients with chronic obstructive pulmonary disease (COPD).[15] It can also occur in the absence of airway obstruction and therefore it is not always associated with COPD.

Defining AECB is difficult given the lack of standardized physiological, laboratory, or radiological diagnostic tests for this condition and its definition in clinical practice is varied. However, it typically involves the three cardinal criteria first established by Anthonisen and colleagues in 1987–increased sputum volume, increased sputum purulence, and increased dyspnea **(Table 2)**.[16] Based on these criteria, a COPD patient typically has 2 to 3 exacerbations each year. These criteria have also been used in the Canadian guidelines on AECB management to stratify patients into 3 categories–Type 1 (severe exacerbation), Type 2 (moderate exacerbation), and Type 3 (mild exacerbation) **(Table 2)**.

Table 2. AECB criteria and stratification

AECB Criteria established by Anthonisen and colleagues in 1987[16]	
1. Increased sputum volume 2. Increased sputum purulence 3. Increased dyspnea	
AECB Stratification based on Canadian guidelines for the management of AECB[15]	
Type 1 (severe exacerbation)	**All three symptoms present**
Type 2 (moderate exacerbation)	**Two symptoms present**
Type 3 (mild exacerbation)	**At least one of the symptoms present + one of the following: • Upper RTI in previous 5 days • Increased cough and wheezing • Increased respiratory or heart rate (20% above baseline) • Fever**

ETIOLOGY OF AECB

80% of all AECB episodes are due to viral/bacterial infections (30% due to viral and 50% due to bacterial) and only 20% are due to environmental exposure **(Table 3)**. Antimicrobial therapy should only be considered when a bacterial infection is responsible for the AECB episode. The therapy itself depends on the specific pathogen suspected.

Table 3. Causes of AECB

Infectious Disease (80% of all episodes)[17]	
Viral Infections • 30% of all AECB episodes ***Optimal Management Strategy*** No antimicrobial therapy	**Bacterial Infections** 50% of all AECB episodes ***Bacterial Etiology*** • Aerobic gram-positive and gram-negative pathogens (40%-50% of episodes) - Patients with well-preserved lung function: *Haemophilus influenzae, Moraxella catarrhalis,* and *Streptococcus pneumoniae* - More severely ill patients with declining lung function: *H. influenzae, M. catarrhalis,* and *S. pneumoniae* + *Pseudomonas aeruginosa* and Enterobacteriaceae • Atypical pathogens, primarily *C. pneumoniae* (<10% of episodes) ***Optimal Management Strategy*** Antimicrobial therapy based on the pathogen
Non-Infectious Disease (20% of all episodes)	
Environmental Exposure • Tobacco smoke • Dust • Allergens • Pollutants ***Optimal Management Strategy*** • Treat the allergy • Encourage eliminating exposure to tobacco smoke (though this can be challenging for many patients)	

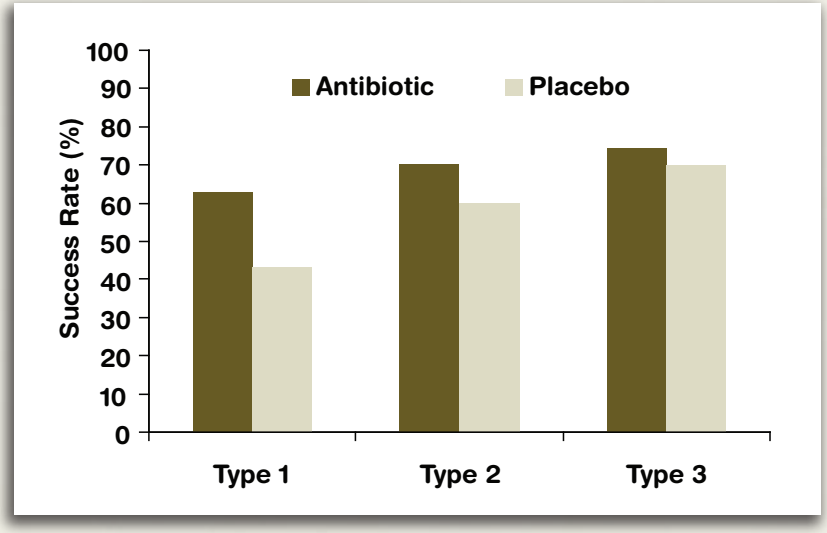
APPROPRIATE USE OF ANTIMICROBIALS FOR AECB

Early studies on the use of antimicrobials for the treatment of AECB showed little benefit when compared with placebo.[18, 19] However, when patients were categorized by type of symptoms, studies were able to identify those who were more likely to benefit from antimicrobial treatment.

In a randomized, double-blind study, Anthonisen and colleagues divided patients into Type 1, Type 2, and Type 3 (based on the Canadian guidelines) and compared success rates for those receiving antimicrobials (trimethoprim/sulfamethoxazole, amoxicillin, or doxycycline) versus placebo.[16]

- Overall success rates were 55% in the placebo group and 68% in the antimicrobial group.
- Results stratified by type of exacerbation
  - Differences in success rate between antimicrobial and placebo groups were greatest in patients with Type 1 (severe exacerbation), while the differences were less obvious for Type 2 (moderate exacerbation) and Type 3 (mild exacerbation) **(Figure 1)**.
  - The rate of deterioration was double in Type 1 patients receiving placebo versus those receiving antimicrobials (30.5% versus 14.3%).

Figure 1. Success rates among patients with AECB stratified by severity[16]



Patient stratification has become an important input in deciding when an antimicrobial is necessary for managing AECB. The Canadian Thoracic Society (CTS) and the Canadian Infectious Diseases Society (CIDS) offer guidelines on how to stratify patients having a "Type 1" exacerbation to which antimicrobial should be selected **(Table 4)**.[15]

Table 4. Stratification of patients with AECB and suggested management approach[15]

Risk Group	Basic Clinical State	Symptoms and Risk Factors	Antimicrobial Needed?	Rationale
0	Acute tracheobronchitis	Cough and sputum without previous pulmonary disease	No	These patients typically have a viral infection and would not require an antimicrobial unless symptoms persist for more than 10-14 days.
I	Chronic bronchitis without risk factors (simple)	Increased cough and sputum, sputum purulence, and increased dyspnea	Yes	These patients are likely to be infected with a common respiratory tract pathogen–*H. influenzae, M. catarrhalis,* or *S. pneumoniae*.
II	Chronic bronchitis with risk factors (complicated)	As in Group I + One of the following: – FEV_1<50% predicted – >4 exacerbations per year – Cardiac disease – Use of home oxygen – Chronic oral steroid use – Antimicrobial use in the past 3 months	Yes	These patients are more likely to be infected with an Enterobacteriaceae (such as *Klebsiella pneumoniae*) or *P. aeruginosa*, and multidrug resistance may also be a concern, particularly if there is a history of recent prior antimicrobial use. These patients may require referral to a specialist or hospital and treatment should be tailored to the specific pathogen.
III	Chronic suppurative bronchitis	As in Group II with constant purulent sputum – Some have bronchiectasis – FEV_1<35% predicted – Multiple risk factors (eg, frequent exacerbations and FEV_1<50% predicted)	Yes	These patients are more likely to be infected with an Enterobacteriaceae (such as *Klebsiella pneumoniae*) or *P. aeruginosa*, and multidrug resistance may also be a concern, particularly if there is a history of recent prior antimicrobial use. These patients may require referral to a specialist or hospital and treatment should be tailored to the specific pathogen.

COMMUNITY-ACQUIRED PNEUMONIA (CAP)

CAP is a leading cause of morbidity and mortality in the United States associated with nearly 6 million cases each year and approximately 1.5 million hospitalizations[20, 21]–1 million of these cases are attributed to those ≥65 years.[21]

CAP, along with influenza, is the leading cause of death due to an infectious cause in the US.[22] Mortality rates are relatively low for outpatients with CAP (about 1%), but they increase substantially for patients requiring hospitalization (~15%) and those admitted to the ICU (30%-40%).[21] Therefore, once a diagnosis of CAP is made, it is important to first determine the appropriate site of care for the patient.

SITE OF CARE DECISION

We present two typical cases to emphasize the importance of site of care.

Case 1	Case 2
• 72-year-old male • Fever: 100°F • Respiratory rate: 22 per minute • Blood pressure: 109/69 mmHg • Physical findings: Rales at the right base with dullness to percussion **Do you need to know anything else to make a decision about site of care?**	• 68-year-old female • Fever: 101°F • Respiratory rate: 32 per minute • Blood pressure: 109/78 mmHg • Rales at right base with dullness to percussion • Alert • BUN level: 25 mg/dL **What do you think is the appropriate site of care for this patient?**

Discussion on these cases is presented on page 13

Whether a patient requires hospitalization depends on the following factors:

1) mortality prediction tools,
2) social circumstances of the patient, and
3) co-existing conditions.[20]

Several mortality prediction tools have been developed to help assess the severity of illness **(Table 5)**.

- In the 1990s, Fine and colleagues developed the PORT (Pneumonia Outcomes Research Team) Severity Index (PSI) that used a combination of demographic variables, co-morbidities, physical observations, and laboratory and radiographic findings.[23] However, practical application of the PSI score in primary care can be particularly difficult given the time required and the need for laboratory findings.
- The CURB-65 criteria were developed to provide a simpler and more practical tool for PCPs to help decide whether a patient can be treated as an outpatient.[24] Though the CURB-65 criteria offers an improvement in the ease of use compared to the PSI score, there is still a laboratory requirement to assess uremia.
- The CRB-65 criteria, by eliminating the blood urea requirement, offer a more convenient tool to assess patient risk.[25]

Table 5. CAP mortality prediction rules

CURB-65[24]		**CRB-65[25]**	
CURB-65 score based on assigning 1 point for each of the following: **– Confusion** **– Uremia (BUN >19 mg/dL)** **– Respiratory rate (>30/minute)** **– Low Blood pressure (<90/<60 mmHg, either value)** **– Age >65 years**		**CRB-65 score based on assigning 1 point for each of the following:** **– Confusion** **– Respiratory rate (>30/minute)** **– Low Blood pressure (<90/<60 mmHg, either value)** **– Age >65 years**	
CURB-65 Score	**Risk**	**CRB-65 Score**	**Risk**
0 or 1	**Low risk** ***(Home treatment)***	**0**	**Home treatment**
2	**Moderate risk** ***(Short inpatient stay or very closely supervised outpatient therapy)***	**1**	**Hospital-supervised treatment**
3, 4, or 5	**Severe CAP** ***(Hospitalization; ICU admission for the most severe cases)***	**≥2**	**Hospitalization**

A study that compared the mortality rates of patients using the PSI, CURB-65, and CRB-65 criteria showed a strong correlation among all three methods to evaluate risk for patient mortality.[25] It is important to remember that these scores should be supplemented with the physician's determination of several subjective factors (such as reliability to follow-up, support of family or friends, etc.) to decide whether an inpatient or outpatient stay is in the best interest of the patient.

ETIOLOGY OF CAP

Viral pathogens are associated with only a small proportion of CAP cases (2%-15%).[26] *S. pneumoniae* remains the most common bacterial cause of CAP (20%-60%), including mild, moderate, and severe cases.[27] Other causative bacterial pathogens include *H. influenzae* (3%-10%) and atypical pathogens (10%-20%).[26]

Similar to AECB, more severe cases of CAP are predominantly due to Enterobacteriaceae and *P. aeruginosa*, and multidrug resistance should be considered when selecting a treatment for severe cases. The choice of initial antimicrobial therapy should, therefore, depend on the patient severity of illness, the likely pathogens, and risk of resistance and multidrug resistance. *(Risk factors for resistant infections will be discussed in greater detail in Bulletin #2.)*

TREATMENT OF CAP

In 2007, the Infectious Diseases Society of America (IDSA) and the American Thoracic Society (ATS) released updated guidelines on the management of CAP in adults.[28] The guidelines are a helpful resource when selecting initial empiric therapy, though antimicrobial selection should also consider patient factors and local epidemiology **(Table 6)**.

Table 6. IDSA and ATS Guidelines for the management of CAP in adults

Outpatients	
Previously healthy patients with no risk factors for drug-resistant *S. pneumoniae* infections	• Macrolide (azithromycin, clarithromycin, or erythromycin): strongly recommended • Doxycycline can be used as an alternative (weak recommendation)
Patients with comorbidities (such as chronic heart, lung, liver, or renal disease; diabetes mellitus; alcoholism; malignancies; asplenia; immunosuppressing conditions or use of immunosuppressing drugs) ***or*** who had prior use of an antimicrobial within the past 3 months (in which case an alternative from a different class of agents should be selected) ***or*** other risk of a drug-resistant *S. pneumoniae* infection	• Respiratory fluoroquinolone (moxifloxacin, gemifloxacin*, or levofloxacin [750 mg]): strongly recommended ***or*** • ß-lactam + macrolide: strongly recommended
In regions with a high rate (>25%) of infection with high-level (≥16 µg/mL) macrolide-resistant *S. pneumoniae*	An alternative agent should be considered for any patient, including those without comorbidities. • Respiratory fluoroquinolone • High-dose amoxicillin • Amoxicillin-clavulanate • Ceftriaxone • Cefpodoxime • Cefuroxime • Doxycycline
Note: For outpatient treatment, these recommendations should adequately cover the vast majority of CAP pathogens.[28] Exceptions may be the small number of *P. aeruginosa* CAP cases as well as community-associated methicillin-resistant *Staphylococcus aureus* (CA-MRSA) infections. Clinicians should be aware of specific epidemiological patterns or clinical presentations to detect these types of infections, especially if the patient does not respond to initial therapy.	
Hospitalized Patients	
In the general medical ward	Respiratory fluoroquinolone: strongly recommended ***or*** ß-lactam + macrolide: strongly recommended ***Note:*** Doxycycline can be used as an alternative to a macrolide.
Admitted to the ICU	• ß-lactam + either azithromycin or fluoroquinolone. • For patients suspected of *Pseudomonas* infection, an antipneumococcal, antipseudomonal ß-lactam (piperacillin-tazobactam, cefepime, imipenem, or meropenem) + either ciprofloxacin or levofloxacin (750-mg dose)

*Not currently marketed in the US

CASE 1 DISCUSSION

This patient likely has CAP and for complete and comprehensive evaluation using the CRB-65 criteria, you will need to assess the patient's mental status. (To use the CURB-65 criteria, you will additionally need to conduct a laboratory blood test to evaluate renal function [BUN]).

If the mental status and BUN levels are normal, this patient will only have a score of 1 for either criteria (age >65 years), suggesting mild illness and can likely be treated on an outpatient basis. However, before discharging the patient to home care, it is important to assess his social environment and support group (family support) as well as his reliability and accessibility for follow-up.

CASE 2 DISCUSSION

CAP is suspected and the CURB-65 criteria can be used to assign a point for age, respiratory rate, and uremia. This results in a score of 3. Her CRB-65 score is 2. This patient should, therefore, be admitted to the hospital. ICU admission should be considered depending on the presence of other comorbidities.

REFERENCES

1. Yokoe DS, Classen D. Improving patient safety through infection control: a new healthcare imperative. *Infect Control Hosp Epidemiol.* Oct 2008;29 Suppl 1:S3-11.
2. Karchmer AW. Increased antibiotic resistance in respiratory tract pathogens: PROTEKT US–an update. *Clin Infect Dis.* Sep 1 2004;39 Suppl 3:S142-150.
3. Fleming DM, Ross AM, Cross KW, Kendall H, Elliot AJ. Concerning: 'Why has antibiotic prescribing for respiratory illness declined in primary care? A longitudinal study using the General Practice Research Database'. *J Public Health (Oxf).* Jun 2005;27(2):228-229; author reply 229-231.
4. Cosby JL, Francis N, Butler CC. The role of evidence in the decline of antibiotic use for common respiratory infections in primary care. *Lancet Infect Dis.* Nov 2007;7(11):749-756.
5. Gonzales R, Malone DC, Maselli JH, Sande MA. Excessive antibiotic use for acute respiratory infections in the United States. *Clin Infect Dis.* Sep 15 2001;33(6): 757-762.
6. Gill JM, Fleischut P, Haas S, Pellini B, Crawford A, Nash DB. Use of antibiotics for adult upper respiratory infections in outpatient settings: a national ambulatory network study. *Fam Med.* May 2006;38(5):349-354.
7. Benson V, Marano MA. Current estimates from the National Health Interview Survey, 1995. *Vital Health Stat 10.* Oct 1998(199):1-428.
8. Li J, De A, Ketchum K, Fagnan LJ, Haxby DG, Thomas A. Antimicrobial prescribing for upper respiratory infections and its effect on return visits. *Fam Med.* Mar 2009;41(3):182-187.
9. Aagaard E, Gonzales R. Management of acute bronchitis in healthy adults. *Infect Dis Clin North Am.* Dec 2004;18(4):919-937.
10. Gonzales R, Bartlett JG, Besser RE, et al. Principles of appropriate antibiotic use for treatment of uncomplicated acute bronchitis: background. *Ann Emerg Med.* Jun 2001;37(6):720-727.
11. Macfarlane J, Holmes W, Gard P, et al. Prospective study of the incidence, aetiology and outcome of adult lower respiratory tract illness in the community. *Thorax.* Feb 2001;56(2):109-114.
12. Gonzales R, Steiner JF, Sande MA. Antibiotic prescribing for adults with colds, upper respiratory tract infections, and bronchitis by ambulatory care physicians. *JAMA.* Sep 17 1997;278(11):901-904.
13. Becker L, Glazier R, McIsaac W, Smucny J. Antibiotics for acute bronchitis. *Cochrane Database Syst Rev.* 2000(2):CD000245.
14. Bent S, Saint S, Vittinghoff E, Grady D. Antibiotics in acute bronchitis: a meta-analysis. *Am J Med.* Jul 1999;107(1):62-67.
15. Balter MS, La Forge J, Low DE, Mandell L, Grossman RF. Canadian guidelines for the management of acute exacerbations of chronic bronchitis: executive summary. *Can Respir J.* Jul-Aug 2003;10(5):248-258.
16. Anthonisen NR, Manfreda J, Warren CP, Hershfield ES, Harding GK, Nelson NA. Antibiotic therapy in exacerbations of chronic obstructive pulmonary disease. *Ann Intern Med.* Feb 1987;106(2):196-204.
17. Sethi S. Infectious etiology of acute exacerbations of chronic bronchitis. *Chest.* May 2000;117(5 Suppl 2): 380S-385S.
18. Nicotra MB, Rivera M, Awe RJ. Antibiotic therapy of acute exacerbations of chronic bronchitis. A controlled study using tetracycline. *Ann Intern Med.* Jul 1982;97(1):18-21.
19. Pines A, Raafat H, Greenfield JS, Linsell WD, Solari ME. Antibiotic regimens in moderately ill patients with purulent exacerbations of chronic bronchitis. *Br J Dis Chest.* Apr 1972;66(2):107-115.
20. File TM. The science of selecting antimicrobials for community-acquired pneumonia (CAP). *J Manag Care Pharm.* Mar 2009;15(2 Suppl):S5-11.
21. Niederman MS, Mandell LA, Anzueto A, et al. Guidelines for the management of adults with community-acquired pneumonia. Diagnosis, assessment of severity, antimicrobial therapy, and prevention. *Am J Respir Crit Care Med.* Jun 2001;163(7):1730-1754.
22. Kung H-C, Hoyert DL, Xu J, Murphy SL. Deaths: Final data for 2005. *National Vital Stat Rep.* 2008;56(10):1-121.
23. Fine MJ, Auble TE, Yealy DM, et al. A prediction rule to identify low-risk patients with community-acquired pneumonia. *N Engl J Med.* Jan 23 1997;336(4):243-250.
24. Lim WS, van der Eerden MM, Laing R, et al. Defining community acquired pneumonia severity on presentation to hospital: an international derivation and validation study. *Thorax.* May 2003;58(5):377-382.
25. Capelastegui A, Espana PP, Quintana JM, et al. Validation of a predictive rule for the management of community-acquired pneumonia. *Eur Respir J.* Jan 2006;27(1): 151-157.
26. File TM, Jr., Garau J, Blasi F, et al. Guidelines for empiric antimicrobial prescribing in community-acquired pneumonia. *Chest.* May 2004;125(5):1888-1901.
27. File TM. Community-acquired pneumonia. *Lancet.* Dec 13 2003;362(9400):1991-2001.
28. Mandell LA, Wunderink RG, Anzueto A, et al. Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. *Clin Infect Dis.* Mar 1 2007;44 Suppl 2:S27-72.

SELF-ASSESSMENT, EVALUATION, AND CREDIT APPLICATION

Release Date: September 9, 2009 Expiration Date: September 9, 2010 Center Serial #: CV3113

Select your professional title: ☐ Physician ☐ Other _____

Select your practice setting: ☐ Teaching hospital ☐ Community hospital ☐ LTAC ☐ Other _____

Your evaluation and suggestions will help improve the quality of future continuing education activities. Please answer the following general questions and provide written comments. Thank you for your cooperation.

SELF-ASSESSMENT (Please check the most appropriate answers)

What percent of acute bronchitis episodes are caused by viral infections?

- ☐ 25%
- ☐ 50%
- ☐ 75%
- ☐ >90%

Which of the following is not a cardinal symptom of an AECB episode?

- ☐ Fever
- ☐ Increased sputum volume
- ☐ Increased sputum purulence
- ☐ Increased dyspnea

The most common bacterial cause of community-acquired pneumonia is:

- ☐ *Haemophilus influenzae*
- ☐ *Streptococcus pneumoniae*
- ☐ *Staphylococcus aureus*
- ☐ *Moraxella catarrhalis*

Which of the following is not part of the CURB-65 criteria to evaluate severity of illness in CAP patients?

- ☐ Respiratory rate
- ☐ Low blood pressure
- ☐ Cough
- ☐ Uremia

According to the 2007 IDSA/ ATS guidelines, which agent is recommended for outpatient treatment of CAP in a previously healthy patient with no recent history of antimicrobial use?

- ☐ Penicillin
- ☐ Macrolide
- ☐ Fluoroquinolone
- ☐ Cephalosporin

LEARNING OBJECTIVES: Was the learning objective met?

	Yes	Somewhat	No
1. Determine when an antimicrobial agent is needed to treat a respiratory tract infection (RTI)	☐	☐	☐

If you answered 'No', please explain why

SCIENTIFIC CONTENT: Please rate

	Excellent	Good	Fair	Poor
1. The scientific content of this activity was	☐	☐	☐	☐
2. The level of expertise of the authors was	☐	☐	☐	☐

OVERALL EVALUATION

	Yes	Somewhat	No
1. This activity met my expectations.	☐	☐	☐
2. The content was relevant to my practice.	☐	☐	☐
3. This activity was fair and balanced?	☐	☐	☐
4. This activity was without commercial bias.	☐	☐	☐

If you answered 'No' to 3 or 4 please explain.

LEARNING FORMAT

	Yes	Somewhat	No
1. The format enhanced achievement of learning objectives.	☐	☐	☐
2. The format was easy to follow and understand.	☐	☐	☐

PRACTICE APPLICATION

1. What aspects of this activity were most relevant to your practice?

2. Will you make changes to your practice setting based on participation in this activity? Why or why not?

3. What aspects of RTI do you need to learn more about in order to improve your practice performance?

DO YOU HAVE (1) ANY SUGGESTIONS FOR IMPROVING THIS ACTIVITY or (2) ANY ADDITIONAL COMMENTS?

CREDIT APPLICATION (Please Print Clearly)

Name and Degree _____

Address _____ City _____ State _____ ZIP _____

Email _____ May we contact you by e-mail? ☐ Yes ☐ No

Type of Credit requested ☐ MD/DO *AMA PRA Category 1 Credit™* ☐ Other _____

I certify that I have reviewed in its entirety *RTI Resistance On the Frontline of Care: PCPs Fight Back!* Bulletin 1: *To Prescribe or Not: Differentiating the Need for Antimicrobials in RTIs.* Signature _____ Date _____