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ORIGINAL RESEARCH

Acute respiratory tract infection: A practice examines its antibiotic prescribing habits

Unexpected findings from an in-office study point out correctable measures to improve patient care.

Abstract

Purpose ► We wanted to better understand our practice behaviors by measuring antibiotic prescribing patterns for acute respiratory tract infections (ARTIs), which would perhaps help us delineate goals for quality improvement interventions. We determined (1) the distribution of ARTI final diagnoses in our practice, (2) the frequency and types of antibiotics prescribed, and (3) the factors associated with antibiotic prescribing for patients with ARTI.

Methods ► We looked at office visits for adults with ARTI symptoms that occurred between December 14, 2009, and March 4, 2010. We compiled a convenience sample of 438 patient visits, collecting historical information, physical examination findings, diagnostic impressions, and treatment decisions.

Results ► Among the 438 patients, cough was the most common presenting complaint (58%). Acute sinusitis was the most frequently assigned final diagnosis (32%), followed by viral upper respiratory tract infection (29%), and acute bronchitis (24%). Sixty-nine percent of all ARTI patients (304/438) received antibiotic prescriptions, with macrolides being most commonly prescribed (167/304 [55%]). Prescribing antibiotics was associated with a complaint of sinus pain or shortness of breath, duration of illness ≥ 8 days, and specific abnormal physical exam findings. Prescribing rates did not vary based on patient age or presence of risk factors associated with complication.

Variations in prescribing rates were noted between individual providers and groups of providers.

Conclusions ► We found that we prescribed antibiotics at high rates. Diagnoses of acute sinusitis and bronchitis may have been overused as false justification for antibiotic therapy. We used broad-spectrum antibiotics frequently. We have identified several gaps between current and desired performance to address in practice-based quality improvement interventions.

Most acute respiratory tract infections (ARTIs) are caused by viruses, do not require antibiotics, and resolve spontaneously.^{1,2} And yet, unnecessary prescribing of antibiotics for ARTIs continues—accounting for approximately half of all such prescriptions²—despite its well-known contribution to antimicrobial resistance, a public health threat as declared by the Institute of Medicine, the Centers for Disease Control and Prevention (CDC), and the World Health Organization (WHO).³⁻⁵

Even though the CDC has widely disseminated clinical guidelines for ARTI⁶⁻¹⁰ and annually publicizes recommendations for ARTI management during “Get Smart About Antibiotics Week,”¹¹ it appears that providers have difficulty implementing the guidelines.¹²⁻¹⁴ Granted, antibiotic prescription rates in general have declined somewhat, but the use of broad-spectrum antibiotics (macrolides and

 INSTANT POLL

Do patient expectations affect your decision to prescribe an antibiotic?

- Often or always
- Sometimes
- Rarely or never
- Other _____

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fluoroquinolones) and antibiotics for older Americans has increased.¹²

There are several plausible reasons for overprescribing. Patients have expectations for treatment based on prior experience or on a false assumption that their illness is bacterial in origin.¹⁴ Providers may be concerned that certain individuals are at risk of complications if not treated. Patient race, health maintenance organization membership, and insurance status have all been implicated as factors related to antimicrobial overutilization.¹²⁻¹⁶ It can be perceived as time consuming to educate patients about the likely viral nature of their illness and the lack of utility and increased risks in taking unneeded antibiotics.¹⁷ Furthermore, attempts at patient and physician education (eg, physician performance feedback) do not always reduce antibiotic overuse.¹⁸⁻²⁰

We wanted to know the state of ARTI antibiotic use in our practice and whether we could identify goals for improvement through quality interventions. We sought to determine the distribution of ARTI final diagnoses in our practice, the frequency and types of antibiotics prescribed, and factors associated with antibiotic prescribing.

Methods

Setting and subjects

Subjects were adult patients seen at Mayo Clinic Family Medicine offices in Arizona between December 14, 2009, and March 4, 2010. We created a convenience sample from visits scheduled for patients with ARTI symptoms. We encouraged, but did not require, clinic staff to use a standardized data collection form to document symptoms, physical examination findings, diagnostic impressions, and prescription decisions that were then entered into an Excel spreadsheet. At one of our 2 sites, clinicians (attending physicians, nurse practitioners, and resident physicians) used the form at the point of care to enroll a portion of the sample population. A retrospective chart audit (with or without use of the form) was the means of selecting the remainder of the sample at this site and the entire sample at our second site. We obtained informed consent from all patients enrolled with the

data collection form. The Mayo Foundation Institutional Review Board approved the project.

We defined an ARTI as a new illness occurring within the previous 3 weeks, associated with cough, sinus pain, nasal congestion or rhinorrhea, sore throat, or fever. We excluded patients who had a longer duration of symptoms, a previous evaluation, or a noninfectious diagnosis. We included ARTI patients with concomitant asthma or chronic obstructive pulmonary disease (COPD).

We enrolled 438 patients. Two hundred thirty-one (53%) consented prospectively to data collection with our standardized form; 207 (47%) were reviewed by retrospective chart audit. The mean age of subjects was 54 years (range 18-94, intraquartile range 45-69). Cough was the most frequent chief complaint (58%).

Statistical analysis

We calculated the frequency of each ARTI final diagnosis and its associated antibiotic prescription rate. We also tested for associations between clinical features and the provision of antibiotics. We hypothesized that our providers would be more likely to prescribe antibiotics for patients of advanced age and in the presence of other risk factors for complications.

Results

We determined patient risks for ARTI complication in the prospective data collection group only. Of the 231 patients, 147 (64%) had at least one risk for complication, the most common being age ≥ 65 (37%). Other risks were employment as a health care worker (12%), asthma (11%), atherosclerotic heart disease (8%), COPD (7%), and tobacco use (5%).

Final diagnoses for all patients appear in **TABLE 1**. We allowed clinicians to report more than one diagnosis, resulting in 501 final diagnoses reported for 438 patients (63 received 2 final diagnoses). Sinusitis was diagnosed most frequently (32%). Other common diagnoses were viral upper respiratory infection (URI) and acute bronchitis (29% and 24%, respectively).

■ Antibiotics most often prescribed.

Three hundred four ARTI patients (69%) re-



Those who received an antibiotic had been sick, on average, for a little more than 8 days; those who didn't receive one had been sick for 7 days.

➤ We had expected, but did not see, differences in prescribing rates between older and younger patients, as well as those with and without risk factors for complications.

TABLE 1
Final diagnoses for 438 patients with ARTI

| Diagnosis | n (%)* |
|----------------------------|----------|
| Acute sinusitis | 141 (32) |
| Viral URI | 125 (29) |
| Acute bronchitis | 104 (24) |
| Asthma | 31 (7) |
| Acute nonstrep pharyngitis | 28 (6) |
| Pneumonia | 17 (4) |
| COPD | 14 (3) |
| Influenza-like illness | 14 (3) |
| Acute otitis media | 14 (3) |
| Strep pharyngitis | 13 (3) |

ARTI, acute respiratory tract infection; COPD, chronic obstructive pulmonary disease; URI, upper respiratory infection.

*Percent total >100% due to 63 patients receiving 2 diagnoses and rounding.

ceived antibiotic prescriptions. Macrolides were most commonly prescribed (167/304 [55%]). Two hundred eight ARTI patients (68%) received broad-spectrum antibiotics (macrolides or fluoroquinolones); 96 (32%) received narrow-spectrum agents (penicillin, cephalosporin, sulfa, or tetracycline derivatives). TABLE 2 lists the frequency of antibiotic prescription and the antibiotic class most frequently prescribed for each ARTI diagnosis.

■ **Factors associated with increased prescribing** included specific history and physical exam findings (TABLE 3). A major determinant of treatment was duration of illness. Those who received antibiotics had a mean duration of illness of 8.3 days, compared with 7.0 days for those not receiving antibiotic therapy ($P=.03$).

The rate of antibiotic prescribing varied by provider type (TABLE 4). Four resident physicians (all of whom were investigators) prescribed least often, followed by attending physicians, then nurse practitioners. Investigators were significantly less likely to prescribe antimicrobials than noninvestigators ($P<.001$). We assessed whether use of our standardized data collection form affected prescribing rates. When we excluded patients whose data were entered with this form, no

difference in rates was seen.

We also noted wide ranges of prescribing rates between individual providers. While all providers enrolled patients, numbers ranged from one to 51, with a mean of 18. For those who enrolled ≥ 10 subjects, prescribing rates ranged from a low of 29% (8/28) for a resident physician investigator to 93% (63/68) for 4 noninvestigator attending physicians.

■ **Factors not associated with increased prescribing.** We had hypothesized that specific patient characteristics (age and medical complication) would be associated with provision of antimicrobials. However, there was no correlation between patient age and rate of prescribing. The 304 patients who received an antibiotic had a mean age of 54 years (standard deviation [SD]=18), as did the 134 who did not receive one (mean age, 54; SD=20; $P=.95$). There was a nonsignificant trend for a reduced rate of prescribing for patients younger than age 30. For patients 18 to 29 years old, the rate was 60% (31/52); for those ≥ 30 years, it was 71% (273/386; odds ratio [OR]=1.64; 95% confidence interval, 0.90-2.97).

Similarly, presence of medical complication did not significantly affect antibiotic prescribing rates. Patients with any risk factor for complication (age >65, diabetes, atherosclerotic heart disease, heart failure, COPD, asthma, tobacco smoking, or active cancer treatment) had a 62% prescription rate (91/147), which was the same as that of patients without such risks (52/84 [62%]; $P=1.0$).

Discussion

Providers in our practice had surprisingly high rates of antibiotic prescribing for ARTIs (69% overall). By comparison, the overall antibiotic use rate for ARTIs in the most recent National Ambulatory Medical Care Survey (NAMCS) analysis (1995-2006) was 58%.¹² The prescribing rate for office settings alone was just 52%. Steinman's analysis of NAMCS data from 1997-1999 revealed an overall rate of 63%.¹³

Data analyzed from >4200 Medicare enrollees seen for ARTI visits revealed great variation in prescribing rates by office site: 21% to 88%, with a median rate of 54%.²⁰ The rate varied by final diagnoses: sinusitis, 69%;

TABLE 2

Antibiotic use and type prescribed for ARTI varied by diagnosis

| Diagnosis (total) | Antibiotics prescribed* | No antibiotics prescribed | Antibiotic class most frequently prescribed |
|---------------------------------|-------------------------|---------------------------|---|
| Acute sinusitis (141) | 139 (99%) | 2 (1%) | Macrolide (53%) |
| Viral URI (125) | 45 (36%) | 80 (64%) | Macrolide (24%) |
| Acute bronchitis (104) | 95 (91%) | 9 (9%) | Macrolide (56%) |
| Acute nonstrep pharyngitis (28) | 16 (57%) | 12 (43%) | Macrolide (36%) |
| Pneumonia (17) | 17 (100%) | 0 | Fluoroquinolone (53%) |

ARTI, acute respiratory tract infection; URI, upper respiratory infection.

*Although 304 patients received prescriptions, some patients received more than one antibiotic.

TABLE 3

Historical features, exam findings associated with antibiotic prescribing

| Historical feature | P value |
|------------------------------|---------|
| Sinus pain | .0002 |
| Duration of illness >8 days | .0110 |
| Shortness of breath | .0427 |
| Physical exam finding | |
| Abnormal sinus exam | <.0001 |
| Abnormal lung exam | .0005 |
| Abnormal tympanic membrane | .0017 |
| Abnormal pharynx | .0026 |
| Cervical lymphadenopathy | .0141 |
| Abnormal nasal exam | .0363 |

bronchitis, 59%; pharyngitis, 50%; and URI, 26%. A rate of 77% was recently reported in a Veterans Administration office setting.²¹ Those with sinusitis and bronchitis similarly received more prescriptions than those with acute pharyngitis and URI.

In addition to our high overall rate, we also diagnosed patients with sinusitis and bronchitis frequently (32% and 24% of all patients, respectively), perhaps as false justification for prescribing antibiotics (provided for 99% and 91%, respectively). Also noteworthy is that more than one-third of URI patients in our practice received antibiotics.

We had expected, but did not see, differences in prescribing rates between older and younger patients, as well as those with and without risk factors for complications. Our expectations were based on NAMCS data, which have demonstrated increasing use of antibiotics in older patients.²

Treatment for those with bronchitis was surprisingly frequent; 91% received antibiotics. A Cochrane systematic review attributes slight symptom benefit to antibiotic use (improvement in cough by about one day).²² This benefit, however, is rarely seen in patients who have been ill for <1 week. The magnitude of this benefit must be weighed against the cost and adverse effects of antibiotics and the potential for promoting antimicrobial resistance. Most patients' symptoms are mild and self-limited, and risks may exceed benefits.

Guidelines state, "The widespread use of antibiotics for the treatment of acute bronchitis is not justified and vigorous efforts to curtail their use should be encouraged."²³ The CDC agrees, noting that "routine antibiotic treatment of uncomplicated acute bronchitis is not recommended, regardless of duration of cough."¹⁰

As observed in another study,¹⁴ a clinical factor associated with prescribing decisions at our practice was the duration of illness. Patients in our practice had been ill, on average, 8 days before presenting to the office. Over time, our encounters with regular patients may have taught them to wait until their symptoms are prolonged or progressive before seeking evaluation.



We diagnosed patients with sinusitis and bronchitis frequently, perhaps as false justification for prescribing antibiotics.

CONTINUED

TABLE 4

Antibiotic prescription rates for ARTI varied by provider type, investigator status

Antibiotic prescription rate

| Attending physicians | Nurse practitioners | Residents | P value |
|----------------------|---------------------|-------------|---------|
| 153/225 (68%) | 97/115 (84%) | 54/98 (55%) | <.001* |
| Investigator | Noninvestigator | P value | |
| 110/192 (57%) | 194/246 (79%) | <.001 | |

ARTI, acute respiratory tract infection.

*The rate for residents is significantly lower than that for attending physicians and nurse practitioners. The rate for attending physicians is significantly lower than that for nurse practitioners. The P value applies to both rate comparisons among provider types.

➤ Some patients reported that narrow-spectrum medicines “just don’t work,” given their experience with persistent cold symptoms.

We saw large differences in prescribing rates between providers, and hope this means there is room for improvement by addressing reasons for variability. Education about individual prescribing behaviors may motivate those with the highest rates of use to improve.

We noted high rates of broad-spectrum antibiotic use. This is consistent with other research findings of a shift away from narrow-spectrum agents.¹² We did not determine the frequency of allergies to narrow-spectrum agents. Anecdotally, the opinion of some patients was that narrow-spectrum medicines “just don’t work,” given their experience of persistent cold symptoms when using such agents.

Quality-improvement processes such as DMAIC (Define, Measure, Analyze, Improve, Control) or PDSA (Plan, Do, Study, Act) require collection of baseline data so that interventions can be tailored to meet the root

causes identified.²⁴ This project determined preintervention practice behaviors and allowed us to create quality metrics that could define our future success.

■ **Study limitations.** One obvious reason for the prescribing variability noted above is that those who helped plan and implement the project knew their practice behaviors were being reviewed and had studied the relevant practice guidelines. Whether non-investigator providers were up to date with recommendations and could carefully select appropriate treatment candidates is unclear.

This study was of our practice alone, and findings may not be generalizable to other practices. We encourage physicians to similarly examine their own prescribing habits in order to set practice-improvement goals. **JFP**

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References

- Fendrick AM, Monto AS, Nightengale B, et al. The economic burden of non-influenza related viral respiratory tract infection in the United States. *Arch Intern Med.* 2003;163:487-494.
- Werner K, Deasy J. Acute respiratory tract infections: when are antibiotics indicated? *JAAPA.* 2009;22:22-26.
- US Department of Health and Human Services. Preventing emerging infectious diseases: a strategy for the 21st century. *MMWR Morb Mortal Wkly Rep.* 1998;47(RR-15). Available at: <http://www.cdc.gov/MMWR/pdf/rr/rr4715.pdf>. Accessed July 16, 2011.
- Drug resistance threatens to reverse medical progress [press release]. Geneva, Switzerland: World Health Organization (WHO); June 12, 2000. Available at: <http://www.who.int/inf-pr-2000/en/pr2000-41.html>. Accessed July 16, 2011.
- Smolinski MS, Hamburg MA, Lederberg J, eds. Institute of Medicine, Committee on Emerging Microbial Threats to Health in the 21st Century. *Microbial Threats to Health: Emergence, Detection, and Response.* Washington, DC: National Academies Press; 2003. Available at: <http://www.iom.edu/CMS/3783/3919/5381/6146.aspx>. Accessed July 16, 2011.
- Gonzales R, Bartlett JG, Besser RE, et al. Principles of appropriate antibiotic use for treatment of acute respiratory tract infections in adults: background, specific aims, and methods. *Ann Intern Med.* 2001;134:479-486.
- Gonzales R, Bartlett JG, Besser RE, et al. Principles of appropriate antibiotic use for treatment of nonspecific upper respiratory tract infections in adults: background. *Ann Intern Med.* 2001;134:490-494.
- Hickner JM, Bartlett JG, Besser RE, et al. Principles of appropriate antibiotic use for acute rhinosinusitis in adults: background. *Ann Intern Med.* 2001;134:498-505.
- Cooper RJ, Hoffman JR, Bartlett JG, et al. Principles of ap-

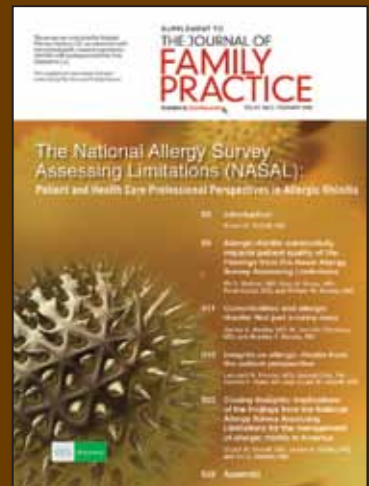
appropriate antibiotic use for acute pharyngitis in adults: background. *Ann Intern Med.* 2001;134:509-517.

10. Gonzales R, Bartlett JG, Bessnar RE, et al. Principles of appropriate antibiotic use for treatment of uncomplicated acute bronchitis: background. *Ann Intern Med.* 2001;134:521-529.
11. CDC. Get smart: know when antibiotics work. Adult appropriate antibiotic use summary: physician information sheets (adult). Available at: <http://www.cdc.gov/getsmart/campaign-materials/adult-treatment.html>. Accessed July 16, 2011.
12. Grijalva CG, Nuorti JP, Griffin M. Antibiotic prescription rates for acute respiratory tract infections in US ambulatory settings. *JAMA.* 2009;302:758-766.
13. Steinman MA, Landefeld CS, Gonzales R. Predictors of broad spectrum antibiotic prescribing for acute respiratory tract infections in adult primary care. *JAMA.* 2003;289:719-725.
14. Wigton RS, Darr CA, Corbett KK, et al. How do community practitioners decide whether to prescribe antibiotics for acute respiratory tract infections? *J Gen Intern Med.* 2008;23:1615-1620.
15. Macfarlane J, Holmes W, Macfarlane R, et al. Influence of patients' expectations on antibiotic management of acute lower respiratory tract illness in general practice: questionnaire study. *BMJ.* 1997;315:1211-1214.
16. Colgan R, Powers JH. Appropriate antimicrobial prescribing: approaches that limit antibiotic resistance. *Am Fam Physician.* 2001;64:999-1004.
17. Coco A, Mainous AG. Relation of time spent in an encounter with the use of antibiotics in pediatric office visits for viral respiratory infections. *Arch Pediatr Adolesc Med.* 2005;159:1145-1149.
18. Arnold SR, Straus SE. Interventions to improve antibiotic prescribing practices in ambulatory care. *Cochrane Database Syst Rev.* 2005;(4):CD003539.
19. Mainous AG, Hueston WJ, Love MM, et al. An evaluation of statewide strategies to reduce antibiotic overuse. *Fam Med.* 2000;32:22-29.
20. Gonzales R, Sauaia A, Corbett KK, et al. Antibiotic treatment of acute respiratory tract infections in the elderly: effect of a multidimensional educational intervention. *J Am Geriatr Soc.* 2004;52:39-45.
21. Franck A, Smith R. Antibiotic use for acute respiratory tract infections in a veteran population. *J Am Pharm Assoc.* 2010;50:726-729.
22. Smucny J, Fahey T, Becker L, et al. Antibiotics for acute bronchitis. *Cochrane Database Syst Rev.* 2004;(4):CD000245.
23. Bramen SS. Chronic cough due to acute bronchitis: ACCP evidence-based clinical practice guidelines. *Chest.* 2006;129(1 suppl):95S-103S.
24. Snee RD. Use DMAIC to make improvement part of "the way we work." Quality Progress Web site. September 2007. Available at: <http://asq.org/quality-progress/2007/09/process-management/use-dmaic-to-make-improvement-part-of-the-way-we-work.html>. Accessed July 16, 2011.

The National Allergy Survey Assessing Limitations (NASAL):

Patient and Health Care Professional Perspectives in Allergic Rhinitis

This supplement presents results from the National Allergy Survey Assessing Limitations (NASAL), which provides an up-to-date assessment of symptoms, burden of disease, and patient and provider perspectives concerning allergic rhinitis and nasal allergy treatment in the United States.



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