RESEARCH LETTER

Overprescribing and Inappropriate Antibiotic Selection for Children With Pharyngitis in the United States, 1997-2010

Pharyngitis is a common reason for pediatric health care visits.[1] While viral infections account for the majority of pharyngitis episodes, group A *Streptococcus* (GAS) is implicated in approximately 37% of episodes among children.[1] Antimicrobial treatment of GAS pharyngitis can shorten illness duration, prevent complications, and minimize transmission to others.[2] Evidence-based guidelines for GAS pharyngitis recommend narrow-spectrum penicillins (amoxicillin or penicillin) as first-line therapy; they are effective and GAS is universally susceptible to these agents.[2]

In a recent study in adults with sore throat, most patients received broader-spectrum antibiotics, commonly macrolides, instead of first-line therapy.[3] We characterized the frequency and appropriateness of antibiotic prescribing for pharyngitis in children.

Methods | We analyzed data from the National Ambulatory Medical Care Survey and the National Hospital Ambulatory Medical Care Survey, which are annual nationally representative surveys of ambulatory care practice in the United States.[4] Data included patient demographics, diagnosis (using *International Classification of Diseases, Ninth Revision, Clinical Modification* [*ICD-9-CM*] codes) and medications prescribed. Weighting of the multistage probability sample allowed for extrapolation to national estimates.

We included ambulatory care visits by patients 3 to 17 years of age between January 1, 1997, and December 31, 2010. We identified pharyngitis visits using the following *ICD-9-CM* codes: 462 (acute pharyngitis); 463 (acute tonsillitis) and 034 (streptococcal sore throat and scarlet fever). For analyses of antibiotic prescribing, we excluded visits if a concomitant infection that may have warranted antibiotic therapy (eg, sinusitis or otitis media) was diagnosed. We enumerated visits when any antibiotic was prescribed and further classified antibiotics into narrow-spectrum penicillins (either amoxicillin or penicillin), macrolides (azithromycin, erythromycin, or clarithromycin), first-generation cephalosporins, second-/third-generation cephalosporins, amoxicillin-clavulanate, and other antibiotics. Trends in antibiotic prescribing were analyzed using the χ^2 test. All estimates and 95% CIs accounted for the complex survey design. Population denominators were from the US Census Bureau. We used Stata version 12 (Stata Corp) for all analyses.

Results | Approximately 11 980 000 (95% CI, 10 980 000-12 970 000) pediatric visits for pharyngitis occurred annually from 1997 to 2010 (**Table**), or 198 visits per 1000 children. Children younger than 12 years accounted for 70% of pharyngitis visits.

Table. Estimated Numbers of Visits for Children With Pharyngitis, Patient Characteristics, and Antibiotic Prescriptions, United States, 1997-2010

Visit Characteristics	Children (n = 11 497)	
	Estimated Annual No. of Visits (Millions)	Weighted Visits, %
Age, y		
3-5	3.00	25
6-11	5.36	45
12-17	3.61	30
Sex		
Male	5.59	47
Female	6.39	53
Race		
White	10.20	85
Black	1.29	11
Other	0.49	4
Insurance status[a]		
Private	7.63	66
Nonprivate	3.98	34
Visit location		
Northeast	2.51	21
Midwest	3.05	26
South	4.61	38
West	1.81	15
Diagnosis[b]		
All pharyngitis	11.98	
Acute pharyngitis/tonsillitis	8.93	75
Strep throat/scarlet fever	3.05	25
Antibiotic prescription		
None	4.47	40
Any antibiotic[c]	6.65	60
Narrow-spectrum penicillins[d]	4.04	61
Penicillins	0.79	12
Amoxicillin	3.25	49
Macrolides[e]	1.04	15
First-generation cephalosporins[e]	0.41	6
Second-/third-generation cephalosporins	0.71	11
Amoxicillin/clavulanate	0.49	7
Other antibiotics	0.11	2

Abbreviation: *ICD-9-CM*, *International Classification of Diseases, Ninth Revision, Clinical Modification*.

[a] Data on insurance status were not available for all observations; visit numbers sum to less than the full number of visits for pharyngitis.

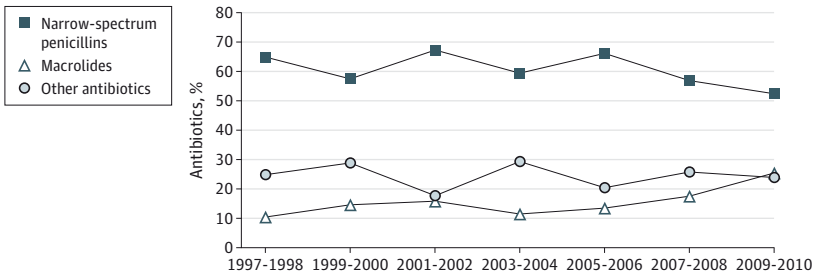
[b] All pharyngitis includes acute pharyngitis (*ICD-9-CM* code 462), tonsillitis (*ICD-9-CM* code 463), and streptococcal sore throat/scarlet fever (*ICD-9-CM* code 034). The acute pharyngitis/tonsillitis category does not include patients with streptococcal sore throat/scarlet fever.

[c] Includes penicillins, cephalosporins, macrolides, quinolones, lincomycin derivatives, tetracyclines, sulfonamides, aminoglycosides, and carbapenems.

[d] Narrow-spectrum penicillins, including aminopenicillins, penicillinase-resistant penicillins, and natural penicillins.

[e] First-generation cephalosporins (for those without anaphylaxis), clindamycin, or azithromycin are indicated for treatment of group A *Streptococcus* pharyngitis in penicillin-allergic individuals.[2]

Figure. Antibiotic Prescribing for Pharyngitis in Children Aged 3 to 17 Years, 1997-2010



								All	*P* value
Antibiotics, % of visits	65%	63%	61%	59%	55%	62%	56%	60%	.06
Narrow-spectrum penicillins	65%	57%	67%	59%	66%	57%	52%	61%	.08
Macrolides	10%	15%	16%	11%	13%	18%	26%	16%	.001
Other antibiotics	25%	29%	18%	29%	20%	26%	24%	24%	.85

Infectious Diseases Society of America group A streptococcal pharyngitis guidelines were published in 1997 and 2002.

Antibiotics were prescribed during 60% of pharyngitis visits for children (Table). Narrow-spectrum penicillins accounted for 61% of antibiotics prescribed. During the 14-year study period, narrow-spectrum penicillin prescribing decreased from 65% (95% CI, 57%-72%) of antibiotics in 1997 to 1998 to 52% (95% CI, 44%-60%) in 2009 to 2010 ($P = .08$), while macrolides increased ($P < .01$) (**Figure**). Macrolides and first-generation cephalosporins (second-line antibiotics for GAS pharyngitis) and second-/third-generation cephalosporins and amoxicillin-clavulanate (not recommended) accounted for 21% and 18% of antibiotics prescribed, respectively.

Discussion | We found evidence of substantial antibiotic overuse and inappropriate antibiotic selection for pharyngitis in children. Given that approximately 37% of pharyngitis episodes are caused by bacteria, the 60% antibiotic prescribing rate found in our study suggests overprescribing. Similar to previous findings in adults and children,[3,5] narrow-spectrum penicillins are underprescribed in favor of broader-spectrum antibiotics, especially macrolides and cephalosporins. Erythromycin resistance is reported in more than 10% of invasive isolates[6]; selection of a macrolide for patients without a penicillin allergy is not recommended. Despite the release of multiple clinical guidelines recommending narrow-spectrum penicillins for first-line treatment of GAS pharyngitis, their use did not increase.[2]

Our study has limitations. The frequency of GAS testing and prevalence of penicillin allergy were unknown. Additionally, accuracy, specificity, and completeness of *ICD-9-CM* codes are uncertain. Continued follow-up is needed to verify a significant negative trend in penicillin prescription.

In summary, there is a gap between observed practice and guideline recommendations for the treatment of pediatric pharyngitis. Multiple strategies, including targeted education and provider audit and feedback, should be used to improve prescribing practices.

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Geographic Variation in Receipt of Psychotherapy in Children Receiving Attention-Deficit/Hyperactivity Disorder Medications

Attention-deficit/hyperactivity disorder (ADHD) is one of the most common childhood disorders, affecting an estimated 11% of boys and 4% of girls in the United States.[1] Stimulant medications manage ADHD symptoms in most children.[2,3] However, many parents prefer that treatment include some nonpharmacologic therapy,[4,5] and combination behavioral therapy and pharmacotherapy may improve outcomes over either modality alone for many youth.[3,6]