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ARTICLE

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ABSTRACT

OBJECTIVE. Sore throat is a common complaint in children and adolescents. With increasing antimicrobial resistance because of antimicrobial overuse, accurate diagnosis is imperative. Appropriate management of acute pharyngitis depends on proper use and interpretation of clinical findings, rapid antigen-detection tests, and throat cultures. We surveyed pediatricians and family physicians to evaluate their management strategies for children and adolescents with acute pharyngitis and to assess the availability and use of diagnostic tests in office practice.

METHODS. In 2004, surveys were mailed to a random sample of 1000 pediatrician members of the American Academy of Pediatrics and 1000 family physician members of the American Academy of Family Physicians. We assessed factors associated with physicians using an appropriate management strategy for treating acute pharyngitis.

RESULTS. Of 948 eligible responses, 42% of physicians would start antimicrobials before knowing diagnostic test results and continue them despite negative results, with 27% doing this often or always. When presented with clinical scenarios of patients with acute pharyngitis, ≤23% chose an empirical approach, 32% used an inappropriate strategy for a child with pharyngitis suggestive of group A *Streptococcus*, and 81% used an inappropriate strategy for a child with findings consistent with viral pharyngitis. Plating cultures in the office was associated with an appropriate management strategy, although not statistically significant. Solo/2-person practice and rural location were both independent factors predicting inappropriate strategies.

CONCLUSIONS. There is much room for improvement in the management of acute pharyngitis in children and adolescents. Most physicians use appropriate management strategies; however, a substantial number uses inappropriate ones, particularly for children with likely viral pharyngitis. Efforts to help physicians improve practices will need to be multifaceted and should include health policy and educational approaches.

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Key Words
pharyngitis, *Streptococcus* group A, *Streptococcus pyogenes*, child, adolescent

Abbreviations
GAS— group A *Streptococcus*
RADT—rapid antigen-detection test
CLIA—Clinical Laboratory Improvement Amendments of 1988
OR— odds ratio
CI— confidence interval

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COMPLAINTS OF SORE throat are common among children and adolescents. In 1999–2000, there were ≥140 physician office visits for pharyngitis per 1000 US children and adolescents <15 years old, resulting in ≥96 antimicrobial drug prescriptions per 1000 such patients.[1] Although viruses cause most acute pharyngitis episodes, group A *Streptococcus* (GAS) causes ~15% to 30% of pediatric cases of acute pharyngitis.[2–4] Treatment of acute GAS pharyngitis is important for preventing acute rheumatic fever and suppurative complications, hastening illness resolution, and preventing transmission. Diagnostic strategies emphasize distinguishing the many patients with viral pharyngitis, for whom antimicrobial therapy would not be beneficial, from the many fewer with acute GAS pharyngitis, for whom such therapy would be beneficial. Correctly distinguishing GAS is imperative to minimize the inappropriate use of antimicrobials, a critical step in reducing antimicrobial resistance.

The American Academy of Pediatrics, the Centers for Disease Control and Prevention, the American Heart Association, and the Infectious Diseases Society of America have published guidelines for the appropriate diagnosis of acute GAS pharyngitis in children and adolescents.[4–7] Clinical findings are neither sensitive nor specific, and diagnosis without laboratory confirmation results in overdiagnosis of GAS pharyngitis[8] with unnecessary antimicrobial prescribing. Clinical prediction rules that assign points for clinical findings can be used to assess pretest likelihood of GAS pharyngitis,[9,10] but a laboratory test for GAS, such as a throat culture or rapid antigen-detection test (RADT), is necessary for the best diagnostic accuracy.[4–7,9] Although most RADTs are highly specific (>95%),[4,5,9,11] have become widely available, and provide immediate results, sensitivities of RADTs in routine clinical practice are usually not high enough to warrant reliance on a negative test alone to exclude GAS infection.[9,12,13] Throat culture confirmation of a negative RADT is recommended to increase diagnostic sensitivity.[4–7,9] Assuming appropriate diagnosis, penicillin remains the antimicrobial of choice; amoxicillin suspension is an acceptable alternative; and a macrolide or first-generation cephalosporin is recommended for penicillin-allergic individuals.[4,5,7]

Previous physician surveys have found that as many as 15% to 20% of physicians follow inappropriate strategies in managing acute pharyngitis.[14,15] Various factors, including medical specialty[16] and type of practice,[15] are associated with physicians' management approaches. In addition, regulations such as the Clinical Laboratory Improvement Amendments of 1988 (CLIA), which categorized office laboratory procedures by complexity level, may affect a physician's management approach, because they may affect the availability of office laboratory tests. Although the purpose of CLIA was to improve the quality of office laboratory testing,[17] decreased availability and use of cultures and RADTs might adversely affect the quality of GAS diagnosis.

This study evaluated the self-reported management of acute pharyngitis in children and adolescents by pediatricians and family physicians. Understanding current practice and factors associated with adherence to the guidelines produced by advisory groups may help in designing and evaluating programs to limit inappropriate antimicrobial use.

METHODS

Study Design and Participants

A survey was developed to include questions about practice type and setting, diagnostic tests, general diagnostic approaches to acute pharyngitis, antimicrobial selection, and effect of parental expectations of antimicrobials on physicians' treatment decisions. To assess management strategies, physicians were presented with 2 scenarios of acute pharyngitis and 8 possible management strategies (Appendix). The first described a child with clinical and epidemiological findings consistent with GAS pharyngitis, and the second described one with findings consistent with viral pharyngitis.[4] The survey also included questions about physicians' knowledge of CLIA and their use of RADTs and cultures subsequent to CLIA. The survey was judged by the institutional review boards of the investigators (Centers for Disease Control and Prevention, Cincinnati Children's Hospital Medical Center, Children's Memorial Hospital, and American Academy of Family Physicians Institutional Review Board of Record, University of Missouri, Kansas City, MO) as exempt from full review per 45CFR46.101(b)(4).

The 6-page survey was mailed in 2004 to 1000 pediatricians and 1000 family physicians across the United States selected randomly from members of the American Academy of Pediatrics and the American Academy of Family Physicians, respectively. Nonresponders were sent ≤2 subsequent mailings every 6 to 8 weeks until the survey was completed. Respondents, who identified themselves as trainees, subspecialists, or nonprimary care physicians and those who had been in practice for <1 year were excluded from data analysis.

Management for Children and Adolescents With Acute Pharyngitis

Management of the 2 clinical scenarios was considered appropriate if consistent with current clinical guidelines.[4–7] Laboratory testing was indicated if a physician could not exclude the diagnosis of GAS based on clinical and epidemiological findings. Appropriate testing included throat culture alone or RADT with culture confirmation of a negative RADT. Physicians sometimes begin empirical antimicrobial treatment pending culture results[14]; this is considered appropriate only when antimicrobials are discontinued if results are negative.[4,7]

Statistical Analysis

Data were double-entered, checked for data-entry errors, and analyzed by using SAS 8.02 (SAS Institute, Inc, Cary, NC). Global tests of homogeneity were used to determine whether the observed distribution of pediatrician responses differed from family physician responses before progressing to additional analyses. To facilitate additional data interpretation, multiple-option questions were collapsed into 2 categories. Predictive factors for appropriate acute pharyngitis management were identified using bivariate analysis by the χ^2 test. Logistic regression was used to assess associations between an outcome and predictors of interest (eg, solo/2-person practice, rural situation, full-time, or number of years in practice) while controlling for medical specialty, the only controllable factor given the study structure. When analyzing CLIA-related responses, physicians with ≤12 years were compared with those with >12 years in practice posttraining to distinguish those with only post-CLIA (ie, post-1992 CLIA implementation) experience from those with potentially pre-CLIA and post-CLIA experience. For all of the other analyses, physicians with ≤5 years were compared with those with >5 years in practice to assess the role of clinical experience in management decisions. Significant results are reported as odds ratios (ORs) with confidence intervals (CIs). Statistical results were considered significant if the *P* value was <.01 and/or the 99% CI did not include 1; only comparisons that had significant ORs/differences were reported.

RESULTS

Survey Respondents

Of the 2000 physicians surveyed, 1193 (60%; 603 pediatricians, 590 family physicians) responded. Of these, 948 (79%) were eligible for analysis. Respondent demographics are presented in Table 1. For responses to current practice situation, practice location, and practice setting, global tests of homogeneity were significant ($P <$ .01), confirming that there were overall differences in pediatricians' versus family physicians' responses. Specific examination of the responses determined that family physicians were more likely than pediatricians to be male, practice full time, practice in a rural location, and be in solo/2-person practice. Pediatricians were more likely to practice in an urban setting. Full-time practice physicians were more likely than part-time or acute care practice physicians to have been in practice for >5 years ($P <$ .01). Years of experience (ie, ≤5 vs >5 years) was not a predictive factor for any other characteristic nor for any particular management approaches.

Rationale for Antimicrobial Treatment

Physicians' reason(s) for treating patients with acute GAS pharyngitis are presented in Table 2. The majority

TABLE 1 **Demographics of Respondents Eligible for Inclusion in Analysis**

Characteristic	Total No. (%) (n = 948)[a]	No. (%) of Pediatricians (n = 423 [45%])	No. (%) of Family Physicians (n = 525 [55%])
Male[b]	573 (60)	205 (48)	368 (70)
Current practice situation			
Full-time[b]	745 (79)	309 (73)	436 (83)
Part-time	162 (17)	100 (24)	62 (12)
Urgent/acute care	41 (4)	14 (3)	27 (5)
Practice location			
Urban, inner city[b]	95 (10)	65 (15)	30 (6)
Urban, non–inner city[b]	174 (18)	96 (23)	78 (15)
Suburb	428 (45)	210 (50)	218 (42)
Rural[b]	216 (23)	41 (10)	175 (33)
Other[c]	19 (2)	5 (1)	14 (3)
Practice setting			
Solo/2-person practice[b]	233 (25)	86 (20)	147 (28)
Group practice (>2 clinicians)	530 (56)	242 (57)	288 (55)
Staff model health maintenance organization	33 (3)	20 (5)	13 (2)
Community health center/public health clinic	42 (4)	19 (5)	23 (4)
Hospital outpatient clinic, nonacademic	39 (4)	14 (3)	25 (5)
Hospital outpatient clinic, academic	55 (6)	35 (8)	20 (4)
Other[c]	14 (1)	6 (1)	8 (2)
Median years in practice (range)[d]	13 (1–50)	13 (1–50)	14 (1–42)

Eligible respondents indicated that they provide primary or acute care and had been in practice ≥1 year.

[a] Note that there were missing responses for some questions (eg, practice location, practice setting), so total responses did not always equal total number of respondents.

[b] $P <$ .01, comparing pediatricians and family physicians by collapsing into 2 categories for comparisons (eg, full-time versus not, urban versus not, rural versus not, solo/2-person versus not).

[c] Other practice locations indicated by respondents: military base, college campus, small town; other practice settings indicated by respondents: military clinic, campus clinic, multispecialty clinic.

[d] There was no significant difference in median years in practice between pediatricians and family physicians by the Kruskall-Wallis test.

(>70%) treat for established indications: prevent acute rheumatic fever, prevent suppurative complications, shorten the symptom course, or decrease communicability. A substantial proportion also treat for unproven reasons: prevent acute glomerulonephritis or prevent pediatric autoimmune neuropsychiatric disorders associated with streptococci.

Availability and Use of Diagnostic Tests

RADTs were available diagnostic options for 850 (90%) respondents. RADTs were performed in-office by 794 (93%) respondents, and 79% of these physicians had results available in ≤10 minutes. Half could not recall the name of the RADT used in their office. When RADTs were not performed in the office, results were delayed; in addition, only 34% of physicians had RADT results in <2 hours. Those who reported that they did not have RADTs as an option cited unavailability of test kits in their facility, lack of reimbursement, cost, or preference for culture as reasons.

Throat cultures were available for 893 (94%) respondents, although only 22% could perform them in their offices. For those who performed cultures in their offices, 36% obtained a final result in ≤24 hours and 92% in ≤48 hours, compared with 69% in ≤48 hours when performed outside the office. Those who reported that performing a culture was not an available option cited regulations, cost, lack of reimbursement, and long turnaround time for results as reasons.

The availability of RADTs and throat cultures did not vary by medical specialty. Although pediatricians and family physicians were equally likely to perform in-office RADTs, pediatricians were significantly more likely to perform in-office throat cultures (32% vs 13%; $P < .01$). Physicians not in solo/2-person practices were more likely to have access to throat cultures and to perform them in their offices ($P < .01$ for both).

Diagnostic Approach to Children and Adolescents With Acute Pharyngitis

Reported Practice

Of the 948 respondents, 401 (42%) would start antimicrobials before knowing the results of diagnostic tests and continue them despite negative results, 257 (27%) doing this often or always. Of the 932 respondents who reported testing for GAS in children and adolescents with sore throat, 234 (25%) would perform repeat tests in asymptomatic patients (201 sometimes, 33 often/always). Family physicians were significantly more likely than pediatricians (76% vs 57%; $P < .01$) to consider starting antimicrobials before learning test results. Rural practice (OR: 2.34; 99% CI: 1.24–4.41) was a factor associated with continuing antimicrobials despite negative test results. Nearly all (94%) of the eligible respondents felt that at least some parents expected antimicrobial treatment for their child's pharyngitis; 708 (75%) admitted that such expectations might have some effect on their decision-making. Family physicians were more likely than pediatricians (90% vs 58%; $P < .01$) to admit that parent expectations might have an effect on their decision to provide antimicrobial treatment.

Response to Clinical Scenarios

For the first clinical scenario, a child with classic findings of acute GAS pharyngitis, no physician was willing to forego either testing or treatment, with 84% using some diagnostic test in their approach. A majority (59%) of physicians used RADTs with culture confirmation (choices 1 and 2, Table 3). Two hundred sixteen (23%) physicians chose an empirical approach (choices 6 and 7). Family physicians were more inclined than pediatricians to follow an empirical approach ($P < .01$); controlling for specialty, rural practice was also associated with choosing this approach (OR: 1.71; 99% CI: 1.07–2.73). Plating cultures in the office was associated with choosing an appropriate management approach, although this

TABLE 2 **Physicians' Rationale for Antimicrobial Treatment of Children and Adolescents With Acute GAS Pharyngitis**

Rationale	Total No. (%) ($n = 948$)	No. (%) of Pediatricians ($n = 423$)	No. (%) of Family Physicians ($n = 525$)	χ^2 P[a]
Prevent acute rheumatic fever	897 (95)	407 (96)	490 (93)	.05
Prevent local suppurative complications	669 (71)	303 (72)	366 (70)	.51
Shorten clinical course	666 (70)	313 (74)	353 (67)	.02
Decrease contagiousness	664 (70)	337 (80)	327 (62)	<.01
Prevent acute glomerulonephritis	539 (57)	192 (45)	347 (66)	<.01
Prevent PANDAS	214 (23)	132 (31)	82 (16)	<.01
Other[b]	25 (3)	10 (2)	15 (3)	.63

PANDAS indicates pediatric autoimmune neuropsychiatric disorders associated with streptococci. Respondents were allowed to choose as many options as they felt were applicable.

[a] Comparing pediatricians and family physicians.

[b] Other responses volunteered by respondents included facilitate return to daycare or school, prevent other complications, and prevent illness in patient with chronic illness.

TABLE 3 **Physicians' Approach to a Child or Adolescent With Classic Clinical and Epidemiologic Findings Consistent With Acute GAS Pharyngitis (First Clinical Scenario) and With Viral Pharyngitis (Second Clinical Scenario)**

Management Approach	Appropriate Management?	Total No. (%) of Respondents[a]	No. (%) of Pediatricians[b]	No. (%) of Family Physicians[c]	χ^2 P[d]
First clinical scenario					
RADT; start Abxs if RADT (+); if RADT (−), obtain CX and start Abxs but stop if CX (−)	Yes	279 (30)	125 (30)	154 (30)	.94
RADT; start Abxs if RADT (+); if RADT (−), obtain CX and start Abxs only if CX (+)	Yes	270 (29)	190 (46)	80 (16)	<.01
CX; start Abxs, but stop if CX (−)	Yes	66 (7)	26 (6)	40 (8)	.38
CX; start Abxs only if CX (+)	Yes	13 (1)	10 (2)	3 (1)	.02
RADT; start Abxs only if RADT (+)	No	84 (9)	35 (8)	49 (10)	.57
No tests, start Abxs based on clinical criteria	No	144 (16)	13 (3)	131 (25)	<.01
RADT and/or CX; start and continue Abxs regardless of results	No	72 (8)	15 (4)	57 (11)	<.01
No tests, no Abxs	No	0	0	0	—
Second clinical scenario					
No tests, no Abxs	Yes[e]	174 (19)	80 (19)	94 (18)	.70
RADT; start Abxs if RADT (+); if RADT (−), obtain CX and start Abxs only if CX (+)	No	326 (35)	197 (47)	129 (25)	<.01
RADT; start Abxs only if RADT (+)	No	299 (32)	97 (23)	202 (39)	<.01
CX; start Abxs only if CX (+)	No	78 (8)	27 (6)	51 (10)	.06
RADT; start Abxs if RADT (+); if RADT (−), obtain CX and start Abxs but stop if CX (−)	No	23 (2)	9 (2)	14 (3)	.59
CX; start Abxs, but stop if CX (−)	No	11 (1)	2 (<1)	9 (2)	.08
No tests, start Abxs based on clinical criteria	No	19 (2)	5 (1)	14 (3)	.10
RADT and/or CX; start and continue Abxs regardless of results	No	4 (<1)	0	4 (1)	.13[f]

Abxs indicates antibiotics; CX, culture.

[a] Note that there were missing responses, because not all 948 respondents chose to respond to the scenario. $n = 928$ in the first and 934 in the second clinical scenario.

[b] $n = 414$ in the first and 417 in the second clinical scenario.

[c] $n = 514$ in the first and 517 in the second clinical scenario.

[d] Comparing pediatricians and family physicians.

[e] Guidelines recommend no testing when clinical and epidemiological findings are consistent with viral pharyngitis.

[f] Calculated by using 2-sided Fisher's exact test.

was not statistically significant (OR: 1.49; 99% CI: 0.86–2.58). Those who sent cultures to an outside laboratory were more likely to rely on RADTs alone without culture confirmation of negative results (OR: 4.26; 99% CI: 1.25–14.50). For the second scenario, a child with clinical and epidemiological findings consistent with viral pharyngitis, only 174 (19%) physicians used the appropriate approach, whereas 23 (2%) still chose an empirical strategy (choices 7 and 8, Table 3), and a similar, large proportion of pediatricians (80%) and family physicians (78%) chose to perform some diagnostic test ($P = .63$).

Choice of Antimicrobials

Penicillin-type antimicrobials were the first-line choice for 95% of respondents for GAS pharyngitis treatment (Table 4), although more pediatricians preferred amoxicillin (75% vs 53%; $P < .01$), and more family physicians preferred oral penicillin (38% vs 20%; $P < .01$). Macrolides were chosen by 73% of physicians as first-line therapy for those with penicillin-allergy. Family physicians were more likely than pediatricians to use a macrolide (88% vs 54%; $P < .01$) in this situation, and pediatricians were more likely than family physicians to use a cephalosporin (44% vs 11%; $P < .01$).

Knowledge of CLIA and Its Impact on Acute Pharyngitis Management

The majority (76%) of physicians reported familiarity with CLIA. Of these, 6% reported discontinuing RADTs, and 19% discontinued cultures in their offices after CLIA implementation. Of those who discontinued tests, most (68–93%, depending on the cited factor) agreed that time necessary for proficiency testing and quality control, cost, paperwork, and lack of personnel played roles in their decision to discontinue RADTs or culture. Pediatricians and family physicians responded similarly to CLIA-related questions, and equal proportions reported familiarity with CLIA. Controlling for medical specialty, those who had been in clinical practice for >12 years were significantly more likely to report familiarity with CLIA (88% vs 67%; OR: 3.47; 99% CI: 2.23–5.40) and were more likely to report discontinuing throat cultures (26% vs 11%; OR: 2.78; 99% CI: 1.58–4.89). Those in solo/2-person practice were more likely to report discontinuing RADTs (12% vs 4%; OR: 3.70; 99% CI: 1.60–8.55).

DISCUSSION

As reported previously,[14,15] most physicians in our study reported using an appropriate strategy for managing

TABLE 4 **Physicians' Antimicrobial of Choice for Treatment of GAS Pharyngitis in Children and Adolescents**

Antimicrobial	Total No. (%) (n = 935)[a]	No. (%) of Pediatricians (n = 419)	No. (%) of Family Physicians (n = 516)
First-line therapy (not penicillin-allergic)			
Penicillin-type antimicrobial	889 (95)	410 (98)	479 (93)
Amoxicillin	586 (63)	315 (75)	271 (53)
Oral penicillin	281 (30)	83 (20)	198 (38)
Benzathine penicillin, intramuscular	21 (2)	12 (3)	9 (2)
Ampicillin	1 (<1)	0	1 (<1)
Extended spectrum penicillin-type antimicrobial	13 (1)	3 (<1)	10 (2)
Augmentin	12 (1)	3 (<1)	9 (2)
Dicloxacillin	1 (<1)	0	1 (<1)
Macrolides	14 (1)	0	14 (3)
Azithromycin	12 (1)	0	12 (2)
Erythromycin, Clarithromycin	2 (<1)	0	2 (<1)
Cephalosporins	19 (2)	6 (1)	13 (3)
First generation	15 (2)	4 (1)	11 (2)
Other	4 (<1)	2 (<1)	2 (<1)
First-line therapy (penicillin-allergic):			
Macrolides	680 (73)	225 (54)	455 (88)
Azithromycin	381 (41)	145 (35)	236 (46)
Erythromycin	266 (28)	71 (17)	195 (38)
Clarithromycin	33 (4)	9 (2)	24 (5)
Cephalosporins	241 (26)	185 (44)	56 (11)
First generation	177 (19)	131 (31)	46 (9)
Other	64 (7)	54 (13)	10 (2)
Clindamycin	11 (1)	8 (2)	3 (<1)
Trimethoprim-sulfamethoxazole[b]	3 (<1)	1 (<1)	2 (<1)

Although physicians were instructed to indicate their top choice of antimicrobial, some physicians opted to list >1; in these cases, only the first antimicrobial listed was used in analyses.

[a] Note that there were missing responses, because not all 948 respondents chose to respond to the scenario.

[b] This is ineffective and inappropriate for GAS pharyngitis.

children and adolescents with acute pharyngitis suggestive of GAS. However, whether presented with a scenario or an individual query, 32% to 81% reported using inappropriate management strategies, including: using empirical therapy without diagnostic testing, continuing antimicrobials despite negative test results, performing follow-up tests on asymptomatic children, and performing diagnostic tests on children with clinical and epidemiological findings consistent with viral pharyngitis. Such strategies could contribute to inappropriate antimicrobial use.[9]

Almost all of the physicians reported having access to both RADTs and throat cultures. However, physicians were more likely to rely on RADTs without culture confirmation as a diagnostic method if they reported sending cultures to outside laboratories. Most (84%) physicians performed in-office RADTs and obtained results within 20 minutes, similar to the 1992 pre-CLIA report of pediatricians by Schwartz et al.[15] Improved technology and increased availability of CLIA-waived RADTs may have contributed to many physicians maintaining these tests in the office, although a small minority did report discontinuing RADTs because of CLIA-related factors. Only 22% reported performing in-office cultures compared with 63% in the report by Schwartz et al.[15] CLIA regulations may have contributed to this observed drop, but other factors, such as cost and time associated with performing cultures in-house, increased availability and improved technology of RADTs, and accessibility to outside commercial laboratories that market aggressively may have also contributed to this decrease.

Decreased culture availability may affect the accuracy of GAS pharyngitis diagnosis.[14,15] In this study, physicians who reported plating cultures in their offices tended to follow the recommended strategy for managing a child or adolescent with acute pharyngitis more than those who did not. Of concern, however, is that more than a third read their cultures in ≤24 hours. Armengol et al[13] demonstrated that reading cultures early could miss 40% of GAS-positive plates associated with negative RADTs.

Although newer RADT technology eventually may obviate the need for confirmation of negative RADT results,[14,18] recommendations continue to advise throat culture confirmation unless the particular RADT in use has been validated in that office.[4,5,13] Our survey may have overestimated the proportion of respondents using inappropriate management strategies if some of the physicians reporting RADT use without culture confirmation had validated their RADTs. However, at least half of the physicians could not recall the particular RADT they

use, suggesting that such validation was unlikely to have occurred in most offices and raising the possibility that physicians may be unaware that RADTs differ in both reported sensitivity and specificity. Considering all RADTs equal can be problematic for the management of acute pharyngitis.[11] Understanding when not to perform tests is also important. Retesting asymptomatic patients and performing tests in children with findings consistent with viral pharyngitis would be more likely to identify carriers rather than true infection.

Physicians most often reported prescribing a penicillin-type antimicrobial for GAS pharyngitis, although amoxicillin has surpassed penicillin as the antimicrobial of choice, especially among pediatricians. Use of amoxicillin suspension in preference to penicillin V suspension is acceptable, because it is considerably more palatable. However, general use of amoxicillin in preference to penicillin would be concerning because of the broader spectrum of antimicrobial activity of amoxicillin, potentially contributing to antimicrobial resistance.[7] Most physicians recognize established reasons to prescribe antimicrobials for GAS pharyngitis, but a substantial proportion reported that treatment can prevent acute glomerulonephritis and pediatric autoimmune neuropsychiatric disorders associated with streptococci, neither of which has been proven to be preventable with antimicrobial therapy. Such misconceptions about the benefits of antimicrobial treatment in addition to the inappropriate management strategies reported by physicians in this study suggest shortcomings in the knowledge of acute GAS pharyngitis. Physicians have been shown to be more likely to prescribe antimicrobials inappropriately when they perceive that parents expect them.[19,20] Because almost all of the physicians surveyed thought at least some parents expected antimicrobials for their children and adolescents with pharyngitis, this perception may be an important contributing factor to inappropriate antimicrobial use.

Pediatricians were more likely than family physicians to report that they follow an appropriate strategy,[14,16] with pediatricians less likely to rely on clinical diagnosis to manage a child with classic GAS pharyngitis findings. However, some pediatricians still follow inappropriate management approaches. Family physicians were significantly more likely than pediatricians to be in rural and solo/2-person practices, both independent factors associated with inappropriate strategies and settings that may have fewer resources. In addition, family physicians treat both children and adults. Some advisory groups have accepted the use of empirical treatment based on clinical criteria without testing for some adults[21] but not for children or adolescents. Family physicians might inappropriately extend this adult-oriented approach to their treatment of children and adolescents.

There are inherent limitations to a study based on mailed surveys. Respondents cannot ask for clarification, and nonrespondents may not be similar to respondents. Reported practice may be biased toward reporting more appropriate behavior and not reflect actual practices. In addition, we presented 2 scenarios that were more straightforward than those usually seen in practice. Therefore, physicians completing the survey might have anticipated that 1 scenario would be a case of GAS pharyngitis and the other viral pharyngitis. However, the last 2 issues make the findings of continued inappropriate management of pharyngitis by a substantial number even more disturbing. Our sample population was drawn from 2 separate medical groups. Medical specialty may be a proxy for other uncontrolled factors, and comparisons to previous studies, including only 1 physician specialty, should be interpreted with caution. Finally, because of the study design, we were unable to examine truly independent factors. Our survey was developed for this study, has not been validated, and its reliability has not been assessed. Nevertheless, our findings are consistent with results obtained by other investigators.[14–16,19,20,22]

The results of this survey increase understanding of the factors underlying clinical decision-making and antimicrobial prescribing for acute pharyngitis and may contribute to the development of interventions to improve practice. Most physicians follow an appropriate management strategy for children with probable GAS pharyngitis; however, a substantial number continues to use inappropriate strategies, particularly for children with likely viral pharyngitis. Policy approaches, such as using standardized health care quality measures, which attempt to optimize the use of diagnostic tests, may help physicians improve practice and adhere to guidelines.[22] In addition, educational programs for residents, as well as continuing medical educational programs for practicing physicians, should address the overuse of diagnostic tests and antimicrobial prescribing for children with a very low likelihood of having GAS infection. Limiting antimicrobial overuse likely will continue to require focus on many aspects of clinical practice rather than on any single factor.

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REFERENCES

1. McCaig LF, Besser RE, Hughes JM. Trends in antimicrobial prescribing rates for children and adolescents. *JAMA*. 2002;287;3096–3102
2. Putto A. Febrile exudative tonsillitis: viral or streptococcal? *Pediatrics*. 1987;80:6–12

3. Tanz RR, Shulman ST. Diagnosis and treatment of group A streptococcal pharyngitis. *Semin Pediatr Infect Dis.* 1995;6:69–78
4. Bisno AL, Gerber MA, Gwaltney JM Jr, Kaplan EL, Schwartz RH; Infectious Diseases Society of America. Practice guidelines for the diagnosis and management of group A streptococcal pharyngitis. *Clin Infect Dis.* 2002;35:113–125
5. American Academy of Pediatrics. Group A streptococcal infections. In: Pickering LK, ed. *Red Book: 2003 Report of the Committee on Infectious Diseases*. 26th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2003:573–584
6. Dajani A, Taubert K, Ferrieri P, Peter G, Shulman S. Treatment of acute streptococcal pharyngitis and prevention of rheumatic fever: a statement for health professionals. *Pediatrics*. 1995;96: 758–764
7. Schwartz B, Marcy M, Phillips WR, Gerber MA, Dowell SF. Pharyngitis: principles of judicious use of antimicrobial agents. *Pediatrics.* 1998;101:171–174
8. Poses RM, Cebul RD, Collins M, Fager SS. The accuracy of experienced physicians' probability estimates for patients with sore throats: implications for decision making. *JAMA.* 1985; 254:925–929
9. McIsaac WJ, Kellner JD, Aufricht P, Vanjaka A, Low DE. Empirical validation of guidelines for the management of pharyngitis in children and adults. *JAMA.* 2004;291;1587–1595
10. Centor RM, Witherspoon JM, Dalton HP, Brody CE, Link K. The diagnosis of strep throat in adults in the emergency room. *Med Decis Making.* 1981;1:239–246
11. Gerber MA, Shulman ST. Rapid diagnosis of pharyngitis caused by group A streptococci. *Clin Microbiol Rev.* 2004;17: 571–580
12. Hall MC, Kieke B, Gonzales R, Belongia EA. Spectrum bias of a rapid antigen detection test for group A β-hemolytic streptococcal pharyngitis in a pediatric population. *Pediatrics.* 2004; 114;182–186
13. Armengol CE, Schlager TA, Hendley JO. Sensitivity of a rapid antigen detection test for group A streptococci in a private pediatric office setting: answering the *Red Book*'s request for validation. *Pediatrics.* 2004;113;924–926
14. Hofer C, Binns HJ, Tanz RR. Strategies for managing group A streptococcal pharyngitis: a survey of board-certified pediatricians. *Arch Pediatr Adolesc Med.* 1997;151:824–829
15. Schwartz B, Fries S, Fitzgibbon A, Lipman H. Pediatricians' diagnostic approach to pharyngitis and impact of CLIA 1988 on office diagnostic tests. *JAMA.* 1994;271:234–238
16. Gordis L, Desi L, Schmerler HR. Treatment of acute sore throats: a comparison of pediatricians and general physicians. *Pediatrics.* 1976;57:422–424
17. Centers for Disease Control and Prevention. Current CLIA regulations (including all changes through 01/24/2003). Available at: www.phppo.cdc.gov/clia/regs/toc.aspx. Accessed January 5, 2005
18. Gerber MA, Tanz RR, Kabat W, et al. Optical immunoassay test for group A beta-hemolytic streptococcal pharyngitis: an office-based multicenter investigation. *JAMA.* 1997;277:899–903
19. Mangione-Smith R, McGlynn EA, Elliott MN, Krogstad P, Brook RH. The relationship between perceived parental expectations and pediatrician antimicrobial prescribing behavior. *Pediatrics.* 1999;103:711–718
20. Vinson DC, Lutz LJ. The effect of parental expectations on treatment of children with a cough: a report from the ASPN. *J Fam Pract.* 1993;37:23–27
21. Snow V, Mottur-Pilson C, Cooper RJ, et al. Principles of appropriate antibiotic use for acute pharyngitis in adults. *Ann Intern Med.* 2001;134:506–508
22. Mangione-Smith R, Elliott MN, Wong L, McDonald L, Roski J. Measuring the quality of care for group A streptococcal pharyngitis in 5 US health plans. *Arch Pediatr Adolesc Med.* 2005;159: 491–497

APPENDIX Acute Pharyngitis Clinical Scenarios to Assess Physicians' Management Approach

A. In March, you see a 6-y-old child with a 2-d history of sore throat and headache. He has no cough or coryza. On examination, he is febrile, his pharynx is erythematous with pus on his tonsils, and he has tender cervical adenopathy.
   - Perform no diagnostic tests and give antibiotics based on clinical criteria alone.
   - Perform no diagnostic tests and give no antibiotics.
   - Perform a rapid strep test. If positive, give antibiotics; if negative, give no antibiotics and do nothing further.
   - Perform a rapid strep test. If positive, give antibiotics; if negative, obtain a throat culture, give antibiotics while awaiting culture results, and stop antibiotics if culture is negative.
   - Perform a rapid strep test. If positive, give antibiotics; if negative, obtain a throat culture and give antibiotics only if culture is positive.
   - Perform a throat culture and give antibiotics while awaiting culture results; stop antibiotics if culture is negative.
   - Perform a throat culture and give antibiotics only if culture is positive.
   - Perform a rapid strep test and/or a throat culture, and continue antibiotics despite a negative result.

B. In July, you see a 6-y-old child with a 2-d history of sore throat and coryza but no cough. On examination, he is afebrile, his pharynx is erythematous but there is no pus on his tonsils and he has no adenopathy.
   - Perform no diagnostic tests and give antibiotics based on clinical criteria alone.
   - Perform no diagnostic tests and give no antibiotics.
   - Perform a rapid strep test. If positive, give antibiotics; if negative, give no antibiotics and do nothing further.
   - Perform a rapid strep test. If positive, give antibiotics; if negative, obtain a throat culture, give antibiotics while awaiting culture results, and stop antibiotics if culture is negative.
   - Perform a rapid strep test. If positive, give antibiotics; if negative, obtain a throat culture and give antibiotics only if culture is positive.
   - Perform a throat culture and give antibiotics while awaiting culture results; stop antibiotics if culture is negative.
   - Perform a throat culture and give antibiotics only if culture is positive.
   - Perform a rapid strep test and/or a throat culture, and continue antibiotics despite a negative result.

After each of the following patient presentations, you will be given various diagnostic and treatment approaches. For each approach, indicate the management scenario you would be most likely to use.