

# Diagnosis and Management of Acute Sinusitis by Pediatricians

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## What's Known on This Subject

Acute sinusitis is a common diagnosis in young children and accounts for a substantial amount of antibiotic use. However, little is known regarding how pediatricians diagnose and manage nonsevere acute sinusitis in young children.

## What This Study Adds

This study provides insight into how pediatricians diagnose acute sinusitis in young children, including the importance given to various symptoms and the use of sinus imaging, and manage acute sinusitis, including antibiotic choices and contingency prescription use.

## ABSTRACT

**BACKGROUND.** Acute sinusitis is frequently diagnosed in young children, yet little is known regarding pediatrician practices surrounding its diagnosis and management.

**OBJECTIVES.** The purpose of this work was to describe how pediatricians diagnose and manage nonsevere acute sinusitis in otherwise healthy children  $\leq 6$  years of age.

**METHODS.** We used a mail survey administered from June to August 2007 to a national random sample of 750 general pediatricians from the American Medical Association Master File.

**RESULTS.** The response rate was 45% ( $N = 271$ ). Pediatricians reported first considering acute sinusitis at the ages of 0 to 5 (6%), 6 to 11 (17%), 12 to 23 (36%), 24 to 35 (21%), and  $\geq 36$  (20%) months. Symptoms thought to be "very important" in the diagnosis of acute sinusitis included prolonged symptom duration (93%), purulent rhinorrhea (55%), and nasal congestion (43%); 60% reported that symptom duration is more important than symptom combination. Symptom durations expected before considering the diagnosis were 1 to 6 (3%), 7 to 9 (17%), 10 to 13 (37%), 14 to 16 (38%), and  $\geq 17$  (6%) days. Fifty-eight percent reported using sinus computed tomography scans "occasionally" or more often in the diagnosis of acute sinusitis. Ninety-six percent reported treating acute sinusitis with an antibiotic "frequently" or "always." Fifty-three percent reported using contingency antibiotic prescriptions "occasionally" or more often for acute sinusitis. Adjuvants used "frequently" or "always" included saline washes (44%), systemic decongestants (28%), nasal corticosteroids (20%), and systemic antihistamines (13%).

**CONCLUSIONS.** We found significant variation in the age at which pediatricians begin considering the diagnosis of nonsevere acute sinusitis in children. Most pediatricians consider symptom duration the most important diagnostic factor. The majority of pediatricians use sinus computed tomography imaging at least occasionally in young children with nonsevere symptoms despite its limitations in this clinical setting. Although poorly understood, the use of contingency antibiotic prescriptions is common. Lastly, the use of systemic decongestants and antihistamines in young children is reported, a practice that needs to be reexamined in light of recent Food and Drug Administration warnings regarding their safety. *Pediatrics* 2009;123:e193–e198

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### Key Words

sinusitis, antibiotic use

### Abbreviations

AAP—American Academy of Pediatrics  
CT—computed tomography  
AMA—American Medical Association  
HMO—health maintenance organization  
MCO—managed care organization  
CHC—community health center  
OR—odds ratio  
CI—confidence interval  
FDA—Food and Drug Administration

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**A**CU TE SINUSITIS IS a common diagnosis in children and is treated with an antibiotic ~80% of the time, making it the fifth most common diagnosis for which antibiotics are prescribed in children.<sup>1</sup> Although the majority of children with acute sinusitis are treated with an antibiotic, there is controversy surrounding antibiotic use in young children with acute sinusitis for several reasons. First, the signs and symptoms of acute sinusitis of bacterial etiology in young children tend to be nonspecific, often overlapping those seen in viral upper respiratory tract infections, such as acute viral rhinosinusitis, for which antibiotics are of no benefit. Second, most young children with acute sinusitis improve without antibiotic therapy.<sup>2</sup> Finally, studies on the effectiveness of antibiotic therapy in children have mixed

findings.<sup>3,4</sup> For these reasons, the use of antibiotics for acute sinusitis in young children is controversial, particularly when children have nonsevere symptoms.<sup>5</sup> The most recent American Academy of Pediatrics (AAP) guidelines addressing the diagnosis and management of sinusitis, published in 2001, recommend antibiotic treatment for acute sinusitis in young children ( $\leq 6$  years old) with nonsevere symptoms (no high fever, nontoxic appearance, no facial pain, and no dental pain) when symptoms are prolonged ( $\geq 10$ –14 days) and not improving.<sup>6</sup>

Little is known about how pediatricians currently diagnose and manage young children with nonsevere acute sinusitis. The objectives of this study were to describe how US pediatricians diagnose and manage nonsevere acute sinusitis (no high fever, nontoxic appearance, no facial pain, and no dental pain) in otherwise healthy young children ( $\leq 6$  years old). Specifically, regarding the diagnosis of nonsevere acute sinusitis in young children, we sought to describe (1) the age at which pediatricians begin considering the diagnosis, (2) the importance given to specific symptoms and duration of symptoms, (3) the use of sinus imaging, and (4) factors associated with using either sinus computed tomography (CT) or radiography to aid in the diagnosis. Regarding the management of nonsevere acute sinusitis in young children, we sought to describe (1) the frequency of antibiotic use, (2) first-line antibiotic choice, (3) the use of contingency antibiotic prescriptions (an antibiotic prescription given to a child's parent to be filled should symptoms not improve), (4) factors associated with the use of contingency prescriptions, and (5) the use of other, nonantibiotic therapies.

## METHODS

### Study Setting

From June to August 2007, a survey regarding the diagnosis and management of nonsevere acute sinusitis in young children was conducted in a national sample of primary care pediatricians randomly selected from the American Medical Association (AMA) Master File. The study was reviewed by the Colorado Multiple Institutional Review Board, approved as exempt research, and informed consent was not required.

### Population

We randomly selected 750 general pediatricians from the Medical Marketing Service-maintained AMA Master File for participation in this study. This sample size was selected based on needing 371 respondents to achieve 80% power with a 5% type I error rate to detect a 15% difference when comparing dichotomous variables between 2 groups of equal size and an estimated response rate of 50%. To be eligible for the survey, participants were required to (1) have a valid mailing address listed with the AMA Master File, (2) practice primary care pediatrics, and (3) see patients  $\leq 6$  years of age in their practice.

### Survey Design and Administration

The survey was developed in an iterative process and then pilot tested in a group of 28 general pediatricians from the Denver, Colorado, metropolitan area. After pilot testing was completed, adjustments were made before dissemination of the survey based on results of the pilot testing. This self-administered, mail survey was administered using the Dillman Tailored Design Method.<sup>7</sup> An introductory letter was mailed 1 week before the first survey mailing. The survey was mailed up to a total of 3 times at 2-week intervals with a stamped return envelope. A reminder postcard was mailed 1 week after the first survey was mailed. First-class US mail was used for all of the mailings.

### Analysis

Response-rate calculations were made using the Council of American Survey Research Organization guidelines.<sup>8</sup> This formula applies an eligibility rate to nonrespondents of unknown eligibility based on the eligibility rate of survey respondents.

Descriptive statistics were computed for all of the survey questions. Additional analyses were performed to test for factors associated with the use of either sinus radiograph or CT scans to aid in the diagnosis of nonsevere acute sinusitis in young children and the use of contingency antibiotic prescriptions for nonsevere acute sinusitis in young children. The use of either sinus radiograph or CT imaging was tested for association with the duration of symptoms expected to be present before considering the diagnosis of nonsevere acute sinusitis in young children. Factors tested for association with contingency antibiotic prescriptions were (1) believing that symptom duration versus symptom combination versus neither is more important in the diagnosis of acute sinusitis, (2) considering the diagnosis of acute sinusitis in young children with nonsevere symptoms before symptoms have been present for 10 days, and (3) always as opposed to not always treating children diagnosed with acute sinusitis with an antibiotic. Each of the dependent variables were also tested for association with the following demographic information: years in practice; board certification or eligibility versus no board certification or eligibility; practice setting (private practice, health maintenance organization (HMO)/managed care organization (MCO), hospital/university/community health center (CHC)/other); practicing  $\geq 25\%$  primary care pediatrics versus  $< 25\%$  primary care pediatrics; practice location (urban inner city, rural, urban non-inner city/suburban); gender; and practice region (Midwest, Northeast, South, or West). Factors significant in bivariate testing at a  $P[r]$  value of  $< .25$  were tested in multivariate models. A procedure was used in which the least-significant predictor in each model was sequentially removed. Estimates were checked at each step to ensure that other variables were not largely affected by dropping the least-significant variable. All of the factors significant at a  $P$  value of  $< .10$  were retained in the final model. All of the analyses were performed by using SAS 9.1 (SAS Institute, Inc, Cary, NC).

**TABLE 1** Respondent Characteristics

Characteristic	Respondents (n = 271)
Female, %	60
Years since medical school, mean (SD)	18.7 (11.8)
Practice location, %	
Urban inner city	20
Urban non-inner city/suburban	67
Rural	13
Practice setting, %	
Private practice	65
HMO/MCO	7
Hospital/university/CHC/other	28
Practice region, %	
Midwest	20
Northeast	23
South	32
West	25

## RESULTS

### Survey Response

Our response rate was 45%, with 271 eligible, completed responses. Fifteen percent of those responding were ineligible (no longer practicing/not practicing primary care or not seeing children  $\leq 6$  years of age in their practice), and 4% of participants did not have a valid mailing address with Medical Marketing Service (also ineligible for participation). Demographic data on nonrespondents were unavailable. Shown in Table 1 are demographic and practice characteristics of respondents.

### Diagnosis of Acute Sinusitis

#### Age

Six percent of respondents reported that they first consider the diagnosis of nonsevere acute sinusitis in children 0 to 5 months of age, 17% in children 6 to 11 months of age, 25% in children 12 to 17 months of age, 12% in children 18 to 23 months of age, 18% in children

24 to 29 months of age, 3% in children 30 to 35 months of age, and 20% in children  $\geq 36$  months of age.

#### Symptoms

Figure 1 shows the importance given by pediatricians to various symptoms when considering the diagnosis of acute sinusitis in young children with nonsevere symptoms. Prolonged duration of symptoms (93% very important) and purulent rhinorrhea (55% very important) were given the most importance by pediatricians. Ninety-five percent of pediatricians agreed (strongly or somewhat) that they were less likely to diagnose acute sinusitis in a patient whose symptoms were improving, and 95% agreed (strongly or somewhat) that they were more likely to diagnose acute sinusitis in a patient whose symptoms were worsening. Thirteen percent of pediatricians agreed (strongly or somewhat) that they were more likely to diagnose sinusitis if they thought parents expected the diagnosis, and 16% agreed (strongly or somewhat) that they were more likely to treat sinusitis with an antibiotic if they thought parents expected an antibiotic.

Pediatricians were also asked whether symptom combination or symptom duration was more important in the diagnosis of nonsevere acute sinusitis in young children. Thirteen percent felt that symptom combination was more important, 60% felt that symptom duration was more important, and 27% felt that symptom combination and symptom duration were equally important. Pediatricians reported the following criteria for minimal duration of symptoms before they would consider the diagnosis of nonsevere acute sinusitis in young children: 1 to 6 (3%), 7 to 9 (17%), 10 to 13 (37%), 14 to 16 (38%), and  $\geq 17$  (6%) days.

#### Imaging

The use of sinus CT to aid in the diagnosis of nonsevere acute sinusitis in young children was reported as follows: 6% frequently or very often/always, 53% occasionally,

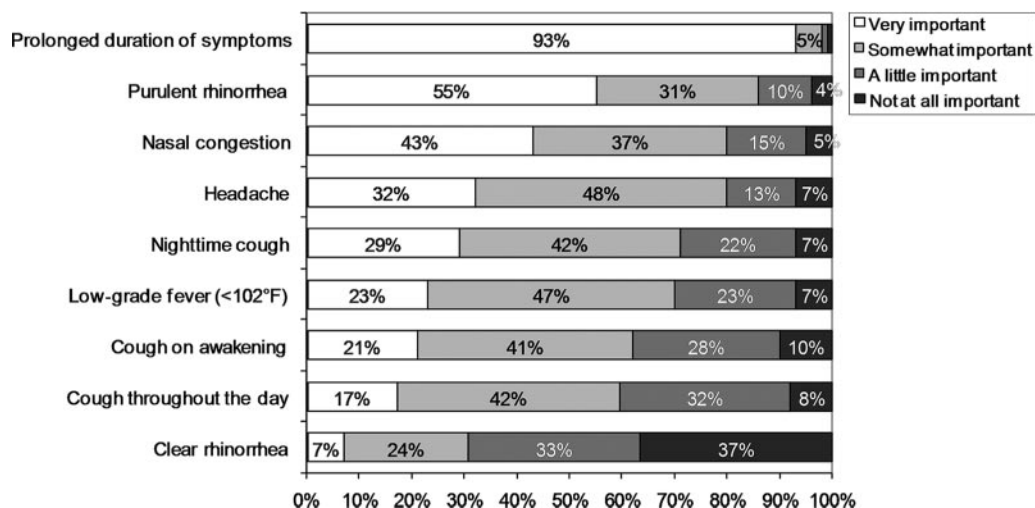


FIGURE 1

Importance given to various symptoms in the diagnosis of nonsevere acute sinusitis in young children by US primary care pediatricians.

and 41% rarely/never. The use of sinus radiography to aid in the diagnosis of nonsevere acute sinusitis in young children was reported as follows: 6% frequently or very often/always, 34% occasionally, and 59% rarely/never. Sinus ultrasound use was reported much less frequently (97% rarely/never). Seventy percent of respondents reported using either sinus radiography or sinus CT imaging occasionally or more to aid in the diagnosis of nonsevere acute sinusitis in young children.

The following factors were significantly associated with reporting the use of either sinus radiography or sinus CT imaging occasionally or more to aid in the diagnosis of nonsevere acute sinusitis in young children: more years in practice (mean of 20.9 years for imaging users versus 13.6 years for non-imaging users;  $P < .0001$ ); board-certified/eligible as opposed to non-board-certified/eligible (76% vs 60%;  $P = .006$ ); and practicing primary care pediatrics  $\geq 25\%$  as opposed to  $< 25\%$  (72% vs 48%;  $P = .02$ ). In multivariate testing, only years in practice remained significantly associated with reporting the use of either sinus radiography or sinus CT imaging.

### Treatment of Acute Sinusitis

#### Antibiotic Use

Sixty percent of pediatricians reported treating with an antibiotic very often/always, once making the diagnosis of nonsevere acute sinusitis in young children, whereas 35% reported treating frequently, 5% reported treating occasionally, and  $< 1\%$  reported treating rarely/never. When asked about their use of contingency antibiotic prescriptions for acute sinusitis, 47% reported rarely/never using them, 41% reported occasionally using them, 9% reported frequently using them, and 2% reported very often/always using them. Figure 2 shows the antibiotics that pediatricians selected as being their first choice for the treatment of nonsevere acute sinusitis in young children. When prescribing antibiotics, 2% of pediatricians reported treating for 7 days, 57% for 10 days, 35% for 14 days, and 4% for 21 days.

The following factors were associated with reporting the use of contingency prescriptions for acute sinusitis at least occasionally: (1) believing that symptom duration, as opposed to symptom combination or neither, is more important in the diagnosis of acute sinusitis (61% vs 23% vs 47%, respectively;  $P < .0001$ ); (2) not always as opposed to always treating with an antibiotic once making the diagnosis of acute sinusitis (61% vs 47%;  $P = .03$ ); (3) working in an HMO/MCO or private practice setting as opposed to a hospital/university/CHC/other setting (65% vs 63% vs 27%;  $P < .0001$ ); (4) practicing primary care pediatrics  $\geq 25\%$  as opposed to  $< 25\%$  (55% vs 24%;  $P = .009$ ); and (5) having a practice location of rural or suburban as opposed to urban (65% vs 59% vs 26%;  $P = .0001$ ). In multivariate analyses, the following remained significantly associated with the use of contingency prescriptions: (1) believing that symptom duration (referent) as opposed to symptom combination (odds ratio [OR] 0.21 [95% confidence interval {CI}: 0.09–0.52]) or neither (OR: 0.56 [95% CI: 0.31–1.02])

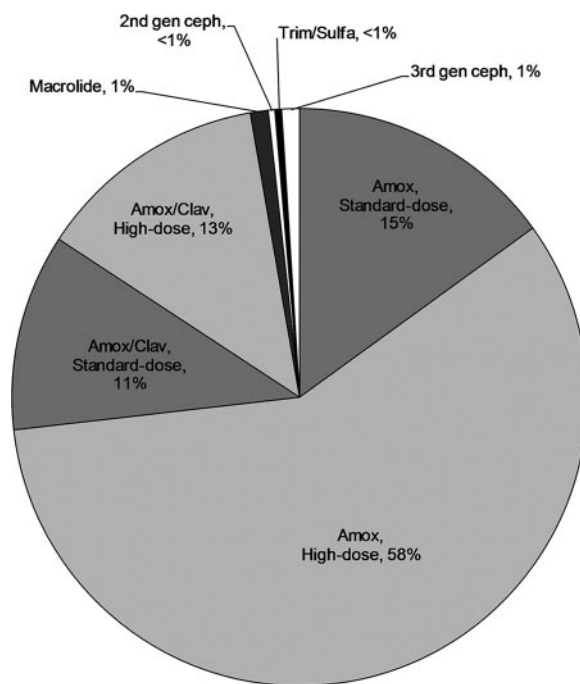


FIGURE 2

First-choice antibiotics for nonsevere acute sinusitis in young children among US primary care pediatricians. amox indicates amoxicillin; clav, clavuloric acid; gen, generation; ceph, cephalosporin; trim/sulfa, trimethoprim/sulfamethoxazole.

is more important in the diagnosis of acute sinusitis; (2) not always (OR: 1.83 [95% CI: 1.06–3.14]) as opposed to always (referent) treating with an antibiotic once making the diagnosis of acute sinusitis; and (3) working in an HMO/MCO (OR: 5.59 [95% CI: 1.83–17.00]) or private practice setting (OR: 4.10 [95% CI: 2.21–7.61]) as opposed to a hospital/university/CHC/other setting (referent).

#### Other Therapies

Figure 3 shows how often pediatricians use other therapeutic modalities for acute sinusitis in young children. Modalities used most frequently (frequently or very often/always) were as follows: saline washes (44%), systemic decongestants (28%), nasal corticosteroids (20%), and systemic antihistamines (13%).

### DISCUSSION

Regarding nonsevere acute sinusitis in young children ( $\leq 6$  years of age), our study demonstrated significant variation in both the age at which pediatricians began considering the diagnosis and in the duration of symptoms expected to be present before making the diagnosis. Most pediatricians considered symptom duration to be more important than symptom combination in the diagnosis, and the majority of pediatricians used sinus CT imaging at least occasionally to aid in the diagnosis. Most pediatricians treated with an antibiotic once the diagnosis was made, and many used contingency antibiotic prescriptions for acute sinusitis. Finally, some pediatricians used systemic antihistamines and decongestants as adjuvants for acute sinusitis in young children.



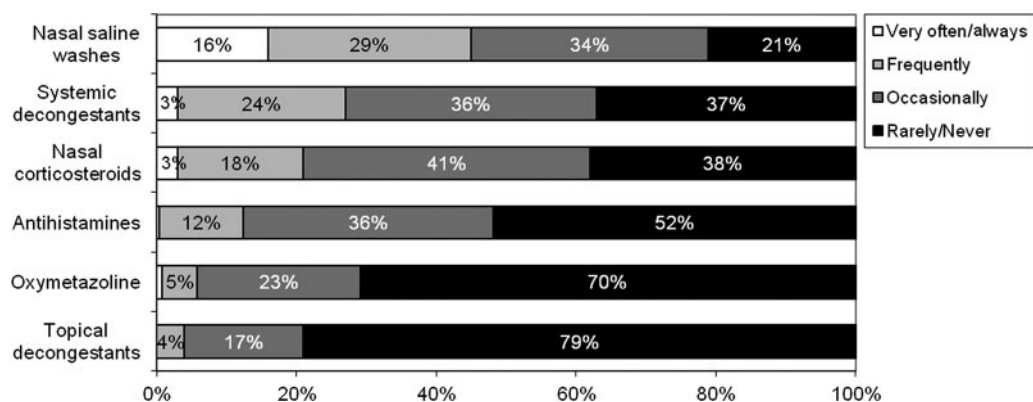


FIGURE 3  
Other therapeutic modality use for nonsevere acute sinusitis in young children among US primary care pediatricians.

There was a great deal of variation in the age at which pediatricians first began considering the diagnosis of acute sinusitis. Nearly one fourth of pediatricians diagnosed acute sinusitis in children <1 year of age, and a similar percentage of pediatricians did not consider the diagnosis until 3 years of age or beyond. These differences likely reflect the lack of data and lack of consensus regarding the occurrence of acute sinusitis by age, especially regarding the occurrence of acute sinusitis in children <1 year of age. These differences could lead to differences in the rate of diagnosis of acute sinusitis in young children and, therefore, the rate of antibiotic use in these children. This is particularly true given that younger children tend to have more frequent upper respiratory tract infections than older children.

Pediatricians also varied in the duration of symptoms that they expected to be present before considering the diagnosis of nonsevere acute sinusitis in young children. AAP guidelines from 2001 recommended that the diagnosis in young children with nonsevere symptoms be primarily based on prolonged symptom duration (10–14 days). The majority of pediatricians started considering the diagnosis of acute sinusitis in children with 10 to 13 or 14 to 16 days of symptoms. Pediatricians who diagnose nonsevere acute sinusitis in children at <10 days' duration may make the diagnosis much more frequently than those who do not. Also consistent with these AAP guidelines, a majority of pediatricians felt that symptom duration is more or equally important to symptom combination in the diagnosis of nonsevere acute sinusitis in young children. The majority of pediatricians reported that purulent rhinorrhea is very important in the diagnosis of acute sinusitis despite existing evidence that this symptom does not generally differentiate between viral and bacterial disease.<sup>9–12</sup>

The majority of pediatricians used sinus CT imaging at least occasionally to aid in the diagnosis of nonsevere acute sinusitis in young children, and nearly half reported using sinus radiography at least occasionally. The AAP guidelines recommend against using imaging to aid in the diagnosis of nonsevere acute sinusitis in young children, because sinus imaging generally does not add to clinical findings in young children, and imaging find-

ings can be nonspecific (children with viral disease often have abnormal sinus imaging studies).<sup>13–24</sup> In addition, sinus CT and radiograph imaging in this setting may expose children to unnecessary radiation and can be financially costly.

The majority of pediatricians treated young children with nonsevere acute sinusitis with appropriate antibiotics, and approximately half of the pediatricians used contingency antibiotic prescriptions in young children with nonsevere acute sinusitis. This practice may be based on the use of contingency antibiotic prescriptions in children with nonsevere otitis media and may be a strategy used in an attempt to reduce unnecessary antibiotic use given the controversy surrounding the use of antibiotic therapy in young children with nonsevere acute sinusitis. However, there are few data regarding the safety or efficacy of contingency antibiotic prescriptions in children with nonsevere acute sinusitis. Parents' decision-making regarding when to fill contingency prescriptions and how they are used once filled are not known. Given the extent of contingency prescription use reported here, this practice should be further studied.

The majority of pediatricians reported using systemic decongestants and antihistamines for nonsevere acute sinusitis in children ≤6 years of age. After a Food and Drug Administration (FDA) meeting regarding the use of these medications in fall 2007 (just after this survey was completed), many experts warned against their use in children <6 years old.<sup>25</sup> In addition, in January 2008, the FDA strongly recommended against the use of these medications in children <2 years of age.<sup>26</sup> The reported use of systemic antihistamines and decongestants by pediatricians should be readdressed in light of these subsequent recent FDA warnings regarding the safety and efficacy of these medications in young children.

Like most survey-based research, this study has several limitations. Response bias was possible. We were not able to compare respondents with nonrespondents, because we had little demographic data available on survey nonrespondents. However, the demographic characteristics of our respondents are similar to national estimates of these characteristics among primary care

pediatricians.<sup>27</sup> Recall bias was also possible, because acute sinusitis tends to occur more frequently during the winter months, and our survey was administered during the summer months. Finally, we measured report of practice, not actual practice.

## CONCLUSIONS

Acute sinusitis is a common condition in children and, as the fifth-leading reason for antibiotic prescribing in children, is an important contributor to overall antibiotic use. However, practices surrounding the diagnosis of nonsevere acute sinusitis in young children are quite varied. The variety of diagnostic approaches reported by pediatricians speaks to the need for a stronger evidence base on which pediatricians can make clinical decisions. Many pediatricians use contingency antibiotic prescriptions in young children with nonsevere acute sinusitis, a practice for which there are few data. Contingency antibiotic prescription use in this setting may be an important mechanism through which unnecessary antibiotic use can be minimized; data on the safety and effectiveness of contingency prescription use for nonsevere acute sinusitis in young children is needed. Finally, many pediatricians reported using systemic cough and cold medications in these young children, a practice that should be readdressed in light of the recent FDA warnings regarding their safety and efficacy.

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## REFERENCES

1. McCaig LF, Besser RE, Hughes JM. Trends in antimicrobial prescribing rates for children and adolescents. *JAMA*. 2002;287(23):3096–3102
2. de Ferranti SD, Ioannidis JP, Lau J, Anninger WV, Barza M. Are amoxicillin and folate inhibitors as effective as other antibiotics for acute sinusitis? A meta-analysis. *BMJ*. 1998;317(7159):632–637
3. Wald ER, Chiponis D, Ledesma-Medina J. Comparative effectiveness of amoxicillin and amoxicillin-clavulanate potassium in acute paranasal sinus infections in children: a double-blind, placebo-controlled trial. *Pediatrics*. 1986;77(6):795–800
4. Garbutt JM, Goldstein M, Gellman E, Shannon W, Littenberg B. A randomized, placebo-controlled trial of antimicrobial treatment for children with clinically diagnosed acute sinusitis. *Pediatrics*. 2001;107(4):619–625
5. Harris SJ, Wald ER, Senior BA, et al. The sinusitis debate. *Pediatrics*. 2002;109(1):166–167
6. American Academy of Pediatrics. Subcommittee on Management of Sinusitis and Committee on Quality Improvement. Clinical practice guideline: management of sinusitis [published correction appears in *Pediatrics*. 2001;108(5):A24 and *Pediatrics*. 2002;109(5):40]. *Pediatrics*. 2001;108(3):798–808
7. Dillman DA. *Mail and Internet Surveys: The Tailored Design Method*. New York, NY: John Wiley and Sons, Inc; 2007
8. Frankel LR. On the definition of response rates: a special report of the CASRO task force on completion rates. Port Jefferson, NY: Council of American Survey Research Associations, 1982
9. Gohd RS. The common cold. *N Engl J Med*. 1954;250(16):687–691
10. Hays GC, Mullard JE. Can nasal bacterial flora be predicted from clinical findings? *Pediatrics*. 1972;49(4):596–599
11. Wald ER, Milmoe GJ, Bowen A, Ledesma-Medina J, Salamon N, Bluestone CD. Acute maxillary sinusitis in children. *N Engl J Med*. 1981;304(13):749–754
12. Wald ER. Purulent nasal discharge. *Pediatr Infect Dis J*. 1991;10(4):329–333
13. Diamant MJ, Senac MO Jr, Gilsanz V, Baker S, Gillespie T, Larsson S. Prevalence of incidental paranasal sinuses opacification in pediatric patients: a CT study. *J Comput Assist Tomogr*. 1987;11(3):426–431
14. Glasier CM, Mallory GB Jr, Steele RW. Significance of opacification of the maxillary and ethmoid sinuses in infants. *J Pediatr*. 1989;114(1):45–50
15. Gwaltney JM Jr, Phillips CD, Miller RD, Riker DK. Computed tomographic study of the common cold. *N Engl J Med*. 1994;330(1):25–30
16. Kronemer KA, McAlister WH. Sinusitis and its imaging in the pediatric population. *Pediatr Radiol*. 1997;27(11):837–846
17. McAlister WH, Kronemer K. Imaging of sinusitis in children. *Pediatr Infect Dis J*. 1999;18(11):1019–1020
18. Engels EA, Terrin N, Barza M, Lau J. Meta-analysis of diagnostic tests for acute sinusitis. *J Clin Epidemiol*. 2000;53(8):852–862
19. Holbrook EH, Brown CL, Lyden ER, Leopold DA. Lack of significant correlation between rhinosinusitis symptoms and specific regions of sinus computer tomography scans. *Am J Rhinol*. 2005;19(4):382–387
20. Lacroix JS, Ricchetti A, Lew D, et al. Symptoms and clinical and radiological signs predicting the presence of pathogenic bacteria in acute rhinosinusitis. *Acta Otolaryngol*. 2002;122(2):192–196
21. Glasier CM, Ascher DP, Williams KD. Incidental paranasal sinus abnormalities on CT of children: clinical correlation. *AJNR Am J Neuroradiol*. 1986;7(5):861–864
22. DeSutter A, Lemiengre M, Van MG, et al. Predicting prognosis and effect of antibiotic treatment in rhinosinusitis. *Ann Fam Med*. 2006;4(6):486–493
23. Lazar RH, Younis RT, Parvey LS. Comparison of plain radiographs, coronal CT, and intraoperative findings in children with chronic sinusitis. *Otolaryngol Head Neck Surg*. 1992;107(1):29–34
24. McAlister WH, Lusk R, Muntz HR. Comparison of plain radiographs and coronal CT scans in infants and children with recurrent sinusitis. *AJR Am J Roentgenol*. 1989;153(6):1259–1264
25. US Food and Drug Administration. Joint Meeting of the Nonprescription Drugs Advisory Committee and the Pediatrics Advisory Committee: October 18–19, 2007. Available at: [www.fda.gov/ohrms/dockets/ac/07/minutes/2007-4323m1-Final.pdf](http://www.fda.gov/ohrms/dockets/ac/07/minutes/2007-4323m1-Final.pdf). Accessed June 4, 2008
26. US Food and Drug Administration. Public health advisory: nonprescription cough and cold medicine use in children. Available at: [www.fda.gov/CDER/drug/advisory/cough\\_cold\\_2008.htm](http://www.fda.gov/CDER/drug/advisory/cough_cold_2008.htm). Accessed June 4, 2008
27. American Academy of Pediatrics. American Academy of Pediatrics Periodic Survey of Fellows. Available at: [www.aap.org/research/periodicsurvey](http://www.aap.org/research/periodicsurvey). Accessed June 4, 2008

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Lon McQuillan, Lori A. Crane and Allison Kempe

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