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Signs and Symptoms that Differentiate Acute Sinusitis from Viral Upper Respiratory Tract Infection

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Abstract

Objective—Differentiating acute bacterial sinusitis from viral upper respiratory tract infection (URI) is challenging; 20% to 40% of children diagnosed with acute sinusitis based on clinical criteria likely have an uncomplicated URI. The objective of this study was to determine which signs and symptoms could be used to identify the subgroup of children who meet current clinical criteria for sinusitis but who nevertheless have a viral URI.

Methods—We obtained sinus radiographs in consecutive children meeting *a priori* clinical criteria for acute sinusitis. We considered the subgroup of children with completely normal sinus radiographs to have an uncomplicated URI despite meeting the clinical diagnostic criteria for sinusitis. We examined the utility of signs and symptoms in identifying children with URI.

Results—Of 258 children enrolled, 54 (20.9%) children had completely normal radiographs. The absence of green nasal discharge, the absence of disturbed sleep, and mild symptoms were associated with a diagnosis of URI. No physical exam findings were particularly helpful in distinguishing between children with normal vs. abnormal radiographs.

Conclusions—Among children meeting current criteria for the diagnosis of acute sinusitis, those with mild symptoms are significantly more likely to have a URI than those with severe symptoms. In addition to assessing overall severity of symptoms, practitioners should ask about sleep disturbance and green nasal discharge when assessing children with suspected sinusitis; their absence favors a diagnosis of URI.

Keywords

Pediatrics; Patient-reported outcome; symptoms

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INTRODUCTION

Sinusitis is the fifth most common diagnosis warranting an antimicrobial prescription in the United States and accounts for 4% of all pediatric visits to primary care physicians annually.¹ Because no laboratory tests are available, the diagnosis is made on the basis of clinical information. Yet, little evidence exists regarding which particular symptoms and signs are useful in the diagnosis of sinusitis. The role of individual clinical findings in the diagnosis of sinusitis has only been evaluated in 5 pediatric studies to date (combined sample size of 238).²

The accuracy of the current clinical criteria in identifying children with *bona fide* acute bacterial sinusitis (defined as the recovery of *Streptococcus pneumoniae*, *Haemophilus influenzae* or *Moraxella catarrhalis* from culture of the antral sinus aspirate) has not been studied directly. Nevertheless, because approximately 80% of children meeting clinical criteria for sinusitis have positive radiographs,³ and because 80% of children with positive radiographs have positive antral cultures,⁴ we estimate the probability of bacterial sinusitis in children with clinically defined acute sinusitis to be approximately 64% ($0.8 \times 0.8 = 0.64$) (Figure 1). Accordingly, roughly 40% of children diagnosed with acute sinusitis based on the current clinical criteria may not have true acute bacterial sinusitis. This is in part due to the large overlap between symptoms and signs of an uncomplicated upper respiratory tract infection (URI) and acute bacterial sinusitis. If one could accurately differentiate children with uncomplicated URI from children with acute bacterial sinusitis, unnecessary antimicrobial use might be reduced, thereby slowing the emergence of resistance to antimicrobials among respiratory pathogens.

To determine the accuracy of symptoms and signs in differentiating viral URI from sinusitis, a cohort of children with clinically suspected sinusitis would need to undergo aspiration of the maxillary antrum. Unfortunately, this procedure is invasive, often requires sedation, and is technically difficult. For this reason, less invasive reference measures, such as plain radiographs, have historically been used.⁵⁻⁸ The plain radiograph is a reasonable reference standard in this context for the following reasons: (1) most children meeting clinical criteria for sinusitis who have significantly abnormal radiographs have acute bacterial sinusitis, and (2) most children with completely normal radiographs (all sinuses well aerated and without mucosal changes) do not have acute bacterial sinusitis. Although, we do not believe that radiographs are necessary or desirable for the diagnosis of sinusitis, our goal in this study was to use radiographs to explore whether, in children who already meet criteria for sinusitis, particular symptoms or signs could help differentiate children with likely acute sinusitis from children with a lingering URI (Figure 1).

PATIENTS AND METHODS

We prospectively enrolled children aged 2 to 12 years with clinically diagnosed acute sinusitis presenting to one of 6 general ambulatory pediatric clinics in Pittsburgh (4 suburban, 2 urban) during two consecutive respiratory seasons. The diagnosis of acute sinusitis was made according to stringently defined *a priori* clinical criteria.⁹ In an attempt to capture every child with sinusitis, we approached families of all children with any respiratory complaints. Children with (1) persistent upper respiratory tract symptoms (i.e., 10-29 days of cough [not exclusively nocturnal] and/or nasal symptoms [rhinorrhea of any quality or congestion]) who were not improving, or (2) worsening symptoms (substantial worsening of nasal symptoms and/or fever after a period of improvement) were eligible. Children with a severe presentation, as defined by the American Academy of Pediatrics Guidelines (temperature $> 39^{\circ}\text{C}$ with purulent nasal discharge for at least 3 days),⁹ were not included. We excluded children who had received antimicrobial treatment within 7 days

before presentation, had evidence of another infection (i.e., acute otitis media or pneumonia), or who had underlying immune deficiency, cystic fibrosis, immotile cilia syndrome, or major developmental delay. Children with asthma, who were otherwise eligible, were included only if they were not wheezing on exam and if they had nasal symptoms that were worsening or persistent (i.e., no child with asthma was enrolled based on prolonged cough alone). Children with a history of allergic rhinitis who met the entry criteria were included only if their respiratory symptoms had acutely worsened. Thus, the diagnosis of sinusitis was made strictly according to the American Academy of Pediatrics guideline.⁹ The Institutional Review Board at the University of Pittsburgh approved this study prior to patient enrollment.

At the time of diagnosis, parents were interviewed regarding their child's symptoms using a questionnaire. We asked about symptoms that their child had experienced since the onset of the illness and also about symptoms exhibited over the past 24 hours. For the latter, the Pediatric Rhinosinusitis Symptom scale (PRSS P) was used. A manuscript describing the development of the PRSS-P is under preparation. Briefly, the scale asks parents to rate the severity of 8 symptoms of acute sinusitis (nighttime cough, daytime cough, runny nose, stuffy nose, green nasal discharge, disturbed sleep, irritability, and tiredness). Each item is scored on a 3 point scale (none=0, a little = 1, a lot =2). A total score is calculated by summing the score on individual items (range 0-16).

At the time of diagnosis, we performed a detailed physical examination on each child. We trained all investigators on the techniques of performing the examination before the initiation of the study. No suctioning was performed before the examination. We examined the anterior nares using an otoscope fitted with a large speculum. If purulent material was visualized superior to the inferior turbinate we coded this as pus in the region of the middle meatus. When assessing tenderness over the maxillary and frontal sinuses, the examiner applied pressure to the area over the sinuses until some blanching of their fingernail was discernible. We assessed tenderness to percussion by firmly tapping on the bone over each sinus using one finger. Tenderness to pressure or percussion was assessed one side at a time. Sinus tenderness to pressure or percussion was judged as being present only if the child visibly flinched, had a change in facial expression, or verbally declared pain (unsolicited). Children <6 years of age do not usually develop frontal sinusitis. Accordingly, tenderness over the frontal sinuses was assessed only in children >6 years of age.

On the day of diagnosis, anteroposterior and occipitomeatal (Water's view) radiographs were obtained on all children in the study. To permit assessment of the frontal and sphenoid sinuses, we also obtained lateral views for children >6 years of age (frontal and sphenoid sinusitis are unusual in children <6 years of age). Older cooperative children were imaged in the upright position; infants and uncooperative young children were imaged in the recumbent position. Sinus radiographs were obtained at three radiology departments with pediatric expertise. We conducted refresher sessions for the radiology technicians to ensure that the technique used was comparable across settings. Sinus radiographs were independently reviewed at the end of the study by two reference radiologists (LF, AB) who were unaware of any clinical data. Each sinus was rated as normal or abnormal. Children with abnormal X-rays (defined by the presence of complete opacification or any mucosal thickening of any sinus on any view) were considered as having likely acute bacterial sinusitis. Those with completely normal x-rays (all sinuses clear on all views) were considered as having a likely URI. Disagreements between the two radiologists were resolved by discussion. Previous studies have used mucosal thickening of > 4mm to indicate the presence of sinusitis. However, it is now clear that no degree of thickening (nor complete opacification for that matter) is sufficient to rule in sinusitis; many children with uncomplicated viral URI will have abnormal sinus x-rays. In contrast, a radiograph in which

all sinuses are completely aerated, is a fairly good indicator that the child does not have significant sinus disease. In addition, because the ethmoidal air cells are superimposed on each other on X-ray, the degree of mucosal thickening cannot be reliably determined. Thus, instead of using the threshold of 4 mm (that was developed to rule in disease), we used the absence of any mucosal thickening to indicate absence of significant sinus disease. In this way, it was more likely that children with radiographs categorized as being normal would have an uncomplicated viral URI.

Statistical Analysis

We used kappa statistics to describe the agreement between the initial readings from the two reference radiologists.¹⁰ We compared the distributions of demographic and clinical characteristics of children with likely URI and likely sinusitis, respectively, using logistic regression. Next, we examined the distribution of individual symptoms and signs according to the likely diagnosis (based on X-ray results). We then calculated positive and negative likelihood ratios for each finding in predicting URI.^{11,12} Children with data missing with regards to a particular sign or symptom were not included in the calculation of accuracy estimates for that particular sign or symptom. We used URI, not sinusitis, as the condition of interest because it could be more reliably ascertained (i.e., completely normal sinus radiographs are a reliable indicator of URI whereas abnormal radiographs do not reliably identify those with bacterial sinusitis). We used the positive and negative likelihood ratios to calculate the probability of URI (post-test probability). For the latter analysis, we used a pre-test probability of URI of 40% (see background section).¹¹ We considered findings for an individual symptom or sign to be clinically significant if its presence or absence changed the probability of URI by more than 15% (i.e., decreased the probability of URI to < 25% or increased it to >55%). To determine whether a combination of findings was better than individual findings in predicting URI, we calculated the post-test probability of URI for combinations of findings that (1) were significantly associated with radiographic diagnosis, and (2) occurred in at least 10% of the sample. Finally, using logistic regression, we evaluated whether symptom severity, as measured by the PRSS-P at the time of diagnosis, or as assessed by the examiner on a visual analog scale (with 0 = “Not Severe” and 100 = “Severe”, as anchors), was associated with diagnosis. All reported p-values are two-sided, and all hypothesis testing was two-sided with significance level of 0.05. Statistical analyses were performed using SAS version 9.2 and STATA version 10.1.

RESULTS

We screened 2023 children with URI symptoms for eligibility. Only 355 (17.5%) of these children met clinical criteria for the diagnosis of sinusitis (Figure 2). A total of 267 children underwent sinus radiography, of which 258 were interpretable. The agreement between the two reference radiologists in differentiating normal vs. abnormal radiographs was good ($\kappa = 0.68$).¹⁰ The 54 children with completely normal radiographs were considered as having a “likely URI” while the remaining 204 children were considered as having “likely sinusitis”.

The demographic and clinical characteristics of the children according to diagnosis are shown in Table 1. The mean age (standard deviation) of children enrolled was 6.4 (2.9) years. Older children were more likely to have a URI, a finding consistent with previous epidemiologic studies. Of note, duration of symptoms was not associated with radiographic diagnosis.

Of the symptoms investigated (Table 2), absence of green nasal discharge in the past 24 hours and the absence of disturbed sleep since the onset of the illness were associated with higher probability of URI. A history of facial pain was associated with a lower probability of URI. Certain combination of symptoms also proved to be statistically and clinically

significant. The absence of both nasal discharge and disturbed sleep was associated with higher probability (CI) of URI [70.0% (53.9-82.4)], whereas the presence of both findings was associated with a lower probability (CI) of URI [24.3% (17.0-33.3)]. No physical exam findings were particularly helpful in establishing the diagnosis (Table 3).

Children with mild symptoms were more likely to have a URI (Table 4). Severity of symptoms as reported by parents on the PRSS-P at the time of diagnosis was strongly associated with diagnosis ($p < .001$). The probability (confidence interval) of URI in children with a PRSS-P of ≤ 6 and > 10 were 62.2% (48.0 – 74.5) and 27.5% (19.1-37.9), respectively. Similarly, children with more severe cough and congestion (as judged by the examining physician) were more likely to have abnormal radiographs. None of these associations was confounded by age.

Only 27 of 258 (10.5%) children presented without green nasal discharge or disturbed sleep. Of these 27 children, 13 had a likely URI. Of note, 19 (70%) of 27 children also had mild symptoms (PRSS ≤ 6).

DISCUSSION

In this study, we show that severity of symptoms correlate with radiographic diagnosis. Because children presenting with mild symptoms are somewhat less likely to have *bona fide* bacterial sinusitis, they are less likely to benefit from antibiotic therapy. In addition, because one of the main reasons to give antibiotics to children with acute sinusitis is to relieve symptoms, children with mild symptoms, in a sense, may have less to gain from antibiotic therapy. Recent guidelines^{13,14} have recommended observation as an alternative to antibiotic use, but most do not provide advice on how to select children who could be safely observed. Findings from this study, if validated in future treatment trials, may help clinicians decide which children to observe and which ones to treat. Specifically, our data suggest that children with mild symptoms may be reasonable candidates for initial observation. In this cohort, such an approach would have reduced antibiotic use by approximately 15%.

We also show that children without green nasal discharge or without disturbed sleep are somewhat more likely to have an uncomplicated URI than children with these findings. Although these findings alone are not sufficient to conclusively rule out sinusitis in all cases, their presence does increase the likelihood of URI; a child without green nasal discharge or disturbed sleep is more likely to have a viral URI than acute bacterial sinusitis (Table 2) despite having fulfilled the current clinical criteria for acute sinusitis.

Some readers may be surprised that some of the more frequently occurring symptoms of sinusitis, such as stuffy nose or cough, were not as useful as the 2 symptoms above. Because most children had to have these latter signs to be included in this study (current guidelines require nasal symptoms and/or cough), these signs were absent in only a handful of children. This may explain the wide confidence intervals around the negative likelihood ratios for these frequently occurring findings. Accordingly, in a sense, the diagnostic ability of these symptoms was already “used up” because these symptoms were required for entry into the study.

The combination of green nasal discharge and disturbed sleep, and a history of facial pain were associated with abnormal radiographs. Abnormal radiographs (unlike normal radiographs), however, have little clinical significance; many children with no symptoms of sinusitis have abnormal radiographs.¹⁵ Thus, the presence of these findings is unlikely to be particularly useful in the diagnostic process.

The prevalence of acute sinusitis as diagnosed by clinical criteria in this study (17.5%) is higher than previously reported (6.5%).³ This may have resulted from our systematically approaching all consecutive children with URI symptoms. In addition, in some of the previous studies all children with a history of allergic rhinitis or asthma were excluded.

A main limitation of this study is that sinus radiographs are only a rough proxy for true bacterial sinusitis. Nevertheless, because most children with completely normal x-rays will not have significant bacterial sinusitis, we feel that our data can provide useful, albeit imperfect, information that can help guide the diagnostic process.

In conclusion, we have shown that children without green nasal discharge or disturbed sleep are somewhat more likely to have uncomplicated viral URI than children with these findings. In addition, because children with mild symptoms are more likely to have uncomplicated URI than children with severe symptoms, initial observation (rather than immediate antibiotic treatment) may be considered in these children.

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Figure 1.
Conceptual model

Figure 2.
Flow-sheet describing the course of patients through the study

Table 1

Selected demographic and clinical characteristics according to diagnosis

Characteristic	Likely URI (n=54)	Likely sinusitis (n=204)	p value
No. of children (%)			
Age at entry, months			
24 -71	23 (42.6)	113 (55.4)	0.01
72-155	31 (57.4)	91 (44.6)	
Mean (SD) ^a	87.2 (34.0)	67.8 (34.5)	
Gender			
Male	29 (53.7)	102 (50.0)	0.63
Female	25 (46.3)	102 (50.0)	
Hispanic			
Yes	4 (7.4)	7 (3.4)	0.21
No	50 (92.6)	196 (96.1)	
Race			
White	34 (63.0)	128 (62.7)	0.98
Black	16 (29.6)	58 (28.4)	
Other	4 (7.4)	18 (8.8)	
Maternal level of education			
< High School	2 (3.7)	9 (4.4)	0.94
High School graduate	31 (57.4)	111 (54.4)	
College graduate	21 (38.9)	82 (40.2)	
Health insurance status			
Private	25 (46.3)	97 (47.5)	0.84
Public	29 (53.7)	106 (52.0)	
None	0	1 (0.5)	
History of asthma or wheezing			
Yes	22 (40.7)	72 (35.3)	0.46
No	32 (59.3)	132 (64.7)	
History of allergic rhinitis			
Yes	13 (24.5)	42 (20.6)	0.53
No	40 (75.5)	162 (79.4)	
Exposed to other children ^b			
Yes	47 (87.0)	163 (79.9)	0.26
No	7 (13.0)	40 (19.6)	
Duration of symptoms			
6 to 9 days	13 (24.1)	45(22.1)	0.83
10 to 14 days	20 (37.0)	95 (46.6)	
15 to 19 days	9 (16.7)	12 (5.9)	
20 to 30 days	12 (22.2)	52 (25.5)	
Mean (SD) ^a	14.4 (6.2)	14.2 (5.9)	

Characteristic	Likely URI (n=54)	Likely sinusitis (n=204)	p value
	No. of children (%)		
Duration of fever, days ^{ac}	2.2 (1.4)	2.8 (2.2)	0.26
Highest reported temperature, °C ^{ac}	38.8 (0.6)	38.7 (0.8)	0.68
Temperature at presentation, °C ^a	37.0 (0.5)	36.9 (0.5)	0.20
Chief complaint			
Cough	31 (57.4)	122 (59.8)	
Runny/stuffy nose	12 (22.2)	54 (26.5)	0.45
Other	11 (20.4)	28 (13.7)	

URI = Upper respiratory tract infection

^a Mean values and standard deviation (SD) presented

^b Defined as spending >10 h/week in a setting with >3 other children

^c Not all 258 children provided data for these findings

Table 2

Accuracy of symptoms in the diagnosis of upper respiratory tract infection (URI), and probability of URI assuming a pre-test probability of 40%. Findings that are both clinically and statistically significant are bolded.

Symptoms	Diagnosis ^a		Likelihood ratio in predicting URI ^b		Probability of URI	
	Likely URI (n=54)	Likely sinusitis (n=204)	Positive likelihood ratio (CI)	Negative likelihood ratio (CI)	If symptom present (CI)	If symptom absent (CI)
In the past 24 hours						
Fever	19 (35.2)	99 (48.5)	0.73 (0.49 - 1.07)	1.26 (0.99 - 1.60)	32.6% (24.7 - 41.6)	45.6% (39.8 - 51.6)
Headache	29 (53.7)	83 (40.7)	1.32 (0.98 - 1.78)	0.78 (0.57 - 1.06)	46.8% (39.5 - 54.2)	34.2% (27.6 - 41.5)
Green nasal discharge	24 (44.4)	146 (71.6)	0.62 (0.46 - 0.85)	1.95 (1.41 - 2.70)	29.3% (23.3 - 36.1)	56.6% (46.5 - 64.3)
Tired	42 (77.8)	160 (78.4)	0.99 (0.85 - 1.16)	1.03 (0.59 - 1.81)	39.8% (36.0 - 43.7)	40.7% (28.1 - 54.7)
Irritable (bad mood)	36 (66.7)	151 (74.0)	0.90 (0.73 - 1.11)	1.28 (0.82 - 2.00)	37.5% (32.8 - 42.4)	46.1% (35.5 - 57.1)
Since the onset of illness						
Bad breath	31 (57.4)	108 (52.9)	1.08 (0.83 - 1.41)	0.91 (0.64 - 1.27)	42.0% (35.7 - 48.5)	37.6% (30.0 - 45.9)
Fever	22 (40.7)	108 (52.9)	0.77 (0.54 - 1.09)	1.26 (0.96 - 1.64)	33.9% (26.6 - 42.1)	45.6% (39.2 - 52.2)
Headache ^b	26 (51.0)	88 (46.3)	1.10 (0.81 - 1.50)	0.91 (0.67 - 1.24)	42.3% (35.0 - 50.0)	37.8% (30.9 - 45.3)
Nighttime cough	47 (87.0)	187 (91.7)	0.95 (0.85 - 1.06)	1.56 (0.68 - 3.56)	38.8% (36.2 - 41.4)	50.9% (31.2 - 70.3)
Daytime cough	47 (87.0)	193 (94.6)	0.92 (0.83 - 1.02)	2.40 (0.98 - 5.91)	38.0% (35.5 - 40.6)	61.6% (39.5 - 79.7)
Eating less	28 (51.9)	117 (57.4)	0.90 (0.68 - 1.20)	1.13 (0.82 - 1.55)	37.6% (31.2 - 44.4)	42.9% (35.4 - 50.9)
Playing less	21 (38.9)	98 (48.0)	0.81 (0.56 - 1.16)	1.18 (0.92 - 1.51)	35.1% (27.3 - 43.7)	43.9% (37.9 - 50.2)
Tired	38 (70.4)	156 (76.5)	0.92 (0.76 - 1.11)	1.26 (0.78 - 2.03)	38.0% (33.7 - 42.6)	45.6% (34.2 - 57.6)
Stuffy nose	46 (85.2)	190 (93.1)	0.91 (0.81 - 1.03)	2.16 (0.96 - 4.88)	37.9% (35.2 - 40.7)	59.0% (38.9 - 76.5)
Disturbed sleep	32 (59.3)	162 (79.4)	0.75 (0.59 - 0.94)	1.98 (1.30 - 3.01)	33.2% (28.3 - 38.6)	56.9% (46.4 - 66.7)
Sneezing more than usual	32 (59.3)	135 (66.2)	0.90 (0.70 - 1.14)	1.20 (0.83 - 1.75)	37.4% (31.9 - 43.2)	44.5% (35.6 - 53.9)
Itchy eyes	22 (40.7)	70 (34.3)	1.19 (0.82 - 1.72)	0.90 (0.71 - 1.15)	44.2% (35.3 - 53.5)	37.6% (32.1 - 43.4)
Itchy nose ^b	23 (42.6)	87 (42.9)	0.99 (0.70 - 1.41)	1.00 (0.78 - 1.30)	39.9% (31.9 - 48.4)	40.1% (34.1 - 46.5)
Teeth/Jaw pain ^b	5 (9.8)	33 (17.4)	0.56 (0.23 - 1.37)	1.09 (0.98 - 1.22)	27.3% (13.4 - 47.8)	42.1% (39.4 - 44.9)
Facial swelling	10 (18.5)	53 (26.0)	0.71 (0.39 - 2.32)	1.10 (0.95 - 1.28)	32.2% (20.6 - 46.5)	42.3% (38.7 - 56.0)
Face pain ^b	4 (7.9)	40 (21.0)	0.37 (0.14 - 0.99)	1.17 (1.05 - 1.30)	19.9% (8.52 - 39.8)	43.8% (41.1 - 46.5)
Asymmetric face pain ^b	1 (2.0)	14 (7.7)	0.26 (0.04 - 1.93)	1.06 (1.00 - 1.12)	14.8% (2.28 - 56.3)	41.4% (40.1 - 42.9)

CI = 95% confidence interval

^aNumber (percent of children)

^bNot all 258 children provided data for these findings

Table 3

Accuracy of signs in the diagnosis of upper respiratory tract infection (URI), and probability of URI assuming a pre-test probability of 40%

Signs	Diagnosis ^a		Likelihood ratios in predicting URI ^b		Probability of URI	
	Likely URI (n=54)	Likely sinusitis (n=204)	Positive likelihood ratio (CI)	Negative likelihood ratio (CI)	If symptom present (CI)	If symptom absent (CI)
Measured temperature >38° C ^b	2 (3.7)	7 (3.4)	1.07 (0.23 - 5.00)	1.00 (0.94 - 1.06)	41.6% (13.2 - 76.9)	39.9% (38.5 - 41.4)
Bluish turbinates ^b	7 (13.0)	48 (23.9)	0.54 (0.26 - 1.13)	1.14 (1.01 - 1.30)	26.6% (14.8 - 43.0)	43.3% (40.1 - 46.4)
Allergic shiners	20 (37.0)	108 (52.9)	0.70 (0.48 - 1.01)	1.34 (1.04 - 1.72)	31.8% (24.3 - 40.3)	47.1% (41.0 - 53.4)
Transverse nasal crease	6 (11.1)	26 (12.7)	0.87 (0.38 - 2.01)	1.02 (0.92 - 1.13)	36.8% (20.1 - 57.3)	40.4% (37.9 - 43.1)
Post-nasal discharge visible in pharynx ^b	12 (22.2)	60 (30.9)	0.72 (0.42 - 1.23)	1.13 (0.95 - 1.34)	32.4% (21.8 - 45.2)	42.9% (38.8 - 47.1)
Facial swelling (either side)	7 (13.0)	51 (25.0)	0.52 (0.25 - 1.08)	1.16 (1.02 - 1.32)	25.7% (14.3 - 41.8)	43.6% (40.5 - 46.8)
Either maxillary sinus tender to percussion	5 (9.3)	27 (13.2)	0.70 (0.28 - 1.73)	1.05 (0.95 - 1.16)	31.8% (15.9 - 53.6)	41.1% (38.7 - 43.5)
Either maxillary sinus tender to pressure	13 (24.1)	48 (23.5)	1.02 (0.60 - 1.75)	0.99 (0.84 - 1.17)	40.6% (28.6 - 53.8)	39.8% (35.9 - 43.9)
Either frontal sinus tender to percussion ^c	5 (16.1)	21 (23.1)	0.70 (0.20 - 1.70)	1.09 (0.90 - 1.32)	31.8% (16.1 - 53.1)	42.1% (37.5 - 46.8)
Either frontal sinus tender to pressure ^c	15 (48.4)	23 (25.3)	1.91 (1.15 - 3.18)	0.69 (0.48 - 0.99)	56.1% (43.5 - 67.9)	31.5% (24.3 - 39.8)
Either inferior turbinate swollen	31 (57.4)	132 (64.7)	0.89 (0.69 - 1.14)	1.21 (0.84 - 1.73)	37.2% (31.5 - 43.2)	44.6% (35.9 - 53.6)
Either inferior turbinate erythematous	21 (38.9)	98 (48.0)	0.81 (0.56 - 1.16)	1.18 (0.92 - 1.51)	35.1% (27.3 - 43.7)	43.9% (37.9 - 50.2)
Pus in nose	21 (38.9)	128 (62.7)	0.62 (0.44 - 0.88)	1.64 (1.24 - 2.16)	29.2% (22.5 - 37.0)	52.2% (45.3 - 59.1)
Pus in middle meatus	9 (16.7)	42 (20.6)	0.81 (0.42 - 1.56)	1.05 (0.91 - 1.20)	35.1% (21.9 - 50.9)	41.2% (37.9 - 44.5)
Pharyngeal cobblestoning ^b	5 (9.3)	22 (10.9)	0.85 (0.34 - 2.13)	1.02 (0.92 - 1.12)	36.1% (18.3 - 58.7)	40.5% (38.1 - 42.8)

CI = 95% confidence interval

^aNumber (percent of children)

^bNot all 258 children provided data for these findings

^cOnly children greater than or equal to 72 months of age (i.e., those with developed frontal sinuses) were included in this analysis

Table 4

Relationship between disease severity at presentation and likely diagnosis

Characteristic	Likely URI (n=54)	Likely sinusitis (n=204)	p value
	Mean (SD)		
Mean symptom severity score at enrollment (PRSS-P)	8.6 (2.8)	10.1 (2.8)	< 0.001
Mean cough severity ^a	35.8 (32.6)	48.2 (32.2)	0.02
Mean nasal congestion severity ^a	40.7 (28.1)	54.5 (27.4)	0.003

URI = Upper respiratory tract infection

^a As assessed by the examining physician on a 100 point visual analog scale (0=not severe, 100=severe)