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Diagnosis and treatment of acute sinusitis in the primary care setting: a retrospective cohort

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Abstract

Objectives and Hypothesis—Our objectives were to characterize the quality of acute sinusitis care and to identify non-clinical factors associated with antibiotic use for acute sinusitis. We hypothesized that we would identify provider level factors associated with antibiotic use.

Study Design—Retrospective cohort at a single academic institution.

Methods—We developed and clinically annotated an administrative dataset of adult patients diagnosed with acute sinusitis between January 1, 2005 and December 31, 2006. We used identify factors associated with receipt of antibiotics.

Results—We find that 66.0% of patients with mild symptoms of short duration are given antibiotics and that non-clinical factors, including the individual provider, the provider's specialty, and the presence of a medical trainee, significantly influence antibiotic use. Relative to internal medicine providers, family medicine providers use fewer antibiotics and emergency medicine providers use more antibiotics for acute sinusitis.

Conclusions—Antibiotics continue to be over used for patients with mild acute sinusitis of short duration. Non-clinical characteristics, including the individual provider, the provider's specialty, and the presence of a medical trainee significantly influence use of antibiotics for acute sinusitis.

Keywords

sinusitis; adult; retrospective cohort; survey; provider

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Introduction

Sinusitis is one of the most common conditions treated by primary care providers.¹⁻³ Like other upper respiratory infections (URI), sinusitis is usually a viral infection. Despite the lack of efficacy, antibiotics are pervasively overused for sinusitis resulting in widespread antibiotic resistance.^{4,5} Decreasing antibiotic use for uncomplicated sinusitis is an important focus of antimicrobial stewardship.

A few studies have examined specific factors related to antibiotic use, including provider specialty,⁶ visit duration,⁷ and resident physician provider.⁶ However, these studies were based on population based surveys that include minimal clinical data. Without clinical data it can be difficult to discern illness duration, symptom severity, or relevant comorbidities that may impact the provider's decision to prescribe antibiotics.

In order to identify factors that may contribute to antibiotic overuse for acute sinusitis, we designed an observational cohort based on administrative data with clinical details extracted from the electronic medical record (EMR). Our first objective was to broadly characterize the quality of care for patients with acute sinusitis at initial diagnosis using the American Academy of Otolaryngology-Head and Neck Surgery (AAO-HNS) "Clinical Practice Guideline: Adult Sinusitis" as a benchmark. Our second objective was to identify non-clinical factors associated with antibiotic use.

Materials and Methods

Patient identification

We identified adult patients diagnosed with acute or chronic sinusitis or URI (ICD-9 codes 461. x, 473. x, 460, 465) between January 1, 2005 and December 31, 2006 within the University of Michigan Health Care System. These patients were identified through our institution's robust Clinical Research and Health Information Exchange ("data repository") which contains demographic, clinical, and professional fee billing information. We included patients from the emergency department or primary care practices, including geriatrics, family medicine, and internal medicine, excluding patients from subspecialty practices. We excluded patients with concurrent pharyngitis, otitis media, acute tonsillitis, bronchitis, strep throat (ICD-9 codes 462, 034.0, 463-464, 381.0 - 381.4, 382, 466, 490, 491.21). To minimize confounding by chronic sinusitis we excluded patients with a visit for sinusitis or URI in the preceding 365 days and patients who may have not have had access to care (no visit to a primary care provider in the preceding 365 days).

We created variables to describe the provider from the visit corresponding to cohort inception, including gender, department affiliation, medical specialty, degree type (MD, DO, MBBS, or mid-level provider) and years in practice (reference year = 2006).

Electronic MEDical Record Search Engine

We clinically annotated the dataset by reviewing EMR documentation from the date of cohort inception using EMERSE (Electronic MEDical Record Search Engine) software.^{8,9} EMERSE is an internally developed web-based application that provides a simple interface

for searching the EMR with a bundle of words and phrases for variables of interest. For example, we created EMERSE search bundles for each of the 3 major symptoms of sinusitis (rhinorrhea, nasal obstruction, facial pressure) using medical and lay terms.³ Figure 1. Each bundle was tested and modified in an iterative fashion. The finalized bundle facilitated rapid and thorough review of the EMR by highlighting text matching one or more of the terms in the search bundle. For example, “pain” was in the facial pressure bundle so that EMERSE highlighted the word “pain” regardless of the textual context: “patient reports facial **pain**”, “patient denies facial **pain**”, “sinuses are **painful**”, allowing the reviewer to quickly identify text for reading and coding.

We created additional EMERSE search bundles as needed to facilitate identification and coding of other clinical data points described in the protocol below.

Protocol for EMR review and coding clinical variables

We developed an explicit protocol to code variables of interest as documented in the provider's narrative documentation of the sinusitis visit. We coded symptoms/signs of sinusitis and patient-reported fever as present or absent. We coded symptom duration as the number of days from symptom onset and systematically coded non-specific references to symptom duration (few = 3, several = 7, week and a half = 10, many = 11, couple weeks = 14, few weeks = 21, several weeks = 28, last month = 30, couple months = 60, several months = 90). We identified patients with possible severe illness with indicator variables for pain (any pain except that characterized as mild or minimal), documented fever ($T > 101$), or immunocompromised status. We coded the provider's impression of sinusitis etiology in 3 categories: bacterial, non-bacterial (includes viral and non-infectious causes), and undocumented.

We extracted recommendations for non-prescription—analgesics and decongestants—and prescription therapy—nasal steroid sprays and antibiotics. We coded antibiotic use in 4 categories: observation without antibiotics, continue current antibiotic, antibiotic prescribed, wait-and-see instructions given with an antibiotic prescription. We coded provider specialty and the presence of a medical trainee (medical student or resident). We reviewed subsequent encounters to determine if i) an antibiotic was prescribed after an initial trial of observations, or ii) if the antibiotic type was changed within 5 days.

We tested the protocol on the first 100 patients. Team members independently coded the cases and then met to review coding and revise the protocol to ensure data capture and uniform coding across team members. Thereafter, study team members worked in pairs. Each member independently reviewed the EMR and the pair met weekly to compare codes. The entire team met weekly to resolve discrepancies.

Statistical analysis

Because we were focused on antibiotic prescription at initial diagnosis, we excluded from statistical analysis 30/1302 patients who were advised to “continue current antibiotic” prescribed prior to the inception visit date. We analyzed the remainder of the cohort (1272) analysis. In order to characterize the quality of sinusitis care institution, we calculated

descriptive statistics to describe demographic and clinical characteristics and medical treatment for the remaining cohort. We determined the proportion of patients who were eligible for observation by excluding from the denominator patients with documented fever, pain, or immune suppression.

To identify clinical and non-clinical factors associated with antibiotic use we performed bivariable, multivariable, and multilevel analyses using receipt of antibiotics versus observation as the outcome of interest. For this outcome we compared patients who were prescribed antibiotics versus those who were i) not prescribed antibiotics, or ii) given wait-and-see instructions with an antibiotic prescription. Bivariable analyses were performed using logistic regression, with $p < 0.05$ as the level of significance.

We developed the multivariable model by including in the full model all variables with $p < 0.2$ on bivariable analysis. To check for confounding the non-significant variables were individually forced back into the model using a 15% change in the parameter estimate as the retention criterion. We developed a two-level generalized linear mixed model (GLMM), logistic regression, to account for the nested study design and to test our hypothesis. The patient was the primary unit of analysis. A total of 1272 patients were nested in 153 providers. The provider level variables were specialty, gender and years in practice. The patient level control variables were gender, age, race, and type of insurance and presence of a medical trainee. The patient level predictor variables were nasal obstruction, rhinorrhea, pain, facial pressure, symptom duration, and presumed etiology.

First we examined the initial effect sizes of all provider level variables followed by all patient level variables. Second, we examined the full model with variables from both levels as fixed effects. We used a cut-off of $p = 0.2$ to determine which variables to retain in subsequent modeling. We also looked for significant interactions between patient symptoms (nasal obstruction, rhinorrhea, pain, facial pressure) and between provider specialty and patient symptoms using $p = 0.1$ as the cut-off. All statistical analyses were performed with SAS 9.3 (Cary, NC).

Results

We identified 7402 adults with sinusitis or URI diagnosed in a primary care or emergency department setting. We excluded patients who might have had pre-existing sinusitis, based on prior visits for sinusitis or without clear access to care (1951). We excluded patients with URI (4024) and reviewed the EMR for the remaining patients with sinusitis (1427). We excluded patients with ineligible encounter type (e.g. telephone notes) or absent documentation (11). We excluded patients diagnosed with chronic sinusitis (114) because they will be described in a separate manuscript. The remaining patients with acute sinusitis (1302) were the focus of this study.

Review of the EMR found that 30 of these 1302 patients were advised to “continue current antibiotic.” In some cases the documentation indicates the current antibiotic was for a recently diagnosed respiratory infection, other cases are unclear. Because the decision to prescribe antibiotics at the initial diagnosis of acute sinusitis is the primary outcome measure

of this study, we excluded these 30 patients from analysis, leaving 1272 patients for statistical analysis. Figure 2

Patient and provider characteristics

Most of the patients were women (73.0%) with a mean age across men and women of 44.5 years. Consistent with our regional demographics, most patients were White (88.8%) with private insurance (86.4%). Similar proportions of patients had symptoms ≥ 10 days (44.3%) versus < 10 days (40.4%) and the rest were undocumented (15.3%). Symptoms of facial pressure (76.7%), rhinorrhea (74.8%), and nasal obstruction (66.0%) were common. The majority of patients (81.3%) reported at least 2 of these 3 symptoms although 3.4% of patients had none. Pain (41.0%) and patient-reported fever (20.1%) were common, but documented fever (0.6%) was very uncommon. Documentation of the presumed etiology of the acute sinusitis, whether viral or bacterial, was lacking in the majority of records (76.7% undocumented). Medical student or resident trainees were present at a minority of patient visits (11.6%). Table 1

Analysis of the providers found similar proportions of internal medicine (42.8%) and family medicine (39.9%) and fewer emergency medicine providers (17.7%). Most were women (52.9%) with a mean of 11.6 years in practice. Table 2

Medical care

Medical therapy included decongestants (40.3%), nasal corticosteroids (12.3%) and analgesics (11.2%). Antibiotic prescriptions were given to 86.1% patients overall, including 79.0% who were given a prescription for immediate use and an additional 7.1% who were given a prescription with wait-and-see instructions. The remaining 13.9% of patients were not given antibiotics. However, for the analysis of antibiotic use versus observation, we defined observation to include the 7.1% of patients given a prescription with wait-and-see instructions. Using this more liberal definition, observation was used for 20.9% of all patients (13.9% no prescription, 7.1% prescription with wait-and-see instructions). Table 3. If we examine only the patients with symptoms less than 10 days and without immune suppression, pain, or documented fever, we find observation was employed for 34.1% (95/184) of eligible patients (data not shown). In other words, 69.9% (89/184) of patients with mild symptoms of short duration were given an antibiotic.

Across all patients, amoxicillin (47.9%) was the most commonly prescribed antibiotic, followed by azithromycin (19.4%) and trimethoprim/sulfamethoxazole (16.6%). Among patients treated with antibiotics, 33.6% were given broad spectrum therapy (macrolides, fluoroquinolones, beta-lactamase inhibitors, and cephalosporins). Table 4. No patient initially managed without antibiotics received an antibiotic within the subsequent 5 days and fewer than 1% of patients prescribed antibiotics changed antibiotics within 5 days.

On bivariable analysis we modeled the outcome of interest as receipt of antibiotics versus observation. We found that none of the patient demographic characteristics was associated with receipt of antibiotics. Of the clinical characteristics, symptom duration, facial pressure, rhinorrhea, pain, reported fever, and presumed etiology were significant predictors of antibiotic use. Of the provider characteristics, provider specialty and years in practice were

significant predictors of antibiotic use. Table 5 On multivariable analysis of the patient and clinical characteristics we found that antibiotic use was significantly associated with symptom duration longer than 10 days, facial pressure, pain, reported fever, bacterial or undocumented etiology and medical trainee (data now shown).

With multilevel analysis we found all of the patient characteristics from the final multivariable model remained statistically significant predictors and rhinorrhea became significant. Notably, addition of the provider level covariates was statistically significant in explaining some of the of the variation in antibiotic use.¹⁰ Table 6

Discussion

This is the first study with detailed clinical data to benchmark the quality of care for acute sinusitis against the AAO-HNS “Clinical Practice Guideline: Adult Sinusitis.” This is also the first detailed study of provider level factors associated with antibiotic use. The primary strength of this paper is the study design which provided detailed patient and provider information that allowed us to focus the analysis on patients with newly diagnosed acute sinusitis.

In this study we find that symptom duration and severity influence the decision for antibiotics. We find the visit provider, the provider's medical specialty, and the presence of a medical trainee influence antibiotic use. Because the diagnosis of acute sinusitis is subjective and because the use of antibiotics may be influenced by patient expectations, it is not surprising that antibiotic use varies across providers. However, we did not expect the magnitude of the effect of individual provider to be as substantial as it is. In this same vein, the presence of a medical trainee appears to have a strong protective effect against antibiotic use for acute sinusitis. It appears that when a trainee is involved in patient care, providers are more likely to observe a patient, rather than treat with antibiotics. This appears to be a case of the Hawthorne effect, mediated by medical students and residents.¹¹

Consistent with CPG statements to assess pain and provide symptom relief, we find that approximately half of all patients receive analgesics, decongestants, or nasal steroid sprays. Despite the CPG recommendation to differentiate viral from bacterial sinusitis and the option to observe the patient with mild bacterial sinusitis without antibiotics, we find 66% of patients with mild symptoms of short duration received antibiotics. As recommended by the CPG, amoxicillin is frequently used as first line antibiotic therapy (48%). Aside from clinical factors, we find the medical provider, the provider's specialty, and the presence of a medical trainee significantly impact use of antibiotics.

The rate of decongestant use we report is higher (40% versus 24%)¹² and analgesic use is lower (11% versus 19-23%) than previously reported.^{13,14} Previous reports analyzed prospectively collected data to determine medical treatment, whereas our study design relied on narrative documentation. As a result, our study may have underestimated some treatments, particularly non-prescription therapies that may not be as well-documented as prescription therapy. This may explain the lower-than expected rates of analgesic use, but

does not explain the higher than expected rates decongestant use.¹² The proposed explanation of our finding of high rates of decongestant use is discussed below.

Antibiotic use overall in this study was high and comparable to other studies (86% versus 75-86%).^{6,12,13,15} However, the strength of this study is the clinically detailed nature of our dataset that allowed us to examine antibiotic use in a manner that has not been reported previously. We were able to i) focus the analysis on patients with mild symptoms,³ and ii) analyze patients who given wait-and-see instructions with the observation group. With this more nuanced analysis, the frequency of antibiotic use decreases from 86% to nearly 66%. It is impossible to know what proportion of patients merit antibiotics versus observation. However in light of the self-limiting nature of acute sinusitis, its high rate of spontaneous resolution, and the large and growing problem of antibiotic resistance, the frequency of antibiotic use in this study and in the published literature, are probably too high.^{16,17}

Amoxicillin as a first-line antibiotic was higher (48% versus 8-29%)^{6,12,13} and broad spectrum antibiotic use was lower than previously reported (34% versus 55-76%).^{6,15} The greater use of amoxicillin and lower use of broad spectrum antibiotics as well as differential use of decongestants as mentioned above likely reflect concerted institutional efforts to influence treatment of acute sinusitis. Those efforts include development of a local CPG for acute sinusitis.¹⁸ The CPG is developed and regularly updated by a multidisciplinary panel, including family medicine, internal medicine, and otolaryngology clinicians. The CPG recommends decongestants and amoxicillin but is silent about recommendation of analgesics. The CPG is promoted through local educational forums and is available on the institutional home page with other commonly accessed clinical care reference for easy access during routine clinical care. In addition to this educational effort centered on the CPG, individual providers also received a periodic profile describing their individual use of antibiotics for acute sinusitis and a comparison with their peers.

These intensive efforts to modify treatment of acute sinusitis began in 1995 and thus proceeded the 2005-2006 time period studied in this thesis. As a result, the educational and physician profiling efforts may partially explain the greater use of amoxicillin and decongestants and lesser use of analgesics. This is interesting because of the known difficulty of changing provider behavior through educational efforts.¹⁹⁻²¹ Because the current dataset does not extend prior to 1995 when the institutional intervention began we don't know how much of these differences are due to these institutional efforts to change provider treatment. However, the finding that some of the marked differences in our study data compared to previously published data correlate with specific recommendations within our local CPG supports the value of locally developed and promulgated CPGs.

Study limitations

This study has important limitations worth noting. There are important differences in our study methodology compared to studies based on a large cross-sectional survey such as that available from the National Ambulatory Medical Care Survey (NAMCS).^{6,12-14} Our study methodology entailed detailed review of clinical documentation from the patient encounter. To our knowledge it is the only study on this topic using such detailed clinical information. Studies using NAMCS data are also based on diagnostic codes and prescription and non-

prescription medication use, but those studies lack important clinical information. For example, studies based on NAMCS are not able to exclude patients who are already taking an antibiotic and are not able to discern patients with newly diagnosed acute sinusitis from those with recurrent or persistent sinusitis. The longitudinal nature of the data repository from which we obtained this dataset and our access to the EMR allowed us to develop a highly selected dataset with detailed clinical information in order to gain insight into the pervasive problem of overuse of antibiotics for acute sinusitis.

Statistics based on administrative data are confounded by providers' biases in their manner of diagnostic coding. For example, one provider may utilize ICD-9 465, "acute upper respiratory infection" for patients with infection whom he manages with observation and reserve ICD-9 461, "acute sinusitis" for those patients whom he treats with antibiotics. This lack of consistency in diagnostic coding across providers would result in a non-differential bias over a large numbers of providers. However, in this institutional dataset, with a more limited number of providers, we do not know the effect of such biases, if indeed they are present. If this bias is present it would contribute to the amount of variation in antibiotic use attributable to the individual provider. Also, the results of this study, from a single institution, cannot necessarily be generalized to a wider population.

Conclusion

Antibiotics continue to be over used for patients with mild acute sinusitis of short duration. We report that non-clinical characteristics, including the medical provider, the provider's specialty, and the presence of a medical trainee significantly influence use of antibiotics for acute sinusitis.

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Figure 1. EMERSE search bundles for each of the 3 major symptoms of sinusitis. EMERSE= Electronic MEDical Record Search Engine

Figure 2. Flow chart depicting identification of patients for inclusion in analytic dataset

Table 1
Patient characteristics for adult acute sinusitis visits, Institution

Characteristic (N=1272)	N (%)
Age, mean (SD)	44.5 (13.9)
Female	928 (73.0)
*Race (n=1227)	
White	1,089 (88.8)
non-White	138 (11.3)
*Insurance (n=1271)	
Private	1098 (86.3)
Public or Uninsured	173 (13.6)
Symptom duration	
Undocumented	194 (15.3)
<10 days	514 (40.4)
10 days	564 (44.3)
Symptoms	
Facial pressure	975 (76.7)
Rhinorrhea	952 (74.8)
Nasal obstruction	839 (66.0)
Pain	521 (41.0)
Patient-reported fever	256 (20.1)
Documented fever	8 (0.6)
Immunocompromised	14 (1.1)
Penicillin allergy	223 (17.5)
Etiology	
Undocumented	975 (76.7)
Non-bacterial	208 (16.4)
Bacterial	89 (7.0)
Trainee present	148 (11.6)

SD standard deviation

* Numbers do not total 100% because of missing observations.

Table 2
Provider characteristics for adult acute sinusitis visits, UMHS

Characteristic (N=153)	N (%)
Provider specialty	
Internal medicine	65 (42.8)
Family medicine	61 (39.9)
Emergency medicine	27 (17.7)
Female	81 (52.9)
Degree	
MD	139 (90.9)
DO	6 (3.9)
Mid-level provider	6 (3.9)
MBBS	2 (1.3)
Years in practice, mean (SD)	11.6 (8.1)

UMHS University of Michigan Health System

MD Doctor of Medicine

DO Doctor of Osteopathic Medicine

MBBS Bachelor of Medicine Bachelor of Surgery

SD standard deviation

Table 3
Medical care across adult acute sinusitis visits at UMHS (N=1272)

*Adjunctive treatment	N (%)
Decongestants	512 (40.3)
Nasal steroid sprays	156 (12.3)
Analgesics	142 (11.2)
No adjunctive treatment	613 (48.2)

Antibiotic treatment	N (%)
Antibiotic prescribed	1,005 (79.0)
“Wait-and-see” prescription for antibiotic	90 (7.1)
No antibiotic	177 (13.9)

UMHS University of Michigan Health System

* Proportions do not total 100% because some patients were prescribed or advised to use more than one medication

Table 4
Antibiotics for adult acute sinusitis at UMHS (N=1095)

Antibiotic	All patients N (%)	No allergy N (%)	Penicillin allergy N (%)
Amoxicillin	524 (47.9)	523 (59.1)	1 (0.5)
Azithromycin	212 (19.4)	117 (13.2)	95 (45.2)
Trimethoprim/sulfamethoxazole	182 (16.6)	112 (12.7)	70 (33.3)
Amoxicillin/clavulanic acid	63 (5.8)	63 (7.1)	0
Fluoroquinolone	54 (4.9)	35 (3.9)	19 (9.1)
Other macrolide	17 (1.6)	8 (0.9)	9 (4.3)
Cephalosporin	21 (1.9)	14 (1.6)	7 (3.3)
Doxycycline	20 (1.8)	12 (1.4)	8 (3.8)
Clindamycin	2 (0.2)	1 (0.1)	1 (0.5)

UMHS University of Michigan Health System

Table 5
Predictors of antibiotic use for acute sinusitis, UMHS (N=1272)

Variable	Unadjusted OR [CI]	P value
Patient demographics		
Age (unit = 10 years)	.99 [0.90 – 1.10]	0.91
Gender (female vs male)	1.17 [0.87 – 1.58]	0.29
Race (non-white vs white) (n=1227)	.90 [0.59 – 1.38]	0.62
Insurance (Public or uninsured vs private) (n=1265)	1.15 [0.77 – 1.72]	0.50
Clinical variables		
Duration		
>10 days vs <10days	2.15 [1.58 – 2.94]	<0.001
>10 days vs undocumented	2.59 [1.75 – 3.83]	<0.001
<10 days vs u undocumented	1.2 [0.83 – 1.74]	0.32
Nasal obstruction	1.28 [0.97 – 1.70]	0.079
Rhinorrhea	1.50 [1.11 – 2.01]	0.008
Facial pressure	3.35 [2.50 – 4.48]	<0.001
Pain	2.78 [2.04 – 3.79]	<0.001
Reported fever	2.75 [1.79 – 4.23]	<0.001
Documented fever	1.33 [0.21 – 8.59]	0.76
Immunocompromised	7.83 [0.42 – 145.45]	0.17
Trainee present	0.68 [0.46 – 1.00]	0.052
Etiology		
Undocumented vs non-bacterial	7.25 [5.24 – 10.05]	<0.001
Bacterial vs undocumented	9.77 [4.79 – 19.91]	<0.001
Provider variables		
Provider specialty		
Internal vs Family medicine	1.89 [1.43 – 2.49]	<0.001
Emergency vs Family medicine	8.11 [2.49 – 26.35]	0.001
Female provider	1.00 [0.76 – 1.32]	1.00
Years in practice	1.03 [1.01 – 1.05]	0.007

UMHS University of Michigan Health System

Table 6
Summary of multilevel regression analysis for variables predicting receipt of antibiotics (N=1272)

Variable	Provider Covariates Adjusted OR [CI]	Patient Covariates Adjusted OR [CI]	Provider & Patient Covariates (Full Model) Adjusted OR [CI]	Final Model Adjusted OR [CI]
Fixed Effects - Level 2 Covariates				
<u>Provider specialty</u>				
Internal vs Family medicine	1.80 [1.19 – 2.74]*		2.56 [1.43 – 4.57]*	2.57 [1.42 – 4.66]**
Emergency vs Family medicine	8.90 [2.45 – 32.30]***		17.7 [3.68 – 85.09]***	18.33 [3.87 – 87.78]***
Emergency vs Internal medicine	4.93 [1.36 – 17.87]*		6.91 [1.44 – 33.22]**	7.13 [1.52 – 33.54]**
Female provider	1.20 [0.77 – 1.88]		1.14 [0.62 – 2.1]	
Years in practice	1.02 [0.99 – 1.05]		1.03 [0.99 – 1.07]	
Fixed Effects - Level 1 Covariates				
Age (unit = 10 years)		0.99 [0.97 – 1.00]	0.99 [0.97 – 1.01]	
Patient gender (female vs male)		0.87 [0.57 – 1.33]	0.88 [0.58 – 1.34]	
Race (non-white vs white)		0.98 [0.52 – 1.82]	1 [0.54 – 1.85]	
Insurance (Public/uninsured vs private)		1.46 [0.78 – 2.75]	1.36 [0.72 – 2.57]	
<u>Duration</u>				
+10 days vs <10 days	1.92 [1.25 – 2.94]**		1.99 [1.3 – 3.04]**	2.10 [1.38 – 3.18]***
10+ days vs undocumented	1.91 [1.1 – 3.3]*		1.9 [1.11 – 3.28]*	1.81 [1.05 – 3.13]*
<10 days vs undocumented	1.00 [0.58 – 1.71]		0.96 [0.56 – 1.64]	0.86 [0.50 – 1.49]
Nasal obstruction	1.42 [0.95 – 2.12]		1.46 [0.98 – 2.18]	
Rhinorrhea	1.9 [1.21 – 2.97]**		2.01 [1.29 – 3.14]**	2.74 [1.71 – 4.39]***
Facial pressure	3.52 [2.23 – 5.58]***		3.49 [2.21 – 5.51]***	5.49 [3.30 – 9.13]***
Pain	2.54 [1.61 – 4.02]***		2.53 [1.61 – 4]	2.40 [1.54 – 3.74]***
Reported fever	4.19 [2.38 – 7.37]***		4.19 [2.39 – 7.34]***	4.88 [2.76 – 8.64]***
Trainee (present vs absent)	0.39 [0.22 – 0.71]**		0.33 [0.18 – 0.59]***	0.36 [0.2 – 0.65]***
<u>Etiology</u>				
Bacterial vs undocumented	17.3 [7.03 – 42.58]***		15.95 [6.49 – 39.19]***	19.71 [8.02 – 48.44]***
Bacterial vs undocumented	1.39 [0.62 – 3.14]		1.37 [0.61 – 3.08]	1.52 [0.68 – 3.43]

Variable	Provider Covariates Adjusted OR [CI]	Patient Covariates Adjusted OR [CI]	Provider & Patient Covariates (Full Model) Adjusted OR [CI]	Final Model Adjusted OR [CI]
Undocumented vs non-bacterial	12.44 [7.64 – 20.25]	***	11.66 [7.20 – 18.90]	*** 12.94 [8.0 – 20.93]
Rhinorrhea * Pressure				
Rhinorrhea yes (Pressure yes vs no)				1.90 [1.11 – 3.24]*
Rhinorrhea no (Pressure yes vs no)				15.86 [6.81 – 6.96]***
Pressure yes (Rhinorrhea yes vs no)				0.95 [0.53 – 1.70]
Pressure no (Rhinorrhea yes vs no)				7.91 [3.70 – 16.94]***

Significance:

*

p<.05;

**

p<.01;

p<.001 (two-tailed test)