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# Academic Institution Pilot Study Shows Far Fewer Diagnoses of Sinusitis Than Reported Nationally

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**Objective:** To compare the prevalence of acute sinusitis (AS) and chronic sinusitis (CS) diagnosed by primary care and emergency medicine physicians in our academic institution to national data.

**Study Design:** Cross-sectional pilot study of institutional census data and a population-based national sample. The setting was primary care and emergency departments at an academic healthcare institution and community healthcare practices nationally.

**Materials and Methods:** We determined the proportion of adults visits at our institution for AS and CS from January 1, 2005, to December 31, 2010. We used the same parameters with the National Ambulatory Medical Care Survey and the National Hospital Ambulatory Medical Care Survey. As a control comparison, we determined the proportion of visits for epistaxis.

**Results:** The sinusitis prevalence was considerably lower at our academic institution: all sinusitis (AS and CS combined) ranged from 0.8% to 1.0% at our institution compared to 3.1% to 3.7% nationally. There were very small differences between AS rates at the academic institution (0.7%–0.8%) and nationally (0.8%–1.4%, $P < 0.001$) but very large differences between CS rates at the academic institution (0.1%) and national data (1.7%–2.9%, $P < 0.001$). Epistaxis rates were nearly identical in both datasets (0.1%–0.2%, $P = 0.98$–$0.99$).

**Conclusion:** The prevalence of CS is much lower at our academic institution, but the prevalence of AS and epistaxis are similar to national data. This suggests CS is over-diagnosed by primary care and emergency medicine providers and that CS diagnosed outside of an academic institution or a specialty clinic may not hold up to diagnostic scrutiny. For this reason, diagnostic and treatment protocols for CS that have been developed in academic specialty clinics should not be extrapolated to patients diagnosed with CS in the community setting. The most appropriate intervention for the majority of patients diagnosed with CS in primary care and emergency medicine may be education of providers and patients about conditions that may be misdiagnosed as CS.

## INTRODUCTION

Sinusitis is reported to be one of the most widespread diseases in the United States and Europe[1–3] and is one of the most common reasons for patients to see a doctor or receive an antibiotic.[1,4,5] Although the disease may be less serious than other common diseases such as asthma or peptic ulcer disease, the cost of sinusitis care including associated emergency room (ER) visits, medical specialist referrals, and work days missed exceeds the costs for both of those conditions.[3]

For such a common and costly condition, we lack valid epidemiologic data. Methodological differences, imprecise terminology, and diagnostic inaccuracy all contribute to the data confusion. For example, provider diagnoses indicate that outpatient visits for chronic sinusitis (CS) substantially exceed those for acute sinusitis (AS), with a visit prevalence of 1.5% for CS and 0.3% for AS.[6] However, considering that AS typically develops following a viral URI—a condition that afflicts tens of millions of Americans annually—it seems implausible that CS could be more common than AS. The self-reported patient prevalence of sinusitis is even less credible: 12% to 16% of patients report sinusitis each year (AS and CS combined).[3]

Two recent studies highlight the inaccuracy of CS diagnosed by nonspecialty providers. By extension, estimates of CS prevalence based on CS diagnosed by nonspecialists are inherently flawed. Hsu et al. used administrative data from a large academic institution to identify patients diagnosed with CS and performed a detailed review of the medical record to validate these diagnoses.[7] They found that most cases of CS are never substantiated with imaging or endoscopy, and they



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ultimately concluded that CS diagnoses are unreliable unless they are confirmed by otolaryngologists or allergists. Novis et al. similarly began with administrative data from a large academic institution to identify patients diagnosed with CS by primary care and emergency medicine providers.[8] The conducted a detailed review of the patients' clinical presentation at the time of diagnosis, including patients' signs, symptoms, endoscopic findings, and any computed tomography (CT) scan results. They found that most all diagnoses of CS made by primary care and emergency medicine providers are not substantiated by history at the time of diagnosis and that most CS diagnoses are never confirmed by specialty consultation, endoscopy, or imaging.

Given our lack of confidence in the validity of existing epidemiologic data, we designed a cross-sectional pilot study to compare the visit prevalence of sinusitis diagnosed by primary care and emergency medicine providers between two cohorts: patients diagnosed at a representative academic institution and patients diagnosed in community medicine practices and private institutions. In order to make the study design comparable to prior reports,[6,9–13] we utilize National Ambulatory Medical Care Survey (NAMCS), which is limited to ambulatory care clinics, and the National Hospital Ambulatory Medical Care Survey (NHAMCS), which is mostly comprised of emergency department (ED) visits.[14,15]

We sought to improve the validity of the visit prevalence rates by using physician-coded rather than patient self-reported diagnoses.[3] We also sought to improve the specificity of the prevalence rates by analyzing CS and AS separately. We used parallel methods between the two datasets. We hypothesized that the relative proportions of AS and CS at our institution would be similar to national estimates. Finally, as a control measure to validate our methods, we also chose to evaluate the prevalence of a very objective diagnosis: epistaxis. This study thus provides novel insights into the prevalence of sinusitis diagnoses made by primary care and emergency medicine provider at academic institutions, private institutions, and community medicine practices.

## MATERIALS AND METHODS

### *Data Sources and Subjects*

For calculation of institutional visit prevalence, we identified adult (age $\geq$ 18 years) patients using the University of Michigan Health System (UMHS) robust Clinical Research and Health Information Exchange. The Exchange contains demographic information; inpatient and outpatient visits; office-based, radiology, and surgical procedures; and professional fee-billing information. We compiled a census of all adult patients with one or more visits to either a primary care clinic or emergency medicine department between January 1, 2005, and December 31, 2010, and then calculated the total number of visits for sinusitis. Primary care clinics included family medicine, general practice, internal medicine, general pediatrics, and internal medicine–pediatrics clinics. We then identified the subset of patients seen for sinusitis using International Classification of Diseases, 9th Revision (ICD-9) codes (ICD-9 461.x for AS, 473.x for CS; both within first three diagnosis codes for each visit). We collected demographic information (e.g., age, gender, and race) for all patients. To validate our methodology, we carried out the same process for epistaxis (ICD-9 784.7), a less subjective diagnosis.

For calculation of a national visit prevalence estimate, we used NAMCS and NHAMCS to identify adult (age $\geq$ 18 years) visits between January 1, 2005, and December 31, 2010, to nonfederal employed office-based physicians and to EDs and outpatient departments of nontertiary care general and short-stay hospitals, respectively.[14,15]

Because NAMCS and NHAMCS are visit-based data sources, we identified sinusitis visits based on primary, secondary, or tertiary diagnoses of AS or CS using ICD-9 codes (ICD-9 461.x, 473.x). NAMCS uses a three-stage and NHAMCS uses a four-stage probability sampling of nonfederal office-based and hospital-based physicians, which is conducted annually by the U.S. National Center for Health Statistics. Sample data collected includes visit-level information on demographic characteristics, comorbidities, up to three diagnoses (one primary and two secondary diagnoses), procedures performed, radiographic studies ordered, and types of providers seen. For example, physician specialty codes allow for the identification of primary care physicians (general or family medicine, internal medicine, and pediatrics) in order to differentiate from medical specialists. Patient visit weights are provided by the National Center for Health Statistics.[16] Application of these weights in a multistage estimation procedure produces unbiased national estimates.

We also compared the visit prevalence of epistaxis between our institution's patient population and the national patient population. We chose to use patients with epistaxis as a control group because the diagnosis of epistaxis is less subjective than sinusitis and we had no a priori reason to think the rate of epistaxis would be different between the two study groups.

This study was approved by the institutional review board at the University of Michigan, Ann Arbor, Michigan.

### *Statistical Analysis*

We compared institutional data from UMHS to national data obtained from NAMCS and NHAMCS. Annual descriptive statistics regarding demographic and clinical characteristics within the institution and nationally were calculated. The prevalence of sinusitis or epistaxis was defined as a ratio of the number of visits with a diagnosis of each disease by ICD-9 code to the total number of visits identified in that calendar year. We calculated prevalence separately for both AS and CS based on ICD-9 codes listed above. Visit weights provided by the National Center for Health Statistics were applied, and we followed recommendations that estimates with a relative standard error $>$30%, or estimates based on sample sizes of less than 30 observations, are considered unreliable. Statistical analyses were performed using STATA SE 12 (StataCorp, College Station, TX) statistical software.

## RESULTS

During the 6-year study period of 2005 to 2010, our institution had an annual average of 79,806 adult patients with at least one visit per year (range 76,474 to 81,776) in primary care offices or hospital EDs. There was an average of 3.8 visits per patient per year (range 1 to 42). During the corresponding period, NAMCS and NHAMCS had an average of 962 million ambulatory care visits per year (range 892 million to 1.03 billion); patient-level statistics are unavailable in this dataset. Demographic analysis revealed a younger patient population at our institution (mean 46.1 years, standard deviation 0.06) versus nationally (mean 52.0 years, standard

TABLE I.
Demographic Description of the Institutional and National Cohorts* for 2005.

| Patient Characteristics | UMHS* % (SD) N = 80,079 | National† % (SE) N = 930, 944, 506 |
|---|---|---|
| Mean Age, years | 46.1 (0.06) | 52.0 (0.5) |
| Gender | | |
| Female | 59.7 (0.2) | 57.3 (0.009) |
| Male | 40.3 (0.2) | 42.7 (0.009) |
| Race | | |
| White | 82.7 (0.4) | 83.3 (0.01) |
| Nonwhite | 17.3 (0.4) | 16.7 (0.01) |

*University of Michigan Health System patient-based institutional cohort, reflecting entire patient population with no sampling error.
†NAMCS and NHAMCS visit-based national cohort, reflecting sample of national visits with population weights applied.
NAMCS = National Ambulatory Medical Care Survey; NHAMCS = National Hospital Ambulatory Medical Care Survey; SD = standard deviation; SE = standard error; UMHS = University of Michigan Health System.

error 0.5) and comparable gender and race distributions (Table I). The distribution between primary care and ER visits in each data set was also calculated. At our institution, primary care visits accounted for 76.0% of visits for sinusitis, whereas ED visits accounted for 24.0%. For NAMCS and NHAMCS, 82.2% of visits for sinusitis were to primary care providers, and 17.8% were to an ED.

The prevalence of epistaxis, our control diagnosis, as a percentage of all patient visits was similar between the two datasets, with a range of 0.1% to 0.2% at our institution and a consistent 0.1% nationally ($P = 0.98$–0.99) (Table II). In contrast, the visit prevalence of sinusitis was substantially lower at our institution (0.7%–1.0%) compared to national data (3.1%–3.7%) ($P < 0.001$) (Table III). We explored this difference by examining AS and CS separately. There were very small differences in prevalence of AS between the two settings, with a difference of only 0.1% to 0.5% ($P < 0.001$). In contrast, there were large differences in prevalence of CS between the two settings, with a difference of 1.6% to 2.8% ($P < 0.001$) (Table IV). We explored regional variations in CS prevalence as a possible explanation for the reduced prevalence of CS at the UMHS. We found the lower prevalence is not due to reduced prevalence of CS in the Midwest, which would be reflected by the Midwest CS prevalence in the NAMCS/NHAMCS (Table V).

## DISCUSSION

In this study, we find our academic institution has a nearly 10-fold lower prevalence of CS, as diagnosed by primary care and ER providers compared to national estimates for the same geographic region. This large discrepancy was not found with the other conditions that we investigated—AS and epistaxis—for which we found very similar prevalence estimates. The regional difference in CS across regions is too modest to account for the full magnitude of this discrepancy.[10] The magnitude of the discrepancy in CS prevalence leads us to question the validity of national estimates of CS prevalence and burden of disease.

Chronic sinusitis is a difficult diagnosis with complex diagnostic criteria, and the condition must be differentiated from multiple other conditions with similar symptoms. Otolaryngologists are experts in CS; however, national estimates of CS prevalence and burden of disease are not based on expert diagnoses but on nonexpert diagnoses, often primary care and emergency medicine providers.[6,10,11,17] These findings reflect the nature of the datasets that are used to study this problem. NAMCS and NHAMCS are the most comprehensive datasets to study ambulatory care in the U.S. population. These surveys include a proportional sample of patient visits to all provider types, and statistical analysis allows one to make estimates about ambulatory care for the entire U.S. population. However, because there are fewer specialists than primary care providers, there are fewer patient visits to specialists in the datasets. Accurate statistical analysis using this data relies on having sufficient number of patient visits in the dataset in order to make reliable estimates about the entire U.S. population. When there are relatively few patient visits to a particular provider type for a particular diagnosis, the types of research questions that can be answered is limited by statistical imprecision.

We speculate that widely cited estimates of CS prevalence based on estimates from NAMCS and NHAMCS are badly flawed by inaccurate diagnoses. This idea is

TABLE II.
Proportion of Adult Ambulatory Care Visits for Epistaxis Comparing the UMHS* With NAMCS/NHAMCS National Cohort.†

| | All Visits | | Epistaxis Visits | | | | |
|---|---|---|---|---|---|---|---|
| Year | UMHS Count | National Count | UMHS % (SD) | UMHS Count | National % (SE) | National Count | *P* Value |
| 2005 | 141,254 | 930,944,506 | 0.1 (0.04) | 141 | 0.2 (0.04) | 930,945 | 0.98 |
| 2006 | 145,806 | 891,805,370 | 0.1 (0.03) | 146 | 0.1 (0.02) | 891,805 | 0.99 |
| 2007 | 135,677 | 959,202,760 | 0.1 (0.03) | 136 | 0.1 (0.03) | 959,203 | 0.98 |
| 2008 | 134,546 | 946,075,792 | 0.1 (0.04) | 135 | 0.1 (0.02) | 946,076 | 0.97 |
| 2009 | 154,141 | 1,020,410,946 | 0.1 (0.03) | 154 | 0.1 (0.02) | 1,020,411 | 0.99 |
| 2010 | 153,876 | 993,159,435 | 0.1 (0.03) | 154 | 0.1 (0.01) | 993,159 | 0.99 |

*University of Michigan Health System patient-based institutional cohort, reflecting entire patient population with no sampling error.
†NAMCS and NHAMCS visit-based national cohort, reflecting sample of national visits with population weights applied.
NAMCS = National Ambulatory Medical Care Survey; NHAMCS = National Hospital Ambulatory Medical Care Survey; SD = standard deviation; SE = standard error; UMHS = University of Michigan Health System.

TABLE III.
Proportion of Adult Ambulatory Care Visits for Sinusitis Comparing the UMHS* With NAMCS/NHAMCS National Cohort.†

| | All Visits | | Sinusitis Visits | | | | |
|---|---|---|---|---|---|---|---|
| Year | UMHS Count | National Count | UMHS % (SD) | UMHS Count | National % (SE) | National Count | *P* Value |
| 2005 | 141,254 | 930,944,506 | 0.8 | 1130 | 3.5 | 32,583,058 | <.0001 |
| 2006 | 145,806 | 891,805,370 | 0.7 | 1021 | 3.7 | 32,996,799 | <.0001 |
| 2007 | 135,677 | 959,202,760 | 0.8 | 1085 | 3.1 | 29,735,286 | <.0001 |
| 2008 | 134,546 | 946,075,792 | 0.9 | 1211 | 3.8 | 35,670,804 | <.0001 |
| 2009 | 154,141 | 1,020,410,946 | 0.9 | 1387 | 3.2 | 32,973,150 | <.0001 |
| 2010 | 153,876 | 993,159,435 | 1.0 | 1539 | 3.1 | 30,787,942 | <.0001 |

*University of Michigan Health System patient-based institutional cohort, reflecting entire patient population with no sampling error.
†NAMCS and NHAMCS visit-based national cohort, reflecting sample of national visits with population weights applied.
NAMCS = National Ambulatory Medical Care Survey; NHAMCS = National Hospital Ambulatory Medical Care Survey; SD = standard deviation; SE = standard error; UMHS = University of Michigan Health System.

supported by a recent longitudinal study of CS diagnoses, also using administrative data in community healthcare practices.[18] The authors explored CS diagnoses and found that most diagnoses were never confirmed by endoscopy or CT. They further explored these diagnoses (both confirmed and unconfirmed cases) and found that, prior to a diagnosis of CS, many patients have visits for upper respiratory illness.[18] The authors interpreted this association as evidence of the *unified airway hypothesis*. An alternative interpretation is that this association between frequent upper respiratory illness and diagnosis of CS reflects imprecise diagnosis of CS. Providers may be assigning the diagnosis of CS to patients with recurrent or persistent URI symptoms without regard to CS diagnostic criteria.

It is not clear why the prevalence of CS is so much lower at our academic institution compared to national data. It is possible that diagnoses of CS made within an academic institution are more accurate than diagnoses made in the community. The NAMCS and NHAMCS datasets surveys thousands of providers. In contrast, the diagnoses within our institution are made by a comparatively small cohort. Physicians at academic centers may have more exposure to institutionally sponsored education that shapes their practice patterns. For example, our institution had an active effort prior to this study period to promote distinction between viral and bacterial sinusitis and judicious use of antibiotics. This institutional effort may have increased the diagnostic rigor, shaping diagnostic patterns locally in a way that the national sample of physicians included in NAMCS and NHAMCS would not be affected.

Regional variation in CS prevalence does not explain the differences we found. Regional differences in CS visit prevalence have been reported NAMCS and NHAMCS.[6,10] Data from those publications agree with the data we report in this study: the Midwestern and Southern regions have a higher prevalence of CS diagnoses than the Northeastern and Western regions. This consistently higher visit prevalence for CS in the Midwest would not explain the lower prevalence we found at our Midwestern academic institution.

Validation of CS diagnoses is a critically important factor that confounds sinusitis clinical research. Although validation of diagnoses was beyond the scope of this pilot study, it was the focus of a recent study at our institution in which we attempted to validate new diagnoses of CS by primary care and emergency medicine providers.[8] In that study, we compared each patient's clinical characteristics to diagnostic criteria.[5]

TABLE IV.
Proportion of Adult Ambulatory Care Visits for Acute and Chronic Sinusitis Comparing the UMHS* With NAMCS/NHAMCS National Cohort.†

| | Acute Sinusitis Visits | | | Chronic Sinusitis Visits | | |
|---|---|---|---|---|---|---|
| Year | UMHS % (SD) | National % (SE) | Proportion Difference [95% CI] | UMHS % (SD) | National % (SE) | Proportion Difference [95% CI] |
| 2005 | 0.7 (0.09) | 0.8 (0.2) | 0.1% [0.06%–0.14%]‡ | 0.1 (0.03) | 2.7 (0.3) | 2.6% [2.58%–2.62%]* |
| 2006 | 0.7 (0.08) | 0.8 (0.1) | 0.1% [0.06%–0.14%]‡ | 0.1 (0.03) | 2.9 (0.3) | 2.8% [2.78%–2.82%]* |
| 2007 | 0.7 (0.09) | 0.8 (0.1) | 0.1% [0.05%–0.14%]‡ | 0.1 (0.03) | 2.3 (0.2) | 2.2% [2.18%–2.22%]* |
| 2008 | 0.8 (0.09) | 1.0 (0.2) | 0.2% [0.15%–0.25%]‡ | 0.1 (0.03) | 2.7 (0.3) | 2.6% [2.58%–2.62%]* |
| 2009 | 0.8 (0.09) | 1.0 (0.2) | 0.2% [0.15%–0.24%]‡ | 0.1 (0.03) | 2.2 (0.3) | 2.1% [2.08%–2.12%]* |
| 2010 | 0.9 (0.09) | 1.4 (0.2) | 0.5% [0.45% – 0.55%]‡ | 0.1 (0.03) | 1.7 (0.2) | 1.6% [1.58%–1.62%]* |

*University of Michigan Health System patient-based institutional cohort, reflecting entire patient population with no sampling error.
†NAMCS and the NHAMCS visit-based national cohort, reflecting sample of national visits with population weights applied.
‡$P < 0.0001$
CI = confidence interval; NAMCS = National Ambulatory Medical Care Survey; NHAMCS = National Hospital Ambulatory Medical Care Survey; SD = standard deviation; SE = standard error; UMHS = University of Michigan Health System.

TABLE V.
Proportion of Adult Ambulatory Care Visits for Chronic Sinusitis Comparing the UMHS* With Four Regions Within NAMCS/NHAMCS National Cohort.†

| Year | UMHS % (SD) | National % (SE) | Northeast % (SE) | Midwest % (SE) | South % (SE) | West % (SE) |
|---|---|---|---|---|---|---|
| 2005 | 0.1 (0.03) | 2.7 (0.3) | 2.1 (0.4) | 2.7 (0.5) | 3.5 (0.6) | 1.6 (0.5) |
| 2006 | 0.1 (0.03) | 2.9 (0.3) | 1.8 (0.4) | 3.4 (0.5) | 3.5 (0.5) | 2.4 (0.4) |
| 2007 | 0.1 (0.03) | 2.3 (0.2) | 2.2 (0.1) | 2.4 (0.3) | 2.6 (0.3) | 1.5 (0.3) |
| 2008 | 0.1 (0.03) | 2.7 (0.3) | 3.5 (0.1) | 2.6 (0.5) | 2.7 (0.5) | 1.9 (0.4) |
| 2009 | 0.1 (0.03) | 2.2 (0.3) | 2.2 (0.7) | 2.2 (0.4) | 2.0 (0.4) | 2.4 (0.7) |
| 2010 | 0.1 (0.03) | 1.7 (0.2) | 1.3 (0.5) | 1.9 (0.3) | 2.2 (0.4) | 1.0 (0.2) |

*University of Michigan Health System patient-based institutional cohort, reflecting entire patient population with no sampling error
†National Ambulatory Medical Care Survey and the National Hospital Ambulatory Medical Care Survey visit-based national cohort, reflecting sample of national visits with population weights applied
NAMCS = National Ambulatory Medical Care Survey; NHAMCS = National Hospital Ambulatory Medical Care Survey; SD = standard deviation; SE = standard error; UMHS = University of Michigan Health System.

We found that of all the patients given a new diagnosis of CS by a primary care or emergency medicine provider, less than 1% of them met clinical diagnostic criteria.[8] Considering symptom duration alone, less than 10% of patients had symptoms $\geq$ 12 weeks. Very few patients were referred for endoscopy or had imaging; of the few patients with imaging, many studies were normal or near normal. Interestingly, we also found that in most patients with a coded diagnosis of CS, the provider's clinical impression did not indicate CS, and the treatment plan was not consistent with CS. We concluded that nonotolaryngologists use the diagnostic code for CS without regard for the American Academy of Otolaryngology–Head and Neck Surgery 2015 definition of CS.

We do not suggest that data from a single institution is indicative of the national disease prevalence. We acknowledge that, at our institution, the diagnostic accuracy of CS is very poor. However, the findings of this study—as well as the study previously by Novis[8]—indicate that, at an institution where the rate of CS diagnosis is far lower than national norms, most patients still do not meet diagnostic criteria. Taken together, they suggest the prevalence of CS may be significantly lower than national estimates from administrative data indicate. However, without better quality data, the true prevalence remains unknown. To our knowledge, the most rigorous study conducted to estimate CS prevalence across a population was a Korean survey utilizing patient history and nasal endoscopy. This study demonstrated a 1% population prevalence of sinusitis.[19] Although the population prevalence cannot be directly compared to visit prevalence among patients seeking treatment, this study illustrates a rigorous methodological approach to address the question.

The prevalence of CS in the United States is highly relevant to diagnostic and treatment recommendations. For example, a prior study suggested that for CS in the primary care setting, upfront CT is more cost-effective than empiric medical therapy. Based on what appears to be an extremely low pretest probability, we suggest instead that perhaps neither empiric medical therapy for CS nor upfront CT is appropriate for the majority of patients diagnosed with CS in this setting. It is critical that we understand these differences before we translate CS care from academic rhinology centers to the broader population of patients diagnosed with CS. Further study of sinusitis in the community setting, as well as the education of primary care and emergency medicine providers, is needed before we encourage wide adaptation of intensive or expensive diagnostic or treatment protocols.

There are two important limitations of this study. First, the cross-sectional design of the NAMCS and NHAMCS datasets makes it impossible to determine if a visit for CS represents the initial diagnosis or a previously established diagnosis. To mitigate this limitation, we also used a cross-sectional design when we created the academic dataset and did not differentiate between visits for the initial versus previously establish diagnosis of CS. Second, it is also worth noting that we were unable to validate the accuracy of the diagnoses. We relied on the diagnosis coded by the provider at the time of evaluation. Epistaxis is a straightforward diagnosis presumably without substantial diagnostic variability, which is why we selected this as our control group. Our finding that epistaxis rates were the same between the two datasets affirms that our analytic methods are valid. In contrast, sinusitis is a less straightforward diagnosis and presumably subject to greater diagnostic and coding variability, and a prior study demonstrated that administrative data are unreliable for identifying cases of CS.[7] However, one of the important strengths of this study is the parallel study design. Both datasets are cross-sectional designs based on provider-coded diagnoses. Thus these limitations would not be expected to bias the results.

## CONCLUSION

This is the first study to examine the prevalence of AS and CS diagnosed by nonotolaryngologists at an academic institution. The prevalence of CS diagnosed by primary care and emergency medicine providers is much lower at our academic institution compared to national data, but the prevalence estimates of AS and epistaxis are similar to national data.

This finding suggests that across the country, where community healthcare settings outnumber academic

institutions, CS is overdiagnosed. This has potentially significant implications for CS care in the community setting. Chronic sinusitis that is diagnosed outside of an academic institution or a specialty clinic may not hold up under diagnostic scrutiny in a specialty clinic. For this reason, diagnostic and treatment protocols for CS that have been developed in academic specialty clinics should not be extrapolated to patients diagnosed with CS in the community setting. Education of primary care and emergency medicine providers and patients about conditions that may be misdiagnosed as CS may be the most appropriate treatment for the majority of patients diagnosed with CS in primary care and emergency medicine.


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