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Regional variations in chronic rhinosinusitis, 2003–2006

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Abstract

Objectives—1. Characterize patient visits for chronic rhinosinusitis, based on age, gender, race, diagnostic services, and medication use. 2. Evaluate regional differences in patient visits for chronic rhinosinusitis.

Study Design—Analysis of cross-sectional survey data from two national databases of ambulatory medical encounters.

Setting—Not applicable.

Subjects and Methods—Four years (2003–2006) of data from the National Ambulatory Medical Care Survey and the National Hospital Ambulatory Medical Care Survey were analyzed. Visits involving chronic rhinosinusitis were identified using reported diagnostic codes from the *International Classification of Disease, Ninth Revision*. They were weighted to provide national estimates of care. Data were analyzed with Pearson chi squared using SPSS 16.2 Complex Samples Module, taking into account the complex survey design and multiple time periods.

Results—4,617 patient visits for chronic rhinosinusitis were identified, accounting for 1.95% of all visits. By applying weights to this sample, these visits represent 91.2 million national visits. A significantly higher proportion of visits in the South involved African-Americans (Pearson chi squared=69.5, F=6.7, df=2.8, 2118, $p<0.01$). Significantly fewer diagnostic services were provided or ordered in the Northeast (chi squared=64.8, F=4.0, df=4.3, 3247, $p<0.01$). Providers in the Northeast were also significantly less likely to order or renew more than 3 medications at the visit (chi squared=54.0, F=3.1, df=2.6, 1930, $p<0.05$). No regional differences were seen for age, gender or setting type.

Conclusion—Significant regional variations exist for chronic rhinosinusitis in patient demographics, diagnosis and management. Continuing research is needed to refine physician awareness, evaluation and treatment of this disorder.

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INTRODUCTION

More than 18 million office visits are made to physicians in the United States (US) for chronic rhinosinusitis (CRS) each year.[1] Additionally, there are approximately 1.2 million annual visits to hospital outpatient departments, emergency rooms and walk-in clinics.[2] A study of over 200,000 adult members of a single health maintenance organization demonstrated that patients with a diagnosis of CRS made 43% more outpatient visits and 25% more urgent care visits as compared to the other enrollees, with an estimated treatment cost of $2609 per patient annually.[3]

As one of the "top 10" most costly physical health conditions affecting American businesses, CRS has a considerable economic impact on residents of the US.[4] The economic burden of CRS is calculated at greater than $5.8 billion annually.[5] The cost of medication alone, including over-the-counter remedies, nasal steroid sprays, and antibiotics, averages between $629–1220 per patient per year.[6] This disease also has an immense impact in terms of quality-of-life and productivity.[7],[8] Based on the National Health Interview Survey (NHIS), approximately 12.5 million lost work days and 58.7 million restricted activity days were attributed to CRS between 1990 and 1992.[9] Per patient, CRS accounts for an estimated 4.8 days of missed work per year.[10]

Nonetheless, our current understanding of the epidemiology of this disease is relatively sparse. Based on the 2006 NHIS, a complex sample survey involving annual in-home interviews of 100,000 non-institutionalized adults in the US, rhinosinusitis is estimated to affect 31 million people (14% of the adult population) annually.[11] Although this survey is based upon self-report measures that may underestimate true prevalence rates, it does demonstrate several interesting trends within the US population. Most notably, this disease appears to have a disproportionate effect upon women and residents in the South. In 2006, the national annual prevalence rate of self-reported CRS was 17% in women, compared to 10% in men. Compared with other groups, white non-Hispanic women and black non-Hispanic women were the most likely to have been told they have CRS. Regional frequencies ranged from 9.8% in the West to 17% in the South.[11] This regional variation may be partially attributed to higher rates of allergic fungal rhinosinusitis (AFRS) in the South. A survey of 20 otolaryngologic practices throughout the US found that the diagnosis of AFRS was much more frequent in the Southern practices, accounting for 10–23% of all endoscopic sinus procedures performed there, as compared to 0–4% in other locations.[12]

The goal of this study was to evaluate regional differences in patient visits for CRS, including age, gender, diagnostic services, and medication use. This approach is distinct from previous studies in that it utilizes physician-derived data, rather than relying upon self-reported diagnoses. Additionally, it explores current diagnostic and therapeutic patterns for this disease. This analysis was based on data from two large annual national surveys, the National Ambulatory Medical Care Survey (NAMCS) and the National Hospital Ambulatory Medical Care Survey (NHAMCS). While this study was designed to provide estimates of disease burden on the US population, it does not report measures of incidence and prevalence. Such measures cannot be derived from sampling surveys based on physician encounters.

METHODS

An analysis of cross-sectional survey data from two national databases, the NAMCS and the NHAMCS, was conducted. The NAMCS collects data annually from a nationally representative sample of patient visits to non-federally employed office-based physicians who are primarily engaged in direct patient care. Visits to free-standing clinics, community

health centers, private offices, and health maintenance organizations are included in the survey. Physicians in the specialties of anesthesiology, pathology, and radiology are excluded from the survey. Approximately 3,000 physicians participate in the survey each year. The NAMCS utilizes a 3-stage design: first, a probability sample of primary sampling units is taken; next, physician practices within the primary sampling unit are sampled; and, finally, patient visits within the physician practices are sampled. During a random 1-week reporting period, each physician (or their office staff) records data for a systematic random sample of visits on an encounter form.

The NHAMCS collects data annually on a national sample of visits to non-federal hospital emergency and outpatient departments. Non-institutional general and short-stay hospitals are included in the survey; whereas, federal, military, Veterans Administration, and institutional hospitals are excluded. The survey uses a 4-stage probability design: first, samples of primary sampling units within geographically defined areas are taken; next, hospitals within these areas are sampled; then, clinics within the outpatient departments and emergency service areas within the emergency departments of these hospitals are sampled; and, finally, patient visits to these clinics and emergency service areas are sampled. Hospital staff complete encounter forms on a systematic random sample of patient visits during a 4-week reporting period.

Visits to physicians in all specialties were included in the analysis, except those excluded by survey design (e.g., anesthesiology, radiology, and pathology). For the NAMCS, detailed information regarding physician specialty was available for each patient visit; during the analysis, Family Practice, Internal Medicine, and General Practice were grouped together as “Primary Care” because of the similarities between these specialties. For the Outpatient subsection of the NHAMCS, data regarding physician specialty were limited to 5 categories which delineated the type of clinic in which the visit took place: “General Medicine,” “Surgery,” “Pediatrics,” “Obstetrics and Gynecology,” and “Other.” For the Emergency Department subsection of the NHAMCS, all providers were presumed to be in Emergency Medicine as no data on provider specialty were available.

For both the NAMCS and NHAMCS, as many as three diagnoses can be linked to each visit, based on *International Classification of Diseases, Ninth Revision* (ICD)-9 diagnostic codes. These codes represent the patient disease(s) that served as a focus for that particular visit; they do not reflect a complete list of comorbidities for that patient. A diagnosis of CRS was identified by the ICD-9 code for chronic sinusitis (473). Please refer to Table 1 for a complete list of diseases captured by this code.

The analysis included data from 2003 to 2006, which were the most recent data available. Visits were weighted to generate national estimates of care. Both the NAMCS and NHAMCS have a built-in weighting program that accounts for variation in sampling based on geographic location, provider non-response, and differences in patient loads. Visits were stratified by geographic region (Northeast, Midwest, South, and West).

For both the NAMCS and NHAMCS, data are collected on patient demographics, symptoms, diagnoses, diagnostic and therapeutic services provided, and medications ordered, supplied, administered, or continued. Up to 8 medications can be listed for each patient visit. Data from both surveys were combined, therefore only those variables which overlapped between both surveys for all years of the study were available for analysis. Variables were selected for analysis based on *a priori* hypotheses regarding their relevance to the diagnosis of interest. Patient age, gender, race identification, setting type (e.g., non-hospital-based outpatient clinic versus hospital-based outpatient department versus emergency department), whether diagnostic services were ordered or provided, number of

medications ordered or continued, and physician specialty were included in the analysis. The number of medications ordered or provided at the visit was arbitrarily dichotomized into "0–3 medications" and "4–8 medications" for ease of analysis. Detailed information regarding the type of diagnostic service ordered (e.g., CT scan, MRI, ultrasound) was not available for all years of the study period. Therefore, visits were defined by whether or not diagnostic services of any type were ordered during the visit. Note that these services may have been provided for CRS or any other diagnosis addressed during the visit. Similarly, medications ordered or continued during the visit may have been related to CRS or any other diagnosis linked to the visit. Analyzing the specific type of medication(s) prescribed at each visit was outside the scope of this analysis, given that it would involve nearly 40,000 medication entries.

Data were analyzed with Pearson chi squared tests using SPSS 16.2 Complex Samples Module (SPSS for Windows, Rel. 16.2. 2008. Chicago: SPSS Inc.), taking into account the complex survey design and multiple time periods. Estimates were considered unreliable if they were based on fewer than 30 (unweighted) patient visits or if they had a relative standard error (RSE) greater than 30%.[13]

This study was performed in accordance with a protocol approved by the University of California, San Diego Human Research Protections Program.

RESULTS

From 2003 to 2006, a total of 4,617 unweighted patient visits for CRS were identified from the NAMCS and NHAMCS databases. By applying weights to this sample, these visits represent 91.2 million national visits for CRS over the study period. This represents approximately 1.95% of all visits for ambulatory care in the US.

Primary care specialties, including Internal Medicine, General Practice, Family Practice, and Pediatrics, were involved in the majority of patient visits for CRS (Table 2). Based on the NAMCS data, which was the only subset that allowed detailed analysis of physician specialty, approximately one-third of ambulatory care visits for CRS involved otolaryngologists. Approximately 20% of all visits for CRS took place in an emergency department. No statistically significant difference was seen between regions for setting type (e.g., non-hospital-based outpatient clinic versus hospital-based outpatient department versus emergency department) (Pearson X^2=50.7, F=2.1, df=3.4, 2543, p=0.88).

Characteristics of patient visits for CRS by geographic region are shown in Table 3. The mean patient age was 35.6 years (SE 0.782). No regional differences were seen in age when stratified into quartiles (i.e., 0–25 years, 26–50 years, 51–75 years, 76+ years). Women accounted for the majority of visits to all regions, with a female to maleratio of 3:2.

While the majority of visits for all regions involved patients identified as "White" (83–92%), a significantly higher proportion of CRS visits in the South involved African-Americans (Pearson X^2=69.5, F=6.7, df=2.8, 2118, p<0.01) as compared to other regions. In the Northeast, Midwest, and West, African-Americans accounted for 7.4% (95% CI, 5.1–10.6), 6.6% (95% CI, 4.4–9.8), and 7.0% (95% CI, 4.1–11.5), of all visits for CRS, respectively. In comparison, in the South, this group accounted for 14.4% (95% CI, 11.0–18.7) of all visits for CRS.

Significantly fewer diagnostic services were provided or ordered at the patient visits in the Northeast (Pearson X^2=64.8, F=4.0, df=4.3, 3247, p<0.01). Diagnostic services were ordered or provided at only 87.6% (95% CI, 80.1–92.6) of all visits for CRS in the Northeast, compared to 93.9–95.0% (95% CI, 91.2–96.7) of visits in the other regions. No

statistically significant difference between regions was seen for the variable “Other Imaging,” which includes any imaging test ordered that is not specified elsewhere on the survey (Pearson X^2=14.9, F=2.0, df=2.8, 2120, p=0.11).

Providers in the Northeast were also significantly less likely to order or renew more than 3 medications at the patient visit (Pearson X^2=54.0, F=3.1, df=2.6, 1930, p<0.05). They did so at only 12.4% of visits (95% CI, 9.0–16.9), compared to 22.2–26.2% (95% CI, 16.8–34.1) of visits for the other regions.

DISCUSSION

Dramatic regional variations in healthcare practice have been reported for rates of lower extremity revascularization, carotid endarterectomy, back surgery, and radical prostatectomy,[14] as well as the frequency of diagnostic testing and the rate of minor surgical procedures.[15] Interestingly, Fisher et al[16] demonstrated that, while Medicare enrollees in higher-spending regions receive more care than those in lower-spending regions, they do not have better health outcomes or satisfaction with care.

This study demonstrates that CRS, a disease that is frequently seen in the offices of both primary care physicians and otolaryngologists, is similarly associated with regional variation. Differences between the Northeastern, Midwestern, Southern, and Western regions of the US in terms of patient demographics, utilization of diagnostic services, and prescription patterns can be seen over a four-year period. Given the high prevalence of this disease, such variation could have a significant impact upon healthcare expenditures. Additionally, since approximately 70% of visits for CRS involve the use of at least one antibiotic,[17] these variations may result in regional differences in antibiotic resistance with significant effects upon disease progression and management. Several studies have been performed in recent years in an attempt to determine the utility and cost-effectiveness of various diagnostic and treatment approaches to CRS. The findings of this study should emphasize the importance of utilizing evidence-based medicine in the management of this common disorder, in order to achieve greater standardization of care throughout the US.

Based on the 2006 NHIS, rhinosinusitis is estimated to affect approximately 14% of the adult US population annually.[11] In comparison, our study found that CRS accounted for approximately 2% of all ambulatory visits in the US. Although these two rates cannot be directly compared, since the NAMCS and NHAMCS provide only an indirect measure of prevalence, it is surprising that CRS is responsible for such a small percentage of physician encounters. This discrepancy may be due to differences in reporting measures. While the NHIS does provide a useful estimate of disease prevalence, it relies upon self-report, with no physician-based confirmation of reported diagnoses. Additionally, CRS may require fewer routine patient visits as compared to other chronic diseases, or it may be under-reported in ICD-9 coding. This latter possibility may be particularly relevant for the elderly population, who accounted for only a small percentage of CRS visits in all regions. Thus, rhinosinusitis-type symptoms may be overshadowed by other, more serious medical problems and therefore not addressed by the patient or the physician or, while addressed, not coded. Alternatively, CRS may be less prevalent within this age group.

Differences observed in CRS visit rates for African-Americans likely reflects overall geographic differences in terms of this population, rather than a process specific to CRS. Based on data from the 2000 US Census, more than half (54.8%) of the African-American population lives in the South, compared to 17.6% in the Northeast, 18.8% in the Midwest and 8.9% in the West. The ratio of these rates corresponds roughly with the ratio in visit

rates seen in this study, with both the African-American population and the number of visits for CRS being approximately twice as high in the South as compared to other regions.

Additionally, Caucasians are over-represented in this patient population. Eighty-three to 92% of all visits for CRS involved patients identified as “White,” while the 2000 US Census showed that only 75% of the US population identified themselves as part of this racial group. Whether this reflects differences in access to care or true differences in disease prevalence is outside the scope of this article but certainly deserves additional attention.

Although the NAMCS and NHAMCS provide a large, nationally representative database with over 4,000 unweighted CRS patient visits during the study period, there are several limitations of this study related to the nature of the NAMCS and NHAMCS survey instruments. First, the sampling of these surveys is based upon visits, not individual patients, thereby only allowing us to draw indirect measures of prevalence rates. Individuals with CRS who do not seek medical care are not represented in this study, nor are those patients who have previously been diagnosed with this condition but are not actively being treated for it at the visit. In addition, due to the sampling design of the survey, certain groups may be over-represented, such as frequent users of care. Since we included visits that were both focused solely upon CRS and those where other diagnoses were also addressed, the study design also limits our ability to associate specific diagnostic tests or medications directly with the diagnosis of CRS. Finally, previous research has demonstrated that ICD-9 coding may be used with some confidence for broad cause groupings but accuracy declines for more specific, focused codes;[18] therefore, some bias may be introduced by relying upon these codes for a given diagnosis.

Thus, significant regional variations exist for chronic rhinosinusitis in terms of patient characteristics, diagnosis and management. Of particular interest are the differences in medical practice seen between the Northeast and the other regions of the US, with physicians in the Northeast utilizing fewer diagnostic services and prescribing or continuing fewer medications per visit. These findings should encourage further investigation into regional differences in the diagnosis and treatment of CRS, as they could have a significant impact upon the management of this disease.

Acknowledgments

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Table 1

ICD-9 Codes Used to Evaluate Frequency of Chronic Rhinosinusitis Visits

ICD-9 Code	Disease
473.0	Maxillary chronic sinusitis
473.1	Frontal chronic sinusitis
473.2	Ethmoidal chronic sinusitis
473.3	Sphenoidal chronic sinusitis
473.8	Other chronic sinusitis
473.9	Unspecified sinusitis (chronic)

Abbreviation: ICD-9, *International Classification of Diseases, Ninth Revision.*

Table 2

Unweighted and Weighted Patient Visits for Chronic Rhinosinusitis by Physician Specialty

Survey	Specialty	Unweighted visits (%)	Weighted visits (SE)
NAMCS	Primary Care	838 (42.6)	46,920,147 (552,755)
	Otolaryngology	675 (34.3)	8,633,927 (369,475)
	Pediatrics	311 (15.8)	17,021,282 (759,547)
	Other	61 (3.1)	2,526,025 (50,554)
	Allergy/Immunology	56 (2.8)	2,817,838 (224,203)
	Pulmonary Specialists	26 (1.3)	2,117,029 (204,402)
NHAMCS			
Emergency Dept	Emergency Medicine	814 (35.4)	3,975,229 (105,313)
Outpatient	General Medicine	1147 (49.9)	6,341,117 (1,324,523)
	Pediatrics	198 (8.6)	591,799 (192,587)
	Surgery	110 (4.8)	238,623 (115,417)
	Other	21 (0.9)	42,680 (36,169)
	Obstetrics & Gynecology	9 (0.4)	29,318 (24,961)

Abbreviations: SE, standard error. NAMCS, National Ambulatory Medical Care Survey. NHAMCS, National Hospital Ambulatory Medical Care Survey. Dept, department.

Table 3

Characteristics of Chronic Rhinosinusitis Visits in the United States, 2003–2006

	Northeast	Midwest	South	West
Total ambulatory visits (*n*)	920,750,390	1,010,701,331	1,689,136,737	892,669,486
Visits for CRS (% of total)	14,993,579 (1.6%)	21,590,618 (2.1%)	41,296,730 (2.4%)	14,305,593 (1.6%)
Age (mean +/− SD in years)	35.1 +/− 1.3	37.0 +/− 1.3	35.0 +/− 1.4	36.1 +/− 1.8
0–25 years (%)	35.2	33.0	36.9	32.6
26–50 years (%)	40.9	38.0	35.2	39.2
51–75 years (%)	20.4	25.0	24.3	24.5
76+ (%)	NR	NR	3.6	NR
Gender (%, Female/Male)	66.0/34.0	58.7/41.3	60.4/39.6	60.5/39.5
Race (%)				
White	91.0	92.4	82.9	83.7
Black/African-American	7.4	6.6	14.4	7.0
Other	NR	NR	2.7	9.3
Were diagnostic services ordered or provided? (%)				
Yes	87.6	94.3	93.9	95.0
No	11.9	4.9	4.8	4.4
Unknown	NR	NR	NR	NR
Number of medications coded (%)				
0–3	87.6	77.8	75.7	73.8
4–8	12.4	22.2	24.3	26.2

Abbreviations: NR, estimate not reliable (due to <30 unweighted patient visits or a relative standard error >30%). CRS, chronic rhinosinusitis. SD, standard deviation.