

Medications for Allergic Rhinitis: An Opportunity for Quality Improvement?

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Abstract

Objectives. Adherence to the allergic rhinitis clinical practice guideline is being considered as a potential focus for national performance metrics. To help inform this discussion, we assessed patient- and clinician-reported medication administration among nationally representative populations of patients with allergic rhinitis.

Study Design. Cross-sectional analyses.

Setting and Subjects. Home health assessments, ambulatory visits.

Methods. Participants in the National Health and Nutrition Examination Survey and the National Ambulatory Medical Care Survey / National Hospital Ambulatory Medical Care Survey were assessed. The primary outcomes were the percentage of patients reporting receipt of antihistamines and/or nasal steroids among those with allergy-related symptoms and the percentage for whom a clinician administered these medications when diagnosing allergic rhinitis. Secondary outcomes included assessments of those with worse quality of life, confirmatory allergy testing, and leukotriene receptor antagonist use.

Results. Within the National Health and Nutrition Examination Survey, an estimated 29.2 million patients were diagnosed with “hay fever,” while 92.2 million were diagnosed with “allergies.” Patients with symptoms of allergic rhinitis reported that antihistamines or nasal steroids were prescribed in 21.1% to 24.0% of cases. Leukotriene receptor antagonists were given to 1.7% of those without asthma or use of other allergy medications. Within the National Ambulatory Medical Care Survey / National Hospital Ambulatory Medical Care Survey, observations representing 149.5 million visits for allergic rhinitis demonstrated that nasal steroids were administered in 29.6% of cases, while nonsedating and sedating antihistamines were given in 22.4% and 17.2%, respectively.

Conclusions. Despite a high prevalence of allergic rhinitis, per patient report and clinician entry, a substantial number of affected patients do not receive antihistamines and nasal steroids.

Keywords

allergic rhinitis, nasal steroids, antihistamines, National Ambulatory Medical Care Survey, prevalence, practice patterns, quality improvement, performance measures

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Allergic rhinitis (AR) is a highly prevalent condition that affects up to 30% of adults and 40% of children.¹ Related costs are substantial, both direct and indirect. Direct expenditures are estimated at \$5.9 billion,² and indirect costs associated with lost and unproductive work hours may constitute an additional \$4.9 million per annum.³ In fact, some economic analyses suggest that AR accounts for greater loss of productivity than any other illness.³

AR is characterized by nasal congestion, rhinorrhea, sneezing, and nasal itching.¹ Such symptoms affect patients adversely, with a significant impact on quality of life.^{4,5} Treatment options include intranasal and oral medications, as well as immunotherapy.⁶ While these interventions have an inherent risk of adverse effects, there are also risks of harm from nontreatment. The National Strategy for Quality Improvement in Health Care aims to reduce harm in health care delivery,⁷ and efforts are directed at optimizing patient care, promoting effective therapy, and reducing nonbeneficial variations in care.

In 2015, the American Academy of Otolaryngology—Head and Neck Surgery Foundation sponsored a clinical practice guideline to support evidence-based diagnosis and management of patients with AR.⁸ Within this guideline, a

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multidisciplinary panel representing a variety of professional organizations made recommendations and strong recommendations when the benefits of an intervention clearly exceeded the harms.⁹ Based on the strength of these data and recommendations, related adherence to the AR clinical practice guideline is being considered as a potential focus for national performance metrics. To help inform this discussion, we evaluated nationally representative databases with these objectives: (1) to assess medication administration in patients affected by AR and (2) to determine whether there were variations according to reported symptoms, quality of life, and confirmatory allergy testing.

Methods

The protocol was evaluated by the Partners Institutional Review Board, who exempted it from oversight. The study population included all patients >2 years of age. We assessed data from the National Health and Nutrition Examination Survey (NHANES) and the National Ambulatory Medical Care Survey / National Hospital Ambulatory Medical Care Survey (NAMCS/NHAMCS).

National Health and Nutrition Examination Survey

Conducted by the Centers for Disease Control and Prevention, NHANES is a cross-sectional nationwide survey designed to assess the health and nutrition status of children and adults in the United States. Demographic, dietary, and health-related queries are collected via interview, physiologic measurements, and laboratory tests administered by trained personnel. Participants are selected through a stratified multistage probability design to provide a representative sample of the US population. Detailed descriptions are available online.¹⁰

NHANES interviews were conducted for subjects ≥ 1 year of age in their home prior to a physical examination. The present study focused on the subset who were at least 2 years of age, since this was the target population for the AR clinical practice guideline. During the 2005-2006 NHANES cycle, subjects were queried about allergy-related items. They were asked whether their doctor had ever told them that they had “hay fever” or “allergies,” and they were asked about the presence of allergy symptomatology over a 12-month period. Participants were also asked about global quality of life as assessed by a 4-question scale; this scale is an abbreviated form of the 36-Item Short-Form Survey,^{11,12} and it assesses general health, physical health, mental health, and activity limitations in the preceding month. Health-related quality of life was considered affected if participants reported “poor” or “fair” general health or >7 days of associated limitations. Participants were also eligible for laboratory allergy testing, which measured IgE levels for a standardized panel of perennial and seasonal allergens; testing varied according to age (see Appendix 1 at www.otojournal.org/supplemental). Allergy testing was considered positive if IgE levels were at least 0.35 kU/L. Patients were asked if they had taken prescription medication in the past month. Medication containers were displayed to the interviewer, who then matched this to a prescription drug

database by computer entry. Verbal entries were included if the container was not available, and up to 20 prescription medications were recorded.

In the present analysis, subject demographic characteristics, allergy-related queries, quality-of-life assessments, laboratory IgE results, and prescription medication use were assessed. The primary outcome was the percentage of those with hay fever or allergy diagnoses and allergy-related symptoms who reported use of nasal steroids or antihistamines (nonsedating, sedating, or nasal). Secondary outcomes included the percentage who reported nasal steroid and antihistamine use among those with general quality of life that was poor or fair or who reported >7 of the preceding 30 days in which physical health, mental health, or activities of daily living were “not good.” In addition, an analysis was performed of the subset with both a clinical diagnosis of hay fever or allergies and positive allergen-specific testing. We also assessed the percentage who received any or none of the guideline-recommended medications (nasal steroids or antihistamines). Since the guideline recommends against leukotriene receptor antagonist use, we performed additional restricted analyses to isolate the potential impetus to prescribe these medications as a primary therapy for AR. Specifically, we assessed their administration in patients without asthma (an expected reason for leukotriene receptor antagonist administration) and those who were also not given nasal steroids and antihistamines. The presence or absence of asthma was defined according to participants’ responses to the query “Has a doctor or other health care professional ever told you that you have asthma?” We also assessed basic population characteristics (ie, age, sex, race/ethnicity). As recommended by the National Center for Health Statistics, NHANES data were considered reliable if the relative standard error was <30% and the raw sample size was at least 30. In addition, the degrees of freedom associated with the queries of interest were evaluated to ensure that the recommended sample sizes were met per the Centers for Disease Control and Prevention.

National Ambulatory Medical Care Survey / National Hospital Ambulatory Medical Care Survey

The NAMCS/NHAMCS focuses on outpatient visits to office-based physicians. The National Center for Health Statistics updates this survey annually, and appended data sets may be assessed with enhanced reliability of estimates.¹³⁻¹⁵ Complete descriptions of NAMCS/NHAMCS are available online.¹⁶ The most recent data are available for 2005 to 2012, and application of visit weights generates estimates representative of all ambulatory care visits in the United States.¹⁷⁻¹⁹ Prevalence was assessed according to standard NAMCS/NHAMCS protocols to determine population proportions and totals. Outcome and predictor variables, as well as potential confounding comorbidities, were based on *International Classification of Diseases, Ninth Revision* codes and Lexicon Plus Cerner Multum medication codes as assigned by the Centers for Disease Control and Prevention.^{20,21} Drugs were also coded to

Table 1. NHANES: Population Characteristics Based on Diagnosis.^a

	Hay Fever	Allergies
Total represented (observed), n	29,193,207 (646)	92,246,470 (2614)
Mean age, y	45.2 (42.6-47.8)	38.8 (37.2-40.5)
Female, %	57.2 (52.5-61.7)	58.1 (55.6-60.5)
Race or ethnicity, %		
Non-Hispanic White	81.6 (77.0-85.5)	74.6 (67.7-80.5)
Non-Hispanic Black	8.1 (5.2-12.3)	11.5 (7.7-16.7)
Mexican American	3.6 (2.3-5.6)	5.3 (3.7-7.6)
Other Hispanic	2.0 (1.0-4.0)	2.8 (1.5-5.2)
Other race/multiracial	4.7 (3.0-7.3)	5.8 (4.2-7.9)
Allergy symptoms or attack in the last 12 mo, %		
Yes	82.6 (78.7-86.0)	69.5 (66.3-72.6)
No	17.0 (13.4-21.2)	30.0 (26.9-33.3)
Don't know	0.4 (0.1-3.4)	0.4 (0.2-0.8)
Sneezing, runny, or blocked nose in the last 12 mo, %		
Yes	68.7 (64.3-72.8)	62.3 (58.5-65.9)
No	31.3 (27.2-35.7)	37.7 (34.0-41.5)
Don't know	No observations	0.0 (0.0-0.3)
Health-related quality of life, %		
General health poor or fair	13.4 (9.6-18.6)	16.6 (13.7-20.0)
Physical health not good >7 of 30 d	16.1 (12.2-20.9)	15.3 (13.0-18.0)
Mental health not good >7 of 30 d	17.1 (11.8-24.2)	17.5 (14.5-20.9)
Usual activities prevented >7 of 30 d	7.2 (4.8-10.6)	7.2 (5.7-9.0)
Allergy testing, IgE $\geq$ 0.35 kU/L		
Perennial	17.3 (13.3-22.4)	20.4 (18.1-23.0)
Seasonal	26.8 (22.1-32.1)	25.7 (22.5-29.2)

Abbreviations: 95% CI, 95% confidence interval; NHANES, National Health and Nutrition Examination Survey.

^aFor age, sex, race/ethnicity, allergy symptoms, quality of life, and allergy testing results, the 95% confidence interval is shown in parentheses.

identify those that were newly recommended or continued at the time of AR diagnosis. To delineate the population that received recommended medications, since either newly administering or continuing a medication demonstrated usage in accordance with guideline recommendations, we categorized medication types as “any administration” (new or continuing) or “new administration” (new at that visit).

The primary outcome within the NAMCS/NHAMCS evaluation was the percentage of those who received any administration (ie, whether new or continuing) of nasal steroids, antihistamines, or leukotriene receptor antagonists, among the denominator of those who had a primary, secondary, or tertiary diagnosis of AR. The secondary outcomes were those same percentages among those who had AR as a primary diagnosis only and those who received new administrations of medications only. In addition, since the guideline recommends against leukotriene receptor antagonists, we performed restricted analyses to isolate cases in which these medications may have been administered as a primary therapy for AR—specifically, among patients without asthma and those not given antihistamines or nasal steroids. The presence of asthma was defined by *International Classification of Diseases, Ninth Revision* diagnostic codes. We also assessed basic population characteristics,

including age, sex, race/ethnicity, visit setting, and related diagnoses. As recommended by the National Center for Health Statistics, we considered estimates based on >30 affected observations and those with a standard error <30% of the point estimate to be reliable.

Results

Recommended Medications: Nasal Steroids and Antihistamines

NHANES: Hay Fever or Allergy Diagnosis and Allergy Symptoms. There were a total of 2751 criterion-meeting observations in the allergy questionnaire, with a corresponding population estimate of 98,297,258. Among this group, an estimated 29.2 million were told by a physician that they had hay fever. Among those diagnosed, the majority reported symptoms within the preceding 12 months: 82.6% had allergy symptoms, and 68.7% had sneezing or runny/blocked nose unrelated to an upper respiratory tract infection (**Table 1**). In addition, an estimated 92.2 million were advised that they had allergies. The majority of these patients also reported related symptoms: 69.5% had allergy symptoms, and 62.3% had sneezing or runny/blocked nose. Those told

Table 2. NHANES, 2005-2006: Prescription Medications Reported among Respondents with Allergy Diagnoses and Symptoms.

	AGQ.060: Allergy Symptoms or Attack? Yes ^a		AGQ.100: Sneezing, Runny, or Blocked Nose? Yes ^b	
	% (95% CI)	Total, n	% (95% CI)	Total, n
AGQ.010: Has a doctor or other health professional ever told you that you have hay fever? Yes				
Nasal steroids	13.2 (9.6-17.8)	2,515,991	13.2 (10.1-17.1)	2,643,453
Nonsedating antihistamines	7.4 (4.7-11.5)	1,410,711	6.1 (3.9-9.4)	1,218,430
Sedating antihistamines	4.4 (2.8-6.8)	844,136	4.5 (2.8-7.2)	904,718
Nasal antihistamines	1.2 (0.8-1.6)	224,175	0.6 (0.1-3.5)	126,329
Any allergy medication	24.0 (18.6-30.2)	4,580,780	21.9 (17.3-27.3)	4,389,517
None	76.0 (69.7-81.4)	14,538,297	78.1 (72.7-82.7)	15,662,467
AGQ.040: Has a doctor or other health professional ever told you that you have allergies? Yes				
Nasal steroids	9.6 (7.8-11.8)	6,159,217	9.9 (8.1-12.0)	5,694,530
Nonsedating antihistamines	5.1 (3.8-6.8)	3,253,043	4.8 (3.3-7.0)	2,775,795
Sedating antihistamines	7.2 (5.6-9.2)	4,618,884	7.4 (5.6-9.7)	4,230,947
Nasal antihistamines	0.8 (0.5-1.0)	482,194	0.5 (0.1-1.5)	292,395
Any allergy medication	21.1 (18.5-24.0)	13,537,207	21.1 (18.3-24.1)	12,115,086
None	78.9 (76.0-81.5)	50,619,333	79.9 (75.8-81.6)	45,332,426

Abbreviations: 95% CI, 95% confidence interval; NHANES, National Health and Nutrition Examination Survey.

^aAGQ.060: During the past 12 months, have you had any allergy symptoms or an allergy attack? Yes.

^bAGQ.100: During the past 12 months, have you had a problem with sneezing, or a runny, or blocked nose when you did not have a cold or the flu? Yes.

that they had hay fever were older than those who had allergies ($P < .05$) and were more likely to describe allergy symptoms within the preceding 12 months ($P < .05$).

A minority of patients with a diagnosis of hay fever and reported allergy symptoms also described use of related prescription medication (**Table 2**). Nasal steroid administration was reported in 13.2% (95% confidence interval [95% CI]: 9.6%-17.8%) of cases. Nonsedating oral antihistamines were prescribed in 7.4% (95% CI: 4.7%-11.5%), while sedating oral antihistamines were prescribed in 4.4% (95% CI: 2.8%-6.8%). Nasal antihistamines were utilized in just 1.2% of cases (95% CI: 0.8%-1.6%). Usage of any of these 4 medication types were reported by 24.0% (95% CI: 18.6%-30.2%) of participants. Similar results were obtained in patients who were diagnosed with hay fever and had sneezing or a runny/blocked nose irrespective of an upper respiratory tract infection.

Among patients with a diagnosis of allergies and reported allergy symptoms/attack, a minority reported related medication use (**Table 2**). Nasal steroids were reported in 9.6% (95% CI: 7.8%-11.8%) of cases. Nonsedating and sedating oral antihistamines were also prescribed (5.1%, 95% CI: 3.8%-6.8%; 7.2%, 95% CI: 5.6%-9.2%, respectively). Nasal antihistamines were rarely utilized (0.8%, 95% CI: 0.5%-1.0%). Receipt of any of the above 4 medication types was reported in 21.1% (95% CI: 18.5%-24.0%) of cases. Similar results were obtained in patients who were diagnosed with allergy and reported sneezing or a runny/blocked nose.

NHANES: Hay Fever or Allergy Diagnosis and Health-Related Quality of Life. Among those who reported that their physician diagnosed them with hay fever or allergies, a minority reported that their general health was poor or fair or that physical or mental health was “not good” for more than a

week of the prior month; in addition, a minority of those with allergy-related diagnoses could not complete their usual activities of daily living (**Table 1**). Within these affected subsets, allergy medications were also reported in a minority of participants: nasal steroids in 10.1% to 16.1%, nonsedating antihistamines in 6.8% to 9.3%, and sedating antihistamines in 2.4% to 4.6% (**Table 3**). Patients reported using any of these allergy medications in 18.0% to 26.2% of cases.

NHANES: Hay Fever or Allergy Diagnosis and IgE Testing. Nasal steroid and oral antihistamine use was no higher among those patients with positive IgE allergy testing (**Table 4**). Nasal steroids and oral antihistamines were again most frequently prescribed for those with seasonal allergens detected, with the former reported among 9.5% (95% CI: 3.0%-26.1%) of those diagnosed with hay fever and 8.5% (95% CI: 2.9%-22.0%) of those with allergy. Patients with hay fever, positive allergy testing, and allergy symptoms/attack reported that they were prescribed nonsedating oral antihistamines in 7.4% (95% CI: 3.3%-16.0%) of cases and sedating antihistamines in 7.2% (95% CI: 4.1%-12.3%) of cases. Patients with a diagnosis of allergies, positive allergy testing, and allergy symptoms/attack reported using sedating antihistamines (9.4%, 95% CI: 6.1%-14.3%) more frequently than nonsedating oral antihistamines (3.7%, 95% CI: 2.1%-6.4%). There were not enough observations of nasal antihistamine use to make reliable population estimates for patients with hay fever, although 0.6% (95% CI: 0.1%-4.8%) of those with allergy used nasal antihistamines. Usage of any of these 4 medication types were reported by up to 22.3% (95% CI: 14.0%-33.6%) of patients with hay fever and 20.0% (95% CI: 15.2%-26.0%) of those with allergy. Similar results were obtained in patients who were diagnosed with hay fever or allergy and had sneezing or a runny/blocked

Table 3. NHANES, 2005-2006: Prescription Medications Reported among Respondents with Hay Fever and Allergies Diagnoses and Impact on Global Quality of Life.^a

AGQ.010: Hay Fever? Yes ^b	HSD.010: Health in General? Fair, Poor ^c		HSQ.470: Past 30 d, Physical Health Not Good? >7 d ^d	
	Percent (95% CI)	Total, n	Percent (95% CI)	Total, n
Nasal steroids	11.2 (4.5-25.2)	394,647	16.1 (9.6-25.9)	680,267
Nonsedating antihistamines	8.7 (4.1-17.8)	306,889	9.3 (4.1-19.9)	391,639
Sedating antihistamines	4.6 (1.1-18.2)	163,815	2.4 (0.3-15.3)	99,003
Nasal antihistamines	—	—	—	—
Any allergy medication	22.0 (9.8-42.4)	776,788	26.2 (18.3-35.9)	1,100,701
None	78.0 (57.6-90.2)	2,748,484	73.8 (64.1-81.7)	3,105,587

AGQ.040: Allergies? Yes ^g	HSD.480: Past 30 d, Mental Health Not Good? >7 d ^e		HSD.490: Past 30 d, Poor Health Keep You From Doing Usual Activities? >7 d ^f	
	Percent (95% CI)	Total, n	Percent (95% CI)	Total, n
Nasal steroids	10.1 (5.8-17.0)	453,123	15.5 (3.7-46.4)	299,566
Nonsedating antihistamines	8.2 (3.8-16.9)	369,201	6.8 (2.0-20.3)	126,876
Sedating antihistamines	—	—	—	—
Nasal antihistamines	—	—	—	—
Any allergy medication	18.0 (10.7-28.6)	805,514	24.1 (9.8-48.1)	450,878
None	82.0 (74.4-89.3)	3,670,995	75.9 (52.9-90.2)	1,423,318

AGQ.040: Allergies? Yes ^g	HSD.010: Health in General? Fair, Poor ^c		HSQ.470: Past 30 d, Physical Health Not Good? >7 d ^d	
	Percent (95% CI)	Total, n	Percent (95% CI)	Total, n
Nasal steroids	6.8 (4.0-11.2)	848,301	11.8 (7.8-17.5)	1,360,404
Nonsedating antihistamines	8.1 (4.1-15.2)	1,011,550	7.6 (4.6-12.4)	874,224
Sedating antihistamines	5.9 (3.9-9.0)	741,152	4.7 (1.7-11.9)	535,106
Nasal antihistamines	0.8 (0.1-6.2)	98,473	1.7 (0.4-6.6)	193,289
Any allergy medication	21.0 (15.8-27.4)	2,618,703	23.2 (17.0-30.8)	2,662,621
None	79.0 (72.6-84.2)	9,844,090	76.8 (69.2-83.0)	8,827,216

AGQ.040: Allergies? Yes ^g	HSD.480: Past 30 d, Mental Health Not Good? >7 d ^e		HSD.490: Past 30 d, Poor Health Keep You From Doing Usual Activities? >7 d ^f	
	Percent (95% CI)	Total, n	Percent (95% CI)	Total, n
Nasal steroids	6.8 (4.7-9.8)	888,530	6.9 (2.5-17.8)	374,351
Nonsedating antihistamines	6.2 (3.8-9.9)	804,574	6.9 (3.2-13.4)	360,439
Sedating antihistamines	3.2 (1.6-6.3)	417,191	5.7 (2.5-12.7)	308,014
Nasal antihistamines	0.8 (0.1-5.5)	107,652	1.8 (0.2-13.2)	94,815
Any allergy medication	16.6 (13.2-20.8)	2,174,540	20.8 (14.4-29.1)	1,123,719
None	83.3 (79.2-86.8)	10,895,915	79.2 (70.9-85.5)	4,267,235

Abbreviations: 95% CI, 95% confidence interval; NHANES, National Health and Nutrition Examination Survey.

^aDashes denote too few observations to meet NHANES criteria for reliable population estimates.^bAGQ.010. Has a doctor or other health professional ever told you that you have hay fever? Yes.^cHSD.010. Would you say your health in general is . . . ? Fair, poor.^dHSQ.470. Thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good? >7 days.^eHSD.480. Now thinking about mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good? >7 days^fHSD.490. During the past 30 days, for about how many days did poor physical or mental health keep you from doing usual activities, such as self care, work, school or recreation? >7 days^gAGQ.040. Has a doctor or other health professional ever told you that you have allergies? Yes.

nose. Medication use was slightly lower for all participants who had perennial allergens detected regardless of whether hay fever

or allergies were diagnosed; participants reported the use of any allergy medication in only 16.1% to 19.1% of cases.

Table 4. NHANES, 2005-2006: Prescription Medications Reported among Respondents with Allergy Diagnoses and Symptoms and IgE ≥ 0.35 kU/L for Any Tested Allergen.^a

Seasonal Allergens	AGQ.060: Allergy Symptoms or Attack? Yes ^b		AGQ.100: Sneezing, Runny, or Blocked Nose? Yes ^c	
	% (95% CI)	Total, n	% (95% CI)	Total, n
AGQ.010: Has a doctor or other health professional ever told you that you have hay fever? Yes				
Nasal steroids	8.5 (2.9-22.0)	413,616	9.0 (3.5-21.2)	499,369
Nonsedating antihistamines	7.4 (3.3-16.0)	363,028	5.7 (2.3-13.3)	315,652
Sedating antihistamines	7.2 (4.1-12.3)	350,605	7.4 (3.8-13.8)	411,187
Nasal antihistamines	—	—	—	—
Any allergy medication	22.3 (14.0-33.6)	1,090,934	19.8 (11.4-32.4)	1,104,140
None	78.7 (66.4-86.0)	3,796,826	80.2 (73.4-88.6)	4,459,774
AGQ.040: Has a doctor or other health professional ever told you that you have allergies? Yes				
Nasal steroids	8.2 (4.6-14.0)	1,369,247	8.2 (4.7-13.9)	1,271,310
Nonsedating antihistamines	3.7 (2.1-6.4)	616,567	3.5 (1.8-6.5)	535,957
Sedating antihistamines	9.4 (6.1-14.3)	1,582,776	9.7 (6.3-14.5)	1,505,135
Nasal antihistamines	0.6 (0.1-4.8)	94,815	0.6 (0.1-5.3)	94,815
Any allergy medication	20.0 (15.2-26.0)	3,360,067	19.7 (14.6-26.1)	3,063,480
None	80.0 (74.0-84.8)	13,414,781	80.2 (73.9-85.4)	12,466,174
Perennial Allergens				
AGQ.010: Has a doctor or other health professional ever told you that you have hay fever? Yes				
Nasal steroids	9.5 (3.0-26.1)	290,155	8.4 (2.9-22.1)	297,325
Nonsedating antihistamines	10.4 (3.7-26.4)	318,350	8.8 (3.1-22.7)	310,050
Sedating antihistamines	3.5 (1.3-8.9)	105,570	2.7 (1.0-7.0)	94,979
Nasal antihistamines	—	—	—	—
Any allergy medication	19.1 (10.2-32.8)	581,998	16.1 (9.1-27.0)	570,277
None	80.9 (67.2-89.8)	2,468,118	83.8 (73.0-90.1)	2,955,132
AGQ.040: Has a doctor or other health professional ever told you that you have allergies? Yes				
Nasal steroids	7.7 (4.0-14.3)	954,175	7.1 (3.8-13.0)	868,045
Nonsedating antihistamines	4.1 (2.0-8.4)	511,923	4.2 (1.9-9.0)	509,657
Sedating antihistamines	6.3 (3.8-10.0)	774,974	6.2 (4.0-9.5)	748,779
Nasal antihistamines	0.7 (0.1-6.0)	94,815	0.7 (0.1-6.3)	94,815
Any allergy medication	17.2 (12.5-23.2)	2,123,090	16.8 (12.4-22.5)	2,033,911
None	82.8 (76.8-87.5)	10,242,514	83.2 (77.5-87.6)	10,047,050

Abbreviations: 95% CI, 95% confidence interval; NHANES, National Health and Nutrition Examination Survey.

^aDashes denote too few observations to meet NHANES criteria for reliable population estimates.

^bAGQ.060: During the past 12 months, have you had any allergy symptoms or an allergy attack? Yes

^cAGQ.100: During the past 12 months, have you had a problem with sneezing, or a runny, or blocked nose when you did not have a cold or the flu? Yes

NAMCS/NHAMCS: AR Diagnosis. Within the NAMCS/NHAMCS 2005-2012 data set, 494,987 observations were assessed, representing 8,048,129,266 visits, of which 149,502,842 were associated with a diagnosis of AR. Patients with AR were younger (mean age: 36.2 vs 47.4 years, $P < .001$) and more frequently female (56%, $P = .029$). Those with AR were also more likely to be seen in a generalist or primary care setting than by an otolaryngologist ($P < .001$) and were significantly more likely to have asthma (**Table 5**).

Nasal steroids were given in 29.6% (95% CI: 26.9%-32.6%) of visits in which a health care professional diagnosed AR; 16.5% received new administrations (**Table 6**). Among those who had AR specified as the primary diagnosis, nasal steroids were administered with similar frequency

(28.8% any, 17.5% new; **Table 6**). There was no statistically significant change in medication administration over the period studied (**Table 7**).

Nonsedating antihistamines were administered in 22.4% (95% CI: 20.5%-24.4%) of visits in which AR was diagnosed, while 17.1% (95% CI: 15.0%-19.5%) received sedating antihistamines; 11.6% and 9.8% received new administrations, respectively (**Table 6**). Among those who had AR specified as the primary diagnosis, antihistamines were administered with similar frequency (**Table 6**). Prescribing patterns from 2005 to 2012 were evaluated, and nonsedating antihistamines were prescribed significantly less frequently in 2012 (odds ratio, 0.50; 95% CI: 0.33-0.75; $P = .001$). Sedating antihistamines were more frequently reported in 2007, 2008, 2011, and 2012 (**Table 7**).

Table 5. NAMCS/NHAMCS Population Characteristics, 2005-2012.

	No Allergic Rhinitis		Allergic Rhinitis		P Value
	Point Estimate	95% CI	Point Estimate	95% CI	
Visits: total (observed), n	7,898,626,424 (708,551)		149,502,842 (7314)		
Mean age, y	47.41	46.92-47.90	36.20	34.93-37.47	<.001
Pediatric (≤ 18 y), %	15.63	15.06-16.21	31.91	29.15-34.81	<.001
Male, %	40.56	40.08-41.04	43.85	42.00-45.72	.029
Race/ethnicity, %					<.001
Non-Hispanic white	72.93	71.08-74.71	71.47	67.37-75.24	
Non-Hispanic black	10.92	9.63-14.74	11.72	9.25-14.74	
Hispanic	11.38	9.92-13.04	10.64	8.40-13.41	
Asian	3.88	3.25-4.62	5.73	4.12-7.92	
Pacific Islander	0.25	0.18-0.35	0.11	0.03-0.36	
American Indian / Alaska Native	0.39	0.31-0.49	0.15	0.06-0.41	
Multiple races	0.23	0.19-0.29	0.17	0.08-0.36	
Visit location, %					<.001
General practitioner / family practice	22.74	20.93-24.66	28.34	24.63-32.36	
Internal medicine	15.98	14.85-17.18	17.71	14.51-21.43	
Pediatrics	9.45	8.83-10.11	19.21	16.06-22.81	
Otolaryngology	1.89	1.71-2.09	11.60	9.03-14.77	
Other allergic conditions	0.25	0.21-0.30	0.42	0.23-0.76	.108
Asthma	1.90	1.72-2.11	3.61	2.78-4.67	<.001

Abbreviations: 95% CI, 95% confidence interval; NAMCS, National Ambulatory Medical Care Survey; NHAMCS, National Hospital Ambulatory Medical Care Survey.

Table 6. NAMCS/NHAMCS 2005-2012: Medications Administered for Allergic Rhinitis Diagnoses.

Diagnoses	Any Administration		New Administration	
	% (95% CI)	Total Visits, n	% (95% CI)	Total Visits, n
All allergic rhinitis ^a				
Nasal steroids	29.6 (26.9-32.6)	44,318,985	16.5 (14.7-18.6)	24,730,291
Nonsedating antihistamines	22.4 (20.5-24.4)	33,488,736	11.6 (10.2-13.2)	17,366,469
Sedating antihistamines	17.1 (15.0-19.5)	25,624,261	9.8 (8.1-11.8)	14,582,562
Nasal antihistamines	4.0 (2.9-5.3)	5,888,843	2.2 (1.6-3.1)	3,332,023
Any allergy medication	56.5 (52.9-60.0)	84,404,826	33.5 (30.6-36.6)	50,076,430
None	43.5 (40.1-47.1)	65,098,016	66.5 (63.4-69.4)	99,426,413
Primary allergic rhinitis				
Nasal steroids	28.8 (24.5-33.6)	20,068,480	17.5 (14.4-21.1)	12,189,871
Nonsedating antihistamines	22.1 (19.0-25.4)	15,371,099	12.4 (10.1-15.2)	8,668,450
Sedating antihistamines	17.6 (14.5-21.2)	12,253,379	10.5 (8.0-13.7)	7,331,989
Nasal antihistamines	5.2 (3.5-7.7)	3,649,089	2.8 (1.8-4.5)	1,981,499
Any allergy medication	55.1 (48.8-61.2)	38,393,583	34.9 (29.9-40.2)	24,297,218
None	44.9 (38.8-51.2)	31,299,969	65.1 (59.8-70.1)	45,396,333

Abbreviations: 95% CI, 95% confidence interval; NAMCS, National Ambulatory Medical Care Survey; NHAMCS, National Hospital Ambulatory Medical Care Survey.

^aPrimary, secondary, or tertiary.

Medications Recommended Against: Leukotriene Receptor Antagonists

NHANES: Hay Fever/Allergy Diagnosis and Allergy Symptoms. Leukotriene receptor antagonists were administered in 6.1% (95% CI: 3.8%-9.7%) of those with a diagnosis of hay fever

and allergy symptoms/attack and 5.8% (95% CI: 3.3%-9.8%) of those with sneezing or runny/blocked nose. Those with a diagnosis of allergies had a very similar pattern. When the analysis was restricted to those without asthma, leukotriene agents were given in 2.2% to 3.5% of cases. When the evaluation was further restricted to those without

Table 7. NAMCS/NHAMCS, 2005-2012: Medication Administration by Year (Any: New or Continuing).

Year	Nasal Steroids		Nonsedating Antihistamines		Sedating Antihistamines	
	OR (95% CI)	P Value	OR (95% CI)	P Value	OR (95% CI)	P Value
2005	Reference	Reference	Reference	Reference	Reference	Reference
2006	0.89 (0.48, 1.67)	.723	0.81 (0.51, 1.28)	.362	1.64 (0.86, 3.15)	.136
2007	1.22 (0.78, 1.89)	.382	0.92 (0.61, 1.40)	.700	2.01 (1.24, 3.25)	.005
2008	0.93 (0.57, 1.52)	.774	0.92 (0.58, 1.46)	.722	2.36 (1.32, 4.22)	.004
2009	1.11 (0.73, 1.69)	.629	1.09 (0.70, 1.71)	.704	1.21 (0.71, 2.04)	.484
2010	1.19 (0.66, 2.15)	.561	0.62 (0.38, 1.01)	.055	1.50 (0.78, 2.90)	.222
2011	1.22 (0.72, 2.07)	.453	0.86 (0.56, 1.32)	.481	2.50 (1.52, 4.14)	<.001
2012	0.94 (0.61, 1.45)	.791	0.50 (0.33, 0.75)	.001	2.04 (1.24, 3.36)	.001

Abbreviations: 95% CI, 95% confidence interval; NAMCS, National Ambulatory Medical Care Survey; NHAMCS, National Hospital Ambulatory Medical Care Survey; OR, odds ratio.

Table 8. NHANES, 2005-2006: Leukotriene Receptor Antagonist Prescriptions Reported among Respondents with Allergy Diagnoses and Symptoms.

	AGQ.060: Allergy Symptoms or Attack? Yes ^a		AGQ.100: Sneezing, Runny, or Blocked Nose? Yes ^b	
	% (95% CI)	Total, n	% (95% CI)	Total, n
AGQ.010 Has a doctor or other health professional ever told you that you have hay fever? Yes				
Leukotriene antagonists	6.1 (3.8-9.7)	1,175,105	5.8 (3.3-9.8)	1,158,870
Without asthma	3.5 (2.2-8.3)	440,148	3.3 (1.1-9.2)	440,148
Without asthma, nasal steroid, or oral antihistamines	1.7 (0.4-7.9)	185,317	1.6 (0.4-7.3)	185,317
AGQ.040 Has a doctor or other health professional ever told you that you have allergies? Yes				
Leukotriene antagonists	4.9 (3.7-6.6)	3,171,923	5.0 (3.5-7.3)	2,887,053
Without asthma	2.2 (1.6-3.1)	990,589	2.4 (1.5-3.7)	952,056
Without asthma, nasal steroid, or oral antihistamines	1.2 (0.7-2.0)	452,328	1.2 (0.6-2.3)	413,975

Abbreviations: 95% CI, 95% confidence interval; NHANES, National Health and Nutrition Examination Survey.

^aAGQ.060: During the past 12 months, have you had any allergy symptoms or an allergy attack? Yes

^bAGQ.100: During the past 12 months, have you had a problem with sneezing, or a runny, or blocked nose when you did not have a cold or the flu? Yes

asthma, nasal steroid, or antihistamine, the estimated prescription risk was 1.2% to 1.7% (**Table 8**).

NAMCS/NHAMCS: AR Diagnosis. New administration of leukotriene receptor antagonists in patients with a primary diagnosis of AR occurred in 4.7% (95% CI: 3.4%-6.5%) of visits, and any administration (new or continuing) occurred in 10.7% (95% CI: 8.5%-13.4%) of visits (**Table 9**). A subgroup analysis of patients without a concomitant diagnosis of asthma demonstrated a similar rate of new administration (4.7%) and any administration (10.4%). Further analysis of patients without asthma or treatment with antihistamines or nasal steroids demonstrated that leukotriene receptor antagonists were newly prescribed in 2.4% (95% CI: 1.2%-4.6%) of visits, while any administration occurred in 6.1% (95% CI: 3.9%-9.2%).

Discussion

The AR clinical practice guideline emphasized these key action statements: (1) clinicians should recommend nasal steroids for patients with a clinical diagnosis of AR whose symptoms affect their quality of life; (2) clinicians should recommend oral second-generation/less sedating antihistamines for patients with AR and primary complaints of sneezing and itching. These data, however, suggest that a substantial number of patients with AR may not receive nasal steroids or oral nonsedating antihistamines, even among subsets who have reported associated symptoms, affected quality of life, and positive allergy testing and for whom it is a primary diagnosis. Among patients reporting a hay fever or allergy diagnosis and symptoms related to AR, 14,538,297 to 50,619,333 patients did not report receiving allergy medications. Among those who had a primary

Table 9. NAMCS/NHAMCS, 2005-2012: Leukotriene Receptor Antagonist Administration for Allergic Rhinitis Diagnoses.

Diagnoses	Any Administration		New Administration	
	% (95% CI)	Total Visits, n	% (95% CI)	Total Visits, n
All allergic rhinitis ^a	9.7 (8.2-11.3)	14,517,346	4.3 (3.4-5.4)	6,462,012
Without concurrent asthma diagnosis	9.1 (7.7-10.8)	13,107,494	4.2 (3.3-5.4)	6,044,589
Without concurrent asthma diagnosis, nasal steroid or antihistamine usage	6.5 (5.1-8.4)	4,272,883	3.2 (2.3-4.5)	2,081,147
Primary allergic rhinitis	10.7 (8.5-13.4)	7,455,587	4.7 (3.4-6.5) ^b	3,285,764
Without concurrent asthma diagnosis	10.4 (8.2-12.1)	7,088,473	4.7 (3.4-6.5) ^b	3,209,700
Without concurrent asthma diagnosis, nasal steroid or antihistamine usage	6.1 (3.9-9.2)	1,938,405	2.4 (1.2-4.6)	753,062

Abbreviations: 95% CI, 95% confidence interval; NAMCS, National Ambulatory Medical Care Survey; NHAMCS, National Hospital Ambulatory Medical Care Survey.

^aPrimary, secondary, and tertiary.

^bThe seeming percentage duplicates were checked and in fact the same numbers.

diagnosis of AR, an estimated 31,299,969 to 45,396,333 visits were not associated with antihistamine or nasal steroid administration. These data suggest a potential for improvement in medication use, particularly for increasing intranasal steroid or nonsedating antihistamine administration among patients with AR.

Nasal steroids are highly effective for AR, and their anti-inflammatory properties modulate the allergy cascade. Randomized placebo-controlled trials have demonstrated their effectiveness in reducing symptoms of sneezing, itching, rhinorrhea, and congestion in adults and children.²²⁻²⁴ Nasal steroids also improve quality of life^{22,23,25} and sleep.²⁶ The onset of action occurs 3 to 36 hours after the first dose,²⁷⁻³¹ with continuous use more efficacious than intermittent.^{32,33} The evidence supporting the use of oral second-generation/less sedating antihistamines for patients with AR and primary complaints of sneezing and itching is also strong, as supported by multiple controlled trials.³⁴⁻³⁷ Oral second-generation antihistamines may not be as effective as nasal steroids, particularly for nasal obstruction, but they may be adequate for patients with mild to moderate symptoms.⁸ Overall, a plethora of studies support using nasal steroids and antihistamines, but these nationally representative data suggest that they may have remained underutilized.

The AR guideline also recommended against the use of leukotriene receptor antagonists as primary therapy for patients with AR. This recommendation was based on studies demonstrating that leukotriene receptor antagonists are less efficacious than oral antihistamines³⁸ or intranasal steroids.³⁹ However, the guideline did suggest that a subset of patients with both asthma and AR may be an exception who can benefit from leukotriene receptor antagonists. The present data demonstrate that among those with hay fever or allergies and related symptoms who did not have asthma or usage of nasal steroids or oral antihistamines, leukotriene receptor antagonists were administered in 185,317 to 452,328 cases.

A strength of this study is its large sample size: in the NHANES data set, 92.2 million subjects were advised that they had allergies, and the NAMCS/NHAMCS sample encompasses 149.5 million visits for AR diagnoses. However, there

are also limitations. NHANES encompasses patient reports and may thus be limited by individual recall. In addition, the NHANES assessment focuses on prescription medications, so it is unclear whether over-the-counter medications were simultaneously utilized. Oral antihistamines have been increasingly available without a prescription: diphenhydramine (1985), loratadine (2002), cetirizine (2007), and fexofenadine (2011). Nasal steroids became over-the-counter after the study period, so these data are not affected. A limitation of the NAMCS database is its reliance on providers' coding accuracy, an admittedly imperfect process. Furthermore, no diagnostic allergy testing results are available to confirm clinician impressions.

Conclusions

While there is a high prevalence of AR, by patient report (NHANES) and clinician entry (NAMCS/NHAMCS), a minority of affected patients receive antihistamines and nasal steroids.

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Author Contributions

Rachel E. Roditi, draft writing, data presentation, revisions for intellectual content, final approval; **Stacey Ishman**, draft writing, data interpretation, revisions for intellectual content, final approval; **Stella Lee**, draft writing, data presentation, revisions for intellectual content, final approval; **Sandra Lin**, draft writing, data presentation, revisions for intellectual content, final approval; **Jennifer J. Shin**, draft writing, revisions for intellectual content, corresponding author, final approval.

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Supplemental Material

Additional supporting information may be found at <http://otojournal.org/supplemental>.

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Appendix 1 (available online only). Allergens Evaluated, IgE Antibody Allergy Testing, NHANES 2005-2006

	Perennial Allergens	Seasonal Allergens
Age 1 Year and Older	D. Farinae D. Pteronyssinus Cat Dog Cockroach Alternaria	
Age 6 Years and Older	Aspergillus Mouse Rat	Ragweed Rye grass Bermuda grass Oak Birch Thistle