

The prevalence of nasal symptoms attributed to allergies in the United States: Findings from the burden of rhinitis in an America survey

Robert A. Nathan, M.D.,* Eli O. Meltzer, M.D.,# Jennifer Derebery, M.D.,§ Ulka B. Campbell, Ph.D.,¶ Paul E. Stang, Ph.D.,¶ Marlo A. Corrao, M.P.H.,|| Gina Allen, M.P.H.,|| and Richard Stanford, Pharm.D., M.S.||

ABSTRACT

Although the annual prevalence of physician-diagnosed hay fever has been previously reported, the prevalence of allergic rhinitis symptoms in the United States is uncertain. The purpose of this study was to estimate the prevalence of allergic rhinitis symptoms in the United States. A self-administered 10-item screening questionnaire regarding nasal symptoms was sent to representative households in the United States in January 2004. A total of 8708 members (44.3%) reported nasal symptoms on ≥ 7 days in the past 12 months. The majority of these responders described their symptoms as seasonal or perennial allergies ($n = 5944$) compared with cold or flu only ($n = 1841$), cold or flu and vasomotor rhinitis ($n = 175$), or vasomotor rhinitis only ($n = 748$). The prevalence of self-reported seasonal and perennial allergic rhinitis symptoms on ≥ 7 days in the past 12 months was 30.2%, which corresponds to 89.6 million persons in the United States. The prevalence of self-reported physician-diagnosed seasonal or perennial allergic rhinitis with symptoms on ≥ 7 days was 22%, or ~ 65 million persons nationwide. Among responders with a higher burden of nasal symptoms (≥ 30 days), the prevalence of physician-diagnosed hay fever, allergic rhinitis, or nasal allergies was 11.9% of the total population. The prevalence of nasal symptoms attributed to rhinitis related to seasonal and perennial allergies in the United States ranged between 11.9 and 30.2% depending on duration of symptoms and physician diagnosis. Almost one-half of Americans experience troublesome nasal symptoms on at least 7 days throughout the year, with most attributing their symptoms to allergies.

(Allergy Asthma Proc 29:600–608, 2008; doi: 10.2500/aap.2008.29.3179)

Key words: Allergic rhinitis, burden, hay fever, nasal symptoms, perennial allergies, prevalence, questionnaire, seasonal allergies, United States

The nasal and ocular symptoms of rhinitis—inflammation of the nasal mucosa—are familiar and troublesome symptoms experienced by most Americans at some point in their lives. Rhinitis can occur as a result of many factors but is commonly categorized as either allergic or nonallergic rhinitis. Nonallergic rhinitis includes conditions such as acute viral rhinitis, vasomotor rhinitis, hormonal and drug-induced rhinitis, rhinitis medicamentosa, and nonallergic rhinitis with eosinophilia syndrome (e.g., aspirin intolerance, IgE-mediated asthma, and nasal polyps).¹ The disease mechanisms of nonallergic rhinitis are not as well understood as those associated with allergic rhinitis. Al-

lergic rhinitis, a common immunologic IgE-mediated disorder, is characterized mainly by nasal symptoms (i.e., congestion, sneezing, itching, and rhinorrhea) and ocular symptoms associated with either seasonal or perennial allergens. It is the most common chronic condition in the United States and symptoms of allergic rhinitis have been reported to affect the lives of 10–30% of adults and up to 42% of children.^{2–5} However, recent epidemiologic data suggest that the incidence of allergic rhinitis is rising worldwide.^{2,6–13}

In 2005, the Centers for Disease Control and Prevention estimated that 8.5% of U.S. adults and 10.5% of U.S. children reported being told by a doctor or other health care professional that they had hay fever (allergic rhinitis) in the past 12 months.^{14,15} Although the Centers for Disease Control and Prevention estimates the annual prevalence of physician-diagnosed hay fever, the prevalence of allergic rhinitis symptoms in the United States is uncertain and difficult to determine for a number of reasons. Prevalence rates vary widely (from 9 to 42%) depending on the allergic rhinitis case definition and the type of research design employed (e.g., sample selection and data collection methods).¹⁶

From the *Asthma and Allergy Associates, Colorado Springs, Colorado, #Allergy and Asthma Medical Group and Research Center, San Diego, §House Clinic, Los Angeles, California, ¶West Chester University, West Chester, Pennsylvania ||GlaxoSmithKline, Research Triangle Park, North Carolina

Presented at the annual meeting of the American Academy of Allergy, Asthma, and Immunology, Philadelphia, Pennsylvania, March 14–18, 2008

Supported by a research grant from GlaxoSmithKline

Address correspondence and reprint requests to Richard Stanford, Pharm.D., M.S., GlaxoSmithKline, Research Triangle Park, NC 27709

E-mail address: richard.h.stanford@gsk.com

Copyright © 2008, OceanSide Publications, Inc., U.S.A.

Underdiagnosis of allergic rhinitis is of particular concern in estimating true prevalence. Given that only one of eight allergy sufferers in the United States seek treatment for their symptoms, it is not surprising that underdiagnosis, undertreatment, and nonadherence to treatment regimens for allergic rhinitis contribute significantly toward the increased costs associated with the illnesses.^{17,18}

Although allergic rhinitis is not generally associated with severe morbidity and mortality, the disease represents a significant social and economic burden to society and greatly affects allergy sufferers' quality of life.¹⁹ Symptoms of allergic rhinitis typically manifest early in childhood. Complications of allergic rhinitis in the pediatric/adolescent population can be particularly troublesome and may include otitis media with effusion, recurrent and/or chronic sinusitis, asthma, poor sleep, poor school performance, and hyperactivity.²⁰ Approximately 50% of patients with allergic rhinitis experience symptoms 4 months out of the year and 20% are symptomatic 9 months each year.² In 1996, the cost of allergic rhinitis, in terms of direct medical expenditures, exceeded \$3 billion and an additional \$4 billion was attributed to exacerbations of concomitant conditions such as asthma and otitis media.²¹ Over \$6 billion were spent on prescription medications alone in 2000.⁵ Indirect costs associated with allergic rhinitis are also substantial and include 3.5 million lost workdays and 2 million missed school days each year.²² Traumatic injuries in the workplace associated with the use of sedating antihistamines for self-treatment of allergic rhinitis resulted in direct medical costs of \$143 million.²³

In 1993, the prevalence of self-reported allergic rhinitis and self-reported physician-diagnosed allergic rhinitis was ascertained from a survey sent to 15,000 randomly selected households from the National Family Opinion, Inc. (NFO), database, a nationwide panel of 200,000 households.²⁴ The prevalence of self-diagnosed allergic rhinitis, defined as ≥ 7 days of nasal/ocular symptoms in the previous 12 months was estimated to be 31.5%.

This study provides updated data for nasal symptom prevalence from the same large database using the same number of households used in the first study published in 1997. These representative households cover all geographic regions of the United States. Because of the high prevalence, increasing incidence, and health impact of allergic rhinitis, this article focuses on nasal symptoms specifically attributed to allergies by patients in this survey—which may or may not be true allergic rhinitis. Both self-reported nasal symptoms and self-reported physician-diagnosed “allergic rhinitis” were assessed.

METHODS

Sample

In collaboration with the NFO WorldGroup (Toledo, OH), 15,000 households were selected from a representative U.S. sample of households. Given the known prevalence of allergic rhinitis and an expected response rate of $\sim 60\%$, this targeted sample would allow for a large enough sample to study. Panel members were recruited through a variety of sources, including direct mail and referral. Those interested in participating in the panel completed a recruitment survey, which provided demographic information on members. Mean panelist tenure is just over 4 years, and respondents were not compensated for their participation. Information about the gender and ages of all members of the household were obtained so that results could be extrapolated to the general age and gender population strata of the United States.

The general advantage of this study approach is that it can access a large number of people quickly and for a fixed number of questions, addressing key issues in a reasonable amount of time as well as allowing for follow-up questions to be administered. To develop national projections, a common margin weighting methodology called iterative proportional fitting was used. This technique uses an iterative process, which allows for weighting back to census quotas. The final weight for each individual is further adjusted by a projection factor, which is the size of the population divided by the sample. The weighting variables used include geographic division, head of household, age, income, and household size.

Survey

A self-administered 10-item screening questionnaire regarding nasal symptoms was sent to 15,000 households in January 2004 (Appendix). The household member who knew the most about the family's health status (usually the mother) over the prior 12 months was asked to complete the questionnaire for up to three household members.

The presence of nasal symptoms was assessed by first asking how many days in the past 12 months each household member suffered from sneezing, runny nose, itchy nose, or stuffy nose. Respondents (head of households) selected from six response categories, ranging from <7 days to 7–12 months. Respondents were then asked to characterize their nasal symptoms in terms of the most likely cause, including common cold or flu, seasonal allergies, perennial allergies, or exposure to pollution; smoke; strong odors; or changes in the weather (vasomotor rhinitis). Respondents were also asked if each household member had ever been diagnosed by a doctor as having allergic rhinitis, hay

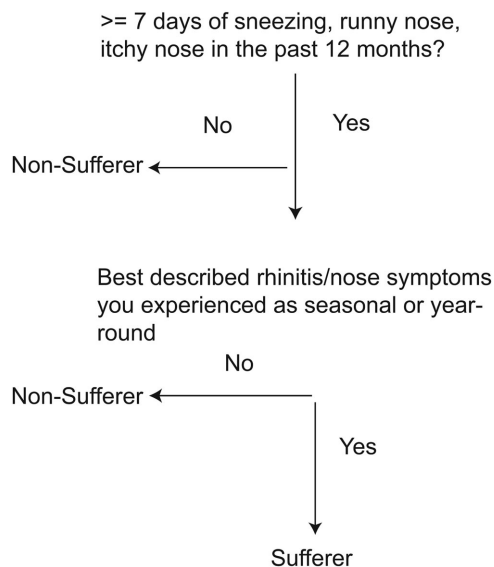


Figure 1. Algorithm of screening questionnaire for allergic rhinitis symptoms.

fever, or nasal allergies to dust, pollen, or household pets.

In this analysis, allergic rhinitis symptoms were defined as having nasal symptoms on ≥ 7 days in the past 12 months and attributing the symptoms to seasonal or perennial allergies (Fig. 1). Diagnosed allergic rhinitis was defined as having allergic rhinitis symptoms and being diagnosed by a doctor with hay fever, allergic rhinitis, or nasal allergies.

Four census regions, which were based on the geographic classifications defined by the U.S. Census Bureau, were used (Northeast, Midwest, South, and West). These census regions were subdivided into nine census divisions.²⁵ The data were stratified by age categories, household income levels, and population density levels based on rural or urban dwellings.

RESULTS

Household Demographics

The demographic characteristics of the total households contacted and households reporting symptomatic persons are listed in Table 1. Of 10,013 households that responded to the survey (66.7%), 4657 households (46.5%) experienced rhinitis symptoms on ≥ 7 days in the past 12 months and 2077 households (20.7%) experienced rhinitis symptoms on ≥ 30 days in the past 12 months.

The demographics of each individual responder and individual responders who reported symptoms on ≥ 7 days in the past 12 months are listed in Table 2. All regions of the continental United States were represented. Slightly more women (53.2%) than men responded to the survey.

Self-Reported Symptom Prevalence

Of 19,678 possible individual responders, 8708 persons (44.3%) reported nasal symptoms on ≥ 7 in the past 12 months. Of these responders, the majority of patients attributed symptoms to seasonal or perennial allergies ($n = 5944$) compared with cold or flu ($n = 1841$), cold and vasomotor rhinitis ($n = 175$), and vasomotor rhinitis ($n = 748$). After extrapolation to the total base population, the prevalence of self-reported seasonal or perennial nasal allergy symptoms on ≥ 7 days in the past 12 months was 30.2%. Census data from 2005 suggest that this corresponds to 89.6 million persons in the United States.²³ Similarly, in Table 3, 3712 persons (18.9%) reported nasal symptoms on ≥ 30 days in the past 12 months, while 15.7% of these individuals also described their symptoms as seasonal or perennial allergies.

Physician-Diagnosed Prevalence Rates

The prevalence of physician-diagnosed hay fever, allergic rhinitis, or nasal allergies as reported by all responders regardless of type of symptoms or duration of symptoms was 30.9% (Table 4). Among responders who experienced at least 7 days of nasal symptoms in the past 12 months, 46.7% were diagnosed with allergic rhinitis, hayfever, or allergy symptoms (Table 5). Approximately 22% of the subjects reported nasal symptoms on ≥ 7 days in the past 12 months and reported a physician-diagnosed seasonal or perennial allergic rhinitis. When extrapolated to the total base population, this figure corresponds to ~65 million persons nationwide. In addition, 11.9% of subjects reported nasal symptoms (>30 days in the past 12 months), and reported a physician-diagnosed hay fever, allergic rhinitis, or nasal allergies.

Prevalence rates for self-reported and physician-diagnosed seasonal and perennial allergies were higher in the Midwest and the South. However, neither urban/rural location nor household income appeared to influence prevalence.

DISCUSSION

Results from this study indicate that in the United States, the nationwide prevalence of self-reported nasal symptoms on ≥ 7 days attributed to seasonal or perennial allergies in 2004 was 30.2%. In addition, the prevalence of self-reported physician-diagnosed hay fever, nasal allergies, or allergic rhinitis in patients that reported nasal symptoms on ≥ 7 days was 22%. The prevalence of self-reported seasonal or perennial allergy symptoms that lasted >30 days was 15.7%, suggesting that a substantial portion of the population may suffer with chronic rhinitis symptoms. The prevalence of self-reported physician-diagnosed hay fever,

Table 1 Comparison of total households contacted with households reporting symptomatic persons

Variable	No. of Households (%)	No. of Households with Symptomatic Persons, >7 days (%)	No. of Households with Symptomatic Persons, >30 days (%)
Total	10,013 (100%)	4657 (100%)	2077 (100%)
Head of household age (yr)			
<30	665 (6.6%)	325 (7%)	125 (6%)
30–39	1451 (14.5%)	725 (15.6%)	316 (15.2%)
40–49	1777 (17.7%)	864 (18.6%)	392 (18.9%)
50–59	1399 (14%)	618 (13.3%)	288 (13.9%)
≥60	1476 (14.7%)	627 (13.5%)	274 (13.2%)
Single, under 35 yr	477 (4.8%)	248 (5.3%)	106 (5.1%)
Single, ≥35 yr	2768 (27.6%)	1250 (26.8%)	576 (27.7%)
Annual household income			
<\$22,500	2376 (23.7%)	1137 (24.4%)	538 (25.9%)
\$22,500–39,999	2019 (20.2%)	960 (20.6%)	438 (21.1%)
\$40,000–59,999	1778 (17.8%)	848 (18.2%)	364 (17.5%)
\$60,000–89,999	1877 (18.7%)	842 (18.1%)	363 (17.5%)
>\$90,000	1963 (19.6%)	870 (18.7%)	374 (18%)
Household size (no. persons)			
1	2762 (27.6%)	1251 (26.9%)	569 (27.4%)
2	3567 (35.6%)	1651 (35.5%)	737 (35.5%)
3	1534 (15.3%)	718 (15.4%)	313 (15.1%)
4	1306 (13%)	626 (13.4%)	287 (13.8%)
≥5	844 (8.4%)	411 (8.8%)	171 (8.2%)
Region			
Northeast			
New England	552 (5.5%)	251 (5.4%)	102 (4.9%)
Middle Atlantic	1376 (13.7%)	598 (12.8%)	272 (13.1%)
Midwest			
East North Central	1721 (17.2%)	793 (17%)	364 (17.5%)
West North Central	722 (7.2%)	367 (7.9%)	179 (8.6%)
South			
South Atlantic	1906 (19%)	838 (18%)	364 (17.5%)
East South Central	621 (6.2%)	318 (6.8%)	129 (6.2%)
West South Central	1046 (10.4%)	520 (11.2%)	246 (11.8%)
West			
Mountain	634 (6.3%)	331 (7.1%)	150 (7.2%)
Pacific	1435 (14.3%)	641 (13.8%)	271 (13%)

nasal allergies, or allergic rhinitis in patients that noted symptoms that lasted >30 days was 11.9%.

The gap between the percentage of individuals who have any nasal symptoms for ≥7 days of the year that are attributed to seasonal or perennial allergies (30.2%) and those who were diagnosed by a physician as having allergic rhinitis (22%) indicates a large number of individuals who remain potentially undiagnosed. Self-reported physician-diagnosed prevalence of allergic rhinitis tends to be lower than self-reported symptom prevalence because of the high numbers of individuals who self-treat with over-the-counter products and never seek medical attention (~88%).^{17,18} Many of

these individuals remain undiagnosed because they may not understand the nature of allergic rhinitis, the consequences of untreated illness (*i.e.*, respiratory complications, loss of productivity, and reduced health-related quality of life), and the potential benefits of treatment.

These allergic rhinitis nasal symptom and physician-diagnosed allergic rhinitis prevalence estimates update and extend the findings from the first NFO study from 1993 that reported prevalence using a similar questionnaire.²⁴ In that study, 31.5 and 17.7% of responders reported ≥7 days or ≥31 days of nasal symptoms in the past 12 months, respectively. In 1993, the preva-

Table 2 Responders: Distribution of total and symptomatic persons (≥ 7 days of symptoms in past 12 months)

Variable	Total Persons	Cold or Flu	Seasonal/Perennial Allergies	Cold and Vasomotor Rhinitis	Vasomotor Rhinitis
Total	19,678 (100%)	1841 (100%)	5944 (100%)	175 (100%)	748 (100%)
Gender					
Male	9209 (46.8%)	922 (50.1%)	2505 (42.1%)	78 (44.6%)	318 (42.5%)
Female	10,469 (53.2%)	919 (49.9%)	3439 (57.9%)	97 (55.4%)	430 (57.5%)
Age (yr)					
≤ 17	2260 (11.5%)	315 (17.1%)	707 (11.9%)	18 (10.3%)	84 (11.2%)
18–34	3400 (17.3%)	382 (20.7%)	1100 (18.5%)	24 (13.7%)	129 (17.2%)
35–49	5382 (27.4%)	509 (27.6%)	1729 (29.1%)	52 (29.7%)	192 (25.7%)
50–64	4928 (25%)	383 (20.8%)	1510 (25.4%)	53 (30.3%)	186 (24.9%)
≥ 65	3708 (18.8%)	252 (13.7%)	898 (15.1%)	28 (16%)	157 (21%)

Table 3 Responders: Distribution of total and symptomatic persons (≥ 30 days of symptoms in past 12 months)

Variable	Total Persons	Cold or Flu	Seasonal/Perennial Allergies	Cold and Vasomotor Rhinitis	Vasomotor Rhinitis
Total	19,678 (100%)	296 (100%)	3099 (100%)	37 (100%)	280 (100%)
Gender					
Male	9209 (46.8%)	151 (51%)	1283 (41.4%)	12 (32.4%)	119 (42.5%)
Female	10,469 (53.2%)	145 (49%)	1816 (58.6%)	25 (67.6%)	161 (57.5%)
Age (yr)					
≤ 17	2260 (11.5%)	44 (14.9%)	368 (11.9%)	3 (8.1%)	31 (11.1%)
18–34	3400 (17.3%)	64 (21.6%)	548 (17.7%)	5 (13.5%)	53 (18.9%)
35–49	5382 (27.4%)	82 (27.7%)	923 (29.8%)	12 (32.4%)	67 (23.9%)
50–64	4928 (25%)	65 (22%)	785 (25.3%)	10 (27%)	67 (23.9%)
≥ 65	3708 (18.8%)	41 (13.9%)	475 (15.3%)	7 (18.9%)	62 (22.1%)

lence of self-reported physician-diagnosed seasonal allergic rhinitis alone and seasonal plus perennial rhinitis was 8.2 and 14.2%, respectively. Because questions regarding nasal symptoms were slightly different between the two surveys and different definitions were implemented in 2004, it is very difficult to directly compare these prevalence numbers. However, using the ≥ 7 -day symptom criteria, self-reported physician diagnosis of hay fever and self-reported allergic rhinitis, the point prevalence was 14.5% in 1993 and 22% in 2004.

These differences were not unexpected because prevalence rates for allergic rhinitis vary widely from study to study.²⁶ Nonstandardization of inclusion and exclusion criteria to identify patients with allergic rhinitis is probably the most important explanation for large differences in these studies. However, a wide range in prevalence rates occurred worldwide even when using a standardized, validated questionnaire. The International Study of Asthma and Allergies in Childhood (ISAAC) project utilized such a questionnaire in 280

centers and 106 countries and standardized methods for determining prevalence of asthma, allergic rhinoconjunctivitis, and atopic eczema in children.²⁶ Self-reported allergic rhinitis in the ISAAC studies ranged from 6.1% in Spain to 31.7% in Brazil.^{4,11,27–30} Self-reported physician-diagnosed allergic rhinitis in the ISAAC studies ranged from 7.9% in Turkey to 17.2% in Hong Kong.^{12,31–33} In an earlier non-ISAAC study in the United States, a much higher physician-diagnosed allergic rhinitis prevalence rate of 42% was noted by parents of 747 6-year old children.³ More recently, the prevalence of physician-diagnosed allergic rhinitis obtained from physician visit ICD-9 codes in Manitoba residents between 1985 and 1998 was 14%.³⁴

Another explanation for higher prevalence rates in the current study is that the prevalence of allergic rhinitis worldwide may be on the rise.^{18,35,36} In a cross-sectional ISAAC survey of 193,404 children aged 6–7 years in 37 countries and 304,679 children aged 13–14 years in 56 countries, increases in prevalence were twice as common as decreases in the prevalence of

Table 4 Prevalence of physician-diagnosed symptoms (no restriction on duration of symptoms or symptoms) within the cohort

Variable	Physician-Diagnosed (Yes)
Total (of 18,800 yes/no responses)	5817 (30.9%)
Gender	
Male	2370 (27%)
Female	3447 (34.4%)
Age (yr)	
≤17	2176 (30.1%)
18–34	3272 (32.9%)
35–49	5180 (33.8%)
50–64	4698 (32.1%)
≥65	3474 (23.9%)

"Yes" responses to screening question 4 (Ever been diagnosed by a doctor with allergic rhinitis, hay fever, or allergy symptoms?). Total Yes/no/missing responses (n = 19,678). Total yes/no responses (n = 18,800).

allergic disorders (including allergic rhinoconjunctivitis).⁹ In Norway, the prevalence of allergic rhinoconjunctivitis in 7079 children 9–11 years of age rose from 16.5% in 1985 to 29.6% in 2000.¹¹ The prevalence of rhinoconjunctivitis in 8066 children aged 6–7 years in Hong Kong rose from 13.6% in 1995 to 17.2% in 2001.¹² In Danish children 7–17 years of age, the prevalence of rhinitis (including nonallergic rhinitis), which was confirmed by symptoms and skin test reactivity, increased almost twofold from 11.8% in 1986 to 23.3% in 2001.⁸ Children aged 13–14 years old in Taiwan (n = 6381) had the greatest increase in prevalence of allergic rhinitis (51%) over a 7-year period before 2002.¹⁰

Allergic rhinitis is a disease that has been thought to peak in childhood and adolescence with its mean onset of 8–11 years of age and its usual development by the age of 20 years. However, at least one study indicates that the disease may be more prevalent in older individuals. In a 23-year follow-up study of 738 former Brown University students, the prevalence of allergic rhinitis increased by 10% from age 18 years to age 40 years.³⁷ These data mirror the results in the current study in which prevalence rates peaked in the 35- to 49-year age group and sharply declined in individuals >65 years of age. The increased prevalence of atopy (specific IgE sensitivity), particularly in the >20-year age group, corroborate these findings.^{38,39} In the National Health and Nutrition Examination Surveys (NHANES) III administered from 1976 to 1980 and from 1988 to 1994 in the United States, male individuals 20–29 years of age were more likely to have a positive skin test to one or more common allergens

than other age groups.³⁹ Over one-half of the U.S. population was estimated to have positive skin tests (54.3%), an estimate that was 2.1–5.5 times higher than those reported in NHANES II (1976–1980). The increased prevalence in positive skin tests supports the increased prevalence in allergic rhinitis observed in this study and reported by many investigators around the world.

In this study, a large majority of symptomatic responders (≥7 days) with self-reported allergic rhinitis were women (57.9%). Data from the National Health Interview Survey, which suggest a higher prevalence of hay fever in women, support this finding. In contrast, men were equally as likely as women to have symptoms in the 1993 NFO study.

Prevalence rates of allergic rhinitis by region tended to be higher in the South Atlantic region followed by the East North Central, Pacific, and Middle Atlantic regions. A higher prevalence of allergic rhinitis in more urban versus rural areas as noted in this study has also been identified as a risk factor for acquiring the disease by other researchers.⁴⁰ Although many studies have shown an association between allergic rhinitis symptoms/allergen sensitivity and low socioeconomic status, the prevalence of allergic rhinitis in this study was not related to socioeconomic status as measured by household.^{41–44}

As expected with prevalence studies of this type, there are many limitations that prevent accurate representation and interpretation of these results. The NFO database tries to provide a representative sample with regard to age, household income, geographic region, and population density, of the U.S. population. However, the population in this survey is slightly different from the NHANES population. Similar to NHANES, the questions used to determine nasal symptoms and allergic rhinitis prevalence in this study are not validated and rely strictly on patient recall and understanding level of what is being asked. This is further complicated by the head of household answering as proxy for other members of the family. In addition, the diagnosis of allergic rhinitis was unable to be verified by medical records or skin tests and may overestimate the true prevalence of allergic rhinitis. Other data that were also not collected and may have confounded the results of this study include history of infection, antibiotic use, allergy treatment, and migration history. Whether nasal symptoms truly reflect an allergic mechanism as described by patients or by self-report of physician diagnosis is less than certain. Self-reported physician diagnosis of allergies is not clearly defined and may or may not reflect appropriate physician diagnostic evaluations. Ongoing initiatives to provide standardized diagnostic criteria across studies (e.g., the ISAAC project) will provide more accurate and meaningful results in future studies.

Table 5 Prevalence of physician-diagnosis and ≥ 7 days of symptoms in the past 12 months

Variable	Symptoms for ≥ 7 Days	Physician Diagnosed (Yes)	Physician Diagnosed (No)
Total	9301 (100%)	4344 (46.7%)	4857 (52.2%)
Gender			
Male	4080 (43.9%)	1733 (39.9%)	2347 (48.3%)
Female	5121 (55.1%)	2611 (60.1%)	2510 (51.7%)
Age (yr)			
≤ 17	1164 (12.5%)	526 (12.1%)	638 (13.1%)
18–34	1691 (18.2%)	817 (18.8%)	874 (18%)
35–49	2583 (27.8%)	1291 (29.7%)	1292 (26.6%)
50–64	2247 (24.2%)	1105 (25.4%)	1142 (23.5%)
≥ 65	1516 (16.3%)	605 (13.9%)	911 (18.8%)

Yes/no responses to screening question 4 (Ever been diagnosed by a doctor with allergic rhinitis, hay fever, or allergy symptoms?).

In summary, the prevalence of allergic rhinitis in the United States, as defined by self-report of seasonal or perennial allergies with ≥ 7 days of nasal symptoms in the past 12 months was 30.2%. In addition, 22% of these individuals had symptoms reported as allergic and self-reported a physician diagnosis of allergic rhinitis. These data suggest that a large number of Americans suffer with allergic rhinitis symptoms but may remain underdiagnosed and subsequently undertreated. Similar to prevalence rates worldwide, the prevalence of symptoms associated with allergic rhinitis in the United States may have increased in the past 10 years.

ACKNOWLEDGMENTS

The authors acknowledge editorial assistance in article preparation provided by Kim Poinsett-Holmes, Pharm.D. (Poinsett Publications, Inc).

REFERENCES

- Quillen DM. Diagnosing rhinitis: Allergic vs. nonallergic. *Am Fam Physician* 73:1583–1590, 2006.
- Berger WE. Overview of allergic rhinitis. *Ann Allergy Asthma Immunol* 90(suppl 3):7–12, 2003.
- Wright AL, Holberg CJ, Martinez FD, et al. Epidemiology of physician-diagnosed allergic rhinitis in childhood. *Pediatrics*. 94:895–901, 1994.
- Kabir ML, Rahman F, Hassan MQ, et al. Asthma, atopic eczema and allergic rhino-conjunctivitis in school children. *Myensingh Med J* 14:41–45, 2005.
- Stempel DA, and Woolf R. The cost of treating allergic rhinitis. *Curr Allergy Asthma Rep* 2:223–230, 2002.
- Bellanti JA, and Wallerstedt DB. Allergic rhinitis update: Epidemiology and natural history. *Allergy Asthma Proc* 21:367–370, 2000.
- Schoenwetter WF. Allergic rhinitis: Epidemiology and natural history. *Allergy Asthma Proc* 21:1–6, 2000.
- Hakansson K, Thomsen SF, Ulrik CS, et al. Increase in the prevalence of rhinitis among Danish children from 1986 to 2001. *Pediatr Allergy Immunol* 18:154–159, 2007.
- Asher MI, Montefort S, Björkstén B, et al. Worldwide time trends in the prevalence of symptoms of asthma, allergic rhinoconjunctivitis, and eczema in childhood: ISAAC phases one and three repeat multicountry cross-sectional surveys. *Lancet* 368:733–743, 2006.
- Yan DC, Ou LS, Tsai TL, et al. Prevalence and severity of symptoms of asthma, rhinitis, and eczema in 13- to 14- year old children in Taipei, Taiwan. *Ann Allergy Asthma Immunol* 95: 579–585, 2005.
- Selnes A, Nystad W, Bolle R, and Lund E. Diverging prevalence trends of atopic disorders in Norwegian children. Results from three cross-sectional studies. *Allergy* 60:894–899, 2005.
- Lee SL, Wong W, and Lau YL. Increasing prevalence of allergic rhinitis but not asthma among children in Hong Kong from 1995 to 2001 (Phase 3 International Study of Asthma and Allergies in Childhood). *Pediatr Allergy Immunol* 15:72–78, 2004.
- Verlato G, Corsico A, Villani S, et al. Is the prevalence of adult asthma and allergic rhinitis still increasing? Results from an Italian study. *J Allergy Clin Immunol* 111:1232–1238, 2003.
- Pleis JR, and Lethbridge-Cejku M. Summary health statistics for U.S. adults: National Health Interview Survey, 2005. *Vital Health Stat* 10 232:1–153, 2006.
- Bloom B, Dey AN, and Freeman G. Summary health statistics for U.S. children: National Health Interview Survey, 2005. *Vital Health Stat* 10 231:1–84, 2006.
- Settipane RA, and Charnock DR. Epidemiology of rhinitis: Allergic and nonallergic. *Clin Allergy Immunol* 19:23–32, 2007.
- Malone DC, Lawson KA, Smith DH, et al. A cost of illness study of allergic rhinitis in the United States. *J Allergy Clin Immunol* 99:22–27, 1997.
- Schoenwetter WF, Dupclay L, Appajosyula S, et al. Economic impact and quality of life burden of allergic rhinitis. *Curr Med Res Opin* 20:305–317, 2004.
- Nathan RA. The burden of allergic rhinitis. *Allergy Asthma Proc* 28:3–9, 2007.
- Blaiss MS. Pediatric allergic rhinitis: Physical and mental complications. *Allergy Asthma Proc* 29:1–6, 2008.
- Nash DB, Sullivan SD, and Mackowiak J. Optimizing quality of care and cost effectiveness in treating allergic rhinitis in a managed care setting. *Am J Manag Care* 6(suppl 1):S3–S15, 2000.
- Kay GG. The effects of antihistamines on cognition and performance. *J Allergy Clin Immunol* 105:S622–S627, 2000.
- Hanrahan LP, and Paramour LC. Aeroallergens, allergic rhinitis, and sedating antihistamines: Risk factors for traumatic occupational injury and economic impact. *Am J Ind Med* 44:438–446, 2003.
- Nathan RA, Meltzer EO, Selner JC, and Storms W. Prevalence of allergic rhinitis in the United States. *J Allergy Clin Immunol* 99:S808–S814, 1997.

25. U.S. Census Bureau, Statistical Abstract of the United States: 2007, 126th ed. Washington, D.C., 2006. Available online at www.census.gov/compendia/statab/overview.html; last accessed June 13, 2007.
26. Ellwood P, Asher MI, Beasley R, et al. ISAAC Steering Committee. The international study of asthma and allergies in childhood (ISAAC): Phase three rationale and methods. *Int J Tuberc Lung Dis* 9:10–16, 2005.
27. Akçakaya N, Kulak K, Hassanzadeh A, et al. Prevalence of bronchial asthma and allergic rhinitis in Istanbul school children. *Eur J Epidemiol* 16:693–699, 2000.
28. Carvalho N, Fernández-Benítez M, Cascante L, et al. International study of asthma and allergies in childhood. Results on rhinitis of first phase in Pamplona, Spain. *Allergol Immunopathol (Madr)* 28:207–212, 2000.
29. Vanna AT, Yamada E, Arruda LK, et al. International study of asthma and allergies in childhood: Validation of the rhinitis symptom questionnaire and prevalence of rhinitis in schoolchildren in São Paulo, Brazil. *Pediatr Allergy Immunol* 12:95–101, 2001.
30. Asher MI, Barry D, Clayton T, et al. The burden of symptoms of asthma, allergic rhinoconjunctivitis and atopic eczema in children and adolescents in six New Zealand centres: ISAAC Phase One. *NZ Med J* 114:114–120, 2001.
31. Tamay Z, Akcay A, Ones U, et al. Prevalence and risk factors for allergic rhinitis in primary school children. *Int J Pediatr Otorhinolaryngol* 71:463–471, 2007.
32. Karaman O, Turgut CS, Uzuner N, et al. The determination of asthma, rhinitis, eczema, and atopy prevalence in 9- to 11-year old children in the city of Izmir. *Allergy Asthma Proc* 27:319–324, 2006.
33. Georgiev V, Fahim HI, El-Gaafary M, and Walters S. Prevalence and socioeconomic associations of asthma and allergic rhinitis in northern Africa. *Eur Respir J* 28:756–762, 2006.
34. Dik N, Anthonisen NR, Manfreda J, and Roos LL. Physician-diagnosed asthma and allergic rhinitis in Manitoba: 1985–1998. *Ann Allergy Asthma Immunol* 96:69–75, 2006.
35. Sly RM. Changing prevalence of allergic rhinitis and asthma. *Ann Allergy Asthma Immunol* 82:233–248, 1999.
36. The International Study of Asthma and Allergies in Childhood (ISAAC) Steering Committee. Worldwide variation in prevalence of symptoms of asthma, allergic rhinoconjunctivitis, and atopic eczema: ISAAC. *Lancet* 351:1225–1232, 1998.
37. Greisner WA, Settipane RJ, and Settipane GA. Natural history of hay fever: A 23-year follow-up of college students. *Allergy Asthma Proc* 19:271–275, 1998.
38. Linneberg A, Jørgensen T, Nielsen NH, et al. The prevalence of skin-test-positive allergic rhinitis in Danish adults: Two cross-sectional surveys 8 years apart. The Copenhagen Allergy Study. *Allergy* 55:767–772, 2000.
39. Arbes SJ, Gergen PJ, Elliott L, and Zeldin DC. Prevalences of positive skin test responses to 10 common allergens in the U.S. population: Results from the third national Health and Nutrition Examination Survey. *J Allergy Clin Immunol* 116:377–383, 2005.
40. Braun-Fahrlander C, Gassner M, Grize L, et al. Prevalence of hay fever and allergic sensitization in farmer's children and their peers living in the same rural community. SCARPOL team. Swiss Study on Childhood Allergy and Respiratory Symptoms with respect to Air Pollution. *Clin Exp Allergy* 29:28–34, 1999.
41. Bråbäck L, Hjertqvist A, and Rasmussen F. Social class in asthma and allergic rhinitis: A national cohort study over three decades. *Eur Respir J* 26:1064–1068, 2005.
42. Almqvist C, Pershagen G, and Wickman M. Low socioeconomic status as a risk factor for asthma, rhinitis and sensitization at 4 years in a birth cohort. *Clin Exp Allergy* 35:612–618, 2005.
43. Chen JT, Krieger N, Van Den Eeden SK, and Quesenberry CP. Different slopes for different folks: Socioeconomic and racial/ethnic disparities in asthma and hay fever among 173,859 U.S. men and women. *Environ Health Perspect* 110(suppl 2):211–216, 2002.
44. Lewis SA, Weiss ST, Platts-Mills TA, et al. Association of specific allergen sensitization with socioeconomic factors and allergic disease in a population of Boston women. *J Allergy Clin Immunol* 107:615–622, 2001. □

APPENDIX I

☐ ANSWER THIS SIDE FIRST 57807 ☐

Answer for up to 3

household members:

HH Member

#1 #2 #3

1. Indicate age: 1 ☐ 2 ☐ 3 ☐
2. Indicate sex: Male 1 ☐ 2 ☐ 3 ☐
Female 1 ☐ 2 ☐ 3 ☐

3. In the past 12 months, how many days did this person in your household suffer from sneezing, runny nose, itchy nose or stuffy nose and DID NOT have a cold or the flu? (X ONE For EACH Household Member)

- Less than 7 days 1 ☐ 2 ☐ 3 ☐
7 to 14 days 1 ☐ 2 ☐ 3 ☐
15 to 30 days 1 ☐ 2 ☐ 3 ☐
1 to 3 months 1 ☐ 2 ☐ 3 ☐
4 to 6 months 1 ☐ 2 ☐ 3 ☐
7 to 12 months 1 ☐ 2 ☐ 3 ☐

4. Has this person ever been diagnosed by a doctor as having allergic rhinitis, hay fever or nasal allergies to dust, pollen or household pets?

- Yes 1 ☐ 2 ☐ 3 ☐
No 1 ☐ 2 ☐ 3 ☐

5. In the past 12 months, which of the following best describes the group of rhinitis/nose symptoms (sneezing, runny nose, itchy nose or stuffy nose) this person experienced? (X ONE For EACH Household Member)

- Common cold or flu 1 ☐ 2 ☐ 3 ☐
Seasonal allergies (i.e., hay fever) during the spring or fall 1 ☐ 2 ☐ 3 ☐
An allergy they have year round ... 1 ☐ 2 ☐ 3 ☐
Nasal symptoms only when exposed to pollution, smoke, strong odors or changes in the weather 1 ☐ 2 ☐ 3 ☐
None of the above 1 ☐ 2 ☐ 3 ☐

6. In the past 12 months, have these rhinitis/nose symptoms (sneezing, runny nose, itchy nose or stuffy nose) been accompanied by sleep disturbance?

- Yes 1 ☐ 2 ☐ 3 ☐
No 1 ☐ 2 ☐ 3 ☐

CONTINUE →

☐ ANSWER OTHER SIDE FIRST 57807 ☐

Continue to answer for same HH members as Side 1:

7. In the past 12 months, how much have these rhinitis/nose symptoms (sneezing, runny nose, itchy nose or stuffy nose) interfered with daytime activities, such as school and/or work and/or leisure, and/or sport? (X ONE For EACH Household Member)

HH Member

#1 #2 #3

- Not at all 1 ☐ 2 ☐ 3 ☐
A little 1 ☐ 2 ☐ 3 ☐
A moderate amount 1 ☐ 2 ☐ 3 ☐
A lot 1 ☐ 2 ☐ 3 ☐

8. In the past 12 months, did this person take any of the following medications for their rhinitis/nose symptoms (sneezing, runny nose, itchy nose or stuffy nose)? (X All That Apply For EACH Household Member)

- Prescription medication (prescribed by a doctor) 1 ☐ 2 ☐ 3 ☐
Over-the-counter medication (purchased at a pharmacy or grocery store) 1 ☐ 2 ☐ 3 ☐
Herbal medication 1 ☐ 2 ☐ 3 ☐
Immunotherapy (allergy shots or injections) 1 ☐ 2 ☐ 3 ☐

9. How old was this person when they first began to experience rhinitis/nose symptoms (sneezing, runny nose, itchy nose or stuffy nose)? (X ONE For EACH Household Member)

- Less than 4 years 1 ☐ 2 ☐ 3 ☐
4 to 12 1 ☐ 2 ☐ 3 ☐
13 to 17 1 ☐ 2 ☐ 3 ☐
18 to 44 1 ☐ 2 ☐ 3 ☐
45 to 64 1 ☐ 2 ☐ 3 ☐
65 + ... 1 ☐ 2 ☐ 3 ☐

10. Has a member of this person's biological family (parents, siblings, children) ever been diagnosed by a doctor as having allergic rhinitis, hay fever or nasal allergies to dust, pollen or household pets?

- Yes 1 ☐ 2 ☐ 3 ☐
No 1 ☐ 2 ☐ 3 ☐

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.