Additional Disease Burden From Hay Fever and Sinusitis Accompanying Asthma

Neil Bhattacharyya, MD; Lynn J. Kepnes, ANP

Objectives: We sought to determine the additional disease burden imparted by sinusitis and hay fever (allergic rhinitis) to patients with asthma.

Methods: Patients with a diagnosis of asthma, hay fever, or sinusitis were extracted from the National Health Interview Survey for the 1997 to 2006 adult sample. Disease groups consisting of patients with asthma alone, asthma + hay fever, asthma + sinusitis, and asthma + hay fever + sinusitis were assembled. Disease groups were then compared according to total health-care visits per year, emergency room visits per year, health-care spending per year, and number of workdays lost per year to determine the disease burden.

Results: We identified 11,813 patients (mean age, 45.5 years) who reported active asthma with or without hay fever or sinusitis comorbidity. Of these, 5,931 patients (50%) were identified with asthma alone, 1,134 (10%) with combined asthma + hay fever, 2,461 (21%) with asthma + sinusitis, and 2,287 (19%) with combined asthma + hay fever + sinusitis. Patients with asthma + sinusitis and those with asthma + sinusitis + hay fever had more total health-care visits and emergency room visits than did those with asthma alone (p < 0.001). All three groups with comorbidities had higher health-care expenditures than did the group with asthma alone (p < 0.002). Patients with asthma + sinusitis and those with asthma + hay fever + sinusitis missed more workdays than did patients in the group with asthma alone (10.0 and 13.1 versus 7.2, respectively; p < 0.001). Comorbid hay fever alone did not increase workdays lost (6.6 days; p = 0.983).

Conclusions: The additional disease burden of sinusitis on asthma is greater than that of hay fever. These data highlight the importance of identifying comorbid diagnoses with asthma.

Key Words: asthma, disease burden, hay fever, sinusitis.

INTRODUCTION

Asthma, hay fever, and sinusitis are among the most common respiratory tract ailments in the United States. Hay fever or allergic rhinitis affects approximately 36 million Americans, with substantial direct and indirect costs to the health care system.1 Approximately 20 million cases of acute bacterial rhinosinusitis occur annually in the United States, and chronic rhinosinusitis exhibits a lifetime prevalence of 14% to 16% in the US population.2-5 Asthma is thought to affect nearly 5.5% of the US population and results in estimated direct and indirect costs of $13.8 billion per year.6 Solely from an epidemiological standpoint, combinations of these three conditions may coexist in a substantial fraction of the US population.

More recently, substantial interest and evidence have surfaced regarding interactions between the upper and lower airways, described commonly as the unified airway hypothesis.7 In this model, complex interactions may occur between the upper airways and the lower airways, resulting in exacerbations of sinusitis, allergic rhinitis, and asthma that may be more severe and more refractory than exacerbations that occur without simultaneous upper airway and lower airway disease.8 Alternatively, the same inflammatory disease process may simultaneously affect both the upper and lower airways. Importantly, the associations and interactions between the upper and lower airways have been primarily studied in referral and specialty clinic populations, which may be subject to selection bias clouding the true rate of comorbidity.9

This study was undertaken to determine 1) the prevalence of upper airway disease comorbidities in patients with asthma on a large scale and 2) the additional health-care disease burden imparted by rhinitis and sinusitis on asthma. Such information would help us to epidemiologically validate on a larger scale the interactions between the upper and lower airways in asthma and would highlight the unified airway as an important respiratory disease construct.

From the Division of Otolaryngology, Brigham and Women’s Hospital (both authors), and the Department of Otology and Laryngology, Harvard Medical School (Bhattacharyya), Boston, Massachusetts.

Correspondence: Neil Bhattacharyya, MD, Division of Otolaryngology, 45 Francis St, Boston, MA 02115.
METHODS

The National Health Interview Survey, as aggregated in the Integrated Health Interview Series for the calendar years 1997 to 2006, served as the data source for the study population. Because this is a completely de-identified data set, Institutional Review Board approval was not required for this study, and this study was conducted in compliance with the Health Insurance Portability and Accountability Act. From the integrated data files, the following variables were extracted for each case, restricted to the adult population (at least 18 years of age). The demographic variables extracted included survey year, sample weight, sample adult flag, age, and sex. The condition variables extracted included “told by health care provider had hay fever, past 12 months,” “told by health care provider had sinusitis, past 12 months,” and “had asthma attack/episode, past 12 months.” Health-care disease burden variables extracted for each case included total health-care visits per year, emergency room visits per year, health-care spending per year, and number of workdays lost per year. The term “sinusitis” is used herein, as the survey method does not distinguish between acute sinusitis and chronic rhinosinusitis.

Data were imported into and combined in SPSS version 17.0 and then cross-checked for accuracy. Four patient groupings were assembled on the basis of disease conditions: 1) patients with active asthma alone, as indicated by 1 or more asthma attacks or episodes over the past 12 months, 2) patients with combined asthma and hay fever, both in the past 12 months, 3) patients with combined asthma and sinusitis in the past 12 months, and 4) patients with combined asthma, hay fever, and sinusitis in the past 12 months.

Total health-care visits per year and emergency room visits per year were compared across the 4 disease groups with the \( \chi^2 \) test to determine whether significant variability in health-care utilization occurred according to comorbid conditions. Total health-care spending was similarly compared across patient groupings. Finally, the number of workdays lost per year was compared across patient groupings with an analysis of variance with Dunnett’s T3 for post hoc testing. Because the National Health Interview Survey is a complex sample, analyses were conducted with adjustment for stratification, clustering, and sample weights with the SPSS complex samples algorithm. Statistical significance was set at a \( p \) level of less than 0.05.

RESULTS

For the calendar years 1997 to 2006, a total of 11,813 adult patients were identified who reported in the prior 12 months active asthma alone or asthma in combination with hay fever and/or sinusitis. The mean patient age was 45.5 years. The distribution of patients according to disease group is represented in Fig 1. Asthma alone was the most common diagnosis in isolation, whereas asthma + sinusitis was the most common combined diagnosis (21%). Overall, concurrent asthma and sinusitis was more common than concurrent hay fever with sinusitis.

The distribution of emergency room visits over the previous 12 months according to disease group is represented in Fig 2. Patients with asthma + hay fever actually had slightly lower emergency room visitation rates than did those with asthma alone (\( p > 0.05 \)). In contrast, patients with asthma + sinusitis had statistically significantly higher emergency room visitation rates than did those with asthma alone (\( p < 0.001 \)) and those with asthma + hay fever (\( p < 0.001 \)). Patients with all three diagnoses (asthma + hay fever + sinusitis) had higher utilization rates than did those with asthma + hay fever (\( p <
Fig 3. Total number of physician visits over past 12 months according to disease group.

0.001), but did not have higher utilization rates than those with asthma alone or asthma + sinusitis (p > 0.05).

The distribution of total health-care visits over the past 12 months according to disease group is represented in Fig 3. Compared to the asthma-alone group, all three of the asthma + comorbidity groups had higher total health-care visitation rates (all p < 0.02). However, the additional visitation rates for patients with sinusitis as one of the comorbidities (ie, asthma + sinusitis or asthma + hay fever + sinusitis) was significantly greater than the additional visitation rate for those with asthma + hay fever.

The distribution of household health-care expenditures per year is represented in Fig 4. Patients with asthma + hay fever, asthma + sinusitis, and asthma + hay fever + sinusitis all had statistically significant increases in health-care expenditures per year as compared to patients with asthma alone (all p ≤ 0.002). However, patients with asthma + sinusitis and asthma + sinusitis + hay fever had still greater additional health-care expenditures, ie, statistically significantly greater than those in the group with asthma + hay fever (all p ≤ 0.003).

The differences in the number of workdays lost according to disease group are graphically presented in Fig 5. A statistically significant difference in workdays lost was noted among groups (p < 0.001, analysis of variance). Patients with asthma alone lost an average of 7.2 workdays. Post hoc testing indicated that 2 disease groups, asthma + sinusitis (workdays lost, 10.0) and asthma + hay fever + sinusitis (13.1 days), both manifested statistically significant elevations in the number of workdays lost (all p < 0.003). With respect to asthma, comorbid hay fever did not increase workdays lost compared to asthma alone (6.6 days; p = 0.983).

DISCUSSION

Although asthma, hay fever, and sinusitis are extremely common respiratory conditions in the United States, the interaction between these airway diseases has only recently gained attention. Several authors have reported increases in the disease severity and refractoriness of chronic rhinosinusitis when it is accompanied by a comorbid diagnosis of asthma. Conversely, other investigators have highlighted the deleterious effect of uncontrolled chronic rhinosinusitis on the effective management of asthma. Substantial epidemiological, clinical, and pathophysiologic evidence has now been elaborated linking upper airway diseases such as allergic rhinitis and/or sinusitis with lower airway diseases, most commonly asthma.

We hypothesized that if, indeed, the unified air-
way theory is valid, we should be able to objectively identify a more severe disease burden in patients with combined upper and lower respiratory tract inflammatory disease as compared to patients with isolated lower airway inflammation, i.e., asthma alone. In order to do this on an epidemiological, national scale, we adopted the National Health Interview Survey.\textsuperscript{10,14} One of the authors previously used this database to analyze the disease burden of sinusitis \textit{without} comorbid disease relative to other chronic disease conditions.\textsuperscript{15} This survey has also been used to quantify the incidence and differential presentations of asthma in the United States.\textsuperscript{16,17} We similarly chose objective measures of health-care utilization to determine the disease severity burden.

A significant body of literature has been elaborated concerning the epidemiology, severity, impact, and treatment responses of allergic rhinitis in conjunction with asthma.\textsuperscript{7} Previous authors have implicated allergic rhinitis as a risk factor for asthma, and the prevalence of allergic rhinitis in the setting of asthma ranges from 55\% to 90\%, depending on the population under study.\textsuperscript{12,18,19} Several investigators have also documented increased asthma severity based on symptom assessment when allergic rhinitis is also present.\textsuperscript{18,20} Finally, substantial recent evidence has emerged that identification and treatment of allergic rhinitis in the setting of asthma may have a significant effect on asthma symptoms and scores, decreasing asthma-related events by one third to one half.\textsuperscript{5,11} Overall, and in particular compared to the comorbid disease burden of sinusitis, we did not find a tremendous increase in the magnitude of disease burden related to hay fever with asthma as measured by our selected outcome measures, except for health-care spending.

Notably, the current data suggest that the additional morbidity imparted by sinusitis to an underlying diagnosis of asthma is greater than that imparted by the addition of hay fever to asthma. The overall 40\% prevalence of sinusitis in patients with asthma in our study is consistent with that reported in the literature.\textsuperscript{21} Interestingly, we found that the combination of asthma and sinusitis (40\% overall) was more common than the combination of asthma and hay fever (29\%; Fig 1). Given that allergic rhinitis is more prevalent than sinusitis in the general adult population, this higher prevalence of sinusitis with asthma in this cohort suggests more than an isolated epidemiological linkage between the two.

In terms of disease severity measures, when added to asthma, sinusitis was consistently associated with greater health-care utilization in terms of office visits and emergency room visits, as well as health-care expenditures, and even more compelling, with a substantial increase in the number of workdays lost. The latter two elements deserve further attention, as they directly relate to patients' health-care costs and the societal economic costs of these diagnoses when they occur in concert. Again, these additional disease burdens were greater than the additional disease burden imparted by hay fever to asthma.

The fact that the additional disease burden from sinusitis was greater than the additional disease burden from hay fever suggests that the association of the sinusitis disease burden with asthma is more than the simple addition of the disease burden from two separate diagnoses. These data are important, in that oftentimes clinicians look for allergic triggers and allergic rhinitis in conjunction with asthma, but in fact, clinical identification of sinusitis in conjunction with asthma may be as important as a separate disease influencing comorbidity.\textsuperscript{12} The current epidemiology would suggest that clinicians should explore for additional upper airway diagnoses in patients with refractory or difficult-to-control asthma. This idea could be especially important if similar reductions in asthma events could be demonstrated after treatment of associated sinusitis.

The current study does possess some limitations associated with the use of a secondary data set as the data source. Because the data for the prevalence of disease conditions were collected by a structured survey and from the patient's perspective, there is an inherent trade-off between the accuracy of the diagnosis and the efficiency of the survey. Although survey respondents are given clear instructions by survey personnel and asked specifically if they were told by a health-care provider that they had a fever or asthma, patients may have responded with their perceived self-diagnosis and/or physicians may have overdiagnosed these conditions. Thus, it is possible that the prevalence of sinusitis may be overestimated by the survey method. Although this may affect the individual disease prevalence data, it is less likely that there is a systematic bias that would affect the comparisons between the two diagnoses, because both sinusitis and hay fever were queried with the same question construct. In addition, the data set variable for sinusitis likely includes both acute and chronic sinusitis, which we are unable to further segregate. Nonetheless, the National Health Interview Survey is considered a gold-standard data set for monitoring trends in US health care.\textsuperscript{22} Because of these disease prevalence estimates, the issues with the accuracy of diagnosis, and the fact that patients' perceived diagnoses (even if inaccurate) will still lead to health-care resource consumption,
further research and education should be conducted with respect to the accurate diagnosis of acute and chronic sinusitis and hay fever.11

CONCLUSIONS

The prevalence (40%) of sinusitis in the setting of active asthma is significant. The presence of sinusitis in addition to asthma is associated with a significant increase in health-care utilization, health-care expenditures, and workdays lost. These increases are substantially greater in magnitude than is the additional disease burden imparted by hay fever to asthma. Because of this impact, the relationship between asthma and sinusitis merits further attention—clinically, economically, and from a research perspective.

REFERENCES
