

Incremental Healthcare Utilization and Expenditures for Allergic Rhinitis in the United States

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Objective: Determine incremental increases in healthcare expenditures and utilization associated with allergic rhinitis (AR).

Methods: Patients reporting a diagnosis of AR were extracted from the 2007 Medical Expenditure Panel Survey medical conditions file and linked to the consolidated expenditures file. AR patients were then compared to non-AR patients determining differences in healthcare utilization: office visits, emergency facility visits, and prescriptions filled, as well as differences in healthcare expenditures: total healthcare costs, office-based costs, prescription medication costs, and self-expenditures using demographically and comorbidity adjusted multivariate models.

Results: An estimated 17.8 ± 0.72 million adult patients reported AR in 2007 ($7.9 \pm 0.3\%$ of the U.S. population). The additional incremental healthcare utilizations associated with AR relative to non-AR patients for office visits, emergency facility visits, and number of prescriptions filled were 3.25 ± 0.40 , 0.01 ± 0.02 , and 8.95 ± 0.80 , respectively ($P < .001$, $.787$, and $<.001$, respectively). Similarly, additional healthcare expenditures associated with AR for total healthcare expenses, office-based visit expenditures, prescription expenditures, and self-expenditures were $\$1,492 \pm 346$, $\$461 \pm 122$, $\$876 \pm 126$, and $\$168 \pm 25$, respectively (all $P < 0.001$).

Conclusions: AR is associated with substantial incremental increases in healthcare utilization and expenditures due to increases in office-based visits and prescription expenditures. As a commonly prevalent and costly disease, AR would be a prime target for guideline development and standardization of care.

Key Words: Allergic rhinitis, healthcare expenditures, costs, burden of illness, office visits.

Level of evidence: 2b.

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INTRODUCTION

Allergic rhinitis (AR) is one of the most common and likely underdiagnosed conditions affecting the U.S. population. Recently, serious efforts have been directed at understanding the impact of AR on quality of life and the impact of AR on comorbid conditions, such as asthma. However, recent cost data concerning the economic and healthcare burden of AR are lacking. Most published studies quote data based on 1996 estimates of the health impact and economic impact of AR, which corresponds, for example, to an era before many medical therapies for AR transition from prescription to over-the-counter availability.

We sought to quantify the healthcare and economic burden of AR in the United States on a contemporary basis, utilizing a nationally recognized data set specifically meant for the tracking of healthcare expenditures. Such data are particularly important because of the cur-

rent focus on cost containment in healthcare as well as the current feeling that the prevalence of allergic disease and related conditions is on the rise. To do this, an incremental cost approach was used to estimate the additional expenditures specifically associated with AR by obtaining the difference between expenditures associated with the treatment of patients diagnosed with the disease versus similar patients not diagnosed with the disease.^{1,2} The incremental expenditure methodology measures expenditures attributable to that particular disease, as it adjusts for differences in variables considered to have an impact on expenditures, such as age, gender, insurance status, and comorbid conditions using the Charlson comorbidity index, among others.³

The MEPS is a national survey conducted by the Agency for Health Research and Quality and serves as a benchmark data set specifically designed for the assessment of healthcare costs in the United States.⁴ The MEPS comprises a nationally representative sample of the civilian noninstitutionalized population in the United States, and collects comprehensive data on individuals and their healthcare experiences over a span of 2 years. Household survey data are collected by means of computer-assisted personal interviews, and those data are supplemented by information collected directly from the medical providers used by survey participants. Insurance data are collected both from households and through a separate state and nationally representative survey of business establishments, which collects information on

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health insurance provided by United States employers.⁵ Approximately 15,000 families and 40,000 individuals are sampled overall. MEPS data have been previously used to examine costs related to many different medical conditions and therapies including asthma, diabetes, and hypertension, as well as medication utilization and office visit utilization for various conditions.^{1,3,6}

METHODS

The data source for this study was the Medical Expenditure Panel Survey (MEPS) for calendar year 2007 as administered by the Agency for Healthcare Research and Quality under the United States Department of Health and Human Services. This study was reviewed by our hospital's committee on clinical investigations and designated as exempt from review. In accordance with data access agreements, precautions were taken to avoid individual patient identification. The 2007 medical conditions file component of the MEPS was merged with the 2007 consolidated expenditures file according to the appropriate linkage variables in SPSS version 17.0 (Chicago, IL). Because patients may report more than one medical condition, up to 34 medical condition variables were allowed per patient after data file merge.

Next, patients were identified as suffering from AR by examining on the ICD9CODX data field for each listed medical condition. This field consists of the three digit International Classification of Diseases version 9 code for a given medical condition based on an assessment of medical conditions recorded as verbatim text and then coded by a professional coder. Patients for whom any one of the 34 medical condition codes corresponded to "477.x" were considered as having reported AR and the remainder were considered as not reporting AR.

Standard demographic information including age and sex distribution was compiled for those patients reporting and not reporting AR. The additional demographic information extracted and compared included race, ethnicity, level of education, insurance status, geographic region, and marital status (Table I). Additionally, the D'Hoore et al.⁷ adaptation of the Charlson comorbidity index was calculated based on comorbid medical conditions for each subject.⁷ This index adjusts for comorbidities including: myocardial infarction, congestive heart failure, peripheral vascular disease, dementia, cerebral vascular disease, asthma, chronic obstructive pulmonary disease, peptic ulcer disease, liver disease, among others. It allows patients to be compared with "like" patients with similar comorbidities.

Data are reported as mean or proportion $\pm$ standard error of the estimate (SE). Because the sample design of the MEPS survey includes stratification, clustering, multiple stages of selection, and disproportionate sampling, appropriate complex survey design statistical methods were utilized to determine nationally representative means and standard errors. Estimates were considered reliable if the relative standard error of the estimate was less than 30%. Differences in healthcare consumption measures between those with and without AR were compared with a general linear model, adjusting for age, sex, race, ethnicity, education, insurance, region, marital status, and Charlson comorbidity index score with statistical significance set at $P = .05$.

Two broad types of measures of healthcare consumption were determined from utilization and expenditure variables within the MEPS. First, national estimates of office visits, emergency facility visits, and total number of prescription fills were determined and compared between AR and non-AR patients. Second, differences in estimated healthcare expenditures were determined between AR and non-AR patients with respect to annual total healthcare expenditures, office-based

healthcare expenditures, prescription expenditures, and patients' self-expenditures for medications in 2007 dollars.

RESULTS

An estimated 17.8 ± 0.72 million adult patients sought medical care for AR as a medical condition in 2007. This represented an estimated $7.9 \pm 0.3\%$ of the United States population who sought medical care also reporting a diagnosis of AR. Table I details the demographic differences between those patients reporting and not reporting AR, including the Charlson comorbidity index, that were used in the adjusted multivariate model.

Table II presents the provider visit frequency and medication utilization for adult patients with and without a diagnosis of AR, adjusted for differing patient demographics and Charlson comorbidity index in the multivariate model. Patients with AR incurred approximately +3 additional office visits and a significant +9 additional prescription fills compared to those without AR. Not surprisingly, there was not a significant difference in emergency facility visits attributable to AR. Table III presents the healthcare expenditures associated with a diagnosis of AR also adjusted for demographics and Charlson comorbidity index. A diagnosis of AR contributed substantially to increased costs in multiple cost areas, with an overall incremental increase in total healthcare expenditures of \$1,492/person/year.

DISCUSSION

AR is one of the most common chronic health conditions the United States. Its prevalence is similar to that of other chronic conditions such as diabetes (8.0%), asthma (8.7%), and chronic sinusitis (4.9%).^{6,8,9} Interestingly, epidemiologic considerations suggest that AR and allergic conditions in general are thought to be on the rise.^{10,11} Because otolaryngologists commonly diagnose and treat patients with symptoms that often overlap among AR, chronic sinusitis, and other sinonasal conditions, awareness of the epidemiology and cost of the AR component are important. Furthermore, because of governmental and societal efforts to control healthcare costs, potentially by allocating care resources based on epidemiology and predicted costs, data for the expenditure impact of AR need to be defined.

The MEPS is a national survey conducted by the Agency for Health Research and Quality and serves as a benchmark data set specifically designed for the assessment of healthcare costs in the United States.⁴ Because this data set includes specific data fields for healthcare-related charges, costs, and utilization, the current study is able to provide national estimates of the utilization and economic impact of AR on a contemporary basis. As a nationally representative sample of the noninstitutionalized U.S. population, MEPS data have been previously used to examine costs related to many different medical conditions and therapies including cardiovascular disease, medication utilization, and office visit utilization for various conditions.

Use of the incremental model with statistical adjustment for demographic factors and comorbid

TABLE 1.
Comparison of demographic characteristics between adults with and without AR**

Characteristic	No AR		AR		p-value
	Value	SE	Value	SE	
Age (mean years)	45.8	0.2	48.5	0.5	<0.001
Gender(%)					<0.001
Male	49.5	0.3	36.9	1.4	
Female	50.5	0.3	63.1	1.4	
Race (%)					0.001
White	81.1	0.6	85.2	1.1	
Black	11.8	0.5	8.5	0.9	
Other	7.1	0.4	6.3	0.7	
Ethnicity (%)					<0.001
Hispanic	14.0	0.6	8.3	0.9	
Non-Hispanic	86.0	0.6	91.7	0.9	
Education (%)					<0.001
No degree	17.4	0.4	10.8	0.9	
GED	3.8	80.0	3.3	0.5	
High school diploma	44.9	0.5	43.0	1.4	
Bachelors degree	17.1	0.4	22.0	1.3	
Masters degree	6.5	0.3	7.8	0.8	
Doctorate degree	2.1	0.2	3.4	0.6	
Other degree	8.2	0.3	9.7	0.8	
Insurance (%)					<0.001
Uninsured	68.7	0.6	79.9	1.3	
Private	15.4	0.4	14.6	1.0	
Public	15.9	0.4	5.6	0.7	
Region (%)					0.001
Northeast	18.9	0.7	16.8	1.4	
Midwest	21.8	0.8	21.7	1.5	
South	36.0	0.9	42.7	2.0	
West	23.4	0.7	18.8	1.3	
Marital status (%)					<0.001
Presently married	54.0	0.5	61.6	1.7	
Presently not married	46.0	0.5	38.4	1.7	
Charlson comorbidity Index score (mean)	0.44	0.01	0.64	0.03	<0.001

*SE: Standard error of the estimate

**For an estimated population of 10.9 million adults reporting AR and 208.6 million adults not reporting AR

medical conditions is essential and allows for the determination of incremental healthcare costs more specifically associated with AR.¹ For example, pulmonary disease and asthma, which are common in patients with AR, are included as a component of the Charlson

comorbidity Index, which is included as a covariate in the multivariate model.⁷ This then controls for the cost contributions of these often comorbid conditions in the model. We have recently used the incremental cost model to determine the additional expenditures related

TABLE 2.
Incremental direct healthcare costs associated with AR in the United States, 2007.

Expenditure/utilization measure*	Without AR		With AR		Difference		p-value
	Mean	SE	Mean	SE	Mean	SE	
Number office-based visits	4.73	0.20	7.98	0.43	3.25	0.40	<0.001
Number emergency facility visits	0.19	0.01	0.20	0.02	0.00	0.02	0.787
Number of prescription fills	10.07	0.35	19.03	0.88	8.95	0.80	<0.001

*Means adjusted for age, sex, race, ethnicity, education, insurance status, geographic region, marital status and Charlson comorbidity index
SE: Standard error

TABLE 3.
Incremental healthcare unit utilization associated with AR in the United.

Expenditure/utilization measure*	Without AR		With AR		Difference		p-value
	Mean	SE	Mean	SE	Mean	SE	
Total health care expenses (\$)	3848	393	5340	494	1492	346	<0.001
Total office-based expenditures (\$)	841	79	1303	152	461	122	<0.001
Total prescription expenditures (\$)	768	51	1644	123	876	126	<0.001
Total self-expenditures for prescriptions(\$)	196	11	363	28	168	25	<0.001

*Means adjusted for age, sex, race, ethnicity, education, insurance status, geographic region, marital status and Charlson comorbidity index
SE: Standard error

to chronic rhinosinusitis.⁸ In that study, we found that additional healthcare expenditures associated with CRS for total healthcare expenses, office-based visit expenditures, prescription expenditures, and self-expenditures were \$772 ± 300, \$346 ± 130, \$397 ± 88, and \$90 ± 24, respectively. It is notable that the bulk of the difference in medical expenditures for these two conditions is related to a substantially greater amount of prescription expenditures for AR (\$876 per year) versus that for chronic rhinosinusitis (\$397 per year).

As might be expected, we found that as a diagnosis, AR was associated with substantial increases in medical resource utilization, naturally contributing to increased healthcare costs. Intuitively, we would not expect AR to be associated with increased emergency department visits, but this utilization measure was included as a test for internal consistency. Indeed, patients with and without AR did not have any significant differences in the emergency department visits. Overall, AR contributed to an almost doubling in the number of office-based visits and prescription fills for patients afflicted. Interestingly, a comparable cost study in Germany found that the average annual cost of seasonal AR was 1,0890 per child and 1,543 per adult.¹² Given that AR is a chronic disease without specific surgical remedy, these costs will likely contribute to a patient's healthcare resource consumption for several years.

These data do pose some limitations which merit mention. First, these data are representative only of patients who sought medical care and were diagnosed with one or more disease conditions. For example, patients who are "self-diagnosed" with AR and who treat with over-the-counter remedies including nonsedating antihistamines, would not be captured in this analysis. Second, we are unable to differentiate costs between patients with perennial AR and those with seasonal AR, because of ICD-9 code limitations. One would expect healthcare-related consumption and costs to be higher in the former group.

The current analysis also does not specifically analyze the relationship between AR and asthma; asthma is one of the adjusted Charlson comorbidity components. It is well-known that asthma and other atopic diseases such as dermatitis are more prevalent in patients with

AR. We did not herein include a subanalysis for asthma to maintain the specificity of the analysis for AR. Because of this somewhat unique relationship between AR and asthma, a further analysis is planned to examine the cost impact of these interactions and those with CRS. Finally, cost data particularly for prescription medications is constantly in flux because of medication transition to generic counterparts, which are often substantially cheaper. Thus, continued surveillance of medication related costs in AR is warranted.

CONCLUSIONS

AR is associated with substantial incremental increases in healthcare utilization and healthcare expenditures. Because AR is such a prevalent disease with significant associated expenditures, future efforts should be specifically directed at determining efficient and economical diagnostic and therapeutic protocols for AR, possibly in conjunction with guideline development.

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