

Healthcare expenditures for sinusitis in 1996: Contributions of asthma, rhinitis, and other airway disorders

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Background: There have been no recent assessments of the economic burden of sinusitis in the peer-reviewed literature. **Objective:** We sought to estimate the 1996 total direct health care expenditures for the treatment of sinusitis.

Methods: This study determined (1) direct expenditures of medical and surgical encounters in which sinusitis was the primary diagnosis and (2) attributable expenditures when related airway diseases were the primary diagnosis and sinusitis was a comorbid condition. An expert panel used the Delphi consensus-building technique to determine the proportions for the latter.

Results: Overall health care expenditures attributable to sinusitis in 1996 were estimated at \$5.8 billion, of which \$1.8 billion (30.6%) was for children 12 years or younger. A primary diagnosis of acute or chronic sinusitis accounted for 58.7% of all expenditures (\$3.5 billion). About 12% each of the costs for asthma and chronic otitis media and eustachian tube disorders were attributed to diagnosis and treatment of comorbid sinusitis. Nearly 90% of all expenditures (\$5.1 billion) were associated with ambulatory or emergency department services. **Conclusion:** The economic burden of sinusitis in the United States is significant. However, the limitations of this type of evaluation suggest the \$5.8 billion amount may be an underestimate of the true direct costs. (*J Allergy Clin Immunol* 1999;103:408-14.)

Key words: Sinusitis, asthma, otitis media, allergic rhinitis, cost of illness, health care expenditures

Sinusitis is one of the most commonly reported chronic diseases in the United States, affecting an estimated

Abbreviation used

NCHS: National Center for Health Statistics

14% of the population.¹ Despite the prevalence of this disorder, there have been no recent, published assessments of the morbidity and economic consequences of this disorder. We sought to evaluate these medical and surgical health care costs.

The signs and symptoms of sinusitis are similar to those for other upper airway disorders, such as allergic rhinitis, chronic otitis media, and upper respiratory tract infections, and it may worsen the course of these diseases, as well as that of asthma.¹⁻⁴ Because patients may be first seen with more than one diagnosis during a medical encounter, the decision of which disorder to list as the primary, ICD-9-CM-coded⁵ diagnosis on the medical encounter form may be arbitrary. As a result, sinusitis may be underreported as a primary diagnosis but included as a secondary ICD-9-CM diagnosis. This practice represents a problem for the development of national databases because they often record only the primary diagnosis and ignore the secondary diagnoses. This is a problem for the performance of national cost-of-illness studies because the data sources will provide only the costs of the primary diagnosis, whereas costs caused by simultaneous treatment of the secondary diagnoses, such as sinusitis, may be unavailable. As a result, it has been necessary to develop other methods to divine the potential contributions of secondary diagnoses to the overall cost of illness.

The Delphi technique was used for this prevalence-based cost-of-illness study. Our goal was to estimate the direct medical expenditures for treatment of sinusitis for all persons in the United States in 1996. The methodology was unique because the expenditures were estimated for inpatient and outpatient medical encounters in which (1) sinusitis was the primary diagnosis and (2) another airway disease was the primary medical diagnosis and sinusitis was a comorbid, secondary diagnosis. The other primary conditions included allergic rhinitis, chronic rhinitis, acute upper respiratory infections, pharyngitis and tonsillitis, rhinorrhea, asthma, nonatopic conjunctivitis, and chronic otitis media and eustachian tube disorders. The results were intended to provide a frame of reference for evaluating the patterns of medical expenditures for sinusitis, to assess the magnitude to which sinusitis was concomitantly treated with other related

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TABLE I. Proportional estimates for comorbid sinusitis as a component of other primary diagnoses by age

Primary diagnosis	ICD-9-CM Code	Percent with comorbid sinusitis as a secondary diagnosis					
		12 years and younger			13 years and older		
		%	SD	Validity rank*	%	SD	Validity rank*
Acute and chronic sinusitis	461, 473	100	—	—	100	—	—
Chronic otitis media and eustachian tube disorders	381.1-381.9, 382.1-382.9	15	7.3	2	15	7.9	2
Asthma	493	10	9.3	1.8	10	10.3	1.8
Acute upper respiratory infections	465	10	3.7	1.8	10	21.5	1.8
Allergic rhinitis	477	15	21.3	2	15	21.2	2
Pharyngitis and tonsillitis	462, 463	10	2.4	2	5	3.3	1.8
Chronic rhinitis	472.0	15	11.2	2	15	11.2	2
Nasal polyps	471	50	7.5	2	50	8.4	2
Rhinorrhea	478.1	15	8.1	1.6	15	7.5	1.6
Acute otitis media	381.0, 382.0	10	5.1	1.8	10	6.0	1.8
All other conjunctivitis	Remainder of 372	5	4.5	1.4	5	6.1	1.4
Atopic conjunctivitis	372.05, 372.13, 372.14	0	9.7	1.4	0	11.7	1.4

*Validity rank: 1, $\pm 5\%$ error; 2, $\pm 10\%$ error; 3, $\pm 20\%$ error; 4, $>20\%$ error.

upper and lower airway disorders, and to identify the categories of spending that might be modified to reduce overall health care expenditures.

METHODS

Sinusitis

Clinical syndromes of sinusitis include acute, subacute, recurrent acute, chronic persistent, and chronic with acute exacerbations.¹⁻⁴ Because of the overlap between these syndromes, sinus disease was considered to be one entity for the purposes of this initial investigation, and data for acute (ICD-9-CM code 461) and chronic (ICD-9-CM code 473) sinusitis were pooled together. Other airway disorders that could have been simultaneously treated with sinusitis were identified by extensive literature reviews and the expert panel, and they are shown in Table I.

Delphi technique

An expert panel of 4 practicing physicians (JNB, MK, SJ, Y-HP) and an epidemiologist (PJG) were recruited on the basis of their clinical and research expertise in airway disease. They represented academic, private practice, and government affiliations.

A 3-round modified consensus Delphi procedure was used to develop a group judgment on the proportion of patients with a related airway disorder and comorbid sinusitis.⁶⁻⁹ Round I was conducted by mail to permit an initial independent assessment by each panelist of these relationships. The original question to be investigated was as follows: "What is the percentage of patients with each of following airway disorders that also have sinusitis?" Proportional estimates were reported in 5% increments and were analyzed in advance of the expert panel meeting. To attribute the greatest weight to the most common responses, the mode and range of the proportion estimates were calculated for each airway disorder by age group.

The expert panel convened in a face-to-face meeting to discuss the results of Round I. After some debate, the panel decided a more concrete research question was appropriate: "For each primary ICD-9-CM coded airway disorder, determine the percentage of encounters where sinusitis was a secondary diagnosis evaluated, treated, and contributing to the primary disorder." This fraction was felt to estimate the "hidden" or uncoded contribution of sinusitis that was "embedded" within the cost of the other primary disorders. This was the attributed cost of sinusitis for that disorder. The panel

decided that sex and race were not critical factors for these initial evaluations. Because sinusitis may represent a separate spectrum of problems in different age groups, proportional estimates were obtained for "children" 12 years of age and younger and "adults" 13 years of age and older. Separation into smaller age groups, such as 0 to 3 years, would not have led to statistically viable data by using the criteria of the National Center for Health Statistics (NCHS) (standard error of estimates $>30\%$). These modifications were used for Round II.

For Round II, panelists made their proportional estimates, and the modal probabilities and associated ranges were again calculated. Another discussion ensued regarding the areas of greatest disagreement for the attribution of sinusitis to the other disorders. Round III then commenced, with each panelist assigning a final proportional estimate for each airway disorder. In this final stage of consensus building, median proportional estimates were calculated. These final estimates were mailed to each panel member who then ranked their level of confidence in the final result according to the following numeric validity scale: 1 = certain, proportion estimate is dependable within $\pm 5\%$; 2 = reliable, dependable within $\pm 10\%$; 3 = risky, dependable within $\pm 20\%$; and 4 = unreliable, undependable by more than $\pm 20\%$ (Table I).

Estimating health resource use attributable to sinusitis

National health care survey data from the NCHS were analyzed (Table II).¹⁰ The total number of inpatient and outpatient encounters for each airway disorder was extracted and then multiplied by the panel's final proportional estimates (Table I) to estimate resource use attributable to sinusitis (Table III). Data from these 1994 surveys were extrapolated to 1996 values by using standard epidemiologic techniques.¹¹⁻¹³ Precise data for radiology examinations were not available in these databases. Some of the costs for X-ray and computerized tomography scans that were performed during physician encounters were included in the cost-per-encounter figures for the latter 3 surveys but were not included in the *National Hospital Discharge Survey* data. The costs for medication refills were also not included.

Estimating expenditures attributable to sinusitis

The unit price per encounter was determined for each type of service (Table II) on the basis of the 1987 *National Medical Expen-*

TABLE II. Sources of data for sinusitis health resource use and expenditure estimates (in 1996 dollars)

Type of service	Source of use data	Unit price per encounter*
Institutional care		
Hospital discharges and inpatient days	1994 <i>National Hospital Discharge Survey</i> . An ongoing survey of noninstitutional general and short-stay hospitals (hospitals with an average length of stay of fewer than 30 days), exclusive of federal, military, and Veterans Administration hospitals, located in the 50 states and the District of Columbia. In 1994, 276,533 discharges were obtained from the 478 hospitals that participated in this survey.	\$1881
Outpatient care		
Office-based physician encounters and prescriptions	1994 <i>National Ambulatory Medical Care Survey</i> . A national sample of office-based nonfederal physicians, excluding anesthesiologists, pathologists, and radiologists. In 1994, 35,598 patient record forms were received from the 1704 physicians who participated in this survey.	\$95
Hospital outpatient encounters and prescriptions	1994 <i>National Hospital Ambulatory Medical Care Survey</i> . A national sample of hospital outpatient departments of noninstitutional general and short-stay hospitals exclusive of federal, military, and Veterans Administration hospitals located in the 50 states and the District of Columbia. In 1994, 29,095 patient records were obtained from the 260 hospital outpatient departments participating in this survey.	\$547
Free-standing ambulatory surgery center encounters	1994 <i>National Survey of Ambulatory Surgery</i> . A national sample of ambulatory surgery procedures performed in hospitals and free-standing ambulatory surgery centers (FSASCs) in the United States. The hospital universe includes noninstitutional general and short-stay hospitals exclusive of federal, military, and Veterans Administration hospitals located in the 50 states and the District of Columbia. In 1994, 117,861 patient records were obtained from the 491 hospitals and FSASCs participating in this survey.	\$547
Emergency department encounters	1994 <i>National Hospital Ambulatory Medical Care Survey</i> . A national sample of hospital outpatient departments of noninstitutional general and short-stay hospitals, exclusive of federal, military, and Veterans Administration hospitals located in the 50 states and the District of Columbia. In 1994, 29,547 patient records were obtained from the 418 emergency departments participating in this survey.	\$350
Outpatient medications	1994 <i>National Ambulatory Medical Care</i> ; 1994 <i>National Hospital Ambulatory Medical Care</i> .	\$32

*The 1987 National Medical Expenditure Survey is the source for all cost data used in this study. All services were inflated by using the Consumer Price Indices for Hospital and Related Services, Physician Services, Medical Care Services, Professional Medical Services, and Medical Care Commodities. All of the above-listed surveys were conducted by the NCHS, with the exception of the National Medical Expenditure Survey, which was conducted by the Agency for Health Care Policy and Research.

TABLE III. Health resource use attributable to sinusitis in the United States by type of service and airway disorder, 1996

Primary diagnosis	Hospital inpatient			Outpatient encounters			
	Discharges	Days	Ambulatory Surgery center	Hospital outpatient	Physician office	Emergency department	Medications
Sinusitis	45,107	156,260	18,479	713,624	15,299,797	745,852	30,684,591
Chronic otitis media and eustachian tube disorder	5,557	13,187	13,474	212,667	2,842,732	466,240	5,000,644
Asthma	46,004	185,521	*	102,919	1,096,717	163,886	3,260,819
Acute upper respiratory infection	4,439	13,589	*	112,406	1,743,478	208,225	3,066,919
Allergic rhinitis	*	0	*	68,501	1,420,579	13,000	2,680,528
Pharyngitis and tonsillitis	1,478	4,159	192	39,093	670,601	105,176	1,122,249
Chronic rhinitis	*	0	*	16,201	316,453	10,706	613,292
Miscellaneous	*	0	1,342	14,638	298,989	28,976	497,256
Total	102,585		33,488	1,280,049	23,689,256	1,742,061	46,926,299

Medications included prescription and nonprescription drugs ordered during outpatient encounters.

*Data could not be reported because the weighted estimate was not statistically valid (standard error >30%, NCHS).

TABLE IV. Medical expenditures attributable to sinusitis in the United States by type of service and airway disorder, 1996 (in millions of dollars)

Primary diagnosis	Inpatient	Outpatient encounters					Total
	Hospital discharge	Ambulatory surgery center	Hospital outpatient	Physician office	Emergency department	Medications	
Sinusitis	293.9	10.1	390.4	1453.5	261.0	981.9	3390.8
Chronic otitis media and eustachian tube disorder	24.8	7.4	116.3	270.1	163.2	160.0	741.8
Asthma	349.0	*	56.3	104.2	57.4	104.3	671.2
Acute upper respiratory infection	25.6	*	61.5	165.6	72.9	98.1	423.7
Allergic rhinitis	*	*	37.5	135.0	4.5	85.8	262.8
Pharyngitis and tonsillitis	7.8	0.1	21.4	63.7	36.8	35.9	165.7
Chronic rhinitis	*	*	88.6	30.1	3.7	19.6	62.3
Miscellaneous	*	0.8	80.1	28.4	10.1	15.9	63.2
Total	701.1	18.3	700.2	2250.5	609.7	1501.6	5781.4

Medications included prescription and nonprescription medications ordered during outpatient encounters.

*Data could not be reported because the weighted estimate was not statistically valid by NCHS criteria (standard error >30%).

dition Survey of the Agency for Health Care Policy and Research. These average expenditures were based on payments from Medicare, Medicaid, private third-party payers, and other sources. The cost per inpatient hospital day represents the sum of facility and physician expenses. Unit prices were inflated from 1987 to 1996 dollars.¹¹ Numbers of encounters (Table III) were multiplied by unit price per encounter (Table II) to yield the cost for each type of resource use and ICD-9-coded disorder (Table IV). The sum of these components was the total attributable cost of sinusitis. Data were disaggregated by age (≤ 12 years and ≥ 13 years) to estimate costs for children and adults (Table V).

RESULTS

Health resource use attributable to sinusitis

A total of 26.7 million outpatient physician, hospital office, and emergency department encounters were attributed to sinusitis in 1996 (Table III). Of this total, 62.7% were for the primary treatment of sinusitis. For the remaining encounters, 13.2% had a primary diagnosis of chronic otitis media and eustachian tube disorders, 7.7% were for acute upper respiratory infection, and approximately 5% were for asthma and allergic rhinitis. Treatment for all remaining airway conditions constituted less than 5% of sinusitis encounters. Overall, the expert panel felt that only about 10% to 15% of the costs associated with these other primary diagnoses could be attributed to acute or chronic sinusitis. The expert panel members were fairly confident in the percentage estimates, with no validity rank higher than 2.0 (<12% error) (Table I). The standard deviations for all estimates were relatively small, suggesting little disparity among the panel members' individual estimates.

Outpatient office-based physician care for sinusitis was most frequently delivered by the primary care specialties of family medicine and general medicine (43.3%), followed by internists (21.6%), pediatricians (15.4%), otolaryngologists (9.9%), and allergists and pulmonary physicians (2.2%) (data not shown). About

46.9 million prescription and nonprescription medications were ordered during these outpatient examinations, including drugs in the following therapeutic classes: antibiotics (74.5% of all sinusitis encounters), nasal decongestants (21.6%), and antitussives, expectorants, and mucolytics (14.2%). Sinus computed tomography scans were reported for 1.9% to 4.9% of all sinusitis encounters (*National Health Ambulatory Medical Care Survey*); however, their exact number and cost could not be estimated from the available databases.

Inpatient hospitalizations for asthma were estimated to contribute 185,521 hospital days (4.0 days per admission) and 6.0% of overall costs.

Inpatient admissions for sinusitis caused 45,107 hospital discharges, 156,260 hospital days (3.6 days per stay), and accounted for 6.3% of the overall cost of sinusitis. The most frequently reported hospital surgical procedures were nasal sinusotomy (ICD-9-CM 22.6) (28.6% of inpatient stays), intranasal antrostomy (ICD-9-CM 22.2) (16.1%), and repair and plastic operations of the nose (ICD-9-CM 21.8) (8.6%). About 77% of the 33,488 ambulatory surgical center encounters were for the treatment of sinusitis or chronic otitis media and eustachian tube disorders. The principal surgical procedures were nasal sinusotomy (ICD-9-CM 22.6), repair and plastic operations on the nose (ICD-9-CM 21.8), intranasal antrostomy (ICD-9-CM 22.2), and external maxillary antrostomy (ICD-9-CM 22.3).

Expenditures attributable to sinusitis

Expenditures attributable to sinusitis totaled \$5.78 billion in 1996, of which 59% were for treatment of sinusitis as the primary medical diagnosis (\$3.39 billion), 12.8% for comorbid chronic otitis media and eustachian tube disorders, and 11.6% for asthma (Table IV). The remaining airway conditions each constituted less than 10% of total attributable medical expenditures. Costs for each of the other primary diagnoses were substantial:

TABLE V. Medical expenditures attributable to sinusitis in the United States by age and airway disorder, 1996 (in millions of dollars)

Primary diagnosis	≤12 years	≥13 years	Total
Acute and chronic sinusitis	586.7	2804.1	3390.8
Chronic otitis media and eustachian tube disorder	586.8	155.0	741.8
Asthma	170.2	501.0	671.2
Acute upper respiratory infection	228.6	195.1	423.7
Allergic rhinitis	52.8	210.0	262.8
Pharyngitis and tonsillitis	76.5	89.2	165.7
Chronic rhinitis	30.3	32.0	62.3
Miscellaneous	36.9	26.4	63.2
Total	1768.6	4012.8	5781.4

asthma, \$6.71 billion; chronic otitis media and eustachian tube dysfunction, \$4.94 billion; upper respiratory tract infections, \$4.23 billion; and allergic rhinitis, \$1.75 billion.

Outpatient visits with sinusitis as the primary diagnosis accounted for 36% of the overall medical expenditures, with medications adding another 17%. Outpatient visits with primary diagnoses of otitis media and asthma contributed 9.5% and 5.3% to the overall costs, respectively. Medication costs for all other primary disorders were only 9% of the total.

Children and adults had different spectrums of diseases as demonstrated by the different costs for allied airway disorders (Table V). Children were responsible for 30.6% of the overall costs (\$1.77 billion), with 10% caused by sinusitis, 10% by chronic otitis media and eustachian tube dysfunction, 4% by upper respiratory tract infections, and 2.9% by asthma. Sinusitis and chronic otitis media accounted for 66% of all childhood attributable costs. Adults accounted for 69.4% of the overall attributable costs (\$4.0 billion), with 48.5% caused by sinusitis, 8.7% by asthma, and 3.6% by allergic rhinitis. Costs per child or adult could not be calculated because number of visits per individual and total number of individuals were not specified in the databases.

Inpatient and outpatient ambulatory surgery center costs for the primary diagnosis of sinusitis were \$304 million and accounted for 9% of the cost of the primary diagnosis of sinusitis and 5.3% of the overall cost attributable to sinusitis. Asthma hospitalization was another major contributing factor (6% of overall attributable costs). Surgical treatment of otitis media and eustachian tube dysfunction attributed to sinusitis was 0.6% of the overall cost.

The attributed costs for nasal polyps, rhinorrhea, conjunctivitis, and acute otitis media were small, and in the case of nasal polyps, deemed insignificant by using NCHS criteria. These costs were listed as "miscellaneous" and accounted for 1.1% of the overall cost.

DISCUSSION

Sinusitis encompasses a spectrum of acute and chronic, neutrophilic and eosinophilic, nonallergic and possibly allergic inflammatory processes in the paranasal sinuses with viral, bacterial, and fungal infections.¹⁻⁴ The clinical manifestations of sinusitis vary greatly depending on the duration of infection (ie, acute or chronic) and the age of the patient (ie, child or adult). Acute suppurative sinusitis is defined as any infectious process in a paranasal sinus lasting 1 day to 3 weeks, subacute sinusitis is defined as any sinus infection lasting from 3 weeks to 3 months, and after 3 months the disease is considered to be chronic and may involve irreversible mucosal damage.² In children symptoms of acute sinusitis are often difficult to distinguish from those of the common cold or allergic rhinitis. The most common symptoms include cough (80%), nasal discharge (75%), and malodorous breath (50%).¹⁻⁴ In adults postnasal discharge and facial pain over the affected sinus that worsens with movement are the principal symptoms. Symptoms associated with chronic sinusitis are usually less intense but more protracted than those in acute sinusitis. Affected patients often experience fatigue, irritability, and mood and cognitive disturbances that substantially interfere with their quality of life.

Sinusitis has been linked to several other airway disorders, including allergic rhinitis, asthma, otitis media with effusion, and nasal polyposis. Allergic rhinitis is present in 25% to 40% of patients with acute maxillary sinusitis^{14,15} and 40% to 67% with chronic sinusitis.^{1-4,14} Newman et al¹⁶ assessed subjects with extensive sinus disease on computerized tomography scans and found allergies in 78% and asthma in 71%. Shapiro¹⁷ reported that as many as 70% of children with allergy and chronic rhinitis have abnormal radiologic findings of the sinuses. Nasal polyps were reported in 51.5% of patients with chronic sinusitis, whereas 14.5% had asthma and 5.5% had both nasal polyps and asthma.¹⁸ The optimal medical management of allergic, nonallergic, acute, and chronic sinusitis subsets is largely undefined and remains multifaceted.^{2,3} Drug choice, dosing frequency, and duration of antibiotic, decongestant, antihistamine, glucocorticoid, leukotriene-active agents, and other therapies are often empirically determined or based on historical use of unrelated drugs in unrelated diseases, such as chronic bronchitis and allergic rhinitis. Even when recognized, acute sinusitis is often inappropriately treated and may result in the development of chronic sinusitis, which is even less well understood and may be even less adequately treated.^{2-4,19,20}

To overcome the complexities of these interrelationships, we considered acute and chronic sinusitis to be one entity for this economic analysis. The best estimates of the consensus panel were used in the absence of empiric data. The primary diagnosis of sinusitis lead to expenditures of \$3.39 billion (1996), whereas the cost attributable to other primary diagnoses was \$2.39 billion or 41% of the estimated overall cost of illness. Outpatient care accounted for 61.6%, surgical and inpatient care for

12.4%, and medications for 26.0%. Because the databases did not identify the number of encounters per individual, it was not possible to assess the cost of illness for adults, children, or acute or chronic sinusitis. The significant contributions of chronic otitis media and eustachian tube dysfunction (13% overall) and asthma (12% overall) suggest common etiologies, mechanisms of disease pathogenesis, direct anatomical links with contiguous spread of mucosal infection or inflammation, or the statistical overlap of frequently diagnosed diseases in patients seeking medical attention.

The limitations to this study are noteworthy and could inflate or deflate the true cost of sinusitis. Both physician diagnosis and population-based questionnaires that detect self-diagnosed chronic "sinus" problems may be unreliable because specialized testing for perennial allergic rhinitis, nonallergic rhinitis, rhinitis medicamentosa, and anatomical defects that cause nasal obstruction are required for correct diagnosis. For economic evaluations, this problem is compounded by the ICD-9-CM system, which limits the primary diagnosis codes that may be entered into large databases. It is not possible, for example, to reliably determine the proportion of subjects treated for both allergic rhinitis and sinusitis from these sources. ICD-9-CM coding does not reflect clinical or pathologic classifications of airway diseases, nor does this coding system presume that the physician has explored the essential links between allergic rhinitis, asthma, chronic upper respiratory tract infections, otitis media with effusion, and underlying sinusitis.

Treatment of sinusitis has become an expensive proposition because of the increased prevalence of β -lactamase-producing bacteria, use of more expensive antibiotics, addition of adjunctive treatments such as intranasal glucocorticoids, and more expensive antihistamines. Extrapolations of the costs of prescriptions from 1987 (\$1.5 billion) may have substantially underestimated current prescription patterns and retail costs. The costs for refills were not captured in the databases. Newer data may be available from current HMO and prescription service databases or from longitudinal studies that determine costs per patient. Out-of-pocket costs for patients who do not seek medical care, including costs for over-the-counter medications, are not known.

The costs of diagnostic services, such as computerized tomography scans, rhinoscopy, and blood tests, are anticipated to be substantial. Only a portion of these costs are captured and were included in the average cost per patient encounter (Table II).

Indirect costs caused by lost work productivity or the care of sick children were not estimated because we believe that the available data sources do not accurately measure the productivity losses associated with either acute or chronic sinusitis. On the basis of data from the 1994 National Health Interview Survey, a nationally representative personal interview survey of a nationwide sample of households in the US, the morbidity associated with chronic sinusitis is significant (acute sinusitis was not reported in this survey). Among persons 18 years

or older who self-reported having chronic sinusitis, the number of work-loss days is estimated at 12.5 million days, the number of restricted activity days is estimated at 58.7 million days, and the number of bed days is estimated at 20.3 million days in 1994.

Health resource use and expenditures are underestimated because surveys conducted by the NCHS and the Agency for Health Care Policy and Research do not include the federal, military, and Department of Veterans Affairs population. We have not included the medical expenditures associated with the treatment of sinusitis among residents of nursing homes and other institutions, which may also be substantial.

Several allergists were on the expert panel. Each had intimate clinical and research knowledge of sinusitis. It could be anticipated that they would overestimate the influence of atopy. However, proportional estimates were conservative, and the costs attributed to sinusitis were modest. The panelists were familiar with national and international demographics, scientific investigations, clinical experiences, and the opinions of concerned professional organizations regarding sinusitis and other airway diseases. Previous Delphi evaluations for the overall costs of diabetes and osteoporosis have had panelists from a limited geographic area, yet have generated balanced and credible estimates for the costs of disease.

The expenditures for other diseases that were secondary diagnoses when sinusitis was the primary diagnosis were not deducted from the cost of sinusitis. These deductions were not made because it was the intention of the exercise to estimate the overall impact of sinus disease. It is anticipated that more precisely defined databases will permit the tracking of subjects with multiple ICD-9-CM-coded diagnoses, and that this future data collection technique will obviate the reliance on the round table discussion as a means of determining the cost of health care.

The overall costs for sinusitis or other diseases determined by the Delphi technique cannot be added or extrapolated to other cost-of-illness measures or disease.⁶⁻⁹

In conclusion, this study demonstrates the substantial economic impact of sinusitis and other diseases leading to or resulting from acute and chronic sinusitis. The need for more precise data is apparent. From the clinical perspective, upper airway disorders need to be recognized as serious, debilitating, costly diseases that warrant precise diagnosis and effective, specific therapy. It is possible that early recognition of sinusitis as a component of "allergies," otitis media, eustachian tube dysfunction, and asthma may lead to more comprehensive, but lower cost, outpatient therapy, with a reduction in the need for more expensive long-term or hospital care.

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