Health Care Utilization in the 10 Years Prior to Diagnosis in Obstructive Sleep Apnea Syndrome Patients

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Summary: Obstructive sleep apnea syndrome (OSAS) patients may have symptoms for years prior to recognition of their disorder, or they may be treated for the associated comorbidities. We hypothesized that such patients would be heavy consumers of health care resources for several years prior to diagnosis. We therefore compared health service utilization for a 10-year interval prior to diagnosis of 181 OSA patients to those of randomly selected age-, gender-, and geographically matched controls from the general population. OSAS patients used approximately twice as many health care services (as defined by physician claims and overnight stays in hospital) in the 10 years prior to their initial diagnostic evaluation for apnea. Physician claims for the OSA patients totaled $686,365 ($3972 per patient), compared to $356,376 ($1969 per patient) for the controls for the 10-year period examined in this study. Use of health services was significantly higher in 7 of 10 years prior to diagnosis. The OSAS patients also had more overnight hospitalizations: they spent 1118 nights (6.2 per patient) in hospital vs 676 nights (3.7 per patient) for controls in the decade prior to diagnosis. We conclude that by the time patients are finally diagnosed for sleep apnea, they have already been heavy users of health services for several years. It is possible that our findings reflect not OSAS per se, but the presence of some of the risk factors that predispose to OSAS, such as obesity, alcohol usage and perhaps tobacco consumption.

Key words: Sleep; obstructive sleep apnea; health care utilization; medical economics

Obstructive sleep apnea syndrome (OSAS) is the consequence of repetitive periods of cessation of breathing terminated by nervous system arousals. This disorder has been associated with excessive daytime sleepiness, increased risk of automobile accidents, psychiatric conditions (mood disorders), cardiovascular disorders (systemic hypertension, left heart failure, arrhythmias, ischemic heart disease, cerebral infarction) and death.[1,2] OSAS is relatively common, affecting 2% to 4% of the adult population,[3] but is likely underdiagnosed and undertreated.[4] This may be due in part to the belief that OSAS may not pose a serious health risk.[5] For this reason, the diagnosis and treatment of this condition may thus have a low priority in some health care systems.

Because OSAS has been associated with the comorbidities mentioned above, we hypothesized that OSAS patients would be heavy users of health care services not only when first evaluated for apnea, but also for several preceding years. In a previous study we showed heavy usage by 97 obese (body mass index (BMI) >35) OSAS patients for the years immediately prior to diagnosis.[6] This report explores how far back the increased utilization is seen by determining overnight hospital stays and payments

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to doctors for the 10 years prior to initial diagnosis for all OSAS patients seen in our center, regardless of BMI.

METHODS

This study was done in the Canadian province of Manitoba. The population is just over one million, and all residents have access to government-funded health care services. These services include visits to physicians as well as hospitalizations. When physicians see a patient, a standardized claim is submitted to the government agency responsible (Manitoba Health), which then renders payment. The Manitoba Health computer system maintains a database (see below) that maintains detailed records of all hospitalizations and physician claims. Our center also evaluates patients from the provinces of Ontario and Saskatchewan. We did not analyze the data from any of these patients, since their utilization records are in those other provinces.

The Manitoba Health database (MHdb) is described in depth elsewhere.[7] It maintains a detailed record of all hospital stays and visits to doctors' offices, with relevant diagnoses and costs. This allows tracking of health care utilization of patients and controls over long periods of time. It also allows us to observe the frequency with which diagnoses of other medical conditions—such as hypertension, myocardial infarction, and cerebrovascular accident—correlate with OSAS. We are able to ascertain total individual usage in any given time interval for any Manitoba resident.

We selected all patients with polysomnographically proven OSAS initially evaluated and diagnosed in our sleep disorders center who had comprehensive health care utilization information in the MHdb going back 10 years before their diagnosis of sleep apnea. We then constructed a working database of patients and controls using data from the MHdb. The control patients were matched based on age, gender, and postal code (to correct for socioeconomic factors) to the OSAS cases. We attempted to obtain three to four controls for each subject. Patient data were thereafter compared to the mean of his or her own controls to produce a single virtual control for each case. This allowed taking advantage of the large numbers of controls available to provide us with more statistical power. Patients and controls were residents of Manitoba for the length of the study period and, as such, were fully insured for health care throughout the entire 10 years.

Any case or control with extreme usage (greater than 100 days in hospital over 10 years) or who was institutionalized for a chronic or congenital illness was excluded from the study. This exclusion was performed to limit our sample to "typical" OSAS patients and "typical" controls, and was done prior to analysis and without knowledge of whether the excluded person was a case or control. This excluded 22 cases and controls from the study.

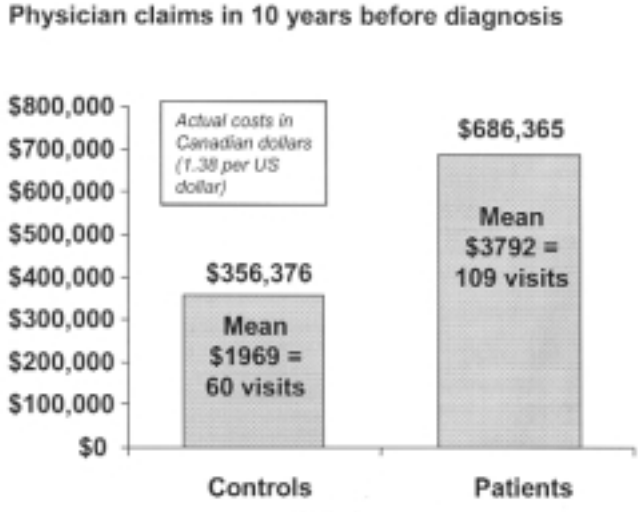

Figure 1.—Total physician claims for 181 patients versus control subjects over a 10-year period prior to diagnosis with OSAS. Per patient costs and visits are set within the bars for each group.

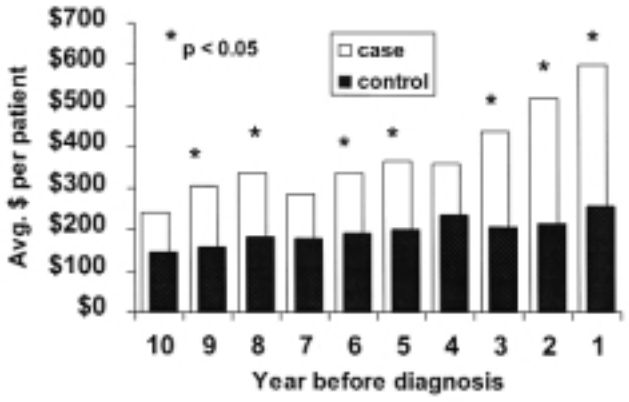

Figure 2.—Average physician claims for 181 patients versus control subjects for the 10 years prior to diagnosis with OSAS. Difference between groups indicated by asterisk (see Table 2).

The final working database included the complete health care utilization information for 181 OSAS patients and for three or four randomly selected control subjects (without known OSAS) for each OSAS patient (34 had three controls each, 147 had four controls each). Confidentiality for persons in the control group and patient group was ensured by "encrypting" each patient's health insurance number and using the encrypted number as that patient's only identifier; this was done by Manitoba Health before data were made available to the Manitoba Health Research database that we used. This research was approved by the University of Manitoba Human Ethics Committee and the Access and Confidentiality Committee of Manitoba Health.

Table 1.—Patient demographics

	Women	Men
Number	36	145
Age	50.4 ± 12.3	50.6 ± 10.0
BMI	36.6 ± 8.5	33.8 ± 7.6
AHI	17.0 ± 19.2	33.8 ± 27.8

AHI = Apnea-hypopnea index; values are mean ± SD

Table 2.—Comparison of yearly physician claims

Year before diagnosis	Patients ($/person)	Controls ($/person)	Ratio
	n = 181	n = 690	
1	$600.48	$257.37	2.3*
2	$517.39	$217.06	2.4*
3	$438.07	$206.76	2.1*
4	$359.81	$236.96	1.5
5	$365.58	$199.27	1.8*
6	$338.29	$191.58	1.8*
7	$287.51	$179.25	1.6
8	$337.54	$181.43	1.9*
9	$304.11	$154.74	2.0*
10	$243.29	$144.51	1.7

*significant using Scheffe's multiple comparison test ($p < 0.05$)

Table 3.—Comparison of yearly hospital admissions*

Year before diagnosis	Patients (n=181)	Controls (n=690)	p-value**
1	24 (13.3%)	39 (5.7%)	0.001
2	22 (12.2%)	42 (6.1%)	0.009
3	18 (10.0%)	30 (5.1%)	0.006
4	15 (8.3%)	28 (4.7%)	0.032
5	16 (8.8%)	34 (4.9%)	0.067
6	16 (8.8%)	39 (5.7%)	0.162
7	16 (8.8%)	45 (6.5%)	0.356
8	18 (10.0%)	38 (5.5%)	0.046
9	10 (5.5%)	34 (4.9%)	0.892
10	11 (6.1%)	41 (5.9%)	0.914

*Values are the number (percentage) of patients and controls hospitalized in a given year;
**In years 1-4, eight admissions to hospital for patients were greater than controls ($p < 0.05$) (length of stay not factored in)

Table 4.—Total expenditure over 10 years

	Patients	Controls
Hospitalizations*	$1,118,000	$676,000
Physician claims**	$686,365	$356,376
Total	$1,804,365	$1,032,376

*Cost projection assuming $1000 Canadian per hospital day
**These are actual billings paid to physicians

Statistical analysis of the data using physician claims as the outcome measurement was performed using a general linear-model ANOVA. Scheffe's Multiple Comparison Test allowed us to determine whether patients were different from controls in each of the previous 10 years. This conservative post hoc test examines all possible pairs, comparing each year to every other year for case and control groups. Differences in admission to hospital were assessed using chi-square analysis.

Costs are presented in actual Canadian dollar amounts unadjusted for inflation. Because each patient is compared with his or her own control in the same year, inflation does not skew the data. Presented total cost is conservative, reflecting the combination of 1984 to 1995 dollars.

RESULTS

The patients were typical of OSAS (see Table 1). The 181 patients were, on average, obese, 50 years old, and having symptomatic OSAS. There were more men (145) than women (36), reflecting the gender bias in both the prevalence and recognition of this condition.

Physician Claims

A strong, statistically significant relationship was seen between OSAS and heavy use of health care resources in the 10 years studied; physicians claimed more for cases than for controls ($p<0.001$), and an interaction was seen that showed the increasing difference in physician claims approaching the time of diagnosis (group and year interaction, $p<0.001$). Physician claims for patients exceeded controls in the 10 years prior to evaluation (Fig. 1). Physician claims for the patient group totaled $686,365 ($3972 for each patient), compared to $356,376 ($1969 for each patient) for the controls for the length of the study. The average number of physician visits for patients was nearly twice that of controls (109 for each patient, 60 for each control subject over 10 years).

Over the 10 years, patients used more physician resources (measured as the dollar amount of the physician claims) for each year (from 1.5 to 2.4 as much), and these differences were significant by Scheffe's post hoc test for 7 of 10 years (Table 2). While a difference exists as far back as 10 years prior to diagnosis, the usage by OSA patients increases greatly 3 years prior to diagnosis. The small incremental increases in the control group may be due to aging and inflation, but—since cases and controls are compared for each year—the increasing gap in expenditure must be attributed to increasing usage by the cases. Over the 4 years prior to diagnosis, mean annual physician claims increased by $240.67 for patients compared to $20.41 for controls (Table 2).

Hospital Admissions

OSAS patients had more hospitalizations: 1118 nights (6.2 per patient) in hospital vs 676 nights (3.7 per patient) for controls over the 10-year period. The chance of having had an admission in the 10-year period was greater for the patient group than for their controls (Table 3) ($p<0.001$). In a similar manner to the increase in the physician claims seen 3 years before diagnosis (Fig. 2), the probability of admission increases dramatically and becomes statistically significant around 3 years before diagnosis.

Combining total nights in hospital multiplied by $1000 per night with actual physician claims for the 10 years yields an estimate of the total cost (Table 4). We believe that transforming hospital stay into dollars using Refined Diagnostic Related Groups (RDRG) would not enhance our understanding of the overall utilization for this group, given the fact that RDRGs do not include OSAS as a diagnosis.

DISCUSSION

We found that sleep apnea patients use health care resources at approximately twice the rate of controls as far back as 10 years before their diagnosis. Analysis of the two main components of medical costs, physician claims and hospital stays, demonstrates greater utilization of both in the patient group.

If this type of research were done in a community without universal access to health care and a single payer, one would have had to deal with whether access were equal in patients and controls. Insofar as one can judge access by system characteristics (as opposed to detailed personal factors), patients and controls had equal access. All residents of Manitoba are on one database so that we could match by gender, age, and area of residence. The latter helps correct for possible socioeconomic differences, and for distance from hospital and medical services. This study does underestimate cost differences by not taking into account costs associated with medications, home care, outpatient visits, most hospital laboratory tests, or sessional fees covered under global hospital budgets. In addition, taking inflation into account would have also increased the difference between patients and controls. Since we compared a patient's and a matched control's expenditures in a given year, the effect of inflation in a given year was negligible.

It is possible that our findings reflect not OSAS per se, but the presence of some of the risk factors that predispose to OSA, such as obesity, alcohol usage, and perhaps tobacco consumption. Another possible confound is that about 4% of the age- and gender-matched controls may have OSAS.[3] Future research will thus focus on the factors determining the utilization of health care resources, including analysis of what OSAS patients and controls are being diagnosed with and treated for. This subsequent work will be done on a larger number of patients over a 5-year span, and will examine relative frequencies of diagnosis and differences between genders. Patients were not matched to controls for body mass index (BMI), because that information is not included in the MHdb. Patients are—on average—obese, but represent a range of weights. We will examine the contribution of BMI to cost within a stratified patient group as well as the effect of treatment on cost. These will be presented in subsequent publications.

Although the OSAS patients are more likely to be heavy users of health care resources, other factors should be considered. For example, people with other medical problems and thus increased contact with the health care system are more likely to be referred for evaluation of OSA. Thus one may ask whether our control population chosen at random from the general population may be more heavily weighted with people with little or no contact with the health care system, even though they had free access. However, only 6 of the 690 control subjects had no contact with the health care system in the 10-year period. Because all residents of Manitoba have access to health care, it is likely that apnea was present for several years prior to referral, but was undiagnosed and therefore untreated. This is consistent with the authors' clinical impression that apnea symptoms are often present for years before apnea is considered.

Sleep apnea may be underdiagnosed[4] because the amount of time allotted in medical schools to teaching about sleep disorders is minimal and so most practitioners have had little or no training in this area.[8] In addition, in many communities, resources to manage apnea patients are severely compromised.[9] It has been argued that sleep apnea may not be a significant medical problem and that the relationships between apnea and the comorbidities mentioned above may be based on research studies that may not meet modern evidence-based standards.[5] Our study looked at the issue by examining not comorbidities but actual utilization of health care resources. Our study showed unambiguously that patients ultimately diagnosed with OSAS, compared with the general population, go to the doctor far more often and are hospitalized more often for many years. The very conservative Scheffe's post hoc test showed that for 7 of the 10 years, expenditures for cases exceeded that of controls, despite the loss of statistical power due to examining all pairwise comparisons. Future research will help determine the causes of the increased expenditure by examining diagnostic patterns; they were certainly not being treated for apnea.

The effectiveness of treatment of OSAS is generally accepted.[1] Many patients who are treated with CPAP experience a dramatic improvement in their quality of life and are able to return to work and lead productive lives after

having been seriously handicapped by OSAS. Because early diagnosis and treatment would improve the health of OSA patients and should help reduce overall usage, education of physicians in detection of OSA and treatment of patients should be priorities for health care policy-makers. Nevertheless, as seen in a large survey in the United Kingdom by Ohayon et al,[4] OSAS remains underdiagnosed and undertreated; patients continue to be both ill and financially burdensome to governments and health care providers.

Besides the increased utilization of health care, patients may incur costs related to reduced productivity and increased accidents which are a byproduct of the impairment of cognitive function and performance that has been documented in many studies.[10-16] Not having resources available for management (diagnosis and treatment) would perpetuate the increased utilization; more importantly, the absence of management for apnea would serve neither the patient—who would still be symptomatic and have a poor quality of life[17,18]—nor society, which would pay the bills of increased health costs, automobile accidents,[19,20] and reduced productivity.

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