

Determinants Affecting Health-Care Utilization in Obstructive Sleep Apnea Syndrome Patients*

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Study objective: To investigate determinants of health-care utilization in patients with obstructive sleep apnea syndrome (OSAS).

Design: Case-control prospective study with OSAS patients and a control group. We compared 218 patients with OSAS to those of age-, gender-, geographically-, and family physician-matched control subjects from the general population, matched 1:1 ($\chi^2 = 0.999$).

Participants: All participants were members of Clalit Health Care Services, a health maintenance organization in the southern region of Israel. All OSAS patients underwent nocturnal polysomnography studies. Indexes of health-care utilization 2 years prior to the polysomnography were analyzed.

Measurements and results: Health-care utilization was 1.7-fold higher ($p < 0.001$) in the OSAS patients due to more hospitalization days ($p < 0.001$), consultations ($p < 0.001$), and cost for drugs ($p < 0.05$), particularly those for the cardiovascular system. In comparison to men, women consumed significantly more health-care resources ($p < 0.001$). OSAS patients ≤ 65 of age years consumed 2.2-fold more health-care resources than control subjects ($p < 0.001$). Polysomnography findings and OSAS severity and body mass index (BMI) did not predict health-care utilization, using multivariate logistic regression analysis. Age > 65 (odds ratio [OR], 2.2; $p < 0.04$) and female gender (OR, 2.0; $p < 0.05$) were the leading elements predicting the most costly OSAS patients. Arbitrarily dividing the OSAS group by cost of health-care utilization, the upper 25% ($n = 55$) of patients who were the "most costly" consumed sevenfold more health-care resources than the lower 75% of the patients. This was due to higher comorbidity, *ie*, 10 to 30% more hypertension, ischemic heart disease, diabetes mellitus, and pulmonary disease.

Conclusions: OSAS patients are heavy users of health-care resources. Age > 65 years and female gender were the leading elements predicting the most costly OSAS patients, and not necessarily patients with a high BMI and classic OSAS severity indexes. (CHEST 2005; 128:1310–1314)

Key words: age; costs; gender; health-care utilization; obstructive sleep apnea syndrome

Abbreviations: BMI = body mass index; CHS = Clalit Health Care Services; CI = confidence interval; ESS = Epworth sleepiness scale; OR = odds ratio; OSAS = obstructive sleep apnea syndrome; RDI = respiratory disturbance index

Obstructive sleep apnea syndrome (OSAS) is a common sleep-related breathing disorder and is a risk factor for both chronic and acute conditions, such as cardiovascular events and even sudden death.^{1,2}

OSAS patients are heavy consumers of health-care resources.^{3,4} Most information regarding adults comes from the Canadian health-care system^{4–8}; only limited information is available from other parts

of the world.^{9,10} These studies have shown that physician costs and hospital admissions are > 1.6 -fold higher in patients with OSAS than in the general population. Five years prior to OSAS diagnosis, patients with OSAS have been shown to be heavy users of medications, particularly those used to treat cardiovascular diseases.^{5,8} Diagnosis of OSAS and adherence to treatment results in a significant reduction in resource utilization, *eg*, physician claims and hospital stays.⁶

In Israel,¹¹ OSAS is underdiagnosed and undertreated. This may be due in part to the commonly held belief that OSAS may not pose a serious health risk,¹² and low awareness of the manifestations of OSAS¹³ by primary care physicians, as well as its relationship to health-care utilization and quality of life.

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We present data on determinants affecting health-care utilization in OSAS patients, in the Israeli health-care arena, 2 years prior to diagnosis. In this system, which is similar to most industrialized countries, patients have obligatory National Health Insurance and physicians do not have any economic incentive to prevent or deter patients from medical services. We hypothesized that increased health-care utilization is related to comorbidity and OSAS patient characteristics. The current study explores the effect of age, gender, and apnea severity on utilization of health-care resources among patients with OSAS.

MATERIALS AND METHODS

Subjects are enrollees of Clalit Health Care Services (CHS), the largest health maintenance organization in Israel; all had been permanent residents of the southern region for at least 3 years prior to study initiation. Recruited subjects are “typical” OSAS patients (with or without chronic diseases and prescribed medication respectively) and control subjects, entitled to a polysomnographic study and all diagnostic and treatment information free of charge. Control subjects ($n = 218$) randomly selected from the general population were matched (1:1 with OSAS patients) by family physician, age, gender, and area of residency.⁵ In cases where we matched more than one control subject, we arbitrarily selected the first subject. We excluded three enrollees with OSAS who exhibited extreme consumption (> 10 times the mean values) of health-care services and none from the control group. Patients were not matched to control subjects for body mass index (BMI) because that information is not included in the CHS database. By law, we were not permitted to contact the control subjects. We confirmed that the control group was healthy and none of these subjects had a chronic disease by verifying that they did not receive any regular prescribed medications. However, it is possible that 2 to 4% (at most) of the control subjects might have undiagnosed OSAS. The Institutional Ethics Committee approved the protocol, and informed consent was obtained from all OSAS subjects.

Diagnosis of OSAS was based on history and polysomnographic findings. Data on patient history were acquired by self-administered questionnaires. Overnight polysomnography was performed according to previously described methods in our laboratory.¹⁴

Data were obtained from the CHS billing system, with a reliability $> 98\%$.^{15,16} All costs were collected in the 24-month period prior to the polysomnography. Direct costs of OSAS include the following: (1) number of hospitalization days, number of “day hospital” visits (< 24 -h admission), and number of emergency department visits; (2) number of (new and repeated) visits to the primary care physician and specialist (*ie*, consultations for continuous positive airway pressure titration, pulmonary/otolaryngologists); and (3) drugs prescribed (type and cost), categorized according to World Health Organization recommendations.¹⁷ We did not include indirect costs such as cost of polysomnography, titration study, or out-of-pocket expenses for CPAP purchase in our analysis. We defined *total annual cost* as the sum of the costs for all indicators. Costs are expressed as the mean per patient per year in US dollars according to the price list published by the Israeli Ministry of Health. The exchange rate was 4.2 New Israeli sheqal per US \$1. Values were adjusted for inflation.

Data Analysis

Cost data were analyzed¹⁸ using statistical software (SPSS version 11.5; SPSS; Chicago, IL). Statistical power ($\alpha = 0.05$) was calculated for the women ($n = 44$, control vs OSAS) and was found to be 0.98. One-way analysis of variance was used to compare between mean values. A Mann-Whitney U test was used to determine statistical significance of cost elements between groups; χ^2 was used to confirm “population match” and univariate analysis. Multivariate logistic regression analysis was used to calculate the high costly subgroup of OSAS patients and control subjects. Data were presented as mean \pm SEM for costs and median and range. Statistical significance was accepted at $p \leq 0.05$.

RESULTS

Two hundred eighteen adult OSAS patients were included (mean age, 54.8 ± 10.3 years; 18% > 65 years old; 79.8% male gender). The control subjects were perfectly matched ($\chi^2 = 0.999$) by family physician, age, gender, and address. All symptoms were typical for the OSAS group except for “observed choking” by the spouse, which was reported in 47% of the men vs 25% of women ($p < 0.01$). The comorbidity of the OSAS group (hypertension, 40.5%; diabetes mellitus, 14.5%; pulmonary diseases, 12.4%) was similar between genders and ages (≤ 65 years and > 65 years), except for ischemic heart disease, which was 54% and 19% ($p < 0.001$) in patients > 65 years vs ≤ 65 years old, respectively. The OSAS group had a mean respiratory disturbance index (RDI) of 34.9 ± 22.3 events/h, BMI of 32.8 ± 6.8 , Epworth sleepiness scale (ESS) 7.6 ± 4.4 , arousal index 28.9 ± 16.1 events/h. In comparison to men, women with OSAS were 3 years older ($p < 0.05$), heavier (> 3 BMI units), and had milder OSA (< 8 RDI units) than men ($p < 0.05$).

Health-care utilization was 1.7-fold higher ($p < 0.001$) in the OSAS patients compared with the control group (Table 1) due to more hospitalization days ($p < 0.001$), consultations ($p < 0.001$), and cost of prescribed drugs ($p < 0.05$), particularly those for the cardiovascular system and alimentary tract and metabolism (Table 2). “Other medications,” which represents the remaining 13 pharmacological groups, were significantly reduced among OSAS patients due to significant elevation of “cardiovascular system” and “alimentary tract and metabolism” drugs (Table 2).

In comparison to men (Table 1), women in both groups consumed significantly more health-care resources. OSAS patients ≤ 65 years old consumed 2.2-fold more health-care resources (Table 1) than control subjects ($p < 0.001$), but similar consumption was found among those > 65 years of age in both groups. The leading elements in which the cost ratio (> 65 years/ ≤ 65 years of age) was significantly different in both groups were drugs and consulta-

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