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Original Article

Workplace Accidents, Absenteeism and Productivity in Patients With Sleep Apnea☆

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ABSTRACT

Introduction: Obstructive sleep apnea-hypopnea syndrome (OSAHS) has health-related outcomes, but the impact of OSAHS on occupational health has been scarcely studied. The aim of this study was to evaluate the effect of OSAHS on workplace accidents, absenteeism and productivity.
Method: One hundred eighty-two OSAHS patients and 71 healthy subjects completed the Epworth Sleepiness Scale, the Pittsburgh Sleep Quality Index and the Spanish IMPALA *(Impact of Disease on Work Productivity)* index and answered various questions on workplace accidents and sick leave. Participants were classified to an OSAHS group or a non-OSAHS group according to polysomnography results.
Results: Patients with OSAHS had more sick leave lasting longer than 30 days (16.6% vs 7%, *P*=.049) and lower productivity (63.80% vs 83.20%, *P*=.000) than subjects without OSAHS, although the rate of workplace accidents was similar in both groups (27.4% vs 25.4%; *P*>.050). None of the OSAHS-related variables were associated with workplace accidents. A diagnosis of OSAHS was related with absenteeism. Psychological distress and OSAHS were related with productivity.
Conclusions: OSAHS causes limitations in the working lives of patients and leads to a higher incidence of sick leave and lower productivity. A diagnosis of OSAHS was the variable with most influence on the working lives of patients.

Accidentes laborales, absentismo y productividad en pacientes con apneas del sueño

Palabras clave:
Síndrome de apnea-hipopnea del sueño
Accidentes laborales
Días de baja
Productividad laboral

RESUMEN

Introducción: El síndrome de apneas-hipopneas del sueño (SAHS) provoca consecuencias sobre la salud, pero el impacto del SAHS sobre la salud laboral ha sido escasamente estudiado. El objetivo fue evaluar la influencia del SAHS en la presencia de accidentes laborales, absentismo y productividad laboral.
Método: Un total de 182 pacientes con SAHS y 71 personas sin SAHS contestaron a la escala de somnolencia de Epworth, el índice de calidad de sueño de Pittsburgh, el índice de impacto de la enfermedad en la productividad laboral y algunas preguntas sobre la frecuencia de accidentes laborales y el número de días de bajas laboral por enfermedad. Los participantes fueron clasificados mediante polisomnografía en un grupo con o sin SAHS.

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Resultados: Los pacientes con SAHS presentaron más bajas laborales > 30 días (16,6% vs 7%; p = 0,049) y una menor productividad laboral (63,80% vs 83,20%; p = 0,000) respecto a las personas sin SAHS, aunque la proporción de accidentes laborales fue similar (27,4% vs 25,4%; p > 0,05). Ninguna de las variables asociadas al SAHS se relacionó con los accidentes laborales. Se evidenció una asociación entre el absentismo y el diagnóstico de SAHS, y entre este último, el distrés psicológico y la productividad laboral.
Conclusiones: El SAHS provoca limitaciones en la vida laboral de los pacientes, con un número más elevado de bajas laborales y una menor productividad. El diagnóstico de SAHS fue la variable con mayor influencia en la vida laboral de los pacientes.

Introduction

Obstructive sleep apnea-hypopnea syndrome (OSAHS) is a very common respiratory disorder in industrialized societies, and occurs in 24% of men and 9% of women in middle age.[1] It consists of repeated episodes of limited airflow or airflow blockage during sleep causing micro-awakenings and intermittent hypoxemia. It has a serious impact on health,[2] causing hypertension[3] and cardiovascular disease.[4,5]

OSAHS patients often present significant cognitive limitations[6] and a generally poorer quality of life.[7] Obesity and poor quality of rest, which are often seen with this disorder, are associated with mood disorders such as anxiety and depression.[8] However, one of the most debilitating symptoms of this syndrome is excessive daytime sleepiness. Tiredness, together with loss of alertness and attention deficit, not only makes it difficult for OSAHS patients to function on a daily basis, but also contributes to a general increase in mortality, due to the increased risk of road traffic accidents.[9]

Only 5%–9% of patients with OSAHS are diagnosed[10] and the burden on public health services in Western societies is considerable.[11] Moreover, OSAHS involves indirect costs that are very difficult to calculate, such as limited ability to work, accidents at work, and loss of productivity.[12]

Some studies have evaluated work performance in patients with OSAHS, but results have been disputed. The syndrome has been shown to have a negative impact on patients' ability to concentrate, to organize time, to learn new tasks and to carry out monotonous tasks.[13,14] Another study found that OSAHS, when associated with excessive daytime sleepiness, was detrimental to work performance.[15,16] Despite some methodological limitations, cohort studies have found a higher rate of absenteeism in patients with symptoms of OSAHS.[17,18] However, no solid conclusions have been drawn regarding the relationship between OSAHS and absenteeism.[19]

Some authors have reported a relationship between OSAHS symptoms and increased risk of work-related accidents. In a prospective study, Lindberg et al.[20] showed a 2-fold increase in the risk of workplace accidents in patients who snored and who had daytime sleepiness vs patients without those symptoms. Other large population studies,[21] including professional drivers[22,23] or rural workers,[24] found that some OSAHS symptoms, such as snoring, sleep apneas or daytime sleepiness, evaluated by direct questioning or questionnaires, were associated with a greater risk of accidents in the workplace. However, very few studies have evaluated the rate of work-related accidents in patients with a definitive diagnosis of OSAHS.

In view of the lack of consensus between studies investigating productivity and work accidents in patients with OSAHS, we designed a cross-sectional, descriptive *ex postfacto* study of productivity and work accidents in a sample of OSAHS patients vs a group of non-OSAHS individuals. A sleep study was performed in both the clinical group and the control group using the gold standard test, polysomnography. The study hypothesis was that participants in the clinical group would have a higher rate of work-related accidents and absenteeism than the control group, and that OSAHS patients would have poorer productivity than healthy subjects. This article was written following the Hartley guidelines.[25]

Methods

Data for this study were collected between 2010 and 2012 in 2 sleep units in hospitals in the north and in the south of Spain. The sample comprised 259 individuals who attended the sleep unit and underwent consecutive polysomnography studies. Participants were actively employed or had been unemployed for up to 6 months. All participants signed informed consent; only 6 individuals refused to take part in the study. Of the remaining 253 subjects, 204 were men and 49 were women, with ages ranging from 22 to 65 years, mean 46.85±9.5 years. The clinical group consisted of 182 patients with a diagnosis of OSAHS, and 71 non-OSAHS subjects were included in the control group. Patients with a diagnosis of other sleep disorders, serious debilitating diseases, alcohol or other drug addictions, or who were receiving treatment with neuroleptics, tranquilizers or other medications that could alter sleep or cause excessive daytime sleepiness, were excluded.

Instruments

Sociodemographic data, general health and working conditions, such as work schedule, number of hours worked, shift work and type of employment contract, were collected by means of a questionnaire completed by all participants. Excessive daytime sleepiness was evaluated on the Epworth sleepiness scale (ESS)[26] and the subjective Pittsburgh Sleep Quality Index (PSQI).[27] Emotional disorders were evaluated using the Hospital Anxiety and Depression Scale (HADS).[28] The sum of the 2 subscales was considered, and a cut-off point of 14 was used to determine psychological distress. The survey included questions aimed at evaluating the number of days of sick leave and the number of work-related accidents in the last 18 months. Impact of disease on productivity was evaluated on the IMPALA scale,[29] consisting of 7 items addressing different aspects of the occupational impact of health problems, such as difficulty in following routine work schedules, in working without rest breaks, in avoiding mistakes, and in meeting deadlines. The response scale ranges from 1 (work affected constantly or for most of the time) to 4 (no impact at any time). The total transformed scale was scored from 0 (poorest productivity possible) to 100 (maximum productivity).

Procedure

OSAHS was diagnosed from a complete sleep study with conventional polysomnography. The same methodology was used in both clinics: 3 electroencephalogram channels (F4-M1, C4-M1 and O2-M1), 2 electrooculogram channels, 2 electromyography channels placed under the chin, 1 placed on the anterior tibialis of each leg, and 1 electrocardiogram channel. SaO_2, pulse and snoring

rate were also analyzed. Airflow was measured using a pressure catheter and a thermistor, and chest and abdominal movements were recorded with elastic belts. Sleep studies were analyzed manually by specialists, according to the recommendations of the *American Academy of Sleep Medicine*.[30] SAHS diagnosis was determined using the apnea-hypopnea index (AHI). Any patient with a score ≥5 was considered to have OSAHS. Study participants completed the questionnaire just before beginning their sleep study.

Educational levels were divided into 5 categories (no studies, primary, secondary, technical, and university studies). Types of occupation were classified according to the International Standard Classification of Occupations (ISCO-08)[31] and divided into 10 groups of professions. The presence of other diseases, such as hypertension, diabetes, hypercholesterolemia, and cardiovascular, pulmonary, endocrine and/or neurological diseases, was evaluated in some of the questionnaire items. Co-morbidity was defined as the presence of at least 1 of the above-mentioned diseases. Participants were also asked about their smoking and drinking habits and use of medications. Somatic symptoms of stress were defined as manifestation of at least 1 symptom, such as stomachache, headache, pain or chest tightness, breathlessness or muscle tension. Since the number of days missed from work due to illness did not show a normal distribution, this item was transformed into a qualitative variable. To do this, absenteeism was defined as the number of periods of leave due to illness lasting 30 days or longer in the previous year.

Sample characteristics were expressed as mean and standard deviation. The Pearson chi-squared test was used to compare the clinical group vs the control group for work-related accidents and absenteeism rates, while the Student's *t*-test was used to measure the impact of the disease on productivity. All comparisons were two-tailed, with values of $P<.05$ being taken as significant. To analyze the influence of diagnostic variables and OSAHS symptoms on the incidence of work-related accidents and absenteeism, a logistic regression analysis was used and data were presented as odds ratios (OR) with 95% confidence intervals (CI). A linear regression model was used to analyze the influence of the study variables on productivity. All tests were performed using SPSS 20.0 statistical software.

The project was approved by the Clinical Research Ethics Committee of the healthcare areas that participated in the study. Inclusion in the study was fully voluntary, and patients were duly informed about the objectives and signed informed consent.

Results

The characteristics of the 253 study participants, classified according to diagnosis of OSAHS (n=182; AHI=42.6±28.4) or absence of OSAHS (n=71; AHI=2.1±1.7), are shown in Table 1. The only differences between the OSAHS group and the control group lay in the distribution of sex, BMI and some of the job categories, such as scientific or intellectual professions. The type of working schedule was similar in both study groups. Patients with OSAHS were more frequently hypertensive and had a higher degree of psychological distress than the non-OSAHS control group.

Table 2 shows the characteristics of participants with OSAHS and their assessment of daytime sleepiness and perceived quality of sleep. Patients with OSAHS had more excessive daytime sleepiness than the control group ($P=.021$), but Pittsburgh scores for poor quality of sleep were similar in both groups ($P=.238$).

Table 3 compares repercussions in the workplace between the OSAHS group and the control group. Both groups had similar rates of work-related accidents, but it is interesting to observe that patients with OSAHS had a significantly higher rate of absenteeism and poorer productivity.

A logistic regression model was constructed that included at least age, sex, excessive daytime sleepiness, subjective quality of sleep, and OSAHS or control subject. The only variables of interest when evaluating workplace accidents were use of medications, physically stressful work, and social level; the model produced an adjusted R^2 of 0.126 ($P=.001$), and the only variable that showed an independent association with workplace accidents was physically stressful work (OR=0.347; CI: 0.167–0.718; $P=.004$). With respect to absenteeism, significant variables were: OSAHS or control group subject, and subjective quality of sleep (adjusted $R^2=0.045$; $P=.048$). Notwithstanding, the only factor with an independent influence on work absenteeism was OSAHS subject (OR=2.718; CI: 1.004–7.356; $P=.049$). A linear regression model was used for productivity, and the variables accepted by the model were age, subjective quality of sleep, psychological distress, OSAHS or control subject and AHI. The model showed an adjusted R^2 of 0.133, $F=7.412$ ($P=.000$), and there was an independent association between productivity and a diagnosis of OSAHS (β coefficient=0.251; $P=.002$) and psychological distress (β coefficient=−0.249; $P=.001$).

Discussion

This study found that patients with OSAHS did not have a significantly higher number of work-related accidents, although, compared to the non-OSAHS group, they did have a higher percentage of long-term absenteeism, lower productivity levels, and a high rate of psychological distress. These findings are significant, and confirm that OSAHS is a disease with considerable social and economic repercussions.

The multivariate analysis corroborated the finding that patients with OSAHS had a lower level of productivity. This result was previously reported by Swanson et al.[32] who used an OSAHS symptom questionnaire to show that individuals with a high risk of suffering this disease had problems concentrating and organizing themselves at work, in addition to a loss of productivity. Similarly, Grunstein et al.[33] reported that sleepiness associated with the risk of sleep-disordered breathing was the main factor in loss of productivity and performance, although the sample was composed of obese individuals who were consequently more likely to present other sleep disorders associated with obesity. Nena et al.[34] using the Endicott productivity scale, did not find any relationship with severity of OSAHS or with sleep quality, although it should be borne in mind that their sample contained only patients with OSAHS. Thus, very few studies have investigated productivity in OSAHS patients compared to a control group using standardized questionnaires. Moreover, we found that psychological distress led to poorer productivity in patients with OSAHS. There is very little work on this aspect in the scientific literature.

With regard to days off work due to illness, a greater rate of long-term absenteeism was found in OSAHS patients, in line with the findings of other authors. Sivertsen et al.[18] showed that subjects with OSAHS more often took periods of sick leave of longer than 8 weeks; other authors have also suggested that OSAHS is associated with a greater risk of taking sick leave and receiving a disability allowance.[17] Various studies have emphasized the importance of sleepiness as a determining factor for work absenteeism,[18,32,35] although some of these have limitations. For example, Sivertsen et al.[18,35] used the Karolinska sleep questionnaire, but did not perform an objective sleep study; Accattoli et al.[13] used only polygraph as their sleep study, and only evaluated work performance

Table 1
Sociodemographic and Clinical Characteristics of Study Participants.

Characteristics	Group		*P*
	OSAHS (No.=182)	Controls (No.=71)	
Age, years	47±9	46±10.5	.263
Sex, men, n (%)	157 (86.2)	47 (66.7)	.001
BMI	30.5±5.4	26.88±4.6	.001
Education, n (%)			.405
No studies	5 (2.8)	2 (2.8)	NS
Primary	55 (30.4)	20 (28.2)	NS
Secondary	42 (23.2)	15 (21.1)	NS
Technical training	43 (23.8)	12 (16.9)	NS
University studies	36 (19.9)	22 (31.0)	NS
Type of work, n (%)			.009
Managers	0 (0)	0 (0)	NA
Professionals	10 (5.7)	14 (20.3)	.001
Technicians and associate professionals	28 (16.1)	8 (11.6)	NS
Clerical support workers	1 (0.6)	0 (0)	NS
Services and sales workers	32 (18.4)	15 (21.7)	NS
Skilled agricultural, forestry and fishery workers	6 (3.4)	0 (0)	NS
Craft and related trade workers	3 (1.7)	0 (0)	NS
Plant and machine operators	71 (40.8)	20 (29)	NS
Elementary occupations	16 (9.2)	11 (15.9)	NS
Armed forces occupations	7 (4.0)	1 (1.4)	NS
Working schedule, n (%)			.262
Full time	98 (54.4)	44 (62)	NS
Part time	57 (31.7)	18 (25.4)	NS
Shift work	25 (13.9)	8 (11.3)	NS
High alcohol consumption	19 (10.4)	6 (8.5)	.595
Smoking habit	28 (15.6)	9 (12.7)	.120
Comorbidities, n (%)			
Hypertension	50 (27.5)	10 (14.1)	.024
Diabetes	12 (6.6)	3 (4.2)	.474
Hyper-cholesterolemia	51 (28.0)	19 (26.8)	.840
Cardiovascular disease	10 (5.5)	3 (4.2)	.681
Lung disease	7 (3.8)	6 (8.5)	.136
Endocrine disease	9 (4.9)	5 (7)	.512
Neurological disease	5 (2.8)	3 (4.2)	.551
Habitual use of medications, n (%)	97 (53.9)	32 (45.1)	.208
Psychological distress, n (%)	87 (48.3)	23 (32.4)	.015

BMI, body mass index; NA, not applicable; NS, not significant.
Data are expressed as absolute numbers and percentages for qualitative variables and as mean±standard deviation for quantitative variables.

Table 2
Subjective and Objective Characteristics of Participants' Sleepiness and Work.

Variables	Group		*P*
	OSAHS (No.=182)	Control (No.=71)	
Physically stressful work, n (%)	99 (60.7)	40 (57.1)	.608
Somatic symptom of stress, n (%)	51 (33.6)	16 (22.5)	.095
Excessive daytime sleepiness	10.3±5.3	8.55±4.7	.021
Subjective quality of sleep (Pittsburgh index)	7.9±3.9	7.3±3.72	.238

Data are expressed as absolute numbers and percentages for qualitative variables and as mean±standard deviation for quantitative variables.

Table 3
Comparison of Work-related Accidents, Absenteeism and Work Productivity of Subjects With and Without OSAHS.

Variables	Group		*P*
	OSAHS (No.=182)	Control (No.=71)	
Work-related accidents, n (%)	49 (27.4)	18 (25.4)	.745
Absenteeism due to disease, number of sick leaves>30 days/year, n (%)	30 (16.6)	5 (7)	.049
Impact of disease on work productivity (IMPALA scale)	63±33.6	83±21.1	.001

Data are expressed as absolute numbers and percentages for qualitative variables and as mean±standard deviation for quantitative variables.

on the basis of some questions related to difficulties encountered at work.

The number of work-related accidents in our patients was not significantly higher than in the control group. In line with this study, Karimi et al.[36] found similar work-related accident rates in OSAHS patients compared to healthy participants. In another setting, Accattoli et al.[13] compared the rate of work-related accidents in healthy workers to those with a diagnosis of OSAHS and found that administrative workers with severe OSAHS had a higher percentage of work-related accidents compared to controls in the same sector, but it must be emphasized that this group in general had a higher occupational accident rate than non-OSAHS workers in other areas. Workers with respiratory disorders were also found to have a greater risk of work-related accidents;[37] however subjects were classified on the basis of oximetry, a test that is not recommended for a clear diagnosis of OSAHS.

To conclude, our study was conducted in a large cohort, using rigorous methodology with validated questionnaires for studying work productivity and perceived quality of sleep. Polysomnography was used as the reference test in sleep studies. The most relevant findings are the relationship of OSAHS with low work productivity, increased periods of sick leave lasting longer than 30 days, and a greater degree of psychological distress. These results have a clear application, which should be studied in clinical practices, and demonstrate the involvement of OSAHS in the working life of these patients.

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Conflict of Interests

The authors declare that they have no conflict of interests.

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