Morbidity prior to a Diagnosis of Sleep-Disordered Breathing: A Controlled National Study

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Background: Sleep-disordered breathing (SDB) causes burden to the sufferer, the healthcare system, and society. Most studies have focused on cardiovascular diseases (CVDs) after a diagnosis of obstructive sleep apnea (OSA) or obesity hypoventilation syndrome (OHS); however, the overall morbidity prior to an SDB diagnosis has not been evaluated. The aim of this study was to identify morbidity prior to a SDB diagnosis to identify patients at risk for having/developing SDB.

Methods: Using data from the Danish National Patient Registry (1998-2006), we identified all patients nationwide given a diagnosis of OSA (19,438) or OHS (755) in all hospitals and clinics. For each patient, we randomly selected 4 citizens matched for age, sex, and socioeconomic status from the Danish Civil Registration System Statistics.

Results: Patients with OSA or OHS presented with increased morbidity at least 3 years prior to their SDB diagnosis. The most common contacts with the health system (odds ratio [OR]/confidence interval [CI]) for OSA/OHS were due to musculoskeletal system (1.36[1.29-1.42]/1.35[1.05-1.74];

CVD (1.38[1.30-1.46]/1.80[1.38-2.34]); endocrine, nutritional, and metabolic diseases (1.62[1.50-1.76]/4.10[2.90-5.78]); diseases of the nervous system (1.62[1.0-1.76]/3.54[2.56-4.88]); respiratory system (1.84[1.73-1.96]/2.83[2.07-3.89]); skin and subcutaneous tissue (1.18[1.07-1.30]/2.12[1.33-3.38]); gastrointestinal (1.17[1.10-1.24]/NS); infections (1.20[1.08-1.33]/NS); genitourinary system (1.21[1.13-1.30]/NS); and ear, nose, and throat (1.44[1.32-1.56]/NS).

Conclusions: Patients with SDB show significant morbidities several years prior to a diagnosis of OSA or OHS. OSA should be considered in all medical specialties as an important comorbidity. In our study, evidence points to particular emphasis for considering this diagnosis in endocrinology and metabolic specialties.

Keywords: Sleep apnea, epidemiology, morbidity, obesity hypoventilation, sleep disordered breathing

Citation: Jennum P; Ibsen R; Kjellberg J. Morbidity prior to a diagnosis of sleep-disordered breathing: a controlled national study. *J Clin Sleep Med* 2013;9(2):103-108.

Sleep related breathing disorders (SDBs) such as obstructive sleep apnea (OSA) and obesity hypoventilation syndrome (OHS) affect a significant proportion of the population. SDBs increase the risk of cardiovascular and cerebrovascular (CVD) morbidity and mortality. Because SDBs are chronic, they have deleterious effects on patients' social function, employment, and quality of life, and present a societal burden arising from increased direct and indirect costs.¹ Significant progress has been made in developing the best methods to diagnose and manage SDBs; simpler diagnostic procedures and improved treatment procedures such as continuous positive airway pressure (CPAP) reduce associated CVD morbidity and mortality and improve social functioning difficulties and other consequences of SDB.² Despite this progress, a significant number of patients with SDB remain undiagnosed or untreated.³⁻⁵ By the time a patient has been diagnosed, his or her social and morbid conditions are already affected to such a degree that the effect of intervention (e.g., CPAP) is limited. Therefore, earlier disease detection is needed to avoid the morbidity, mortality, and social consequences of SDB. There is evidence—an increased number of health care contacts and health care usage—that patients with OSA and OHS suffer from disease prior to SDB diagnosis.^{2,6,7} In addition, studies evaluating the consequences of OSA and

BRIEF SUMMARY

Current Knowledge/Study Rationale: Prior studies have presented evidence that sleep disordered breathing causes major morbidity and mortality after diagnosis, but pre-diagnostic morbidities are only sparsely evaluated. We aimed to describe total morbidities prior to diagnoses of obstructive sleep apnea and obesity hypoventilation.

Study Impact: Patients with sleep disordered breathing have major morbidities several years prior to a diagnosis. Sleep apnea and obesity hypoventilation should especially be considered in patients with endocrinological diseases, obesity and cardiovascular diseases, which calls for for screening programs in high risk patient groups.

OHS have focused on the total or CVD morbidity and mortality, and general disease manifestations prior to diagnosis with OSA or OHS have not been evaluated.

In Denmark, a central database (the National Patient Registry [NPR]) makes it possible to evaluate the general disease pattern of all patients with specific diagnoses from hospitals and clinics in the secondary and primary care sectors. We utilized the NPR to evaluate morbidity prior to SDB diagnosis. The aim of this study was to identify patients' health and diseases prior to diagnosis with OSA or OHS. Such information may be useful for identifying health-related consequences of OSA, particular-

ly for identifying groups of patients at high risk for SDB, where screening could be useful for earlier disease identification.

METHODS

Subjects

In Denmark, all hospital contacts are obliged to record to the National Patient Registry (NPR) in terms of the time of contact and with information about primary and secondary diagnoses. The NPR includes administrative information, diagnoses, and diagnostic (e.g., polysomnography [PSG], partial polygraphy) and treatment procedures (e.g., positive airway pressure [PAP], surgery) using several international classification systems, in-

cluding the International Classification of Disorders (ICD-10). The NPR is a time-based national database that includes data from all inpatient and outpatient contacts, so the data we extracted are representative of all patients in Denmark who have received a diagnosis of SA or OHS, irrespective of other diagnoses. As data are available throughout the observation period, we can trace patients retrospectively and prospectively relative to the time of their diagnosis. Furthermore, all contacts in the primary sector (general practice and specialist care in the primary sector) and the use of medications are recorded in the databases of the National Health Security and the Danish Medicine Agency, respectively. There is a small risk of underestimation of the patients with SA or OHS, as patients with a contact in the primary sector but not the secondary sector are recorded as having had contact but not as having had a diagnosis. Beginning in 2009, a national quality database has been introduced to identify quality and set minimum standards for the management of SDB, based on registrations in the NPR. Specific clinical information, such as body mass index (BMI), apnea-hypopnea index (AHI) and blood pressure (BP), was not included in this analysis, as these data were incomplete in the database.

Using the NPR, we identified all patients diagnosed with SDB between 1998 and 2006. For SDB diagnoses, we used ICD-10 codes (G473 for OSA and E662 for OHS in Denmark); these codes are given after patient evaluation in each hospital (based on PSG/polygraphy). SDB severity is not evaluated—the database contains administrative information but not disease severity. Then, using data from Denmark's Civil Registration System Statistics, we randomly selected citizens who had the same age, sex, and marital status as the patients but did not have an SDB-related diagnosis, including snoring (R065). Parity in socioeconomic status (SES) was developed by select-

Table 1—Age and gender distributions of patients and matched controls

	SA	OHS
Total/women (%)	19,438/4,304 (22)	755/247 (33)
Age, y		
< 20	1,931 (10)	5 (1)
20-29	861 (4)	22 (3)
30-39	2,417 (12)	76 (10)
40-49	4,201 (22)	150 (20)
50-59	5,696 (29)	244 (32)
60-69	3,287 (17)	159 (21)
70-79	920 (5)	81 (11)
≥ 80	125 (1)	18 (2)

Data are presented as numbers (%). The 19,438 patients with sleep apnea (SA) were matched with 77,752 control subjects; the 755 patients with obesity hypoventilation syndrome (OHS) were matched with 3,020 control subjects.

Table 2A—Morbidity 3 years prior to a diagnosis of sleep apnea, subgrouped into major disease groups

Disease group	Sleep apnea					
	Cases %	Control %	Odds ratio			p-value
			5%	95%		
Infectious and parasitic diseases	2.69	1.37	1.20	1.08	1.33	< 0.001
Neoplasms	3.55	2.78	0.97	0.89	1.06	NS
Blood and immunological diseases	0.68	0.36	1.08	0.88	1.33	NS
Endocrine, nutritional, and metabolic diseases	4.78	1.86	1.62	1.50	1.76	< 0.001
Mental and psychiatric disorders	1.16	0.93	0.84	0.72	0.98	< 0.05
Nervous system disorders	4.43	1.62	1.68	1.54	1.82	< 0.001
Diseases of the eye and adnexa	3.50	1.97	1.29	1.17	1.41	< 0.001
Ear, nose and throat diseases	4.41	2.55	1.44	1.32	1.56	< 0.001
Circulatory/cardiovascular diseases	11.24	5.96	1.38	1.30	1.46	< 0.001
Respiratory diseases	8.61	3.34	1.84	1.73	1.96	< 0.001
Gastrointestinal diseases	8.86	5.74	1.17	1.10	1.24	< 0.001
Skin and subcutaneous tissue diseases	2.99	1.77	1.18	1.07	1.30	< 0.001
Musculoskeletal system and connective tissue diseases	13.26	8.14	1.36	1.29	1.42	< 0.001
Genitourinary diseases	6.04	3.70	1.21	1.13	1.30	< 0.001
Pregnancy, childbirth, and puerperium	0.79	1.14	0.53	0.43	0.65	< 0.001
Certain conditions originating in the perinatal period	0.22	0.08	1.49	1.04	2.15	< 0.05
Congenital malformations, deformations, and chromosomal abnormalities	1.35	0.58	1.47	1.27	1.71	< 0.001
Abnormal clinical and laboratory findings	12.33	5.54	1.55	1.47	1.64	< 0.001
Injury, poisoning and certain other external causes	27.53	21.91	1.15	1.11	1.20	< 0.001
External causes of morbidity and mortality	0.01	0.02	0.24	0.03	1.85	NS
Other factors influencing health status and contact with health services	26.05	16.30	1.28	1.23	1.33	< 0.001

ing control subjects from the same part of the country in which the patient lived. The ratio of control subjects to patients was 4:1 in order to reduce variations among controls. Data from patients and matched control subjects that could not be identified in the Coherent Social Statistics database were excluded from the sample. More than 99% of the observations in both groups were successfully matched. The patients and matched control subjects were followed from their year of diagnosis until 2006.

Evaluation of Morbidity Prior to SDB Diagnosis

The information prior to SDB diagnosis was extracted from the database for the years 1996-2006. Morbidity data were extracted as primary and secondary diagnoses and further subdivided into main disease groups, in accordance with the World Health Organization (WHO) ICD-10 criteria. Odds ratios (ORs), including 5%-95% confidence intervals (CIs), were calculated for the main diagnoses. For the main diagnostic groups that showed significant differences, we performed subgroup analyses to evaluate the most common diagnosis in each category associated with diagnosis of OSA or OHS. We used a limit > 1% to select disease, and odds ratios were calculated for each of these diseases.

Ethics and Statistical Analysis

The study was approved by the Danish Data Protection Agency. Because the data handling was anonymous, individual and ethical approval was not mandatory. Statistical analysis was performed using OSAS 9.1.3 (SAS, Inc., Cary, NC, USA). The statistical analysis is a conditional logit model, where the left hand side is the binary variable for case-control groups and the right hand side is dummy variables for the 21 diagnosis groups, omitting the group with no diagnosis 3 years prior to the diagnosis. The second analysis includes dummies for ICD-10 di-

agnoses with occurrence > 1% in either case or control group. ICD-10 diagnosis groups with < 1% are summed in the main diagnosis groups. Only estimates for the ICD-10 diagnosis are reported in the results for the second analysis, but the dummies for the main groups (including only the remaining diagnosis) are included in the regression. A patient can have > 1 diagnosis group or ICD-10 diagnosis in the 3 years prior the diagnosis.

Not all patients had an observation period as long as 3 years prior to diagnosis. Since this was true for both patients and controls, we have included these shorter periods in the analysis. The results are presented as OR with 5% to 95% CI and p-values. Extreme values were manually validated, and no errors were identified.

RESULTS

We identified 19,438 patients with OSA and 755 patients with OHS and compared their data with information from 77,752 and 3,020 control subjects, respectively. The age distribution of the patients and control subjects is shown in **Table 1**. As expected, most of the patients with an initial diagnosis of OSA were middle-aged; one-quarter were women and approximately one-tenth were children or adolescents. We included patients of all ages and both sexes in this study.

Morbidity Prior to SDB Diagnosis

The morbidities, subdivided into incidence (percent) and OR with 5% to 95% CI, are shown for main diagnosis groups for OSA (**Table 2A**) and OHS (**Table 2B**) and for diagnoses that occurred in > 1% of OSA patients (**Table 3A**) and OHS patients (**Table 3B**). OSA was positively associated with infections; endocrine, nutritional and metabolic dis-

Table 2B—Morbidity 3 years prior to a diagnosis of obesity hypoventilation, subgrouped into major disease groups

Disease group	Obesity hypoventilation					
	Cases %	Controls %	Odds ratio			p-value
			5%	95%		
Infectious and parasitic diseases	4.05	1.40	1.48	0.86	2.55	NS
Neoplasms	4.33	3.26	0.90	0.56	1.45	NS
Blood and immunological diseases	0.56	0.49	0.64	0.19	2.13	NS
Endocrine, nutritional and metabolic diseases	14.53	2.35	4.10	2.90	5.78	< 0.001
Mental and psychiatric disorders	2.23	1.26	1.13	0.58	2.17	NS
Nervous system disorders	13.97	2.70	3.54	2.56	4.88	< 0.001
Diseases of the eye and adnexa	4.89	2.60	1.42	0.89	2.28	NS
Ear, nose, and throat diseases	3.35	2.03	1.50	0.88	2.56	NS
Circulatory/cardiovascular diseases	20.25	8.10	1.80	1.38	2.34	< 0.001
Respiratory diseases	14.66	3.51	2.83	2.07	3.89	< 0.001
Gastrointestinal diseases	10.20	6.21	1.26	0.91	1.74	NS
Skin and subcutaneous tissue diseases	6.15	1.58	2.12	1.33	3.38	< 0.001
Musculoskeletal system and connective tissue diseases	16.48	10.42	1.35	1.05	1.74	< 0.05
Genitourinary diseases	8.94	4.59	1.26	0.88	1.79	NS
Pregnancy, childbirth, and puerperium	1.12	1.51	0.44	0.16	1.22	NS
Certain conditions originating in the perinatal period	—	0.04	—	—	—	—
Congenital malformations, deformations, and chromosomal abnormalities	0.70	0.18	0.82	0.22	3.05	NS
Abnormal clinical and laboratory findings	13.55	6.70	1.15	0.85	1.56	NS
Injury, poisoning and certain other external causes	24.86	20.73	0.95	0.76	1.18	NS
External causes of morbidity and mortality	0.14	—	—	—	—	—
Other factors influencing health status and contact with health services	33.10	19.78	1.15	0.92	1.44	NS

Table 3A—Sleep apnea: morbidities 3 years prior to an OSA diagnosis

Disease group	Diagnosis	Sleep apnea					
		Cases %	Control %	Odds ratio			p-value
Endocrine, nutritional and metabolic diseases	Diabetes	1.09	0.41	1.50	1.26	1.77	< 0.001
Diseases of the ear and mastoid process	Hearing loss	1.05	0.64	1.32	1.12	1.56	< 0.001
Diseases of the circulatory system	Hypertension	1.95	0.68	1.74	1.54	1.97	< 0.001
	Angina	2.25	1.13	1.10	0.98	1.25	NS
	Atrial fibrillation	1.46	0.60	1.47	1.27	1.70	< 0.001
Diseases of the respiratory system	Pneumonia	1.29	0.63	1.01	0.86	1.18	NS
	Septum deviation	1.24	0.15	3.60	3.05	4.26	< 0.001
	Chronic obstructive pulmonary disease	1.08	0.37	1.55	1.30	1.85	< 0.001
	Bronchial asthma	1.16	0.47	1.45	1.23	1.71	< 0.001
Diseases of the genitourinary system	Prostatic hypertrophy	1.09	0.62	1.25	1.06	1.47	< 0.01
Symptoms, signs and abnormal clinical and laboratory findings not elsewhere classified	Snoring	1.74	0.06	5.94	5.12	6.89	< 0.001
Injury, poisoning, and certain other consequences of external causes	Injuries (extremities)	2.35	1.88	1.12	1.00	1.24	< 0.05
	Deformities (extremities)	1.75	1.32	1.15	1.01	1.30	< 0.05
Factors influencing health status and contact with health services	Observation for nervous disease	2.27	0.83	1.49	1.32	1.68	< 0.001
	Observation for cardiac disease	3.65	1.50	1.47	1.34	1.62	< 0.001
	Observation for urinary disease	2.15	1.11	1.18	1.05	1.33	< 0.01
	Observation for other disease	8.56	5.00	1.11	1.04	1.18	< 0.001

Only diseases with > 1% occurrence are included.

eases (diabetes); eye and ear-nose-throat (ENT) disorders (hearing loss); CVD (hypertension, angina and atrial fibrillation); respiratory system diseases (pneumonia, septum deviation, chronic obstructive pulmonary disease and asthma); gastrointestinal diseases (unspecified tumor); skin and musculoskeletal disease; genitourinary diseases (prostatic hypertrophy); abnormal clinical or laboratory findings; and other factors that influence health status (snoring). Mental and psychiatric diseases and pregnancy showed lower associations with later OSA development.

OHS was positively associated with infections (erysipelas); endocrine, nutritional and metabolic diseases (diabetes and obesity); nervous system disorders (carpal tunnel syndrome and sleep apnea); eye disease (diabetic retinopathy); CVD (hypertension, angina, atrial fibrillation, heart failure, and varicose veins); respiratory system diseases (pneumonia, chronic obstructive pulmonary disease, and asthma); gastrointestinal disease (unspecified tumor); skin and musculoskeletal disease (arthritis or other diseases of the knee); genitourinary diseases (prostatic hypertrophy); abnormal clinical or laboratory findings (dyspnea, chest pain, lipothymia, and syncope); other factors that influence health status (observation for nervous disease, infarction, cardiac disease, urinary disorders, diabetes control, fractures or other diseases/contacts); and injuries (wounds and sprains). Mental and psychiatric dis-

eases and pregnancy showed lower associations with later OSA development.

DISCUSSION

This study shows that patients diagnosed with OSA or OHS show a wide range of morbidities prior to their SDB diagnosis. These include such well-known risk associations as obesity, diabetes, and cardiovascular diseases, as well as a number of lesser-known risk associations.

A previously published paper evaluating the same population showed that morbidity was affected as long as 8 years before a diagnosis of OSA or OHS,¹ which supports other studies.^{6,7} SDB is often diagnosed at a time when the disease has already affected the patient's social functioning and morbidity. Although CPAP treatment has reduced CVD-related morbidity and mortality,² its potential effect is reduced by late diagnosis. Furthermore, a significant number of patients remain unidentified and untreated; diagnostic heterogeneities further complicate this issue.⁹ The societal effects of late-diagnosed or undiagnosed SDB are therefore potentially substantial, especially in the case of OHS, which has severe social consequences, morbidity, and mortality.

The current study was performed to evaluate potential (known and unidentified) comorbidities prior to OSA and OHS diagnosis and shows that many known risks are associated with

Table 3B—Obesity hypoventilation syndrome: morbidities 3 years prior to an OHS diagnosis

Disease group	Diagnosis	Obesity hypoventilation					
		Cases %	Control %	Odds ratio			
					5%	95%	p-value
Certain infectious and parasitic diseases	Erysipelas	2.51	0.42	2.68	1.12	6.43	< 0.05
Endocrine, nutritional and metabolic diseases	Diabetes	1.26	0.35	4.16	2.30	7.52	< 0.001
Diseases of the nervous system	Sleep apnea	8.38	0.25	18.60	7.65	45.19	< 0.001
	Carpal tunnel syndrome	1.26	0.42	15.85	8.68	28.95	< 0.001
Diseases of the eye and adnexa	Diabetic retinopathy	1.26	0.18	2.94	0.99	8.72	0.05
Diseases of the circulatory system	Hypertension	2.79	1.23	5.61	1.68	18.69	< 0.01
	Angina	3.49	1.40	1.35	0.71	2.57	NS
	Atrial fibrillation	2.09	0.77	1.40	0.73	2.68	NS
	Cardiac insufficiency	1.40	0.18	1.36	0.59	3.13	NS
	Heart failure	2.65	0.18	5.02	1.58	16.01	< 0.01
	Varices	1.26	0.91	4.62	1.53	14.00	< 0.01
Diseases of the respiratory system	Pneumonia	4.47	0.74	1.23	0.53	2.87	NS
	Chronic obstructive pulmonary disease, acute exacerbation	3.07	0.39	3.19	1.65	6.19	< 0.001
	Chronic obstructive pulmonary disease	4.75	0.63	2.53	0.92	6.94	NS
	Bronchial asthma	1.26	0.46	2.17	1.00	4.72	< 0.05
Diseases of the musculoskeletal system and connective tissue	Arthrosis, knee	1.82	0.32	7.69	1.74	34.09	< 0.01
	Meniscus lesion	1.40	0.95	5.14	2.27	11.62	< 0.001
Diseases of the genitourinary system	Prostatic hypertrophy	1.12	0.91	2.31	0.99	5.41	NS
Factors influencing health status and contact with health services	Chest pain	1.26	0.49	4.03	1.13	14.39	< 0.05
	Lipothymia, collapse	1.26	0.98	1.92	0.69	5.37	NS
	Observation for myocardial infarction	5.03	1.68	1.91	1.01	3.62	< 0.05

Only diseases with > 1% occurrence are included.

a later SDB diagnosis: cardiovascular diseases (hypertension, atrial fibrillation, and heart failure), respiratory/pulmonary diseases (chronic obstructive lung diseases, asthma, and septum deviation), and endocrine and metabolic diseases (diabetes and obesity). However, other formerly unrecognized diseases seem to show a higher correlation with a later diagnosis of OSA or OHS (e.g., selected infections, genitourinary diseases, musculoskeletal diseases, arthrosis/knee problems and evaluation for a number of health-related problems, including cardiac problems, dyspnea, diabetic complications, carpal tunnel syndrome, and lipothymia). It is likely that certain health-related problems coexist or are associated with one another (e.g., obesity, CVD, and diabetes), but our study shows that patients with OSA and OHS contact the health care system for a wide range of health-related issues prior to their SDB diagnosis.

There are a number of weaknesses of this study: it is based on clinic/hospital reports to the NPR; the diagnostic accuracy depends on the clinic's presentation and reporting of the diagnosis and the comorbidities; confounder variables (e.g., BMI and other cardiovascular risk factors) were not recorded; symptoms and clinical evaluation results were not considered (e.g., PSG, limited channel polygraphy, and cardiac evaluations);

thus we cannot relate the findings to disease severity. We have not excluded diseases, especially SDB among controls; it is to be expected that 2% to 7% or more of the control group have SDB, which are overlooked. The consequence of this factor is that the differences are larger than presented in this study. The strength of the NPR, is that it is a national database that includes all identified patients, it is time-locked (all reports must be associated with the patient contacts) and it includes a substantial follow-up time.

In the data presented, we included a total evaluation of all ages and gender adjusted for age, gender, and demographic variables, which all influence disease outcome. Women with OSA are more likely to be treated for depression, to have insomnia, and to have hypothyroidism than males with OSA¹⁰; women also have higher health care use.¹¹ Age is also likely to have an effect on health care use and indirect costs.¹ Cardiovascular disease and obesity are most present in young adults¹² and middle age,⁷ whereas among elderly OSA patients, effects of medication and comorbid depression may add to disease burden.¹³ The data from this study suggest that health care usage include even more diagnoses. Furthermore social factors also influence occurrences of OSA and in particular OHS.^{1,4,5}

To reduce the consequences of OSA and OHS, a number of issues should be considered: increased diagnostic capacity, improved treatment and management facilities, identification of high-risk groups for screening procedures, and general interventions for high-risk groups (e.g., weight reduction). OSA and OHS show strong associations with lifestyle factors¹⁴⁻¹⁷; however, there is currently no evidence that population-based lifestyle changes, including general weight reduction programs, have any effect on the occurrence and consequences of SDB (OSA/OHS). There is considerable evidence that CPAP use reduces cardiovascular morbidity, mortality, and road traffic accidents traffic consequences in patients with OSA.¹⁸⁻²² Despite the severity of the consequences of OHS, CPAP may improve the symptoms and selected clinical variables of the disease²³⁻²⁶; however, data showing positive effects on prospective cardiovascular or other variables are limited and prospective studies are awaited.

Consequently, there is a need for improved diagnostic capacity and treatment facilities, especially for OSA, but likely also for OHS, so that high-risk groups can be identified and effectively managed. Pre-diagnostic probability may be improved using information gleaned through questionnaires, although this also presents a risk of overlooking high-risk individuals.²⁷ The current study suggests that OSA may be more likely to occur with certain disorders (e.g., obesity, structural abnormalities, diabetes, and CVD) in which OSA or OHS should be considered, but other symptoms (e.g., an abnormal metabolic profile) should also be considered.

Previous studies have established the significant consequences of OSA or OHS, including a high risk of CVD morbidity and mortality, road traffic accidents, and familial or social consequences. The current study shows that morbidity is affected at least 3 years prior to an SDB diagnosis, and possible comorbidities include obesity; diabetes; endocrine, cardiovascular, neurologic, pulmonary and selected genitourinary diseases; and abnormal laboratory findings. This implies that specialties within these areas should focus on the possibility of high-risk patients for screening for SDB.

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ACKNOWLEDGMENTS

Author's contributions: Drs. Jennum and Kjellberg: creation, initiation, and management of the projects. Dr. Jennum is the main author. Drs. Kjellberg and Ibsen performed the statistical and economic analyses.

SUBMISSION & CORRESPONDENCE INFORMATION

Submitted for publication March, 2012

Submitted in final revised form June, 2012

Accepted for publication June, 2012

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DISCLOSURE STATEMENT

This study was supported by an unrestricted grant from the Philips Respiration Foundation and the Centre for Healthy Aging, Faculty of Health Sciences, University of Copenhagen. The authors have indicated no financial conflicts of interest.