

## Age and Gender Related Differences in Patient Awareness of Conditions Associated with Untreated Obstructive Sleep Apnea

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### Abstract

**Introduction:** Patient education has been shown to improve continuous positive airway pressure (CPAP) compliance in the treatment of obstructive sleep apnea (OSA). This is facilitated by improving patient awareness of both the goals of treatment, proper use of the device and consequences of inadequate treatment. The most obvious outcome of successful therapy is an improvement in excessive daytime sleepiness. However, it is hypothesized that the long-term benefits of disease prevention and lessening the severity of conditions known to be associated with untreated OSA are less well recognized by patients. The purpose of this study was to document the degree of patient awareness of conditions associated with OSA. It is anticipated that a lack of knowledge exists in some patient subgroups; that if educated more intensely about these associations might be more diligent in participating in the treatment of their OSA.

**Methods:** This study was a cross-sectional survey of patients who had been prescribed positive airway pressure (PAP) therapy for OSA. This survey assessed patient knowledge of co-morbid medical conditions associated with untreated OSA.

**Results:** The vast majority of participants failed to recognize all of the most common co-morbid conditions. Significant differences in awareness were noted between different age groups and genders.

**Conclusions:** Patient education is important in achieving CPAP compliance. Patient education, as demonstrated by a relative lack of knowledge of associated co-morbidities, appears to be inadequate. Greater efforts at patient education during each and every patient encounter in the sleep disorders clinic are recommended.

**Keywords:** Obstructive sleep apnea; Continuous positive airway pressure; Patient knowledge; Age; Gender

### Introduction

Conditions associated with untreated obstructive sleep apnea (OSA) include hypertension, congestive heart failure, coronary artery disease, cardiac arrhythmias, stroke, diabetes, neurocognitive impairment, depression, decreased quality of life and increased risk of motor vehicle accidents (MVA) [1-10]. These conditions contribute to increased age adjusted mortality rates in patients with OSA. The prevalence of these comorbid conditions and their association with OSA has been well documented. Sleep medicine providers routinely share information regarding these associated conditions with patients to both increase awareness of the potential sequelae of untreated OSA and to provide motivation to those striving to comply with medical treatment of their disease.

It is hypothesized that many of these comorbidities associated with OSA go unrecognized by patients with OSA. In part this occurs because of the vast array of new information presented at the time of diagnosis. This includes the introduction of new medical terminology,

a review of treatment options and potential sequelae of untreated disease. In addition, there may be deficiencies in the educational programs available to patients with OSA. Nevertheless, many clinicians may expect that patients using CPAP would have acquired a high degree of familiarity with the consequences of inadequate treatment since this group has typically completed multiple encounters with their sleep medicine practitioner; sleep facility, and durable medical equipment company. There is a paucity of literature on patient knowledge of comorbidities associated with OSA. The purpose of this study was to determine the degree of patient awareness of conditions associated with OSA.

### Methods

#### Participants

A de-identified cross-sectional survey was undertaken of 669 patients, age 18 years or older, who had been prescribed positive airway pressure (PAP) therapy for OSA. Positive airway pressure therapy included treatment with any form of positive airway pressure; continuous positive airway pressure (CPAP), bi-level positive airway

pressure (Bi-Level PAP), or auto-titrating positive airway pressure (Auto PAP). Recruitment occurred over a consecutive 365 day period from March 2010 to March 2011 at the University of Michigan Sleep Disorders Center, accredited by the American Academy of Sleep Medicine. Patients attending a follow up clinic visit regarding their PAP therapy, ranging from 3 to 6 months following their initial diagnosis, were recruited to participate in a de-identified survey. All patients had been provided verbal counseling regarding short term and long term consequences of untreated OSA in categories of cardiovascular risk, neurocognitive effects, quality of life and risk of MVA during a sleep clinic visit following their initial diagnosis of OSA. Counseling was consistent across groups and was documented in the medical record. There were no exclusion criteria. No compensation was offered for participation.

### Questionnaire

This survey assessed patient knowledge of conditions associated with untreated OSA including hypertension, congestive heart failure, coronary artery disease, cardiac arrhythmias, stroke, diabetes, neurocognitive impairment, depression, decreased quality of life and increased risk of motor vehicle accidents. Each comorbidity was listed as it appears in Table 1. Each patient was instructed to circle any or all conditions they believed to be associated with OSA. No additional description of each condition was provided. In addition, information regarding gender, age, preexisting medical conditions and self-reported duration of nightly PAP therapy use were also tabulated.

Medical Conditions	Female	Male
Arrhythmia	42%	43%
Congestive Heart Failure	51%	55%
Depression	72%	
Diabetes Mellitus	35%	29%
Hypertension	63%	59%
Myocardial Infarction	38%	29% (p=0.02)
Myocardial Ischemia	28%	20%
Motor Vehicle Accident	68%	64%
Stroke	46%	40%
Quality of Life	81%	80%

**Table 1:** Recognition of Conditions Associated with OSA by Gender.

### Statistical analysis

All data were sequentially entered into a Microsoft Access database (Microsoft). Data were then analyzed using SPSS software (version 19, IBM, Armonk NY). Group differences were assessed by Chi Square tests for proportional data. A p-value of <0.05 was considered statistically significant.

## Results

### General results

Surveys were collected from 669 participants; 371 (55.4%) were male, 278 (41.6%) were female and 20 (3%) patients did not disclose their gender. Among the study participants 12% were 21-40 years of age, 54% were 41-60 years of age and 34% were 61 years of age or older. Eighty four percent of study participants reported CPAP use of greater than four hours/night.

### Recognition of co-morbid conditions

The vast majority of participants failed to recognize every associated condition. In fact, only 8% of participants recognized all ten presented conditions known to be associated with untreated obstructive sleep apnea. Just over half of study participants recognized at least 50% of the associated conditions. The most recognized comorbid condition was diminished quality of life (80%) followed by increased risk of motor vehicle accident (65%), depression (64%), congestive heart failure (53%) and hypertension (50%). The least recognized co-morbid conditions were myocardial ischemia (23%), diabetes mellitus (31%), myocardial infarction (32%), stroke (43%) and cardiac arrhythmias (43%).

### Gender differences

Two major differences in gender responses were noted. Women identified the association between depression and OSA more often than men (72% vs. 50%, p=0.001) as well as myocardial infarction (72% vs. 59%, p=0.02), (Table 1). Both men and women identified the association between decreased quality of life and OSA most frequently, at 80% and 81% respectively.

### Age differences

The youngest age group (age 18-40 years) recognized the association of OSA and increased risk of motor vehicle accident, quality of life and depression as co-morbid conditions most frequently (81%, 78% and 71%, respectively), (Table 2). Both younger and middle aged (41-60 years) participants were significantly more likely than older aged (61 years or older) participants to recognize the association of OSA with depression (71% for age 18-40 years, 68% for age 41-60 years and 56% for age > 61 years, p<0.0001). Participants in the youngest age group were unlikely to recognize the association of untreated OSA with myocardial infarction and myocardial ischemia, (26% and 21%, respectively).

Middle aged participants were most likely to identify decreased quality of life, increased risk of motor vehicle accident, depression, hypertension and risk of myocardial infarction as conditions associated with OSA (82%, 70%, 68%, 63% and 59%, respectively). This age group was least likely to identify diabetes, 33%, and myocardial ischemia, 24%, as potential co-morbidities. Middle aged participants were more likely to recognize the association of OSA and myocardial infarction compared to younger study participants (59% vs. 26%, p=0.007) and they were slightly more likely than older patients to recognize this association (59% vs. 35%, p=0.07). The middle age group recognized the association between increased risk of MVA and untreated OSA more frequently than the oldest age group (p=0.03). Although the youngest participants (age 18-40 years) were slightly

more likely to recognize this association than the middle age group, this difference did not reach statistical significance (p=0.06).

Participants older than 61 years of age were most knowledgeable of the association of OSA with impaired quality of life, increased risk of motor vehicle accident, hypertension, depression and congestive heart

failure, with recognition rates of 77%, 61%, 59%, 56% and 53%, respectively. This age group was least likely to recognize myocardial infarction (35%), diabetes (28%) and myocardial ischemia (23%) as co-morbidities associated with OSA.

Medical Conditions	18-40 years	41-60 years	>61 years
Arrhythmia	42%	44%	43%
Congestive Heart Failure	51%	53%	53%
Depression	71%*	68%	56%* (*p<0.0001)
Diabetes Mellitus	36%	33%	28%
Hypertension	60%	63%	59%
Myocardial Infarction	26%*	59%* <sup>**</sup>	35% <sup>**</sup> (*p=0.007) (**p=0.07)
Myocardial Ischemia	21%	24%	23%
Motor Vehicle Accident	81%*	70%* <sup>**</sup>	61% <sup>**</sup> (*p=0.06) (**p=0.03)
Stroke	38%	44%	45%
Quality of Life	78%	82%	77%

**Table 2:** Recognition of Conditions Associated with OSA by Age Group.

### Patients with an underlying existing medical condition

Study participants with an underlying diagnosis of hypertension or diabetes mellitus were significantly more likely to recognize the association of these diseases as associated with OSA than those without these concomitant illnesses (p<0.001). Patients with a diagnosis of either hypertension or diabetes were significantly more likely to recognize the association of OSA with decreased quality of life (p<0.001 and p=0.003, respectively) and depression (p=0.05 and p=0.01) when compared to those without these coexisting illnesses. Study participants with a diagnosis of hypertension were unlikely to be aware of the association of untreated OSA and myocardial ischemia and myocardial infarction (22% and 30%, respectively). Participants with a diagnosis of diabetes were also unlikely to be aware of the association of untreated OSA and myocardial ischemia and myocardial infarction (24% and 29%, respectively).

### Discussion

The effects of untreated OSA include both an increased risk of cardiovascular disease and neurocognitive sequelae that can have a significant impact on quality of life and patient survival. Following a diagnosis of obstructive sleep apnea at the author's institution, a thorough patient educational program includes a review of the pathophysiology of OSA, available treatment options and clinical consequences of inadequate treatment. This study demonstrates that despite recruitment of a mostly compliant group of PAP users, retention of the latter appears to be poor. Awareness of the relationship between untreated OSA and quality of life was most frequent (79%). This is likely reflective of the improvement in quality of life noted by the majority of patients successfully treated with CPAP. Significant improvement in disease specific quality of life following successful CPAP therapy, as assessed by the Functional Outcomes of Sleep Questionnaire (FOSQ), has been previously demonstrated [10,11].

Significant differences between genders were identified. Women were significantly more likely to recognize depression and myocardial infarction as co-morbidities associated with untreated OSA. The higher prevalence of diagnosed clinical depression in women may account for a higher rate of awareness of this comorbidity [12]. Historically, however, there has been a lower rate of awareness of coronary artery disease symptomatology and early detection in women compared to men. Of note, there have been recent efforts to promote awareness regarding the signs and symptoms of myocardial infarction in women via public service campaigns. These educational efforts may account, in part, for the gender differences noted in the current study.

There were significant age group differences for recognition of depression and risk of motor vehicle accident. Both awareness and recognition of depression may be more common in younger adults as there has been a gradual decrease in the stigmata associated with this form of mental illness during the past several decades. In addition, it is generally accepted that the rate of motor vehicle accidents is highest in younger adults. This may be reflected by a greater awareness by younger adults of the increased risk of MVA associated with untreated OSA.

It may not be surprising that patients with a diagnosis of hypertension or diabetes were significantly more likely than those without to recognize these diseases as associated co-morbidities. This subset of patients also had an increased awareness of the relationship between OSA and quality of life. Decreased quality of life has been previously shown to be associated with both hypertension and diabetes [12,13]. Of concern, however, was that neither patients with a diagnosis of hypertension or diabetes, classical risk factors for the development of cardiovascular disease, were likely to be aware of the relationship between OSA and myocardial ischemia or infarction.

Improvement in excessive daytime sleepiness, cognitive function and quality of life following the use of CPAP may serve as positive

reinforcement for many patients. However, even with subjective improvement in quality of life measures, CPAP compliance remains problematic. When compliance is defined as greater than 4 hours of nightly use, 29-83% of patients with OSA are considered to be non-compliant [14]. Furthermore, there is a subset of patients with OSA who do not experience a subjective improvement in symptoms despite their documented use of CPAP. For these patients, CPAP compliance may be even more problematic.

Hence, patient education regarding the potential late sequelae of untreated OSA in this subset of patients is crucial as it may serve as the primary motivation for PAP use. Increased attention to patient education has been shown to be effective at improving CPAP compliance [15]. A recent Cochrane Airways Group review of randomized parallel controlled trials reported that educational interventions significantly increased overall duration of CPAP use and improved compliance as measured defined by >4 hours nightly use.

One strength of the current study is that it assessed knowledge of a wide variety of co-morbidities associated with untreated OSA not just those most commonly reported, e.g. hypertension and heart disease. In addition, the anonymous nature of the survey used should help improve the accurate assessment of patient knowledge, without encouraging guessing as individual patients were not being graded. Another strength is that this large cohort had a roughly equal number of male and female participants. The majority of participants were middle age in keeping with the usual prevalence of OSA. One notable limitation of this study was that the vast majority of participants were PAP compliant, with 84% reporting an average PAP use of greater than four hours/night. Because of this, meaningful statistical analysis to assess if increased knowledge of co-morbidities correlated positively with PAP compliance was not possible.

In this study of patients using CPAP, patient education regarding co-morbidities associated with untreated OSA was provided at the time of initial diagnosis. However, it is clear from the aforementioned results that this information was not fully assimilated by the majority of patients. One potential weakness of this study is that patients were provided a list of medical conditions as opposed to an open-ended questionnaire. This format may have helped patients identify potential comorbid conditions and may have led to an overestimation of study participant's knowledge. Those individuals who already had a pre-existing condition were more likely to identify this association with OSA. However, as CPAP use is important in disease prevention, it is critical that those patients without pre-existing comorbidities be made aware of the cardiovascular and neurocognitive sequelae of untreated OSA in order to encourage CPAP compliance. This may be of particular importance in younger patients in whom the long term deleterious effects of untreated OSA have not yet manifested and may be prevented or attenuated with adequate treatment.

As patient education was provided at the time of diagnosis, it is possible that the time period between diagnosis and questionnaire administration may have affected the retention of this knowledge. Another potential weakness of this study is that the patient's own educational level was not assessed. This factor may have affected the ability of study participants to retain and assimilate new information regarding comorbidities associated with OSA. It is also plausible that the neurocognitive effects of untreated OSA, including poor concentration and impaired memory, may hinder routine attempts at patient education prior to or shortly after initiation of treatment. Patients may struggle to assimilate the vast amount of information presented at the time of their initial evaluations in the sleep disorders

clinic, as the volume of this information regarding diagnosis, pathogenesis, treatment options and sequelae of inadequate treatment may be overwhelming.

Patient education is important in improving CPAP compliance. Knowledge of comorbidities associated with OSA may serve as motivation for improving CPAP compliance. It appears that there is a relative lack of knowledge of conditions associated with untreated OSA by all patients receiving PAP therapy. In addition, significant age and gender differences in patient awareness exist. The responsibility for patient education lies largely with sleep medicine providers who are keenly aware of the potential consequences of untreated OSA. Greater efforts in patient education regarding these associated conditions, with particular attention to subgroups identified as having significant knowledge deficits, during each and every patient encounter in the sleep disorders clinic are recommended [16].

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