Obstructive Sleep Apnea Syndrome in a Publicly Funded Healthcare System

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Background: Despite its current recognition as a major health concern, little has been published about obstructive sleep apnea syndrome (OSAS) as a health problem in public healthcare systems where limited resources, language and cultural differences may present barriers to detection and treatment.

Objective: To describe patients referred for suspected OSAS in a large county-funded healthcare system.

Method: A retrospective, descriptive observational study that included all patients referred for an OSAS evaluation between September 2000 and September 2002.

Results: Only 123 patients were referred and 115 completed an evaluation during the two-year period: 99% met OSAS diagnostic criteria, which was severe in 79% and frequently complicated by related comorbid conditions. CPAP acceptance was lower than in the previous series, especially among Hispanics.

Conclusions: The findings suggest that referral for OSAS evaluation was limited to those most severely affected and raise the possibility of underdetection and undertreatment in the public sector.

Key words: obstructive sleep apnea ■ obesity ■ public healthcare systems ■ excessive daytime somnolence

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INTRODUCTION

Obstructive sleep apnea syndrome (OSAS) is a major health condition associated with accident risk, cognitive impairment and cardiovascular disorders.[1-6] Continuous positive airway pressure (CPAP) treatment of OSAS can improve quality of life, reduce complications and decrease healthcare costs.[7,8]

Epidemiological studies suggest that OSAS is a highly prevalent disorder that often remains undiagnosed.[9,10] Detection and treatment may be particularly hampered in publicly funded healthcare systems where there are limited resources, as well as differences in language and culture. Because of these barriers, we suspect that many patients are not referred until they have severe disease and frequent comorbidities.

This paper describes the clinical and polysomnographic findings of patients referred for suspected OSAS in a county-funded healthcare system. Our study tested the hypothesis that the prevalence and severity of OSAS was particularly great among these patients. The information is a first look at OSAS as a health problem in medically indigent populations and should serve as an impetus for developing strategies for identifying, evaluating and treating affected individuals in the public sector.

METHODS

Setting

The Los Angeles County Department of Health Services, the second largest public health system in the United States, meets its obligation as a safety-net healthcare provider for low-income and medically uninsured residents by running an extensive network of hospitals and clinics over eight service planning areas. ValleyCare is the integrated healthcare delivery system that serves two of the planning areas: San Fernando Valley and Antelope Valley, a population of greater than two million of which more than 300,000 live below the poverty level. Its patient population includes a large group of recent immigrants, many of whom cannot speak English. The racial/ethnic distri-

bution is as follows: 60% Hispanic, 25% Caucasian, 7% African-American and 8% Asian/other. The majority (75%) are medically uninsured and receive funding for their care through the county "Ability-to-Pay" and state-funded programs. The remainder are beneficiaries of the California Medicaid program, MediCal (20%) or Medicare (5%).

The ValleyCare system includes five county-owned outpatient centers; 10 public/private outpatient centers; seven community providers and the Olive View-UCLA Medical Center (OVMC), which provides inpatient and outpatient specialty care. More than 2,000 patients per month are referred from the extramural outpatient centers and community providers to the specialty clinics at OVMC by way of the ValleyCare Referral Center, which is an office that coordinates care between referring primary care providers and specialists. In addition, at least 3,000 new referrals to specialty clinics per month are scheduled directly from the OVMC clinics and from inpatient services.

Patient Population

All adult patients referred to the OVMC Sleep Disorders Service for evaluation of suspected OSAS through the referral center or directly within OVMC between September 2000 and September 2002 were included in this study. Patients were excluded if they were previously diagnosed with OSAS or other specific sleep disorders.

OSAS Evaluation

All patients were evaluated by an American Board of Sleep Medicine (ABSM)-certified physician (JW). An 11-page questionnaire elicited OSAS risk factors with questions like, "Do you snore?" followed by "never," "occasionally," "frequently" and "always," including a ranking of "loudness." Sleepiness while driving was assessed with questions like, "Have you actually fallen asleep while driving a car? How often?" and "How many near-misses or accidents have you had in the past 12 months because of sleepiness?" Other questions addressed sleep habits; use of tobacco, alcohol and recreational drugs; medical diagnoses and use of medications. Patients also completed the Epworth Sleepiness Scale (ESS) instrument[11] to grade symptoms of excessive daytime sleepiness. The questionnaires and ESS were administered by the Sleep Disorders Service's coordinator to English-fluent patients and by a Spanish-fluent respiratory care practitioner (RCP) to those not fluent in English.

Each patient underwent a 12-channel polysomnography (PSG) at a free-standing sleep laboratory (Pacific Sleep Medicine Services Inc.). The waiting period between the initial assessment and PSG was less than one month for all patients. All PSG tracings were scored by an experienced technician using standard criteria[12,13] and transferred to a CD for review and interpretation by the ABSM-certified physician at OVMC (JW). All except five were split-night studies with diagnostic PSG and CPAP titration performed during one overnight stay; the others were full-night

Table 1. General Characteristics of Patients Who Completed the OSAS Evaluation

	Number of Patients	Percent of Sample
Gender		
Male	71	62%
Female	44	38%
Race		
Caucasian	40	35%
Hispanic	61	53%
African-American	8	7%
Other	6	5%
Third-Party Payer		
Uninsured	80	70%
MediCal	35	30%
Alcohol Consumption§	5	4%
Sedative Use	13	14%
BMI (kg/m²)+		
Normal weight: ≤25	3	(3%)
Grade I: 25–29.9 (overweight)	7	(6%)
Grade II: 30–39.9 (obese)	43	(39%)
Grade III: >40 (morbidly obese)	57	(52%)
Neck Circumference (cm)		
<40	13	(13%)
≥40	87	(87%)
Snoring	100	(95%)
ESS¥		
<10	22	(20%)
≥10	88	(80%)
Observed Apneic Episode	77	(79%)*
*Driving*Σ		
Asleep while driving	29	(28%)**
One or more accidents/ near-misses	12	(13%)***

§ Number who admitted to drinking four or more drinks/week. + Based on the 1997 World Health Organization classification of overweight and obesity. ¥ Scored on a 24-point scale. Σ Number who reported having fallen asleep at the wheel and number who had at least one accident or near miss in the past 12 months because of sleepiness. Some categories sum to <115 patients because not all responded to all questions. * 98 patients responded. ** Patients responded. *** 89 patients responded.

studies followed by CPAP titration on a subsequent night. Patients were considered to have OSAS if they had consistent symptoms and an apnea-hypopnea index (AHI) of ≥5 events/hour.[13]

All patients with an AHI >10 events/hour were offered CPAP titration as recommended by AASM practice guidelines.[14] The morning after CPAP titration, patients who tolerated CPAP were asked if they would use it at home. Those who indicated that they would not use CPAP were asked to reconsider after a discussion with a Sleep Disorders Service physician in English or via a Spanish translator. Each patient who was prescribed CPAP attended a one-on-one set up and an educational session with an experienced RCP conducted in English or Spanish, according to the patient's preference.

In this study, patients who tolerated the CPAP titration and agreed to use CPAP after the titration were considered to have accepted CPAP and were provided devices regardless of their insurance status or ability to pay.

Data Analysis

Data from the questionnaires and PSGs were entered into a Microsoft Access database. Access queries were used to generate the data summary. Differences in AHI and proportions by categories were compared using the z-test. An analysis by ethnic group only included Hispanics and Caucasians because there were too few African Americans and Asians for meaningful comparison.

RESULTS

During the study period, 123 patients were referred and 115 completed an OSAS evaluation. Table 1 summarizes the general characteristics and OSAS risk factors. Two-thirds of the patients were male and over half were Hispanic. All were either medically uninsured or MediCal beneficiaries. According to the WHO classification, 97% were obese and 52% were morbidly obese.[15] The characteristic triad of excessive daytime somnolence, snoring and witnessed apnea was present in 70%, while 88% had at least two components of the triad. At least a quarter of the referred patients had experienced driving impairment due to sleepiness.

The PSG findings are shown in Table 2. Among the patients referred, 99% had OSAS, which was severe in 79%.[13] Hypoxic dips to <80% occurred in 61%, and to <70% in 32%. CPAP titration was tolerated in 98 (88%) of 112 patients in whom it was performed, the therapeutic level ranging from 5–19 cm. Overall, 79/112 (71%) with an AHI ≥10 events/hour accepted CPAP.

In comparing OSAS-related characteristics between Caucasian and Hispanic patients, there were no significant differences among average BMI, ESS scores, AHIs or lowest S_aO_2. There was, however, a substantial difference in the proportion agreeing to use CPAP, 83% of Caucasians versus 54% of Hispanics ($p<0.005$).

Table 3 shows the OSAS-related comorbidities among evaluated patients. Most (70%) of the patients were hypertensive, and there was a high prevalence of diabetes, heart disease and depression.

DISCUSSION

ValleyCare is one of four large public healthcare systems that provide the medical safety net for Los Angeles County. As the venue for several university-

Table 2. Results of Polysomnography

AHI Event/Hour	Number of Patients N (%)	Mean AHI Events/Hour (Mean ± SD)	Lowest S_aO_2 [Mean (Range)]
<5	1 (1%)	0	N/A
5–15	7 (6%)	9.4 ± 3.9	82% (53–91%)
16–30	16 (14%)	23.7 ± 3.8	82% (67–90%)
>30	91 (79%)	75 ± 26.9	68% (<60–90%)
Patients with OSAS	114	63 ± 33	72% (<60–91%)

Lowest S_aO_2	Number of Patients N (%)	Mean Lowest S_aO_2 (Mean)	AHI Events/Hour (Mean ± SD)
90–100%	4 (4%)	90%	25 ± 15
80–89%	41 (36%)	85%	48 ± 29
70–79%	32 (28%)	74%	68 ± 29
<70%	37 (32%)	55%	82 ± 29

AHI = apnea-hypopnea index. S_aO_2 = arterial oxygen saturation. N/A = not available. A diagnosis of obstructive sleep apnea syndrome (OSAS) was considered when a symptomatic patient had an AHI ≥5 events/hour. CPAP titration was performed when the AHI was ≥10 events/hour.

based house staff training programs that stress newer medical concepts and treatments, there is general awareness of OSAS, but no specific physician education or screening program. Despite an active, well-organized specialty referral system which handles thousands of cases each month, only 123 ValleyCare patients were referred for an OSAS evaluation during the two-year study period, which is an average of only one per week.

Among those referred, the prevalence of OSAS was extremely high, 99% compared to 50–81%[17-19] in a previously published series of patients undergoing PSG for suspected OSAS. Although our data does not allow meaningful extrapolation to the frequency of OSAS within the system, the low referral rate makes it likely that the high prevalence reflects a bias in which consultations are requested for only the most severe patients.

Those who were referred occupied an extreme position on the spectrum of OSAS severity with 79% having severe OSAS and 18% having an AHI >100 events/hour. Many of our patients experienced repeated profound dips in oxygenation. In line with this observation, the prevalence of hypertension (70%) was substantially higher than general population estimates for a comparable age group (30%)[16] and higher than OSAS patients in the Sleep Heart Study (50%).[6] Related comorbid conditions, including cardiac disease, diabetes and depression, were highly prevalent in this group.

Our patients had significantly impaired quality of life as well, with 80% having ESS scores ≥10 suggesting significant sleepiness and 20% scoring ≥20, indicating the most severe daytime sleepiness. Although the ESS is a subjective screen for excessive daytime somnolence and is susceptible to confounding by language and cultural differences, it is a widely used instrument that was administered in each patient's preferred language and is useful in comparing our patients to other sleep disordered populations. Disturbingly, 28% of our patients admitted to sleepiness while driving and 13% had experienced at least one motor vehicle accident or near-miss in the past year. Not all patients responded to these questions, so the actual figures may be even higher.

Recent publications have suggested that OSAS is an underdiagnosed condition[10] that is highly prevalent in primary care populations.[9] Our experience suggests that the problem of unrecognized OSAS may be magnified in the medically indigent who receive their care in publicly funded healthcare systems. In this paper, the term "medically indigent" refers to people who cannot afford needed healthcare because of insufficient income or lack of adequate health insurance or both.

Medically indigent populations have many obstacles to the diagnosis and treatment of OSAS. Cultural and language barriers may obscure appreciation of symptoms that precipitate referral for OSAS evaluation. Even when the possibility of OSAS is raised, limited resources may discourage access to PSG and other tests used in the diagnosis of OSAS, restricting them to only the most highly motivated or severely symptomatic individuals. For example, some of our patients were referred only after severe hypoxia with sleep was noted during a hospitalization. During the study period, our patients waited less than a month for PSG. But in prior years, ValleyCare referred its patients to a crowded laboratory at another county hospital and the waiting period was substantially longer. Lack of referring physician awareness of improved PSG access may have been one important reason for the infrequent requests for OSAS evaluation observed during this study, yet medically indigent populations would seem to be susceptible to OSAS. Epidemiological studies have found that the prevalence of obesity, a major risk factor for OSAS, is substantially higher in minorities compared to whites and also in individuals living below the poverty line compared to those living above the poverty line.[20]

Significantly, in this study, only 71% of OSAS patients accepted CPAP, which is lower than the 78–98% reported in previous studies.[21-24] CPAP acceptance was lower in Hispanics compared to Caucasians, which is striking since both groups were equally symptomatic and had similar PSG findings. These findings suggest that social and cultural differences may be impediments to adequate treatment of OSAS in the public sector.

The importance of OSAS as a health problem in public healthcare systems has, to our knowledge, not been studied. Our data raise the possibility that it is a substantial health and safety concern which may be currently underrecognized. The cost of untreated OSAS to healthcare systems, as well as to the general populace, can be considerable.[7-8] Furthermore, excessive daytime sleepiness, driving ineligibility and cognitive impairment—all treatable complications of OSAS—could be major obstacles preventing some affected individuals from achieving their potential in terms of employment and earnings, setting them up to remain in a cycle of poverty.

How should we approach OSAS in our publicly

Table 3. Comorbid Health Conditions

Condition	Number of Patients (%)
Hypertension	79 (70%)
Cardiac Disease	41 (37%)
Diabetes	43 (30%)
Stroke	7 (7%)
Depression	44 (40%)

funded healthcare systems? First, we need more information about the scope of the problem, as well as the aspects that are unique to these patients. Larger studies that measure frequency, severity and the associated comorbidities of OSAS among patients who receive their care in the public sector are needed. Obstacles to finding and caring for patients at risk for OSAS must be further identified. Cultural differences regarding issues, such as perception of OSAS as a significant health problem and treatment preferences, should be explored. With a better definition of the problem, better resource allocation and systems modifications for finding and managing these patients can be sought. As we await this information, ValleyCare is planning a system-wide OSAS program with educational and screening components. In the Walla Walla project, OSAS evaluation referrals increased eight-fold with physician support and community education.[17]

Our study suggests that OSAS may be underrecognized and undertreated in medically indigent populations.

Further definition of the extent of the problem and innovative strategies to address it will be important advances for public healthcare systems as they strive to serve their communities.

REFERENCES

1. Young T, Evans L, Finn L, et al. Estimation of the clinically diagnosed proportion of sleep apnea syndrome in middle-aged men and women. *Sleep.* 1997;20:705-706.

2. Young T, Peppard PE, Gottlieb DJ. Epidemiology of obstructive sleep apnea: a population health perspective. *Am J Respir Crit Care Med.* 2002; 165:1217-1239.

3. Duran J, Esnaola S, Rubio R, et al. Obstructive sleep apnea-hypopnea and related clinical features in a population-based sample of subjects age 30 to 70 years. *Am J Respir Crit Care Med.* 2001;163:685-689.

4. Findley L, Powers D, Wilhoit S, et al. Automobile accidents involving patients with Obstructive Sleep Apnea. *American Review of Respiratory Disease.* 1998;138:337-340.

5. Findley L, Barth J, Power D, et al. Cognitive impairment in patients with obstructive sleep apnea and associated hypoxemia. *Chest.* 1986;90.

6. Young T, Peppard PE. Sleep-disordered breathing and cardiovascular disease: epidemiologic evidence for a relationship. *Sleep.* 2000;23(4 Suppl):122S-126S.

7. Ronald J, Delaive K, Roos L, et al. Obstructive sleep apnea patients use more healthcare resources 10 years prior to diagnosis. *J Sleep Res.* 1998:71-74.

8. Mar J, Rueda J, Duran-Cantolla J, et al. The cost-effectiveness of CPAP treatment in patients with moderate-to-severe obstructive sleep apnea. *Eur Respir J.* 2003;21:515-522.

9. Kushida CA, Nichols DA, Simon RD, et al. Symptom-based prevalence of sleep disorders in an adult primary care population. *Sleep Breath.* 2000; 4:11-15.

10. Young T, Palta M, Dempsey J, et al. The occurrence of sleep-disordered breathing among middle-aged adults. *N Engl J Med.* 1993;328:1230-1235.

11. Johns MW. A new method for measuring daytime sleepiness: the Epworth Sleepiness Scale. *Sleep.* 1991;14:540-545.

12. Rechtschaffe A, Kales A, eds. A Manual of Standardized Terminology, Techniques and Scoring System for Sleep Stages of Human Subjects. Bethesda, MD. *NIH.*1968.

13. Sleep-related Breathing Disorders in Adults: Recommendations for Syndrome Definition and Measurement Techniques in Clinical Research. A report of an American Academy of Sleep Medicine Task Force. *Sleep.* 1999;22:667.

14. Chesson AL, Ferber RA, Fry JM, et al. Practice parameters for the indications for polysomnography and related procedures. *Sleep.*1997;20:406-22.

15. WHO. Obesity: preventing and managing the global epidemic. Geneva.1997.

16. Hajjar I, Kotchen T. Hypertension Trends in the U.S. population. *JAMA.* 2003;290:199-206.

17. Ball E, Simmon RDJ, Tall AA, et al. Diagnosis and treatment of sleep apnea within the community: the Walla Walla Project. *Arch Intern Med.* 1997;157:419-425.

18. Sanders MH, Black J, Constantino JP, et al. Diagnosis of Sleep-Disordered Breathing in Half-Night Polysomnography. *American Review of Respiratory Disease.* 1991;144:1256-1261.

19. White DP, Gibb TJ, Wall JM, et al. Assessment of accuracy and analysis time of a novel device to monitor sleep and breathing in the home. *Sleep.* 1994;18:115-126.

20. Kumanyika S. Special issues regarding obesity in minority populations. *Ann Intern Med.* 1993;119:650-654.

21. McArdle N, Grove A, Devereux G, et al. Split-night versus full-night studies for sleep apnea/hypopnea syndrome. *Eur Respir J.* 2000;15:670-675.

22. Fleury B, Rakotonanahary D, Tehindrazanarivedo A, et al. Long-term compliance to continuous positive airway pressure therapy set-up during a split-night polysomnogram. *Sleep.* 1994;17:512-515.

23. Krieger J. Long-term compliance with nasal continuous positive airway pressure (CPAP) in obstructive sleep apnea patients and nonapneic snorers. *Sleep.* 1992;15:S42-S46.

24. Walhorn RE, Herrick TW, Nguyen MC, et al. Long-term compliance with nasal continuous positive airway pressure therapy of obstructive sleep apnea. *Chest.* 1990;97:33-38. ■