Self-Efficacy in Sleep Apnea: Instrument Development and Patient Perceptions of Obstructive Sleep Apnea Risk, Treatment Benefit, and Volition to Use Continuous Positive Airway Pressure

Terri E. Weaver, PhD[1,2]; Greg Maislin, MS, MA[2]; David F. Dinges, PhD[2]; Joel Younger, MD[3]; Charles Cantor, MD[2]; Susan McCloskey, MSN[1]; Allan I. Pack, MD, PhD[2]

[1]School of Nursing and [2]Center for Sleep and Respiratory Neurobiology, School of Medicine, University of Pennsylvania, Philadelphia, PA; [3]Bon Secours Holy Family Regional Health System, Altoona, PA

Study Objectives: The purpose of this study was to evaluate the Self-Efficacy Measure for Sleep Apnea (SEMSA) designed to assess adherence-related cognitions.

Design: Subjects completed the questionnaire prior to the initiation of continuous positive airway pressure (CPAP) treatment. Test-retest reliability of the instrument was evaluated by having a subset of subjects complete the SEMSA a second time at home, 1 week later, returning the questionnaire by mail.

Patients: 213 subjects with newly diagnosed obstructive sleep apnea were recruited from the clinic populations of 2 sleep disorders centers.

Measurements and Results: Content validity was confirmed by a panel of expert judges. Confirmatory factor analysis validated the 3 a priori subscales: risk perception, outcome expectancies, and treatment self-efficacy. The internal consistency of the total instrument was 0.92. Test-retest reliability coefficients (N=20) were estimated to be 0.68, P=0.001, for Perceived Risk; 0.77, P<<0.0001, for Outcome Expectancies; and 0.71, P=0.0005, for the Treatment Self-Efficacy subscale. Subject responses indicated that approximately half of the subjects did not perceive problems with concentration, sexual performance, sleepy driving, or an accident as related to sleep apnea. More than 60% of the subjects acknowledged most of the benefits of CPAP presented to them, but only 53% associated CPAP use with enhanced sexual performance. Frequently identified barriers to treatment use were nasal stuffiness, claustrophobia, and disturbing bed partner sleep.

Conclusion: These findings indicate that the SEMSA has strong psychometric properties and has the potential for identifying patient perceptions that may indicate those most likely to not adhere to treatment.

Key Words: sleep apnea, self-efficacy, CPAP adherence, social cognitive theory, CPAP treatment, health promotion

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INTRODUCTION

THERE IS EVIDENCE THAT ADHERENCE TO NASAL CONTINUOUS POSITIVE AIRWAY PRESSURE (CPAP) THERAPY, THE PRIMARY TREATMENT FOR OBSTRUCTIVE SLEEP APNEA (OSA), IS LESS THAN OPTIMAL.[1-4] For the approximately 45% to 50% of patients who become nonadherent to CPAP treatment,[1,2,4] the pattern of nonadherence is established early in treatment,[1-3] ie, within the first week of therapy.[2,3] Indeed, we have previously demonstrated that nonadherence to CPAP treatment is evident by the fourth day of use.[2] The early abandonment of CPAP treatment suggests that pretreatment factors may be operative in the decision of whether to embrace this treatment.

Lacking appreciation for their own impairment and the consequences of untreated OSA, it is possible that some patients may develop perceptions that are not conducive to taking responsibility for their own treatment. These perceptions are conceptually referred to as self-efficacy. The application of self-efficacy to the problem of identifying predictors of CPAP use derives from the social cognitive theory concept of Bandura (Bandura's model).[5,6] This model has been widely applied in studies of the adoption, initiation, and maintenance of health-promoting behaviors and consists of the concepts of perception of the risk to health, expectations regarding treatment outcome (outcome expectancies), and the confidence or volition to engage in the behavior (treatment self-efficacy).[7,8]

A recent prospective study of CPAP self-efficacy utilizing social cognitive theory showed that pretreatment perception of outcome expectancies and treatment self-efficacy in addition to knowledge and social support predicted the use of CPAP during the first week and 1 month after initiation of therapy.[9] This study employed an investigator-developed measure of self-efficacy that evaluated the constructs of outcome expectancy and treatment-self-efficacy but did not include the third construct of Bandura's model, perception of risk. Thus a key component of the model could not be evaluated, limiting the application of this model to the understanding of CPAP adherence. Moreover, in the appraisal of outcome expectancy, the instrument assesses only 2 outcomes associated with CPAP use. This restricts the evaluation of patient beliefs regarding the positive consequences of CPAP use, especially regarding other well-established benefits.

This paper describes the development and psychometric properties of a new instrument, the Self-Efficacy Measure for Sleep Apnea (SEMSA), based on Bandura's social cognitive model.[5-7] Specifically designed for OSA, this measure assesses the 3 concepts inherent in Bandura's model, including perception of risk, and also utilizes a broad range of circumstances in the appraisal of cognitions associated with the decision to embrace CPAP treatment. An understanding of patient beliefs regarding OSA and CPAP treatment may provide insight into who might be likely to accept CPAP treatment and may provide the basis for the development of targeted interventions to promote adherence.

Disclosure Statement

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Address correspondence to: Terri E. Weaver, PhD, RN, CS, FAAN, University of Pennsylvania School of Nursing, Nursing Education Building, 420 Guardian Drive, Philadelphia, PA 19104-6096; Tel: 215-898-2992; Fax: 215-573-7492; E-mail: tew@nursing.upenn.edu

The Self-Efficacy Measure for Sleep Apnea can be obtained by contacting Dr. Terri Weaver, corresponding author.

METHODS

The Institutional Review Boards of the University of Pennsylvania and Bon Secours-Holy Family Hospital approved the protocol. Written consent was obtained from subjects.

Instrument Development

The SEMSA is a self-administered paper-and-pencil questionnaire that takes approximately 15 minutes to complete. Employing the Flesch-Kincaid[10,11] method of reading-level determination built into the software of Microsoft Word®, it was determined that the questionnaire is at a fifth-grade reading level. The conceptual framework used for the development of this instrument was Bandura's social cognitive theory.[5-7] This theory posits that in addition to existing resources and treatment barriers, health-promoting behaviors are influenced by 3 major cognitions: risk perception—the patient's perceived vulnerability to health risks (ie, that untreated OSA will result in a negative outcome); outcome expectancy—perceived expectations regarding the potential of the behavior to reduce those risks (ie, the perception that CPAP use would result in positive consequences in the patient's life); and treatment self-efficacy—perceived ability to perform the behavior (ie, the perception that the patient has the wherewithal to use CPAP effectively under a wide range of circumstances).

The SEMSA was developed using guidelines for the operationalization of the social cognitive model.[8] The domain of perceived risk is assessed by items, rated on a 4-point scale ranging from very low to very high, that ask the respondent the degree of threat posed to them by risks that have been associated with OSA, such as cardiovascular morbidity, impaired driving, and decreased performance, to any person having OSA. Outcome expectancies are surveyed by a 4-point scale seeking responses (not at all true - very true) to statements of potential general outcomes if CPAP is or is not used, such as decreased snoring and increased alertness with CPAP use and having a driving accident when CPAP is not used. Self-efficacy, or the volition to use CPAP therapy, is evaluated by asking the respondent to rate on a 4-point scale the level of validity (not at all true - very true) of statements regarding their confidence in using CPAP despite certain challenges such as travel, disturbing the bed partner's sleep, or nasal stuffiness.

Content Validity

To establish content validity, 6 judges with expertise in the areas of self-efficacy instrument development, OSA, health-promotion research, or a combination thereof, were asked to rate the clinical relevance of each item and the instrument as a whole, to the concept of self-efficacy as it pertains to OSA using a 4-point ordinal scale (1 = irrelevant, 4 = extremely relevant).[12] The index of content validity was determined by the proportion of items receiving a rating of at least a 3 (relevant) or 4 (extremely relevant) across all judges.[12] Items that did not receive this level of endorsement were eliminated from the bank of 32 items**.** After 2 rounds, 2 items had been removed, and 100% of the judges endorsed each of the remaining 30 items included in the final round with no further suggestions for additions, deletions, or rewording. It was then determined that the SEMSA met the criteria for content validity.[12]

Scoring

The mean of the nonmissing item responses was calculated for each of the 3 subscales: Perceived Risk, Outcome Expectancies, and Treatment Self-Efficacy. Using this mean-weighted score prevents the distortion of the score from missing responses.

Sample

The sample of 213 subjects comprised clinic patients representing a wide spectrum of OSA disease severity constructed from 3 sources. It was considered appropriate to utilize a clinic-based population rather than a community-based population because that would be the population in which this instrument would be utilized. The first source (Sample 1) was a convenience sample of 38 subjects recruited from the sleep disorders clinic of the University of Pennsylvania Health system who underwent a diagnostic polysomnogram (PSG). The second source (Sample 2, N = 22) were participants in a study of the outcomes of 3 months of CPAP treatment from Bon Secours Holy Family Regional Health System (inclusion criteria respiratory disturbance index [RDI] >20, prescribed CPAP treatment, and at least a 5th grade reading level), and the final source (Sample 3, N = 153) were subjects in a study of the role of self-efficacy in CPAP adherence being conducted at the University of Pennsylvania. Inclusion criteria for this study were patients with newly diagnosed OSA (RDI >5) who were prescribed CPAP treatment and had at least a 5th grade reading level. The only exclusion criterion was a medical history of blindness.

Procedure

After providing informed consent, subjects completed a demographic form and the SEMSA in the sleep laboratory either prior to or upon the completion of their routine nocturnal diagnostic or split-night sleep study. In addition to the SEMSA, subjects in Samples 2 and 3 underwent neurobehavioral testing and completed the Epworth Sleepiness Scale,[13] Sickness Impact Profile Scale,[14] Functional Outcomes of Sleep Questionnaire,[15] Beck Depression Inventory,[16] Profile of Mood States,[17] Psychomotor Vigilance Test,[18] and sleep-wake diary as part of the respective protocols of the studies in which they were participating. Aside from information that the subject may have obtained during their interaction with their physician, subjects did not participate in any formal education program.

To evaluate the test-retest reliability of the instrument, 20 subjects from Sample 2 completed the SEMSA a second time 1 week later at home prior to the commencement of CPAP therapy, returning the questionnaire by mail.

Statistical Analyses

Reliability coefficients expressed as the ratio of true score variance to the sum of true score variance plus error variance were estimated by computing test-retest Pearson correlation coefficients.[19] To confirm the 3-factor (Risk Perception, Outcome Expectancy, and Treatment Self-Efficacy) structure and to establish construct validity, confirmatory factor analyses were performed. Since there was no a priori reason to believe that the latent factors would be uncorrelated, the factor pattern matrix following an oblique (promax) rotation was compared to that following a varimax (orthogonal) rotation.[20] The oblique rotation was selected if it resulted in a "simpler structure," that is, a structure in which items loaded highly on only 1 factor. Items were retained if they had a factor loading greater than 0.40. Items will low loading on all factors were dropped, and the factor model was then re-estimated. For other comparisons, statistical significance was set at $P<0.05$. All analyses were performed using SAS statistical software (SAS Institute Inc., SAS OnlineDoc®, Version 8, Cary, NC: SAS Institute Inc., 1999).

RESULTS

Subjects (N = 213) were predominately white men (60% men; 55% white, 39% African American, and 6% other ethnic or racial groups) with a mean (±SD) age of 47.72 ± 12.25 years, mean body mass index equal to 38.08 ± 9.66 kg/m^2, mean Epworth Sleepiness Scale score of 12.90 ± 5.48, and mean RDI of 43.16 ± 33.37 episodes per hour (see Table 1). Samples 1 (N=38) and 3 (N=153) had very similar percentages of men (53% and 58%), percentages of white and African American patients (63%/37% and 52%/43%), and mean age (47 years and 49 years). In contrast, Sample 2 (N=22) included 95% men and 95% whites and tended to be younger (mean age 42 years). Sample 2 also tended to have more severe apnea (median RDI=72 compared to Samples 1 (medi-

an RDI=15) and 3 (median RDI=31). The samples were similar with regard to mean body mass index and Epworth Sleepiness Scale scores.

Psychometric Evaluation

Frequency of Endorsement—Each of the original 30 items was evaluated to determine the proportion of subjects that selected each of the response alternatives for the item, or frequency of endorsement.[21] If there was greater than 95% selection for any 1 response alternative for an individual item, that item was deleted. None of the response alternatives for the items met this criterion, so all were retained.

Construct Validity and Test-Retest Reliability—The next phase of the psychometric evaluation was to ascertain whether the factor structure of the SEMSA reflected the 3 dimensions (subscales) of the scale that were created a priori: Risk Perception, Outcome Expectancies, and Treatment Self-Efficacy. An examination of the Scree plot[22] of the magnitude of the eigenvalues (y-axis) versus number of eigenvalues (x-axis) indicated that it was flat beyond 3 factors. These data suggest that 3 indexes from the instrument are sufficient to capture the variance among responses. The percentage of total variance among the 30 items explained by a 3-factor solution was 48.6%. Oblique rotations were examined; being a priori, there was no reason to believe that the factors should be statistically independent. Comparison of orthogonal and oblique rotations suggested that a simpler factor structure (ie, a factor structure in which every item loaded highly on only 1 factor) could be obtained using an oblique rotation that allowed nonzero interfactor correlations. Using the criteria of a factor loading greater than 0.40, all but 4 of the original questions loaded on the 3 subscales as determined a priori. All 4 items were from the a priori Outcome Expectancies domain. These were dropped, and the factor solution was re-estimated using 26 items. The percentage of total variance among the 26 items explained by a 3-factor solution was 52.8% (computed as the sum of the unweighted final commonality estimates obtained from the factor analysis divided by the number of items). The item factor loadings for the 3 factors after oblique rotation are presented in Table 2. The percentages of total variance explained by each of the factors, ignoring the remaining factors (and eliminating the remaining factors) were the following: Factor 1: risk perception 20.5% (11.6%); Factor 2: outcome expectancy 26.4% (11.8%); and Factor 3: treatment self-efficacy 26.0% (14.3%), respectively. The difference between the total explained variance and partial variance was due to interfactor correlations. The correlation between outcome expectancy and treatment self-efficacy was 0.46. Similarly, the correlation between outcome expectancy and risk perception was 0.41. The correlation between treatment self-efficacy and risk perception was 0.30. Although the latent factors were found to be moderately correlated, these data confirm that the items contained in the SEMSA reflect distinct domains as specified in Bandura's self-efficacy model[5,6,23,24] supporting the measure's construct validity.

Cronbach's alpha statistic was employed to summarize the internal consistency of the constructed indexes. The internal consistency coefficient of the total scale was 0.92 with item-to-total correlations ranging from 0.26 to 0.66. The Cronbach α statistic for each of the 3 subscales was greater than 0.85. Thus, using the criteria of Nunnally and Berstein[25] ($\alpha = 0.70$), this instrument is applicable for research as well as clinical practice. Descriptive statistics for the 3 subscales are presented in Table 3. Test-retest reliability coefficients (N=20) were 0.68, P=0.001 for Perceived Risk; 0.77, P<0.0001 for Outcome Expectancies; and 0.71, P=0.0005 for the Treatment Self-Efficacy subscales. These results indicate that the SEMSA is stable over time. Thus, between 68% and 77% of total variance is attributable to true differences among patients.

Perceptions of Self-Efficacy—We next evaluated the assessment of perceived self-efficacy in the total sample (N=213) to determine whether patients viewed OSA as a threat, whether they saw CPAP as a beneficial treatment, and if they would overcome common barriers such as CPAP side effects and travel to use this treatment. To better portray patients' pretreatment perceptions for each item, the 4-choice Likert responses were dichotomized into 2 levels by combining the frequencies of responses to the first 2 choices as 1 response and the frequencies of responses to the last 2 choices as another response. As shown in Table 4, falling asleep during the day and having high blood pressure were the two risks that more than 60% of the subjects viewed as a threat associated with having OSA.

Table 1—Characteristics of Total Sample

Characteristic	Sample 1 N = 38 Mean (± SD)	Sample 2 N = 22 Mean (± SD)	Sample 3 N = 153 Mean (± SD)
Age (years)	46.63 (14.11)	42.52 (10.05)	48.76 (11.89)
Male	53%	95%	58%
White	63%	95%	52%
BMI (kg/m^2)	38.02 (10.09)	37.88 (6.47)	38.15 (10.24)
RDI (episodes/hour)	29.15 (27.60)	63.91 (28.95)	43.65 (33.76)
ESS Total Score	14.64 (4.94)	14.27 (5.05)	12.51 (5.56)

BMI, body mass index; RDI, respiratory disturbance index; ESS, Epworth Sleepiness Scale

Table 2—Factor loadings in the rotated-factor matrix for the Self-Efficacy Measure for Sleep Apnea (Oblique Rotation)

Item	Factor 1	Factor 2	Factor 3
Factor 1: Risk Perception			
Having OSA, my chances of falling asleep driving	0.78	0.10	-0.5
Having OSA, my chances of having an accident	0.78	0.12	-0.07
Having OSA, my chances of having a heart attack	0.77	-0.18	0.16
Having OSA, my chances of falling asleep during day	0.64	0.18	-0.09
Having OSA, my chances of having high blood pressure	0.63	-0.33	0.22
Having OSA, my chances of difficulty concentrating	0.61	0.21	-0.09
Having OSA, my chances of being depressed	0.59	0.06	0.10
Having OSA, my chances of problems sexual performance	0.48	0.29	-0.12
Factor 2: Outcome expectancies			
If I use CPAP... I will be more active	-0.04	0.84	0.02
If I use CPAP... desire and sexual performance improved	0.02	0.80	-0.09
If I use CPAP... job performance improve	0.01	0.80	0.04
If I use CPAP... my relationship improve	0.02	0.70	0.10
If I use CPAP I will feel better	-0.00	0.65	0.26
If I use CPAP... decrease chance driving accident	0.17	0.53	0.03
If I do not use CPAP I will be less alert	0.09	0.51	0.15
If I use CPAP then I will not snore	-0.10	0.50	0.18
If I use CPAP... my partner will sleep better	0.16	0.44	0.07
Factor 3: Treatment Self-Efficacy			
I would use CPAP ... if it made my nose stuffy	-0.07	-0.02	0.86
I would use CPAP ... if have to wear a tight mask	0.02	-0.02	0.82
I would use CPAP ... if it were a bother	-0.01	0.06	0.81
I would use CPAP ... if it made me feel embarrassed	0.15	-0.03	0.74
I would use CPAP ... if it made me feel claustrophobic	0.00	-0.04	0.67
I would use CPAP ... if it took longer to get ready for bed	-0.03	0.19	0.64
I would use CPAP ... if had to pay for some of the cost	-0.04	0.17	0.63
I would use CPAP ... even when I traveled	0.00	0.22	0.57
I would use CPAP ... if it disturbed my partner	0.07	0.13	0.56
% variance of total instrument explained by each factor ignoring the other factors	20.5%	26.4%	26.0%
% variance of total instrument explained by each factor eliminating the other factors	11.6%	11.8%	11.6%

OSA, obstructive sleep apnea; CPAP, continuous positive airway pressure

Table 3—Characteristics of the 3-factor–based subscales and the total scale of the of the Self-Efficacy Measure for Sleep Apnea

Factor	Mean (±SD)	Potential range	Obtained range	Cronbach's α	Range: item to total correlation
Factor 1: Risk perception (8 items)	2.50 (0.57)	1 – 4	1 – 4	0.85	0.40 – 0.71
Factor 2: Outcome expectancies (9 items)	2.82 (0.69)	1 – 4	1 – 4	0.85	0.35 – 0.71
Factor 3: Treatment self-efficacy (9 items)	2.82 (0.76)	1 – 4	1 – 4	0.89	0.51 – 0.76

Approximately half the subjects did not perceive that problems with concentration, falling asleep while driving, or having an accident were related to OSA. Subjects knew least about the association between sexual desire or performance and OSA.

However, they were more positive about the effect CPAP would have on key outcomes. More than 60% of the subjects linked the use of CPAP to the outcomes of feeling better, snoring less, being more active, improving the bed partner's sleep and their relationship, decreasing the chance of a driving accident, and enhancing alertness and job performance. Consistent with their lack of appreciation of the impact of OSA on sexual functioning, only 53% of the subjects felt that CPAP use would improve their sexual desire and performance. More than 60% of the respondents believed that they could overcome the obstacles to CPAP use presented to them with the exception of the side effects of having a stuffy nose and the feeling of claustrophobia. The greatest deterrent to the use of CPAP besides claustrophobia was the impact of CPAP on the bed partner's sleep. Only 48% of the subjects stated that they would use their CPAP if it disturbed their bed partner's sleep.

DISCUSSION

This study indicates that the SEMSA has internal validity and is a reliable measure of self-efficacy of OSA and CPAP treatment with strong psychometric properties. Moreover, the application of this new instrument has provided insight into the beliefs of patients with OSA. Approximately half of the subjects were not as knowledgeable about or did not perceive risks commonly associated with OSA. However, they were surer about the effect of CPAP treatment on pertinent outcomes.

Table 4—Reported perceived risks of obstructive sleep apnea and outcome expectancies and self-efficacy of continuous positive airway pressure treatment

Construct	Frequency
Perceived Risks	**Percentage perceived OSA as risk for negative outcomes Responding High or Very High**
Falling asleep during day	72%
Having high blood pressure	64%
Having heart attack	59%
Difficulty concentrating	54%
Falling asleep driving	52%
Being depressed	49%
Having an accident	46%
Having problem with sexual desire or performance	38%
CPAP Outcome Expectancies	**Percentage perceived CPAP would produce positive outcomes Responding Somewhat True or Very True**
I will feel better	92%
I will not snore	85%
I will be more active	85%
Bed partner will sleep better	77%
Improve job performance	76%
Decrease chance of driving accident	71%
Improve relationships	67%
Be more alert	66%
Improve desire and sexual performance	53%
CPAP Self-Efficacy I would use CPAP even if...	**Percentage perceived could wear CPAP even if confronted with obstacles Responding Somewhat True or Very True**
Took longer to get ready for bed	85%
I traveled	77%
Feel embarrassed	75%
Had to wear tight mask	68%
It were a bother	68%
Had to pay for some of cost	63%
It made my nose stuffy	58%
Made me feel claustrophobic	49%
Disturbed my bed partner's sleep	48%

OSA, obstructive sleep apnea; CPAP, continuous positive airway pressure

There was fairly strong perceived self-efficacy to overcome frequently experienced barriers, including side effects, to utilizing CPAP treatment. The exceptions to this were nasal stuffiness, feelings of claustrophobia, and disturbing their bed partner's sleep.

Psychometric Properties of the SEMSA

Hoffstein and colleagues[26] were one of the first investigative teams to suggest that perceptions influence CPAP adherence in OSA. In their survey of treated patients with OSA, they found that perception of treatment benefit did not relate to objective findings. They concluded that patients' and families' beliefs about the beneficial effects of CPAP were important in patients' decisions to utilize this treatment. In another study, the application of confrontive coping and planful problem solving as strategies to handle stressful situations were statistically robust predictors of CPAP adherence compared to other psychological factors, including depression, anxiety, stress, and social desirability.[27]

The understanding of beliefs about OSA and dealing with CPAP, and how these beliefs motivate adherent behavior, has been limited. The study by Stepnowsky and colleagues[9] has been the only study (in a review of the English literature) to examine beliefs as they relate to adherence to CPAP using Bandura's Social Cognitive Theory.[24] Using a new instrument that they developed, they found no statistically reliable association between social cognitive constructs (perception of outcome expectancy, perception of treatment self-efficacy, knowledge, and social support) assessed at the time of the CPAP mask fitting and adherence measured at 1 week. However, there was a significant relationship between these beliefs measured at 1 week after treatment initiation and adherence during the first week of treatment. This was also true for beliefs assessed after 1 month of treatment and adherence at 1 month of treatment. This study provides valuable data regarding the generation of beliefs and when these beliefs have an impact on treatment adherence. However, as the instrument that they designed does not assess perception of risk, an integral concept of the Social Cognitive Theory, it provides no information regarding the contribution of the perception of the health risk of OSA to treatment adherence. Moreover, the instrument developed by Stepnowsky and colleagues is restricted in its assessment of outcome expectations and treatment self-efficacy. The only outcomes presented to the patient as benefits of CPAP use are daytime sleepiness and the ability to concentrate. Appraisal of only a few conditions limits the ability to identify those circumstances that may play a role in each patient's decision to apply CPAP treatment. Another concern is that the instrument developed by Stepnowsky and colleagues frames their assessment of outcome expectancies and treatment self-efficacy within the context of using "CPAP regularly". The term *regular* is not defined on the questionnaire. Thus, some patients may believe that regular use implies using CPAP 3 times a week every week while others may believe that it refers to use every night. We believe that not having a standard benchmark, ie, a definition of regular use, creates ambiguity and poses a significant threat to the validity of this instrument.

Based on Social Cognitive Theory,[5-7,23,24] we have developed a new instrument (SEMSA) that is sufficiently robust to provide insight into not only the perceptions of outcome expectancy and treatment self-efficacy, but also perception of risk. Moreover, our application of treatment self-efficacy in terms of the patient's volition to use CPAP within specified situations is consistent with the original theory in which patients are asked if they can use CPAP if they do not feel like it or encounter uncomfortable side effects. We believe that findings from our study add to the current body of knowledge of patient expectations of treatment-benefit volition to use treatment and additionally provides new information regarding perceptions of the risk of OSA.

Social Cognitive Theory has been widely applied in research on the relationship between self-efficacy and several health behaviors, including dental hygiene,[28,29] breast cancer detection,[30] sexual risk behavior,[31] physical exercise,[32] nutrition and weight-control,[33-36] approaches to addictive behaviors,[8] managing heart disease,[37] and the impact of cognitive variables on adherence to medications for asthma,[38] human immun-

odeficiency virus (HIV),[39,40] and after kidney transplantation[41] as well as fluid restrictions in renal disease.[42] Recently, the evaluation of self-efficacy in risk behavior associated with acquired immunodeficiency syndrome [7,43,44] led to a highly successful program to promote HIV risk reduction in adolescents that is currently being used by the Centers for Disease Control and Prevention.[31] The evaluation of health beliefs should be examined by a disease-specific instrument given the differences in the extent of health risk and the target behavior. This notion is supported by Bandura and others [5,23,24,45] who believe that expectancies are not generalizable but are specific to a given situation.[46] Therefore, comparison of concurrent and construct validity with other self-efficacy instruments is not appropriate. However, the fact that the factor analysis confirmed the a priori subscales of Risk Perception, Outcome Expectancy, and Treatment Self-Efficacy demonstrates the SEMSA's construct validity. The values of the Cronbach's alpha statistics indicate that the subscales possess internal consistency. Moreover, the results of the test-retest analysis provide support for the contention that the measure has stability over time. Collectively, these properties indicate that the SEMSA provides important information about patient perceptions that may be useful in identifying patients who may be more or less likely to adhere to CPAP therapy based on their perceptions of risks associated with OSA, their beliefs about the efficacy of CPAP treatment, and whether they feel they can actually apply CPAP treatment under challenging circumstances. It should provide a basis for more targeted efforts to enhance adherence to use of this particular therapy. We are currently investigating whether the perceptions measured by the SEMSA predict measured CPAP adherence.

Perceptions of Self-Efficacy—Several authors have asserted that the cognitive variables that have been employed successfully to motivate healthy behaviors could also be applied to ill individuals within the context of adherence to treatment.[47,48] Elder and associates[48] maintain that before developing an intervention designed to promote a desired behavior, such as adherence to CPAP treatment, there needs to be an understanding of patient perception toward the risk they assign to the disease and their perception of the behavior. There has been little systematic evaluation of OSA patients' perceptions regarding the threat of OSA to their health and their opinion of CPAP as a therapy prior to receiving treatment. Using the SEMSA, we found that, in general, approximately half of the subjects had limited knowledge of the comorbidities and other potential risks associated with OSA. The acknowledgement of daytime sleepiness as a manifestation of OSA is most likely a response to this predominant symptom as a reason to seek medical attention for this syndrome. However, most interesting were the strong feelings expressed by 64% of the sample that high blood pressure was also a risk, given that convincing data supporting the association between hypertension and OSA is relatively recent.[49,50] The fact that approximately half of the sample had a lack of perception of the probability of falling asleep while driving a motor vehicle and the potential for having a crash is consistent with the report by Engleman and colleagues[51] that patients did not perceive a problem with sleepiness-related driving, a perception that was changed following CPAP therapy. In our study, only 38% of the respondents indicated that problems with sexual desire or performance were related to OSA. However, several studies have indicated that OSA has a considerable impact on marital relationships and sexual functioning. In 1 study, 68% of the men with OSA had erectile dysfunction.[52] In a retrospective case-control study of 334 women diagnosed with upper airway sleep-disordered breathing (mean RDI, 26 ± 6.8), 41% of the cases attributed divorce, dissolution of a love relationship, and social isolation to their illness.[53] This was in sharp contrast to only 8% in the control group of women with chronic insomnia. A large study of the obese Swedish population comparing those with a high versus low likelihood of having OSA found that the likelihood of having OSA was an independent risk factor for divorce.[54] The fact that the majority of our patients were unable to link negative outcomes such as problems with sexual relations, concentration, being depressed, or driving while sleepy to OSA presents an opportunity for healthcare providers to provide patient education. These data seem to suggest a lack of knowledge, appreciation, or personal experience regarding the association between these consequences and OSA. It is unclear the extent to which practitioners invest time in assisting the patient to make these associations. The general importance of doing so, in the context of compliance to medical care recommendations, has been emphasized by Becker and Maiman.[47] There is evidence that perceived susceptibility to negative events in ill individuals has predictive value of adherence to treatment.[47]

Understanding obstacles that would deter the patient from using CPAP is crucial if interventions to promote adherence are to be successful. Patients will typically conduct a risk-benefit analysis to decide if the barriers to use (physical, psychological, financial) given the treatment's effectiveness in reducing the health threat is worth embracing.[47] Positive perception of treatment benefit has been connected to adherence to treatment.[47] We were encouraged to find that more than 60% of the subjects indicated that they would still use CPAP despite common hypothetical side effects and logistical challenges such as travel. These subjects indicated that they would overcome the hypothetical barriers posed by such physical challenges as wearing a tight mask. They did not perceive that the nightly regimen of preparing CPAP for use, such as attaching and adjusting headgear, would be enough of a bother to deter them from using the treatment. From a financial perspective, cost also was not perceived as potentially discouraging use, perhaps reflecting recently achieved gains in insurance reimbursement for CPAP treatment in the United States. Although psychological factors, such as feeling embarrassed, were not viewed as a potential problem by the majority of subjects, feelings of claustrophobia were believed to interfere with treatment. Indeed, claustrophobic tendencies have been previously cited as reasons for failure to use CPAP treatment.[1,55,56] Those patients who retrospectively indicated that they felt claustrophobic when using CPAP were less adherent than those who did not feel claustrophobic.[1] The identification of claustrophobia in retrospective studies as a deterrent to CPAP use,[1,55,56] in addition to our findings that patients view claustrophobia as a potential barrier to successful treatment, suggests that patients should be evaluated for the sensation of claustrophobia with CPAP prior to home use.[55,56] We are currently prospectively evaluating the feelings of claustrophobia as a predictor of CPAP adherence. The importance of soliciting the bed partner's experience with CPAP treatment was evident by the finding that almost half of the subjects would find it difficult to use CPAP if it affected their bed partner's sleep. This is consistent with the results of the study by McArdle and colleagues[57] that found a significant relationship ($r = 0.50$) between the change in partner sleep quality prior to and following CPAP initiation and patient adherence to CPAP treatment. In that study, both patients and their partners were similar in their assessment of bed partner sleep quality ($r = 0.6$, $P<0.001$). As it is often the symptoms of OSA that have disturbed bed partners' sleep and prompted medical intervention, these data, along with our findings, suggest that including the bed partner during the commencement of CPAP treatment may be instrumental in the promotion of treatment use. It may indeed be that the quality of the bed partner's sleep serves as feedback to the patient regarding treatment success, further promoting acceptance of this device.

In conclusion, this paper describes the first disease-specific measure of pretreatment expectancies regarding OSA and CPAP treatment. It is also the initial description of patients' beliefs regarding the health risk of OSA, outcome expectancies of CPAP treatment, and self-efficacy in the application of this treatment. The psychometric properties of the SEMSA indicate that it is a valid and reliable measure that could further identify candidates for whom information regarding this disease and treatment is important and who might also potentially be at risk for not adhering to CPAP therapy. The findings from this study stress the importance of seeking patients' perspectives on the risks associated with OSA, whether CPAP will be beneficial, and whether patients can overcome common obstacles in an effort to determine those patients most likely to not be adherent to this treatment and potential interventions to promote use.

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