Do Cognitive Perceptions Influence CPAP Use?

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Acknowledgements: Research support by VA Stars & Stripes Healthcare Network Competitive Pilot Project Fund (Sawyer) and NIH K99NR011173 (Sawyer). The authors would like to acknowledge the VISN 4 Eastern Regional Sleep Center staff and polysomnography technologists at the Philadelphia VA Medical Center for their diligence in caring for our research patients. We also would like to acknowledge the support of the Nursing/Patient Care Services Department at the Philadelphia VA Medical Center. The study was conducted at the Philadelphia Veterans Affairs Medical Center, Philadelphia, Pennsylvania. The University of Pennsylvania IRB and the Philadelphia Veterans Affairs Medical Center IRB approved the study. Drs. Sawyer, Kuna, and Moriarty and Ms Canamucio disclose the absence of financial conflicts of interest. Dr. Weaver has received research support from Philips Respironics Sleep, Respironics Foundation, and Cephalon; consults for Apnex Medical, Inc. and Cephalon, Inc.; receives royalties from Sanofi-Aventis Pharmaceutical, Merck& Co., Inc., Sleep Solutions, N.V. Organon, Apnex Medical, Inc, Ventus Medical, GlaxoSmithKline, Philips Respironics, Cephalon, Inc.

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Abstract

Objective: Nonadherence to CPAP increases health and functional risks of obstructive sleep apnea. The study purpose was to examine if disease and treatment cognitive perceptions influence short-term CPAP use.

Methods: A prospective longitudinal study included 66, middle-aged (56.7 yr ± 10.7) subjects (34 [51.5%] Caucasians; 30 [45.4%] African Americans) with severe OSA (AHI 43.5 events/hr ± 24.6). Following full-night diagnostic/CPAP polysomnograms, home CPAP use was objectively measured at 1 week and 1 month. The Self Efficacy Measure for Sleep Apnea questionnaire (SEMSA), measuring risk perception, outcome expectancies, and self-efficacy, was collected at baseline, post-CPAP education, and after 1 week CPAP treatment. Regression models were used.

Results: CPAP use at one week was 3.99 hr/night ± 2.43 and 3.06 hr/night ± 4.50 at one month. No baseline SEMSA domains influenced CPAP use. Post-education self-efficacy influenced one week CPAP use (1.52±0.53, p=0.007). Self-efficacy measured post-education and after one week CPAP use also influenced one month CPAP (1.40±0.52, p=0.009; 1.20±0.50, p=0.02, respectively).

Conclusion: Cognitive perceptions influence CPAP use, but only within the context of knowledge of CPAP treatment and treatment use.

Practice Implications: Patient education is important to OSA patients’ formulation of accurate and realistic disease and treatment perceptions which influence CPAP adherence.

Word Count: 200

Keywords: Patient compliance; Continuous positive airway pressure; Obstructive sleep apnea; Self efficacy
1. Introduction

Untreated obstructive sleep apnea (OSA) contributes to daytime symptoms and functional impairments such as excessive sleepiness, impaired cognition and memory, mood alterations, and decreased functional capacity(1) and is associated with increased cardiovascular and metabolic risks.(2-5) Continuous positive airway pressure (CPAP) is a highly effective treatment for OSA, eradicating the airway closures during sleep and thereby reversing the daytime effects of OSA.(6,7) Yet, patients’ use of CPAP is often less than optimal and is widely recognized as a factor contributing to poor health and functional outcomes as a result of untreated or under-treated OSA.(8-13) Many patients decide whether or not to use CPAP early in the treatment period, at least during the first week of treatment.(11,12) Furthermore, early CPAP use predicts long-term CPAP use.(11,12,14,15) Taking into account these two important and relatively consistent empiric findings, it is critical to identify newly-diagnosed OSA patients who are at risk for subsequent sub-optimal CPAP use early in the treatment period. With the early identification of individuals who are unlikely to optimally use CPAP, “high risk” patients can be exposed to targeted interventions prior to or at the outset of treatment to promote use of CPAP and thereby improve short- and long-term health and functional outcomes of OSA.

Although the optimal “dose” of CPAP is yet to be consistently defined by empiric studies, there have been several recent trials that suggest “more is better.” A prospective study of 149 newly diagnosed OSA subjects starting CPAP treatment and followed for three months on treatment examined the estimated likelihood of return to normal levels of sleepiness (subjective and objective) and daily functioning in response to nightly duration of CPAP use.(13) The minimal duration of CPAP use per night to restore normal self-rated alertness was 4 hours, objectively measured alertness was 6 hours, and self-reported daily functioning was 7.5 hours.(13) Stradling and Davies found that subjective and objective sleepiness measures and energy/fatigue measures demonstrated a greater improvement with more CPAP use in their
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placebo-controlled trial(16), with at least 5 hours/night of CPAP treatment at effective pressure was necessary to restore sleepiness to normal levels.(16) Both Engelman and colleagues(17) and Barnes(18) examined outcomes relative to CPAP use in mild OSA subjects and identified that improvements in the outcomes of respiratory disturbance, subjective sleepiness, and symptoms improved with CPAP but more hours of use per night was consistent with greater improvements in these outcomes.(17,18) Collectively, these studies suggest that duration of time on treatment is an important factor contributing to symptom resolution and functional improvement. Moreover, these studies highlight the significant sub-optimal use of CPAP that is reported in published studies – CPAP use, or adherence, is a critical problem in terms of measurable outcomes in the OSA population.

Previous studies have examined patient characteristics and disease factors that may reliably identify OSA patients likely to abandon or not adhere to CPAP treatment. Severity of disease (apnea-hypopnea index [AHI])(10,19,20), subjective sleepiness(9,21), and nocturnal oxyhemoglobin saturation nadir(9,10,14,19) are the only patient characteristic predictors, although weak, of CPAP adherence that have been identified to date. Other patient, disease, and systems characteristics, including age, race, mood, CPAP side effects, and diagnostic procedure, have not been shown to influence subsequent CPAP use. In an effort to identify OSA patients who may be at risk for underuse of CPAP, several published studies have examined theoretically-derived cognitive factors that may influence CPAP use, including outcome expectations, self-efficacy, social support, disease-specific knowledge, decisional balance, and readiness for change.(22-24)

From Social Cognitive Theory(25) the cognitive perception domains of (1) knowledge of health risks and benefits of health behaviors, (2) outcome expectations about costs and benefits of health behaviors, (3) self-efficacy as the belief that an individual can control his/her own health habits, and (4) social structures as barriers and/or facilitators to health behavior have been examined in relationship to CPAP use.(22,23) Similarly, from the Health Belief Model(26), readiness to act (i.e., health behaviors), as influenced by perceived susceptibility to health
impairment and disease severity (i.e., threat), external cues to action, and subjective cost-benefit analysis (i.e., perceived benefits of health behavior and barriers) have been studied. Decisional balance, which incorporates the process of weighing pros and cons for engaging in particular health behaviors, and readiness for change as a continuum of health behavior change, both derived from the Transtheoretical Model, have also been identified as influential on CPAP use. When considered collectively, these theory-derived cognitive factors have been shown to significantly influence subsequent CPAP use, with self-efficacy and outcome expectations identified as significant independent predictors of CPAP use.

Studies that have examined cognitive factors as influential on CPAP use have measured these variables at baseline and after treatment exposure. When measured at baseline, cognitive factors have not been identified as influential on subsequent CPAP use. After 1 week of treatment exposure though, there is evidence to suggest that cognitive perceptions of disease and treatment are influential on both short- (i.e., 1 month) and long-term CPAP use (i.e., 6 months). The objective of our study was to determine if disease-specific cognitive perceptions influence CPAP use, specifically examining these factors not only at baseline and after 1 week of CPAP exposure, but also after the delivery of a standardized, simple patient education program provided prior to any treatment exposure. We addressed the study objective by measuring cognitive perceptions with the Self-efficacy Measure in Sleep Apnea (SEMSA) at baseline, immediately following patient education but prior to any treatment exposure, and after one week CPAP treatment in a prospective study.

2. Methods

2.1 Participants

After initial clinical evaluation at a Veterans Affairs hospital-based sleep center by a board-certified sleep physician, patients were referred to the study for participation. Ninety-eight subjects, referred to the sleep center and considered clinically likely to have OSA by a sleep specialist on initial clinical evaluation, were enrolled and consented in the study prior to diagnostic polysomnogram (PSG). The inclusion criteria were: (1) newly-diagnosed OSA
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(apnea hypopnea index [AHI] ≥ 15 events/hr) on an overnight in-laboratory PSG; (2) absence of medical contraindications for CPAP; and (3) ability to speak and understand English. To ensure study-referred patients would be prescribed CPAP treatment, patients with mild OSA (AHI 5-15 events/hour) were not included. Exclusion criteria included: (1) any current or historical medical/surgical treatment for OSA; (2) refusal of CPAP therapy for home treatment; (3) requirement of supplemental oxygen in addition to CPAP; and (4) requirement of bilevel positive airway pressure therapy. Twenty-five subjects were not included in the cohort after diagnostic PSG (i.e. AHI < 15 events/hr), three subjects withdrew, and four subjects refused CPAP treatment, with 66 subjects in the final cohort.

2.2. Measures

2.2.1. Self-efficacy Measure for Sleep Apnea (SEMSA)

The SEMSA was employed to measure cognitive factors that may influence subsequent CPAP use, including perception of OSA risk, treatment outcome expectancies, and perceived treatment self-efficacy. (27) Risk perception was defined as the individual’s perception of health risks associated with OSA. Treatment outcome expectancies included the individual’s expectations of certain changes or improvements with CPAP treatment. Treatment self-efficacy was defined as the individual’s belief in their own ability to use CPAP, even when faced with difficulties (i.e. mask discomfort; noise of device; spouse disturbed by CPAP). The SEMSA is a 26-item Likert type scale with strong evidence of content validity, construct validity, internal consistency (Cronbach’s alpha = 0.92), and adequate test-retest reliability for each subscale (r > 0.68; 27). SEMSA scores were calculated for each subscale (Perception of Risk, Outcome Expectancies, and Treatment Self-Efficacy) by taking the average of all answered items.

2.2.2. CPAP adherence

All participants received the same type of CPAP apparatus (RemStar Pro®, Philips Respironics). This system contains software (Respironics Encore® SmartCard™) that measures and records CPAP mask-on time onto a microchip contained on the SmartCard™. CPAP use was defined as time periods in which the device was applied for more than 20
minutes at effective pressure. Average hours of CPAP use during first 7 days of treatment and during first month of treatment were used as outcome measures.

2.2.3. Epworth Sleepiness Scale (ESS)

Subjective sleepiness was assessed with the valid and reliable ESS.(28,29) The ESS is an 8-item, self-administered questionnaire that measures subjective daytime sleepiness by assessing the self-reported frequency of falling asleep in various settings.

2.2.4. Profile of Mood States (POMS)

Self-reported mood states during the daytime were measured using the POMS.(30) The POMS has established reliability and validity and is sensitive to sleep deprivation(31) and to treatment of OSA with CPAP.(9)

2.3. Protocol

After study enrollment and informed consent, all participants completed a demographic form, Epworth Sleepiness Scale (ESS), Profile of Mood States (POMS), and Self-efficacy Measure in Sleep Apnea (SEMSA). Participants were given a standardized education program that included information about OSA, diagnostic procedures, treatment options, and CPAP. The education program included a 15-minute video in which OSA patients described their diagnostic and treatment experiences and a printed brochure about OSA and CPAP. After completion of the education program, participants completed the SEMSA. Thereafter, participants completed two in-laboratory polysomnograms, the first for diagnosis and the second for establishing effective CPAP pressure. Setup and instruction of the home CPAP unit (Respirronics; standard of care equipment from VA) was provided by one medical equipment company. Following CPAP treatment for 1 week, objectively recorded CPAP use was downloaded from the device and participants completed the ESS, POMS, and SEMSA. After 1 month of CPAP use, participants returned to the sleep center for clinical follow-up visits, at which time CPAP use data was downloaded from the device for the final study outcome measure.

2.4. Analysis
Descriptive statistics were generated for all variables. Subjects with incomplete data were not included in all models. A separate stepwise linear regression model was used for each SEMSA measurement period (baseline, post-education, and after 1 week CPAP use). Three SEMSA domains including risk perception, outcome expectancies, and self-efficacy, and five covariates including age, race, mood, AHI, and ESS, were included in the first step for each model. A forward loading, stepwise selection identified significant covariates ($p \leq 0.15$). These covariates were included in the final linear regression model. Because error variances were unequal in the 1 month models, negative binomial models were also examined for each measurement period. Analyses were performed using SAS 9.1 (SAS Institute, Cary, NC). Statistical significance was identified at $p \leq 0.05$.

3. Results

The participants ($n = 66$) were predominantly middle-aged ($56.7 \pm 10.7$ yr) men (97%) with severe OSA ($AHI = 43.5 \pm 24.6$ events/hr). At least half of the cohort was married, had high school or higher education, and were employed or retired (Table 1). Average CPAP use at 1 week was $3.99 \pm 2.43$ hr/night. Average CPAP use at 1 month was $3.06 \pm 4.5$ hr/night.

3.1. 1 week CPAP use

At baseline, the only influential variable on 1 week CPAP use was race ($p = 0.05$), though the model accounted for only 6.2% of explained variance ($p=0.05$). Variables that were excluded from the final model based on the statistical criteria for inclusion ($p \leq 0.15$) were age, baseline mood and ESS score, AHI, and all SEMSA domains.

After the standardized disease and treatment education program, the only variables included in the final model were from the SEMSA post-education measure, including risk perception ($p = 0.17$) and self-efficacy ($p = 0.007$). Variables excluded from the final model were age, race, baseline mood and ESS score, AHI, and the SEMSA domain outcome expectancies. The final model accounted for 15% explained variance for 1 week CPAP use ($p = 0.012$) with self-efficacy emerging as most influential on 1 week CPAP use ($p = 0.007$)(Table 2).

3.2. 1 month CPAP use
The selection of variables for 1 month CPAP use final linear models was consistent with the procedure used for 1 week CPAP use models. Variables excluded from all models included: age, baseline mood and ESS score, AHl, and SEMSA risk perception and outcome expectancies (p>0.15). At baseline, the model included both African American race (p = 0.02) and baseline self-efficacy (p = 0.06) for the final 1 month CPAP use model, with both variables influencing 1 month CPAP use (R² = 0.15; p = 0.009). Post-education, self-efficacy (p = 0.009) and African American race (p = 0.07) were included in the 1 month model and accounted for 19% of explained variance in one month CPAP use (p = 0.004; Table 3).

Finally, the association between 1-week SEMSA variables and 1 month CPAP use was examined. Similar to the baseline and post-education models, African American race and post-1 week CPAP use self-efficacy were retained for the final model. After 1 week of CPAP treatment at home, self-efficacy (p = 0.02) and African American race (p = 0.02) influenced 1 month CPAP use, with an explained variance of 21% (p = 0.003). Because of unequal error variances, negative binomial models for 1 month CPAP use were examined in addition to the linear regression models. SEMSA self-efficacy and African American race were significant in the final 1 month negative binomial models (Table 4), consistent with the linear regression results.

4. Discussion and Conclusion

4.1. Discussion

Patients’ use of CPAP, or adherence, has become a critically important clinical issue in the effective treatment of OSA. Early recognition of OSA patients who are at risk to fail on CPAP treatment due to poor use is an imperative disease management strategy that will permit earlier intervention to promote adherence and potentially deter the development of intermittent patterns of CPAP use that frequently lead to treatment failures(11). Previous studies have identified cognitive factors, including risk perception, outcome expectancies, and self-efficacy, as influential on OSA patients’ decisions to use CPAP.(22-24) In two of the three studies, cognitive factors measured at baseline, or prior to any treatment exposure, were not suggestive
of subsequent CPAP use behaviors.(22,23) Our study, employing the SEMSA as a measure of
the same cognitive factors, uniquely identified self-efficacy as an important determinant of
subsequent CPAP use, particularly in the context of disease- and treatment-specific education
without treatment exposure. The findings from our study extend the previous findings,
suggesting that OSA patients' formulation of accurate, personalized perceptions of their own
ability to use CPAP (i.e., self-efficacy) are responsive to simple, standardized patient education.
Further, when patients' cognitive perceptions are derived from information that is specific to the
health behavior and health condition, these perceptions are indicators of patients' decisions to
invest in or reject the health behavior (i.e., short- and longer-term CPAP use).

From previous studies, cognitive perceptions are influential on concurrent CPAP
use.(22-24) Yet, measures of these perceptions prior to any CPAP exposure have not been
consistently identified as predictive of future CPAP use. Studies that reported no relationship
between baseline, pre-treatment cognitive perceptions variables and CPAP use outcomes did
not specifically report on the delivery of any disease- and treatment-specific education.(22,23)
Therefore, it is possible that patients were not able to formulate accurate, cognitive perceptions
of OSA and CPAP treatment prior to any treatment experience in the absence of disease- and
treatment-specific information from health providers or study investigators. In our study,
consistent with previous studies, we identified that baseline, pre-treatment measures of
cognitive perceptions did not influence subsequent treatment use; yet, after a standardized,
simple patient education program that focused on OSA and CPAP, the same cognitive
perceptions measures were insightful factors that identified low-use CPAP patients. These
findings are consistent with Olsen and colleagues' results(24), where “baseline” measures of
cognitive factors using the SEMSA were employed after detailed OSA and CPAP information
was provided to participants by their sleep provider but prior to any CPAP exposure in the sleep
laboratory.

In contrast to our own study findings, Olsen and colleagues(24) identified that post-
education outcome expectancies and risk perceptions were predictive of subsequent CPAP use
at four months, while self-efficacy was not an independent predictor of subsequent CPAP use. In their study, while the full model, inclusive of all SEMSA cognitive domains combined with functional outcomes measured by the Functional Outcomes of Sleep Questionnaire was significant (R=0.467; p < 0.01), multicollinearity within the model (SEMSA domains with significant bivariate correlations) may contribute to differing results when the same or similar models are applied in different samples. In order to more precisely identify individual cognitive perception domains from the SEMSA that importantly influence CPAP use, replication studies are needed in larger, heterogeneous samples.

Limitations of our study include a relatively homogenous sample, consisting of veterans, predominantly men, with severe OSA. In a general clinical population inclusive of more women and greater variation in disease severity, our findings may not be replicated. We also acknowledge that the study was a prospective, longitudinal study that included a standardized educational program as part of the protocol. We enrolled consecutive patients in the study who agreed to participate in the research possibly creating a selection bias, enrolling only those persons who were highly motivated to pursue diagnosis and treatment and participate in research. Yet, in terms of CPAP use outcomes (i.e., adherence or mean hours of CPAP use), the sample did not demonstrate a higher level of CPAP use than has been previously published reducing our overall concerns for selection bias. Because the study was not designed as an intervention study, suggestions for future intervention research based on our findings are conceptual and exploratory, not hypothesis-driven. Finally, although we identified African American race as influential on CPAP adherence, this finding has not been consistently identified in other studies specifically examining race as a predictor of CPAP adherence.(32-34) In the only study that explored other salient factors that may better explain race-based differences in adherence to CPAP, socioeconomic status (i.e., neighborhood of residence) was found to more importantly contribute to differences in CPAP adherence than race.(32) 4.2. Conclusion
The results of our study suggest that disease- and treatment-specific cognitive perceptions may be influenced by simple education and that the timing of (1) measuring these variables and (2) providing patient education is critically important in future studies. Moreover, our findings provide preliminary evidence to suggest that particular subgroups of persons with newly-diagnosed OSA may be identified as high risk for treatment failure due to low use (i.e., nonadherence) by measuring disease- and treatment-specific cognitive perceptions. This identification strategy affords us the opportunity to deliver targeted interventions to high risk non-users, testing the overall effectiveness of adherence promotion strategies and potentially improving health and functional outcomes for these high risk CPAP users. Patient education is an essential component of patients’ ability to formulate accurate and realistic disease and treatment perceptions. As Bandura suggests, specific knowledge of health risks and benefits is essential to establishing change conditions. Yet, knowledge alone is not sufficient to successfully motivate and implement a new behavior or change old behaviors, such as initiating and maintaining CPAP treatment of OSA. Future intervention studies aimed at promoting CPAP use will possibly be most effective with the inclusion of appropriately-timed OSA- and CPAP-specific patient education and careful attention to self-efficacy promotion among OSA patient who are at high risk for CPAP nonadherence.

4.3. Practice Implications

Approximately 50% of OSA patients initiated on CPAP treatment fail to use CPAP at optimal levels (i.e., average hours use per night) to effectively improve health and functional outcomes of the disease. Providing interventions to all patients, regardless of their prospective risk for nonadherence to CPAP, is not an efficient use of resources. Strategies to prospectively identify OSA patients at risk for nonadherence are important and will substantially contribute to the identification of effective adherence promotion interventions. Although our study findings are preliminary in nature, and we recognize the need for further risk screening testing in more heterogeneous, larger samples, the SEMSA may provide clinical guidance for risk stratification for nonadherence to CPAP among persons newly diagnosed with OSA. Disease- and
treatment-specific patient education is recognized by the American Academy of Sleep Medicine as a standard of care in the diagnosis and management of OSA to support treatment utilization. The findings from our study highlight the importance of patient education for newly diagnosed OSA patients and suggest that appropriately timed and specific patient education may influence cognitive perceptions of OSA and CPAP treatment and subsequent adherence to CPAP.
References


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32. Platt AB, Field SH, Asch DA, Chen Z, Patel NP, Gupta R, Roche DF, Gurubhagavatula I,
Christie JD, Kuna ST. Neighborhood of residence is associated with daily adherence to CPAP therapy. Sleep 2009;32:799-806.


Table 1. Sample Characteristics (n=66)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Freq (%)</th>
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<tbody>
<tr>
<td>Race</td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>34 (51.5)</td>
</tr>
<tr>
<td>African American</td>
<td>30 (45.4)</td>
</tr>
<tr>
<td>Male</td>
<td>64 (97.0)</td>
</tr>
<tr>
<td>Married</td>
<td>44 (66.7)</td>
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<tr>
<td>Referred from Primary Care</td>
<td>47 (71.2)</td>
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<tr>
<td>Some Post-high school Education</td>
<td>29 (43.9)</td>
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<tr>
<td>Employment</td>
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<tr>
<td>Employed FT*/PT*</td>
<td>27 (71.2)</td>
</tr>
<tr>
<td>Retired</td>
<td>24 (36.4)</td>
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<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mean (SD)</th>
</tr>
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<tbody>
<tr>
<td>Age</td>
<td>56.7 (10.7)</td>
</tr>
<tr>
<td>AHI* (events/hr)</td>
<td>43.5 (24.6)</td>
</tr>
<tr>
<td>ESS* Score</td>
<td>12.4 (5.3)</td>
</tr>
<tr>
<td>Mood Score (POMS)*</td>
<td>12.6 (15.4)</td>
</tr>
<tr>
<td>BMI* (kg/m²)</td>
<td>33.5 (7.4)</td>
</tr>
<tr>
<td>CPAP Use 1 week (hr)</td>
<td>3.99 (2.43)</td>
</tr>
<tr>
<td>CPAP Use 1 month (hr)</td>
<td>3.06 (4.50)</td>
</tr>
</tbody>
</table>

*FT = full time; PT = part time; AHI = Apnea Hypopnea Index; ESS = Epworth Sleepiness Scale; POMS = Profile of Mood States; BMI = Body Mass Index
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Table 2. Linear Regression Models for One Week CPAP Use

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1 Baseline Measures$^{1,2}$: One Week CPAP Use$^1$</th>
<th>Model 2 Post Education Measures$^{3,4}$: One Week CPAP Use$^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B est ± SE</td>
<td>p value</td>
</tr>
<tr>
<td>Race – African American</td>
<td>- 1.26 ± 0.63</td>
<td>0.05</td>
</tr>
<tr>
<td>Risk Perception</td>
<td></td>
<td>0.61 ± 0.44</td>
</tr>
<tr>
<td>Self Efficacy</td>
<td></td>
<td>1.52 ± 0.53</td>
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</tbody>
</table>

1 Variables excluded from final model (p>0.15): age, mood, ESS, AHI, Risk Perception, Outcome Expectancies, and Self Efficacy
2 n=62
3 Variables excluded from final model (p>0.15): race, age, mood, ESS, AHI, and Outcome Expectancies
4 n=59
† $R^2 = 0.06$ (p=0.05)
‡ $R^2 = 0.15$ (p=0.012)
Table 3. Linear Regression Models for One Month CPAP Use

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1 Baseline Measures(^1,2): One Month CPAP Use(^1)</th>
<th>Model 2 Post Education Measures(^1,3): One Month CPAP Use(^2)</th>
<th>Model 3 After First Week CPAP Use(^1,4): One Month CPAP Use(^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B est ± SE  p value</td>
<td>B est ± SE  p value</td>
<td>B est ± SE  p value</td>
</tr>
<tr>
<td>Race – African American</td>
<td>- 1.41 ± 0.60  0.02</td>
<td>- 1.15 ± 0.62  0.07</td>
<td>- 1.54 ± 0.63  0.02</td>
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<tr>
<td>Self Efficacy</td>
<td>0.88 ± 0.46  0.06</td>
<td>1.40 ± 0.52  0.009</td>
<td>1.20 ± 0.50  0.02</td>
</tr>
</tbody>
</table>

\(^1\) Variables excluded from final model (p>0.15): age, mood, ESS, AHI, Risk Perception, Outcome Expectancies

\(^2\) n=62;

\(^3\) n=56;

\(^4\) n=53;

\(^\dagger\) \(R^2 = 0.15; p=0.009;\)

\(^\ddagger\) \(R^2 = 0.19; p=0.004;\)

\(^\S\) \(R^2 = 0.21; p=0.003\)
Table 4. Negative Binomial Model for One Month CPAP Use

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1 Baseline Measures(^1): One Month CPAP Use</th>
<th>Model 2 Post Education Measures(^1): One Month CPAP Use</th>
<th>Model 3 After First Week CPAP Use(^1): One Month CPAP Use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B est ± SE</td>
<td>(X^2)</td>
<td>B est ± SE</td>
</tr>
<tr>
<td>Race – African American Race</td>
<td>- 0.51 ± 0.21</td>
<td>6.06*</td>
<td>- 0.46 ± 0.22</td>
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<tr>
<td>Self Efficacy</td>
<td>0.35 ± 0.16</td>
<td>4.55*</td>
<td>0.58 ± 0.20</td>
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</table>

\(^1\) Variables excluded from final model based on Chi Square distribution goodness of fit criteria: age, mood, ESS, AHI, Risk Perception, Outcome Expectancies

\* \(p < 0.05\)

\** \(p < 0.01\)