Published in final edited form as:

Heart Lung. 2015 ; 44(2): 100–106. doi:10.1016/j.hrtlng.2015.01.002.

Claustrophobic Tendencies and Continuous Positive Airway Pressure Therapy Non-adherence in Adults with Obstructive Sleep Apnea

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Abstract

Objectives—(1) Determine frequency of claustrophobia in adults with obstructive sleep apnea (OSA) after first CPAP night; and (2) determine if claustrophobia influences CPAP adherence.

Background—Claustrophobia is a common clinical problem among CPAP-treated OSA adults yet few studies have examined the problem.

Methods—Secondary analysis of data from prospective, longitudinal study of adults with OSA (n=97). CPAP-Adapted Fear and Avoidance Scale (CPAP-FAAS) collected immediately after CPAP titration polysomnogram. The primary outcome was objective CPAP use at 1 week and 1 month.

Results—Sixty-three percent had claustrophobic tendencies. Females had higher CPAP-FAAS scores than males. FAAS 25, which is a positive score for claustrophobic tendencies, was significantly influential on CPAP non-adherence at 1 week (aOR= 5.53, 95% CI 1.04, 29.24, p=0.04) and less CPAP use at 1 month (aOR= 5.06, 95% CI 1.48, 17.37, p=0.01) when adjusted for body mass index and CPAP mask style.

Conclusion—Claustrophobia is prevalent among CPAP-treated OSA adults and influences both short-term and longer-term CPAP non-adherence. Interventions are needed to address this treatment-related barrier.

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Keywords

obstructive sleep apnea; continuous positive airway pressure; claustrophobia; phobic disorders; anxiety disorders; treatment compliance

INTRODUCTION

Obstructive sleep apnea (OSA) is a highly prevalent sleep-related respiratory disorder affecting an estimated 2–4% of the adult population with significantly higher prevalence among obese adults.^{1,2} Continuous positive airway pressure (CPAP) is the first-line medical treatment for OSA.³ Though CPAP is highly efficacious,⁴ the effectiveness of CPAP is limited by non-adherence.^{5,6} Since 1994 when the seminal studies reporting CPAP non-adherence were published,^{7–9} many studies have examined factors of influence on CPAP adherence outcomes in the adult OSA population.^{10,11} This body of literature has contributed to progress in the field for developing intervention strategies to enhance CPAP adherence; yet, there is relatively little empiric evidence that addresses common patient-described barriers to CPAP use, such as treatment-specific barriers.

One such treatment-specific barrier that is commonly encountered in the clinical setting and anecdotally discussed in the literature is claustrophobia. Claustrophobia is an anxiety disorder of specific phobia type in which individuals experience fear or avoid situations which involve enclosed places.^{12,13} Claustrophobia includes components of fear of restriction and fear of suffocation.¹⁴ Anxiety disorders among adults with OSA are common^{15,16} and evidence suggests that anxiety disorders and the fear of choking may be more prevalent in severe OSA¹⁷ and in those OSA adults with higher body mass index (BMI).¹⁸ As claustrophobia is an anxiety disorder that is associated with elevated anxiety sensitivity¹⁴ and anxiety disorders are prevalent among adults with OSA, it stands to reason that the prevalence of claustrophobia may be higher in adults with OSA than the general population.

Early studies of CPAP non-adherence identify claustrophobia as a self-reported barrier to CPAP treatment adherence;¹⁹ less consistent users of CPAP were also identified as more frequently self-reporting claustrophobia as a treatment barrier.⁹ Since these early exploratory studies of CPAP non-adherence identified claustrophobia as a possible treatment-specific barrier, published reviews of OSA and CPAP adherence suggest claustrophobia is an important influential factor on CPAP adherence and an important clinical problem.^{20–23} Yet to our knowledge, there are relatively few published studies that focus on claustrophobia in adults with CPAP-treated OSA^{24,25} and only one that has systematically examined the relationship and influence of claustrophobia on CPAP non-adherence.²⁶ Interestingly, two of these published reports focus on desensitization for claustrophobia albeit little is actually known about (1) the frequency of claustrophobia in the adult CPAP-treated population, or (2) if claustrophobia significantly contributes to CPAP non-adherence.

With the relative paucity of research that addresses claustrophobia and its potential influence on CPAP non-adherence, this secondary analysis of data from a prospective, longitudinal cohort study of newly-diagnosed OSA adults and newly-initiated CPAP treatment aimed to

1) determine frequency of claustrophobic tendencies in adults with OSA after one night of CPAP exposure in a sleep laboratory setting; and 2) determine if claustrophobic tendencies influence one week and one month CPAP non-adherence.

METHODS

The data for this secondary analysis were derived from a previously reported, prospective, longitudinal cohort study that developed and tested a risk index (Index for Non-adherence to Positive Airway Pressure) for identifying adults with OSA at risk for CPAP non-adherence after one night of CPAP exposure in the sleep laboratory setting.²⁷ The study was approved by the respective Institutional Review Boards at the two recruitment sites.

Sample

Participants were recruited from two clinical sleep centers in the United States during the 18-month study period. Of the participants in the primary study (n=97), sixty-eight participants had complete data for the current secondary analysis. The CPAP-FAAS was added to the parent study assessment battery after the parent study data collection began which explains the sample size differences between the parent study and the reported secondary analysis sample size focusing on claustrophobia tendencies. Inclusion criteria were: (1) adults (≥ 18 years of age) with newly diagnosed OSA (Apnea hypopnea index, AHI ≥ 5 events/hours) by polysomnogram (PSG), (2) referred to CPAP titration PSG, (3) CPAP prescription accepted after in-laboratory CPAP titration PSG, (4) no new psychiatric disorder diagnosis within previous six months prior to study enrollment, and (5) able to read and understand English. Exclusion criteria were: 1) supplemental oxygen or bilevel positive airway pressure required during titration PSG; 2) any medical contraindication to using CPAP for treatment of OSA; 3) refusal of CPAP for home treatment at the time of CPAP treatment recommendation. The inclusion and exclusion criteria were not restrictive in order that the sample was clinically representative of OSA adults attending a clinical sleep center. We excluded adults with new psychiatric diagnoses within the previous six months as these diagnoses were likely to confound both the independent variable of interest, adherence, and the dependent variable of interest, claustrophobia. We did not, however, exclude adults with long-standing psychiatric diagnoses, such as anxiety-related disorders or depression, that were medically managed and stable (e.g., no acute hospitalization in previous six months for primary psychiatric reasons). Participants who underwent CPAP titration PSG, completed all measures and accepted CPAP prescription were included in the analysis; participants who self-terminated CPAP treatment for any reason after prescription of CPAP treatment (n=7) were included in the analysis.

Measures

Polysomnography (PSG)—Full-night polysomnography, including C3-A2 and C3-O1 electroencephalography, single lead II electrocardiography, chin and bilateral anterior tibialis surface electromyogram, and right and left electrooculography, respiratory effort by thoracic and abdominal piezoelectric belts, oxygen saturation by pulse oximetry, and nasal air flow by oronasal thermal sensor and nasal pressure transducer were performed according to established guidelines²⁸ All data were collected and monitored using a computerized PSG

system and attended by registered polysomnography technologists. Study variables extracted from the diagnostic PSG included: (1) AHI, events/hour, and (2) oxygen saturation nadir, %. PSG scoring procedures, including the alternate hypopnea definition were applied per standard criteria.²⁸ AHI was defined as the total number of apneas and hypopneas per hour of sleep. The severity of OSA was graded as mild (AHI 5–15 events/hour), moderate (AHI >15–30 events/hour), and severe (AHI >30 events/hour).

Subject Characteristics—As previously reported,²⁷ a questionnaire eliciting subject characteristics and symptoms at presentation was employed. Height and weight for body mass index were extracted from the diagnostic PSG records. CPAP mask style used during titration PSG was extracted from the titration PSG records.

CPAP-adapted Fear and Avoidance Scale (CPAP-FAAS)—The CPAP-FAAS²⁶ was previously adapted from the Fear and Avoidance Scale (FAAS).²⁹ The CPAP-FAAS includes six items assessing agoraphobia and five items assessing claustrophobia from the FAAS; the instrument was adapted by Chasens and colleagues adding twelve items assessing situations that elicit claustrophobic tendencies similar to the original claustrophobia items but adapted for situations consistent with the U.S. context and exposure to CPAP.²⁶ Respondents were asked to rate the frequency and severity of their feelings about 23 situational items; the rating scale is 1 to 5, with the item response “Virtually no fear, never avoid” scored as 1, “Mild Fear, seldom avoid” scored as 2, “Moderate fear, sometimes avoid” scored as 3, “Very fearful, often avoid” scored as 4, and “Extremely fearful, always avoid” scored as 5. The CPAP-FAAS demonstrated internal consistency with a Cronbach’s alpha of 0.88 in a prospective longitudinal study of adults with OSA initiated on CPAP treatment.²⁶ Cronbach’s alpha in the current study employing the CPAP-FAAS was 0.92. Total CPAP-FAAS scores were examined dichotomously as <25 and ≥25. This CPAP-FAAS score cut-point has been previously employed in a study of CPAP-treated OSA and claustrophobia, with scores ≥25 suggestive of claustrophobic tendencies.²⁶

CPAP Use—CPAP use was measured by an internal processor housed within standard CPAP devices. CPAP use was defined as the mean nightly duration of treatment use at effective pressure after at least 20 minutes; usage was calculated as the mean hours of use at one week and one month of treatment. CPAP use, or adherence/non-adherence, was categorized in several ways: (1) as a continuous variable; (2) <4hrs/night and ≥4hrs/night (commonly employed clinical benchmark), and (3) categorized as <2 hours, 2–5 hours, and >5 hours per night as was previously examined as the dependent variable in a study of claustrophobia and CPAP adherence.²⁶

Procedure

The procedure for this study has been previously reported.²⁷ In brief, after written informed consent, HIPAA permission and eligibility for participation was completed, subject characteristics and study-related variables from diagnostic PSG and titration PSG were collected. All subjects were provided standardized education on OSA, PSG, CPAP titration, and CPAP treatment by educational video and a printed pamphlet about OSA. Immediately

after CPAP titration PSG, performed according to established standards for determining optimal CPAP pressure,³⁰ participants completed the CPAP-FAAS as part of a battery of questionnaires.²⁷ Home CPAP treatment was initiated by the respective clinical sleep provider and CPAP device instruction was provided by a home medical equipment supplier designated by participants' insurance provider. Participants returned to the sleep center after one month of CPAP treatment for a study termination research visit. CPAP use for the outcome intervals was obtained at this visit by data extraction from the CPAP device secure digital memory card.

Analysis

Summary statistics for the characteristic variables, CPAP use and CPAP-FAAS total scores were examined and variable distribution determined. An a priori plan for imputation of CPAP use values (zero values) was implemented for those participants with self-termination of CPAP at any time after CPAP titration PSG (n=7). Differences were examined between those with and without CPAP-FAAS data from the parent trial, employing appropriate tests (Chi-square, t-tests, or Fisher's exact tests). Because there is little published research that addresses claustrophobia in CPAP-treated adults and the CPAP-FAAS has only been employed in one previous study, both continuous and categorical values of the CPAP-FAAS were initially evaluated. Due to non-normality of the CPAP-FAAS variable, median CPAP-FAAS were used in analyses. Based on prior research using the CPAP-FAAS, a score cut-point of <25 and ≥25 was used as a categorical variable in logistic regression analyses.

Median CPAP-FAAS levels were compared between levels of categorical demographic variables (Kruskal-Wallis test) and continuous demographic variables (Spearman correlation coefficients). Associations of CPAP-FAAS scores and one-week and one-month CPAP use, examined dichotomously (<4hrs/night and ≥4hrs/night), were tested with Wilcoxon two-sample tests and Chi Square tests.

Covariates considered for inclusion in multivariable analyses were selected based on bivariate association with CPAP-FAAS at $p < 0.10$. Multivariable logistic regression and proportional odds multivariable logistic regression models were used to examine the influence of CPAP-FAAS on one week and one month CPAP adherence. Statistical significance level was set at $p < 0.05$.

RESULTS

The sample (n=68) included obese ($\text{BMI } 38.6 \pm 9.9 \text{ kg/m}^2$) middle-aged adults (49 ± 11.4 years) with severe OSA ($\text{AHI } 36.7 \pm 18.6 \text{ events/hour}$). Participants self-identified as non-Hispanic/Latino (93%) and of white race (90%; Table 1). Participants without complete CPAP-FAAS data for the secondary analysis included fewer adults with mild OSA ($\text{AHI } 5\text{--}15 \text{ events/hour}$); there were no other significant differences between the participants with complete data for the secondary analysis (n=68) and those with incomplete data (n=29; Table 1). Because we measured claustrophobic tendencies immediately after CPAP titration PSG, mask style specified as full-face mask, nasal pillows, and nasal mask used during titration is reported (Table 1). At one week, mean CPAP use was 4.5 ± 2.7 hours/night with 34% (n=23) of the sample defined as non-adherent, using CPAP on average less than

4hours/night. Average CPAP use at one month was 4.3 ± 2.5 hours/night with 37% (n=25) of the sample defined as non-adherent at one month, using CPAP on average less than 4hours/night.

Claustrophobic Tendencies in Adults with OSA

After one night of CPAP exposure in the laboratory setting, median CPAP-FAAS score for the sample was 27.0 (IQR 23.5 – 35.5). When CPAP-FAAS scores were examined by demographic and clinical characteristics, females had significantly higher scores than males ($p < 0.001$; Table 2). BMI was positively correlated with CPAP-FAAS score ($p < 0.001$). CPAP mask style used during CPAP titration PSG was not associated with CPAP-FAAS score ($p=0.32$).

Employing a CPAP-FAAS score cut-point ≥ 25 , which is indicative of the presence of claustrophobic tendencies, 44% of males had claustrophobic tendencies as compared with 84% of females with claustrophobic tendencies ($\chi^2[1] = 11.6$; $p < 0.001$). No other significant differences were identified, including among OSA severity groups as defined by apnea-hypopnea index (i.e., mild, moderate, severe). When CPAP mask style was examined by CPAP-FAAS score ≥ 25 , there was not a significant association between CPAP mask style and CPAP-FAAS score ≥ 25 . Among full-face mask users, 85% had claustrophobic tendencies; for nasal pillows users, 63% had claustrophobic tendencies; and among nasal mask users, 52% had claustrophobic tendencies ($p=0.17$). Among the entire sample, 63% of the participants reported claustrophobic tendencies after one night of CPAP exposure (CPAP-FAAS score ≥ 25). CPAP-FAAS scores were not significantly different between CPAP adherers (>4 hours/night) and CPAP non-adherers (<4 hours/night) at one week ($p=0.28$) or one month ($p=0.48$).

Claustrophobic Tendencies as an Influential Factor on CPAP Non-adherence

Covariates selected for inclusion in multivariable analyses included demographic and clinical characteristics reaching a significance level of $p \leq 0.10$ in bivariate associations with CPAP-FAAS median scores. Gender, BMI, mask style and oxyhemoglobin saturation nadir were initially evaluated as covariates. No covariates were statistically significant in evaluative logistic regression models, however, the reported results are based on including BMI and mask style as covariates since their inclusion significantly altered the magnitude of the regression parameter for CPAP-FAAS. Median CPAP-FAAS scores were not statistically significant as an independent variable in any model (data not shown). The reported results focus on CPAP-FAAS scores ≥ 25 , examined in logistic regression models wherein one week and one month CPAP use (<4 hours/night and ≥ 4 hours/night) are the dependent variables.

CPAP-FAAS and One Week CPAP Use—CPAP-FAAS scores evaluated as a dichotomized independent predictor variable (≥ 25) were influential on one week CPAP non-adherence (<4 hours/night), when BMI and mask style were adjusted for in a multivariable logistic regression model ($p=0.04$; Table 3). The odds of using CPAP less than 4hours/night at one week were 5.5 times more likely among those with CPAP-FAAS score ≥ 25 .

compared to those with CPAP-FAAS score < 25 when accounting for BMI and CPAP titration mask style.

Chasens and colleagues previously identified minimal CPAP users (i.e., <2hours/night) more frequently reported claustrophobic tendencies as measured by the CPAP-FAAS; those with scores ≥ 25 were at significantly higher risk for minimal CPAP use (<2hours/night).²⁶ Examining CPAP use as a categorical outcome at one week, including <2hours/night, 2–5hours/night, and >5hours/night, the odds of low CPAP use at one week among adults with claustrophobic tendencies was 4.87 times higher than for those who did not have claustrophobic tendencies when accounting for BMI and CPAP titration mask style ($p=0.01$; Table 3). Similar results were identified when one-week low CPAP use was categorized at <1hour/1–4hour/>4hours which is a CPAP use outcome that incorporates the clinical benchmark for CPAP non-adherence ($p=0.04$; data not shown). When data from participants who self-terminated CPAP any time after CPAP titration PSG were excluded from the analysis, the odds of CPAP non-adherence were increased but only for CPAP use <2/2–5/>5 hours/night (aOR=4.07; 95% CI = 1.12, 14.77; $p=0.03$).

CPAP-FAAS and One Month CPAP Use—Claustrophobic tendencies (CPAP-FAAS ≥ 25) were not influential on one month CPAP use when CPAP use was examined at the common clinical benchmark, <4hours/night (Table 3). A clinically meaningful odds ratio, however, was identified in adjusted logistic regression models (aOR=2.82) but the study was likely underpowered to achieve statistical significance as indicated by the estimated precision (95% CI = 0.74, 10.81). When one month CPAP use was examined as a categorical dependent variable, <2hours/2–5hours/>5hours night, claustrophobic tendencies were statistically influential on low CPAP use in both unadjusted and adjusted proportional odds logistic regression models (Table 3). The results were not different when data from participants who self-terminated CPAP after CPAP titration PSG were excluded from the analysis.

DISCUSSION

The results of the secondary analysis of data from a prospective, longitudinal cohort study suggest that claustrophobic tendencies, as measured by the CPAP-FAAS, are prevalent among newly-diagnosed adults with moderate to severe OSA after one night of exposure to CPAP in the laboratory setting with 63% of the sample having claustrophobic tendencies (i.e., CPAP-FAAS score ≥ 25). In our study, females had significantly higher scores and greater frequency of claustrophobia than males. Higher body mass index was associated with claustrophobic tendencies. CPAP mask style, however, was not associated with claustrophobic tendencies. Claustrophobic tendencies were influential on CPAP adherence at one week and on low CPAP use (<2hours/2–5hours/>5hours) at one month. The findings of this study highlight the prevalence of claustrophobia in adults with OSA and that claustrophobic tendencies are a treatment-related barrier for the effective treatment of OSA with CPAP.

Few empiric studies have reported the prevalence of claustrophobia in adults with OSA and CPAP treatment. Our results suggest that more than half of this clinical population may have

claustrophobic tendencies, a considerably higher prevalence rate than was identified by Chasens and colleagues in a cohort with similar OSA characteristics and demographic characteristics.²⁶ The present study sample included nearly 50% women, whereas the study by Chasens et al. included far fewer women (11%). Women in the present study scored higher on the CPAP-FAAS than male participants, indicating a higher prevalence and tendency for claustrophobia among female OSA participants than male OSA participants. These findings are consistent with the incidence and prevalence of general phobic conditions, which are considered anxiety disorder sub-types including claustrophobia, in the general population. The ratio of phobic conditions for females and males are estimated at 2 – 2.5: 1.³¹ Women with OSA have also been reported to have more severe mood impairments than men,³² though it is not known if gender differences for anxiety disorders also exist in adults with OSA. Based on our findings and the epidemiology of anxiety disorders and phobic conditions including claustrophobia in the general population, women with OSA and particularly those with anxiety disorders may benefit from careful pre-treatment screening for claustrophobia in order to reduce this treatment-related barrier.

Although a great deal of research has focused on influential factors on CPAP non-adherence,^{10,11} there are few studies that have rigorously examined claustrophobia as influential on CPAP adherence. The present study findings are consistent with the one previous study that examined the relative risk of CPAP non-adherence related to claustrophobia,²⁶ identifying that the odds of low CPAP use are elevated among OSA adults with high claustrophobic tendencies.²⁶ The magnitude of the effect in our study is notably higher than the earlier study. The current study measured claustrophobic tendencies after the first night of CPAP exposure in the sleep laboratory instead of at pre-treatment, or baseline. With initial CPAP exposure, we identified a greater frequency of claustrophobic tendencies than Chasens and colleagues (63.2% vs. 15%).²⁶ This may, in part, suggest experience or exposure to CPAP is important for self-assessment of CPAP-related claustrophobia. It is therefore important to screen for claustrophobia in OSA clinical patients likely to progress to CPAP treatment. Although screening for claustrophobia may be best timed after the initial CPAP exposure but prior to any extended period of home CPAP treatment, this approach to claustrophobia screening does not account for OSA patients who decline any CPAP consideration or CPAP titration PSG based on self-recognized claustrophobia.

Desensitization, as described by Edinger²⁴ and Means and colleagues,²⁵ may be an effective approach to reducing or eliminating claustrophobia in CPAP-treated OSA. Future research is needed though to test such a strategy in an adequately powered randomized controlled trial. Other claustrophobia intervention strategies have yet to be developed or tested in CPAP-treated OSA. As claustrophobia is hypothesized to include two components, fear of suffocation and fear of restriction,¹⁴ and patient-reported barriers to CPAP are often anecdotally described very similarly, future claustrophobia intervention research in the CPAP-treated OSA population may necessarily address both these components. If these components of claustrophobia are individually and/or collectively contributory to this phobic anxiety disorder in adults with OSA, then it is possible that both claustrophobia components are important intervention targets to reduce or attenuate claustrophobia with CPAP treatment and potentially improve CPAP adherence.

The study has several limitations. First, this was a secondary analysis of data available from a parent study that sought to test and reduce a CPAP non-adherence screening questionnaire. The CPAP-FAAS was not included in the parent study from the outset but added by the investigators after enrollment began for the parent study. The sample for this secondary analysis was therefore of modest size albeit the results are consistent with the prior published results. The modest sample size likely contributed to the imprecision of results (i.e., wide confidence intervals), yet the magnitude of the effect of claustrophobia on CPAP non-adherence was consistently elevated. The current study sample was heterogeneous for OSA disease characteristics yet limited in terms of demographic diversity. CPAP adherence in this study was higher than in many other studies which may limit the generalizability of findings; it is possible, however, that with higher rates of non-adherence in a larger study, the magnitude of effect of claustrophobic tendencies on CPAP non-adherence may be even higher. Future larger studies of claustrophobia and CPAP adherence will potentially address the limited demographic and CPAP non-adherence variability of the current study sample. This will permit a rigorous examination of specific adult subgroups with CPAP-treated OSA that may be at higher risk for, or predisposed to, claustrophobia and more precisely determine the effect of claustrophobia on CPAP non-adherence. The current study design did not permit controlling for other potential confounding or extraneous variables that may be influential on the independent variable of claustrophobia. The in-laboratory experience of using CPAP during a titration polysomnogram is an important consideration of influence. As there was no measure of care delivery and support by polysomnography technologist during the titration sleep study, an estimate of this extraneous variable on participants' ratings of claustrophobia, assessed immediately after the polysomnogram, cannot be estimated by the current research.

One validated measure of claustrophobia was employed in the study. The CPAP-FAAS demonstrated good internal reliability in this study; yet, the CPAP-FAAS was not designed to measure the two components of claustrophobia, fear of suffocation and fear of restriction. Future research employing other claustrophobia instruments, such as the Claustrophobia Questionnaire (CLQ)³³ or the Dutch Claustrophobia Questionnaire³⁴ which measure the two domains of claustrophobia (i.e., suffocation and restriction) is needed to better delineate the prevalence of these components of claustrophobia in adults with CPAP-treated OSA. This line of inquiry will potentially support the development of interventions that address the components of claustrophobia.

Claustrophobic tendencies may affect more CPAP-treated adults with OSA than is generally realized. Recognizing claustrophobia at the outset of CPAP treatment through a clinical systematic screening procedure is an opportunity to potentially reduce the incidence of minimal CPAP use. Patients with claustrophobia are at risk for CPAP non-adherence and therefore interventions are needed to effectively reduce this treatment-related barrier and potentially improve CPAP adherence in the adult OSA population.

Acknowledgements

The research described was supported by Grant Number K99NR011173 (Sawyer, AM, PI) and R00NR011173 (Sawyer, AM, PI) from the National Institute of Nursing Research. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of Nursing Research or the

National Institutes of Health. The investigators acknowledge Leon Sweer, M.D. for his contributions to the research at Penn State Hershey Medical Center's sleep center. The investigators also acknowledge the commitment to clinical research and support during data collection of the sleep center staff at both Penn State Hershey Medical Center's sleep center and Sleep and Lung Enhancement Center's sleep center.

Abbreviations

AHI	apnea-hypopnea index
CPAP	continuous positive airway pressure
CPAP-FAAS	CPAP-adapted Fear and Avoidance Scale
OSA	obstructive sleep apnea
BMI	body mass index
PSG	polysomnogram
IQR	interquartile range
OR	odds ratio
aOR	adjusted odds ratio
CI	confidence interval
CLQ	Claustrophobia Questionnaire Claustrophobic Tendencies and

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Table 1

Sample Description

Characteristic	Total Sample (n=97) Frequency (n[%]) or Mean (±SD)	Participants with Complete FAAS (n=68) Frequency (n[%]) or Mean (±SD)	Participants without Complete FAAS Data (n=29) Frequency (n[%]) or Mean (±SD)	P-value *
Male	53 (55%)	36 (53%)	17 (59%)	0.61 (C)
Age (yrs)	50 (11.6)	49 (11.4)	52 (12.1)	0.24 (T)
Race				
White	84 (87%)	61 (90%)	23 (79%)	0.21 (F)
Black or African American	6 (6%)	4 (6%)	2 (7%)	
Native Hawaiian/Other Pacific Islander	2 (2%)	0 (0%)	2 (7%)	
Asian	2 (2%)	1 (2%)	1 (4%)	
American Indian/Alaska Native	3 (3%)	2 (3%)	1 (4%)	
Ethnicity				
Hispanic or Latino	8 (8%)	5 (7%)	3 (10%)	0.69 (F)
Not Hispanic or Latino	89 (92%)	63 (93%)	26 (90%)	
Married	67 (69%)	46 (68%)	21 (72%)	0.64 (C)
Education				
High School	31 (32%)	20 (29%)	14 (48%)	0.07 (C)
Some College or more	63 (65%)	48 (71%)	15 (52%)	
Employment				
Working Full-time	63 (65%)	47 (69%)	16 (55%)	0.62 (F)
Working Part-time	9 (9%)	5 (7%)	4 (14%)	
Homekeeper	3 (3%)	2 (3%)	1 (4%)	
Unemployed	6 (6%)	5 (7%)	1 (4%)	
Student	3 (3%)	2 (3%)	1 (4%)	
Retired	13 (13%)	7 (10%)	6 (21%)	
Rotating Shift Work	6 (6%)	4 (6%)	2 (7%)	1.00 (F)
Night Shift Work (consistent shift)	3 (3%)	2 (3%)	1 (4%)	1.00 (F)
Referral Source				
Family or Primary Care Provider	64 (66%)	45 (66%)	19 (66%)	0.64 (F)
Pulmonary Specialist	13 (13%)	7 (10%)	6 (21%)	
Cardiology	5 (5%)	3 (4%)	2 (7%)	
Neurology	4 (4%)	3 (4%)	1 (4%)	
Psychiatry	1 (1%)	1 (2%)	0 (0%)	
Family member or friend	5 (5%)	4 (6%)	1 (4%)	
Self	5 (5%)	5 (7%)	0 (0%)	
Body Mass Index (kg/m ²)	38.3 (9.3)	38.6 (9.9)	37.6 (7.8)	0.62 (T)
Apnea Hypopnea Index (events/hour)	36.8 (19.7)	36.7 (18.6)	36.9 (22.3)	0.96 (T)
Mild (5–15 events/hour)	12 (12%)	11 (16%)	1 (4%)	0.01 (C)

Characteristic	Total Sample (n=97) Frequency (n[%]) or Mean ($\pm$ SD)	Participants with Complete FAAS (n=68) Frequency (n[%]) or Mean ($\pm$ SD)	Participants without Complete FAAS Data (n=29) Frequency (n[%]) or Mean ($\pm$ SD)	P-value *
Moderate (>15–30 events/hour)	25 (26%)	12 (18%)	13 (45%)	
Severe (>30 events/hour)	60 (62%)	45 (66%)	15 (52%)	
NR Oxyhemoglobin Saturation Nadir	81.0 (6.0)	81.8 (6.8)	79.1 (7.2)	0.08 (T)
Titration CPAP Mask Style				
Full-face Mask	20 (23%)	13 (21%)	7 (27%)	0.08 (C)
Nasal Pillows	32 (37%)	27 (44%)	5 (19%)	
Nasal Mask	35 (40%)	21 (34%)	14 (54%)	
CPAP Use at 30 days (mean hours/night)	4.25 (2.35)	4.3 (2.5)	4.2 (2.0)	0.90 (T)
4 hr cut-point (nonadherers)	38 (39%)	25 (37%)	13 (45%)	0.46 (C)
CPAP Use at 1 week (mean hrs/night)	4.52 (2.52)	4.49 (2.65)	4.58 (2.22)	0.88 (T)
4hr cut-point (nonadherers)	34 (35%)	23 (34%)	11 (38%)	0.70 (C)

NR, NonREM; CPAP, Continuous Positive Airway Pressure

* C=chi-square, T=t-test, F=Fisher's Exact; for FAAS sample vs. subjects without FAAS

Table 2

CPAP-FAAS By Characteristics

CPAP-FAAS by Categorical Sample Characteristics [†]					
	Mean	SD	Median	IQR	p-value
Gender					
Male (n=36)	26.1	4.3	24.0	23–28	<0.001
Female (n=32)	35.8	11.9	33.5	27–40.5	
Race					
White (n=61)	30.9	10.3	27.0	23–35	0.89
Black or African American (n=4)	29.0	5.0	27.5	25.5–32.5	
Asian (n=1)	24.0	---	24.0	---	0.38
American Indian/Alaska Native (n=2)	30.0	9.9	30.0	23–37	
Education					
High School or less (n=20)	31.7	11.2	27.5	24.5–36	0.59
Some College or more (n=48)	30.2	9.4	26.5	23–35	
OSA Severity (Apneas-hypopnea Index)					
Mild OSA (5<15 events/hr; n=11)	30.0	7.0	29.0	23–37	0.71
Moderate OSA (15–30 events/hr; n=12)	27.8	6.0	25.5	23.5–31	
Severe (>30 events/hr; n=45)	31.5	11.2	28.0	24–36	
Mask Style					
Full Face Mask (n=20)	35.2	15.3	29.0	25–34	0.32*
Nasal Pillows (n=32)	30.9	9.3	28.0	23–37	
Nasal Mask (n=35)	28.2	6.4	25.0	23–31	
CPAP-FAAS by Continuous Sample Characteristics [‡]					
	R	95%CI	p-value		
Age (years at diagnosis)	−0.05	(−0.29, 0.19)	0.66		
OSA Severity (Apnea-hypopnea Index, events/hr)	0.11	(−0.13, 0.34)	0.38		
Body Mass Index	0.47	(0.26, 0.64)	<0.001		
Oxygen Saturation Nadir	0.23	(−0.01, 0.44)	0.06		

[†] Kruskal-Wallis Test;[‡] Spearman Correlation;

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* Cochran-Mantel-Haenszel Correlation

CPAP, Continuous Positive Airway Pressure; FAAS, Fear & Avoidance Scale; SD, Standard Deviation; IQR Interquartile Range; 95%CI, 95% Confidence Interval

Table 3

Claustrophobic Tendencies by CPAP-FAAS Scores as Predictors of CPAP Use

ONE WEEK CPAP USE						
Independent Variable	Dependent Variable	Unadjusted OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value	
CPAP-FAAS 25	One Week CPAP Use <4hrs/night	2.88 (0.91–9.12)	0.07	5.53 (1.04–29.24)	0.04[†]	
CPAP-FAAS 25	One Week CPAP Use <2hrs vs. 2–5hrs and >5hrs/night	2.66 (0.86–8.21)	0.09	5.28 (1.04–26.87)	0.04[‡]	
ONE MONTH CPAP USE						
Independent Variable	Dependent Variable	Unadjusted OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value	
CPAP-FAAS 25	One month CPAP Use <4hrs/night	1.85 (0.64–5.36)	0.26	2.82 (0.74–10.81)	0.13 [‡]	
CPAP-FAAS 25	One Month CPAP Use <2hrs vs. 2–5hrs and >5hrs/night	3.20 (1.18–8.65)	0.02	5.06 (1.48–17.37)	0.01[‡]	

[†] Multivariable logistic regression model adjusted for BMI and CPAP mask style[‡] Multivariable Proportional odds logistic regression model adjusted for BMI and CPAP mask style

Abbreviations: CPAP, Continuous Positive Airway Pressure; FAAS, Fear & Avoidance Scale; OR, Odds Ratio; hrs, hours; 95%CI, 95% Confidence Interval ; BMI, Body mass index.