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Title: ***Health Beliefs Model Predicts Adherence to CPAP before Experience with CPAP***

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Short title: ***Health Beliefs Predict CPAP Adherence***

ABSTRACT

Adherence to Continuous Positive Airway Pressure (CPAP) therapy for Obstructive Sleep Apnoea (OSA) is often poor. Biomedical indices explain little of the variance in CPAP use. This study tested a Health Beliefs model of adherence to determine the contribution of psychological constructs as compared to biomedical indices in the prediction of CPAP adherence.

77 consecutive patients newly diagnosed with OSA and were naive to CPAP treatment (had never tried CPAP before) completed questionnaires at baseline (prior to CPAP treatment). Questionnaires assessed; outcome expectancy with treatment, self-efficacy, functional outcomes of sleepiness, and perceived risk of negative health outcomes. Physiological data from standard clinical diagnostic sleep study was obtained. CPAP adherence was assessed at 4 month follow-up.

Health Beliefs Model constructs alone explained 21.8% of the variance in CPAP adherence ($p<.01$), whilst Health Beliefs Model constructs and biomedical indices together explained 31.8% of the variance in CPAP adherence ($p=.01$). The greatest proportion of CPAP adherence was explained by higher outcome expectancies with treatment, greater functional limitations as a result of sleepiness and lower risk perception.

Results suggest that patients have developed beliefs and expectations about OSA and CPAP even before they have tried CPAP treatment. These beliefs and expectations predict patients' adherence to effective therapy.

Key words: ***CPAP treatment, Obstructive Sleep Apnea, Psychological Models, Adherence, Prediction***

INTRODUCTION

Obstructive Sleep Apnoea (OSA) is a common sleep disorder characterised by collapse of the upper airway during sleep.[1, 2] The estimated American prevalence of OSA is 4% for men and 2% for women.[2-4] OSA incurs high health costs,[4] but is often not adequately treated.[4, 5] Continuous Positive Airway Pressure Therapy (CPAP) is the gold standard treatment for moderate to severe OSA. However the therapy is consistently associated with suboptimal adherence rates.[5, 6] It has been estimated that 15 to 30% of patients do not accept CPAP treatment from the outset.[5] Of those that do initially accept the treatment, 25 - 50% of patients fail to adhere optimally to CPAP.[6] Patients still using CPAP in the long term (up to 5 years) can be expected to use their CPAP machine, on average, between 4 and 5 hours per night.[7-11]

CPAP is an often difficult treatment and requires considerable alteration of a patient's lifestyle. Side effects of the treatment may include skin irritation, nose stuffiness, air leaks around the mask, claustrophobic reactions to the mask, problems with spontaneous intimacy with the bed partner, and the noise of the machine.[6] This side effect profile led to the belief within the literature that biomedical factors and the mask interface were the source of the problem. However, modifications to the CPAP device that have reduced many of these side effects have produced only small improvements in objective adherence to this treatment.[12, 13] In fact, there is inconsistent evidence to suggest that side effects predict patient adherence. Further, linear combinations of biomedical indices, including Body Mass Index (BMI), Respiratory Disturbance Index (RDI)/Apnoea-Hypopnoea Index (AHI) and CPAP pressure, rarely predict more than 10 to 15% of the variance in CPAP adherence.[7]

Indices of the severity of OSA, for example, RDI (a measure of the number of respiratory disturbances, namely, apnoeas and hypopnoeas, per hour of sleep), are not reliably correlated with patients' reported subjective symptom severity and quality of life.[2, 14] This indicates that a patients' subjective perception of the problem may not necessarily reflect the objective severity of the illness, nor their need for treatment. The primary goal of this paper is to present a psychological model of CPAP adherence that predicts patient acceptance and adherence to treatment.

Recent studies have begun to investigate the utility of psychological models in the prediction of CPAP acceptance and subsequent adherence.[13, 15-19] Patients begin to develop expectations and beliefs regarding OSA and CPAP treatment even before taking the treatment home.[20] Their subjective experience of the treatment, including their propensity to report subjective benefits and side-effects (or barriers) of CPAP use may be influenced greatly by these early belief systems. This could explain why objective adherence early in the treatment process is among the strongest predictors of subsequent use,[15] rather than biomedical indices of disease severity.[7] Simply, patients will not adhere to the treatment if they have developed expectations and beliefs regarding the treatment which reduce the likelihood that they will **try to accept** ***it in the first place.***

We propose the Health Belief Model (HBM)[21] as a conceptual basis for understanding patient motivations to accept, and subsequently adhere to CPAP. This model is predictive of preventative health behaviours (such as wearing a bicycle helmet), and has widespread use in predicting health behaviours in other domains.[21, 22] HBM is inclusive in its assessment of potential predictors of adherence, as it allows

for the inclusion of demographic variables (class, gender and age), psychological and psychosocial influences on subsequent action.

HBM proposes that the patients readiness to act is contingent on their perceived susceptibility to illness consequences if left untreated (risk perception), and the perceived seriousness of their illness (impact on current functioning). The patient's belief in the benefit of the proposed treatment is based on their weighting of the perceived benefits to their health if they adhere to the treatment (outcome expectancies) against the perceived barriers to action (such as potential side effects of the treatment). Patients' self-efficacy (confidence)[22] in being able to use the treatment in the face of barriers, as well as the presence of a cue to action, such as advice from a doctor, encouragement from the spouse, or a mass media campaign[21, 22] are also important in the model.

Figure 1 provides a modified conceptual model of CPAP acceptance and adherence using HBM constructs.[21] Biomedical and psychological variables are conceptualised as having an influence on patients' perceived risk of negative health outcomes, perceived severity of the disorder, as well as their weighing of potential benefits and barriers which could affect their acceptance of the treatment. However, biomedical and psychological variables are not expected to have a direct influence on treatment acceptance themselves. Self-efficacy is expected to be associated with patients' perceived benefits of using the treatment (outcome expectancy). HBM predictors of perceived risk, severity, benefits and barriers, in the presence of a cue to action, are expected to directly predict acceptance of CPAP, which will in turn feed back to the degree to which patients perceive benefits and barriers to treatment, as well as their perceived disease severity and risk. CPAP acceptance, in combination with the

feedback loop to these HBM constructs will predict which patients will continue to adhere to CPAP treatment at home.

INSERT FIGURE 1 HERE

One recent study utilised Health Beliefs Model (HBM) constructs in predicting CPAP use.[23] HBM constructs of benefits and barriers were found to be better predictors of CPAP adherence than the objective severity measures of Respiratory Disturbance Index (RDI), BMI and CPAP pressure. These findings lend support to the use of HBM constructs in the prediction of CPAP adherence. Moreover, these constructs were predictive after only one night of CPAP experience, indicating that the model may be of use in the early prediction of CPAP acceptance and adherence.

The purpose of this study was to investigate HBM constructs in the prediction of CPAP adherence early in the treatment process, that is, after a diagnosis of CPAP but prior to starting CPAP. The literature to date has been weak regarding good measures of these constructs. We therefore used only existing, validated, measures of constructs from the model namely self-efficacy, perceived risk (susceptibility), functional outcomes (severity) and outcome expectancies (benefits) will be utilised. We expected that measurement of self-efficacy, perceived risk, functional outcomes and outcome expectancies will provide a better psychological predictive model of CPAP acceptance and adherence than biomedical indices which have been investigated to date.

METHODS

Participants

Participants were consecutive patients diagnosed with Obstructive Sleep Apnoea[1, 3] recruited through a major public hospital, in Brisbane, Australia. Patients were referred to the hospital by their General Practitioner. Additional inclusion criteria included a recommendation by the treating sleep physician for CPAP treatment and that the patient had not tried CPAP treatment before. Exclusion criteria included being less than 18 years of age or an inability to give informed consent (due to intellectual impairment or severe mental illness). The sample consisted of 77 patients (47 males and 30 females) with a mean age of 55.25 years old (SD=12.39, range= 26-80 years). Mean Body Mass Index (BMI) was 35.11 (SD=8.30, range= 19.5-56) and the mean Respiratory Disturbance Index (RDI) was 38.36 (SD=25.85, range= 5.6-124). 54.5% of the patients were married, 11.8% were in a relationship but not married and 19.5% were single. 14.3% of participants did not indicate their relationship status. All participants gave informed consent to participate.

Materials

Participants completed a questionnaire battery that consisted of demographic questions, including age, marital status and whether they had used CPAP before. This information was verified against medical records. The questionnaires consisted of the following questionnaires;

Epworth Sleepiness Scale (ESS)[24]: The ESS is a measure of subjective daytime sleepiness used for patients with OSA. Eight items are rated on a scale from 0 to 3 (0 = would never doze, 3 = high chance of dozing). Total scores range between 0 and 24 with higher scores indicating greater propensity to fall asleep in different situations. It has norms available for the mild, moderate and severe categories of sleep apnoea.

In samples of OSA, it has high internal consistency[24] and correlates well with objective measures of sleep latency.[25]

Functional Outcomes of Sleep Questionnaire (FOSQ)[26]: The FOSQ is a 30 item survey of general quality of life in OSA and is a measure of* perceived severity. *30 items assessing five domains including activity level, vigilance, intimacy, general productivity and social outcomes are rated on a likert scale ranging from 1 to 4 (1= yes, extreme difficulty, 4=no difficulty). Lower scores represent greater impairment in functioning. A mean centred total score representing total functional difficulties related to sleepiness can be calculated. Internal consistency estimates range from .81 to .90 for the subscales and .95 for the total score.

Self-Efficacy Measure for Sleep Apnea (SEMSA)[27]: The SEMSA is a 26 item questionnaire assessing CPAP adherence related cognitions. The measure is divided into three subscales which directly measure three constructs of the HBM* self-efficacy, risk perception and outcome expectancy. *Items are rated on a likert scale from 1 to 4 with higher scores indicating greater perceived self-efficacy, greater risk perception and higher outcome expectancies with treatment, respectively. Internal consistencies range from .85 to .89 and factor analysis confirms the three independent subscales.

Depression Anxiety Stress Scales (DASS21)[28]: The DASS is a 21 item self-report measure of symptoms of state anxiety, depression and stress rated on a likert scale from 0 to 3 (0=did not apply to me at all, 3=applied to me very much or most of the time). Higher scores indicate higher severity ratings of depression, anxiety or stress symptoms over the past week. The DASS21 has good internal consistency estimates

ranging from .73 to .81 and the depression and anxiety subscales correlate well with common Depression and Anxiety Inventories.

Physiological Indices: Participants underwent a standard clinical polysomnography (PSG) scored by trained sleep scientists using recommended guidelines.[3] Air flow was measured using both nasal pressure and and naso-oral thermistors. Apnoea was defined as a reduction of both nasal pressure and thermistor to below 10% of baseline for ten seconds or greater. The presence of respiratory effort was determined by inductive plethysmography and diaphragm electromyography (EMG). Hypopnoea was defined as a discernible reduction (approximately 30% below baseline) of both nasal pressure and/or thermistor for 10 seconds or greater. These events were scored when they were associated (terminated) in an arousal and/or a desaturation of 3% or greater.

Measures attained prior to, and during the diagnostic PSG for this study included, Respiratory Disturbance Index (RDI), Arousal Index (AI), percentage of total sleep time spent below 80% blood oxygenation (< 80% SaO_2) and average minimum blood oxygenation during overnight PSG (Min SaO_2). Body Mass Index (BMI) was calculated based on height and weight measurements (kg/m^2). A CPAP titration PSG approximately 2 weeks following the diagnostic PSG allowed for the calculation of therapeutic CPAP pressure (cmH_2O) required to maintain patent airways throughout sleep. The pressure was titrated to a level that reduced the patient's RDI to less than 5 events per hour.[29]

Procedure

This study had ethical approval Human Research Ethics Committees of the University of Queensland and the Prince Charles Hospital Health Services District.

Patients who met the inclusion criteria for the study were invited to participate in this research during their follow-up appointment with their sleep physician following their diagnostic PSG. Their diagnosis of OSA was explained to them in detail, and the recommended treatment option (CPAP) was described. An appointment for a CPAP titration study was made and patients were then given the questionnaire battery to complete at home.

Questionnaires were accompanied by a stamped, addressed envelope. Mean adherence was assessed through a mail out approximately 4 months after the patients' diagnostic PSG, asking them to indicate the meter reading on their CPAP machine (Mean days=122). This mail out coincided as close as possible to a standard clinic with nurses at the Sleep Centre 12 weeks post-treatment initiation (Mean days=136). This face to face review between the nurse and the patient consisted of a machine reading assessing adherence, and troubleshooting problems encountered with the treatment. Patients who experienced difficulty with identifying the meter on their machine were assessed for adherence at this standard clinic. All meter readings collected during the mail out were compared to the data collected at the nurse clinic to ensure patients were providing accurate and representative adherence data. After the nurse clinic, patients were encouraged to call the Centre and their mask supplier if further problems emerged. From the 2 month standard nurse clinic onwards, telephone consultations with the nurses (initiated by the patient) were the primary means by which any further contact with the patient occurred.

Patients who did not start using CPAP within the follow-up period were recorded as having a mean adherence rate of zero.

Data Analyses

All data analyses were conducted using SPSS for Windows version 13.0. Relationships between predictors with mean hours of CPAP use per night (adherence) were assessed using Pearson's product moment correlation coefficients, t-tests and analysis of variance (ANOVA). Spearman's rank correlations were calculated for variables violating assumptions of normality and linearity (RDI, min SaO_2, AI and < 80% SaO_2). Higher order relationships between biomedical and HBM predictors were assessed using multiple regression analyses. Inspection of the residuals plot indicated that the assumption of homoscedasticity of residuals was met. The assumption of bivariate normality was also met. Cook's distance, an estimate of the change in regression coefficients should cases be removed were not significant. Tolerance levels did not fall below acceptable levels, indicating that collinearity and singularity were not present.[30] Therefore all cases were retained for all analyses. FOSQ total score is derived from subscales all underpinning the "perceived OSA severity" construct, therefore to maintain statistical power and minimise use of extraneous overlapping variables, the total score was entered into the regression equation instead of the individual subscales. [26] Tolerance levels were checked, and there was no evidence that collinearity or singularity of variables was present.

Of the 77 participants who participated in this study, 9 cases were found to have missing physiological data or incomplete questionnaires. Inspection of the data file suggested that missing data was random, as supported by no significant differences in age, gender, BMI, RDI, ESS or adherence between missing and complete data sets. Therefore, cases with missing data were deleted listwise for the multiple regression analysis, leaving 68 cases for analysis. An **a priori** *power analysis indicated that a minimum 64 participants would be required to detect a "moderate" effect size of r=.30*

if power is set at .80 and α=.05 (one-tailed). Therefore the current study attained an adequate sample size to detect significant effects if they exist.

RESULTS

Adherence at 4 month follow-up and baseline CPAP pressure and ESS scores are presented in Table 1. 14 patients (18%) received adherence ratings of 0 as they had not initiated CPAP in the follow-up period, 21 patients (27%) had average meter readings between 1 and 4.5 hours per night, 35 patients (45%) had meter readings between 4.5 and 8.0 hours per night, and the remaining 7 patients (10%) had meter readings between 8.0 and 11.1 hours per night.

TABLE 1 ABOUT HERE

Multiple regression analyses were conducted to assess the relative importance of HBM predictors in explaining CPAP adherence with biomedical indices included and then removed from the analyses. As demonstrated in Table 2, HBM predictors (risk, outcome expectancy, FOSQ and self-efficacy) and biomedical indices (RDI, AI, BMI, ESS, Min SaO_2 and percent time below 80% SaO_2) together explained a significant 31.8% of the variance in CPAP adherence, R=.56, $F(10, 57)=2.66$, $p=.01$. Risk and outcome expectancy explained the most variance in adherence ($p<.05$), followed by FOSQ total score ($p=.065$). Self-efficacy did not contribute to adherence in the model, nor did any of the biomedical indices.

TABLE 2 ABOUT HERE

Contrary to expectation, lower perceived risk of negative health consequences was associated with greater adherence in the context of the Health Beliefs Model. When considered in a bivariate relationship with adherence it was not a significant predictor. The bivariate correlation between perceived risk and adherence is provided in Figure 2.

FIGURE 2 ABOUT HERE

To determine the contribution of HBM predictors in adherence without the inclusion of biomedical predictors, a regression was completed with risk, outcome expectancy, self-efficacy and FOSQ total score as predictors of CPAP adherence (see Table 3). These four constructs explained a significant 21.8% of the variance in CPAP adherence ($R=.48$, $F(4, 70)=4.88$, $p=.002$). Risk, outcome expectancy and FOSQ total score all explained a significant and unique proportion of the variance in adherence (all $p<.05$). Self-efficacy did not explain a significant proportion of the variance in adherence.

TABLE 3 ABOUT HERE

Significant correlations were found between adherence and HBM constructs measured prior to the patient having tried CPAP (see Table 4). Higher mean use of CPAP per night was associated with greater outcome expectancy of treatment, lower pretreatment activity levels, lower self-rated intimacy levels, and lower general productivity throughout the day. Significant inter-correlations between the HBM constructs were also found, with self-efficacy highly correlated with greater expected

benefits with treatment and higher perceived risk of negative health consequences. As demonstrated in Table 4, higher risk perception and higher outcome expectancies with treatment were associated with greater functional limitations in the areas of activity, vigilance, intimacy, general productivity and social outcome.

TABLE 4 ABOUT HERE

There were no significant differences between males and females in their mean adherence, **t*(75)=.29,*** **p*=.77, $p\eta^2$=.001. There was no difference in adherence between individuals of different relationship status*** **F*(3, 62)=.90,*** **p*=.45, $p\eta^2$=.04. As expected, there was no significant direct relationship between adherence and age, BMI, CPAP pressure, ESS, RDI, Min SaO_2, AI, and percent time spent below 80% SaO_2 (see Table 5). Furthermore, there were no direct significant relationships between adherence and psychological variables of depression (r=.07, p=.58), anxiety (r=-.08, p=.52) and stress (r=.04, p=.78).***

TABLE 5 ABOUT HERE

Inspection of inter-correlation matrices revealed that higher BMI prior to treatment was associated with greater perceived risk **r*=.27, p<.05, lower activity levels*** **r*=-29,*** **p*<.05, poorer vigilance*** **r *=-.23,*** **p*<.05, lower productivity throughout the day*** **r*=-.23,*** **p*<.01 and higher depression*** **r*=.33,*** **p*<.01, anxiety*** **r*=.36,*** **p*<.01, and stress scores*** **r*=.32,*** **p*<.01. Higher ESS was associated with greater perceived risk,*** **r*=.29,*** **p*<.05, higher outcome expectancy with treatment,*** **r*=.27, p<.05, lower activity levels,*** **r*=-.42,*** **p*<.001, poorer vigilance*** **r*=-.58,*** **p*<.01, greater intimacy related concerns*** **r*=-.30,***

p<.05, lower general productivity r=-.43, p<.01 and a poorer self-rated social outcome r=-.38, p<.01.

DISCUSSION

The findings of this study support the utility of the HBM in the early prediction of CPAP adherence.[23] Patient's outcome expectancies prior to using CPAP, perception of risk, as well as perceived functional limitations due to sleepiness, such as in the areas of intimacy, activity levels and general productivity, all uniquely predicted CPAP initiation and adherence. As supported by a growing evidence base, biomedical indices of disease severity did not predict more than 10% of the variance in CPAP adherence when HBM variables were included in regression models.[7, 23]

The HBM predictors alone explained 21.8% of the variance in CPAP adherence, whilst biomedical and HBM predictors together explained 31.8% of variance in CPAP adherence. This extends on previous research investigating prediction before[18] and after experience with CPAP.[13, 15, 19] The fact that outcome expectancy prior to trying CPAP, as well as low perceived activity levels, low general productivity and intimacy concerns predicted use of the treatment four months down the track has great significance in terms of early identification and support of patients with factors which are associated with low adherence.

Physiological and disease severity variables such as RDI, AI and drops in blood oxygenation during sleep were unimportant in the early prediction of CPAP adherence. This supports research suggesting that the patient's perceived need for treatment is not directly associated with objective measures of the severity of the disorder (their objective need for treatment).[2, 14] If patients do not see themselves as

having limitations in functioning as a direct result of the disorder, and if expectations for improvements in these functional limitations are low, then consistent CPAP use is unlikely. The present study found that depression, anxiety and stress did not individually predict CPAP adherence.

Epworth Sleepiness Score was not a significant predictor of CPAP adherence, despite its prevalent use in sleep medicine as an index of subjective sleepiness. ESS measured **prior** *to CPAP treatment is an inconsistent predictor of adherence across the literature. Some studies have found it to predict adherence [31] and patient self-referrals for CPAP treatment. [32] Other studies report no effect of ESS score prior to treatment on determining CPAP compliance. [13, 33] However, studies assessing* **changes** *in patient perceptions post-treatment initiation have found that improved ESS score often predicts current CPAP use. [9, 17, 31] Thus, this study supports research suggesting that initial ESS score, along with many other biomedical indices of disease severity, are inconsistent* **early** *predictors of CPAP adherence. However changes in these scores with treatment may be useful in prediction later on.*

Contrary to our expectation, lower perceived risk of negative health consequences if OSA was untreated was associated with greater adherence. This finding is somewhat perplexing given the high relationships between subjective functional limitations due to sleepiness and greater adherence, as well as higher outcome expectancies with higher adherence rates. The sample utilised in this study displayed similar demographic and adherence rates as previous studies,[5, 6, 8-11, 15, 23] suggesting that this study captured a fairly "typical" OSA population. Therefore, these findings are unlikely to be attributable to sampling error. Further investigation of this finding is clearly needed.

One avenue of investigation may be in the context of OSA as a "lifestyle disease", with associations with other health problems such as diabetes, heart disease and obesity. Patients may be overwhelmed with several negative health messages and treatment regimes, and this may serve to decrease rather than increase motivation to adhere to treatment. Coordination of health services and prioritising treatment goals for individual patients to address one or two key underlying problems, such as poor diet and lack of exercise, may be more successful and less overwhelming to the patient than the prospect of medication, CPAP and potentially surgery to target these issues individually.

Limitations of this study are directly tied in with the directions for future research. This study constituted an investigation of the HBM with measures that were available, namely, self-efficacy, perceived risk (susceptibility), functional outcomes (severity) and outcome expectancies (benefits). A modest sample size was utilised in the study, however confidence intervals around the outcome variables and a priori power analysis indicated that the sensitivity to detect important relationships with adherence was adequate. The use of self-report measures of HBM constructs may represent another limitation of this study, however the use of validated measures overcomes some of the subjectivity associated with this. Moreover, beliefs testing can only occur through self-report measures. We have developed OSA specific measures for the barriers and cues to action constructs to fully assess the power of HBM constructs in the early prediction of CPAP initiation and adherence in future research. The potential clinical applications of a well described HBM model would include the development of cut-off points for different expected levels of adherence to treatment (based on arborescence analysis, for example).

The finding that motivations to use CPAP are associated with patients perceptions of disease severity and outcome expectancies, rather than objective measures of severity (such as RDI, AI and oxygen desaturation) support a call in the literature for the identification of psychological predictors of CPAP adherence that are amenable to intervention.[7, 15, 34] Our findings suggest that perceptions of risk, outcome expectancies with treatment, and functional limitations on daily life are important early predictors of initiation and continued use of CPAP. Early identification of these beliefs, and assistance in overcoming barriers to acceptance by facilitating the development of realistic and positive expectations for improvements in daily life as a result of using the treatment, will increase adherence to CPAP therapy.

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Figures

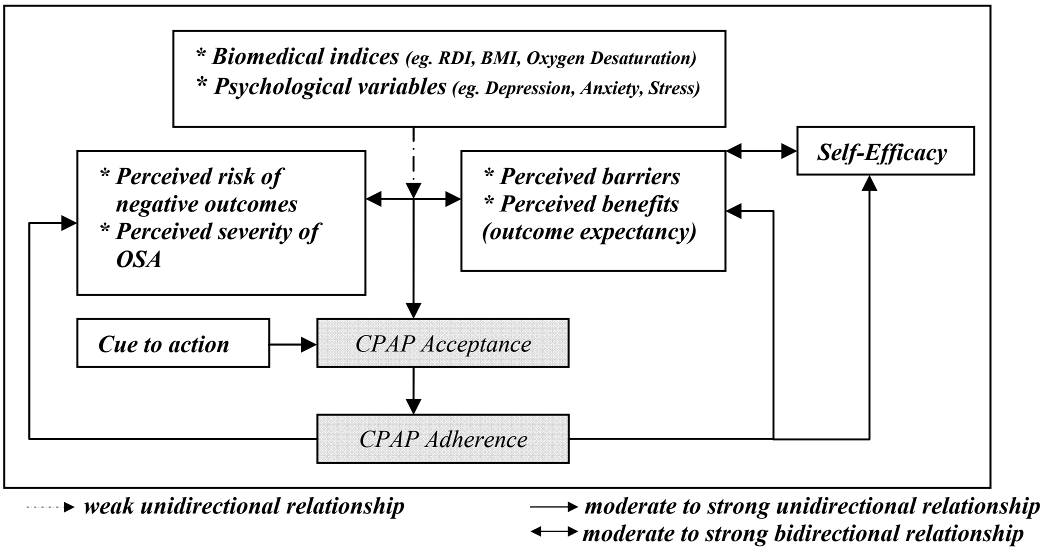

Figure 1. A conceptual model of CPAP adherence (modified from Clark & Becker, 1998)[21]

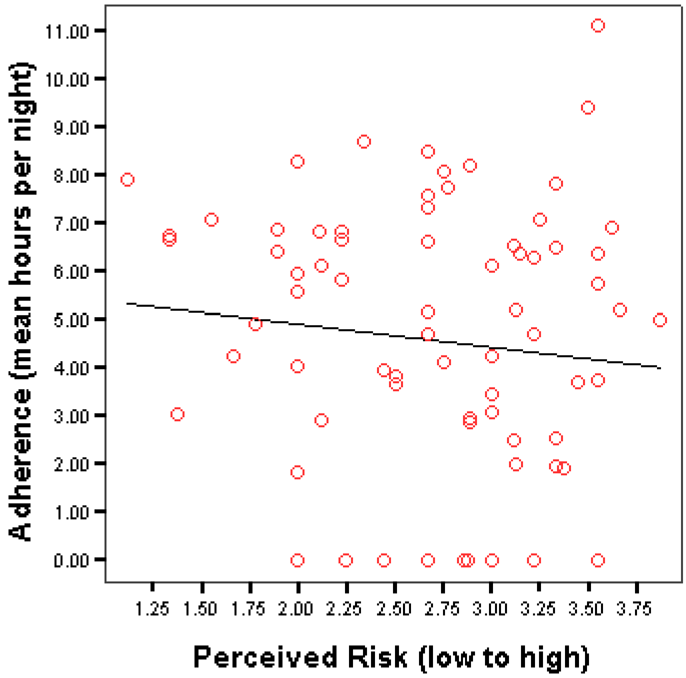

Figure 2: Scatterplot and correlation between perceived risk and adherence

Tables

Table 1: Adherence, CPAP pressure and ESS

	Mean	*Standard Deviation*	*Range*
Adherence (mean hours/night)	***4.57***	***+2.87***	***0 - 11.10***
CPAP pressure (cmH_2O)	***11.68***	***+2.84***	***6 - 19***
ESS	***11.93***	***+5.22***	***2 - 21***

Table 2: Multiple regression analysis including HBM Constructs and Biomedical Indices

	Beta (β)	Confidence Interval (CI)	semi-partial correlation (sr^2)	t value
Biomedical Indices:				
RDI	***.05***		***.02***	***.19***
AI	***-.17***		***-.08***	***-.70***
BMI	***.02***		***.01***	***.13***
ESS	***-.02***		***-.01***	***-.13***
Min SaO_2	***-.02***		***-.01***	***-.11***
<80% SaO_2	***-.19***		***-.12***	***-1.13***
HBM Indices:				
Risk	***-.46***	***-.75 to -.17***	***-.34***	***-3.06****
Outcome Expectancy	***.44***	***.13 to .75***	***.296***	***2.71****
FOSQ total	***-.30***	***-.61 to .01***	***-.21***	***-1.88***
Self-efficacy	***.01***		***.004***	***.04***
	R=.56*			

*****p<.01***

Table 3: Multiple regression analyses with HBM Constructs alone

	Beta (β)	***Confidence Interval (CI)***	***semi-partial correlation (sr^2)***	***t value***
Risk	***-.49***	***-.76 to -.22***	***-.37***	***-3.45*****
FOSQ total	***-.35***	***-.60 to -.10***	***-.28***	***-2.64*****
Outcome Expectancy	***.35***	***.06 to .64***	***.24***	***2.27****
Self-Efficacy	***.04***		***.04***	***.327***
	R=.467**			

**** p<.05***
*****p<.01***

Table 4: Bivariate correlations between HBM constructs and adherence

	FOSQ Total Score	***Risk***	***Outcome***	***Self-Efficacy***	***Activity***	***Vigilance***	***Intimacy***	***General Productivity***	***Social Outcome***
Adherence	*-.23**	*-.11*	*.25**	*.19*	*-.23**	*-.13*	*-.27**	*-.23**	*-.18*
Perceived Risk	***-.57****	***.***	***.55****	***.31****	***-.54****	***-.49****	***-.38****	***-.60****	***-.40****
Outcome Expectancy	***-.45****	***.***	***.***	***.59****	***-.45****	***-.29****	***-.37****	***-.48****	***-.30****
Self-Efficacy	***-.29****	***.***	***.***	***.***	***-.33****	***-.15***	***-.24***	***-.30****	***-.22***

****p<.05***
*****p<.01***

Table 5: Bivariate correlations between demographic and disease severity variables with adherence

	Age	*BMI*	*CPAP pressure*	*ESS*	*Min SaO_2*	*AI*	*<80% SaO_2*	*RDI*
Adherence (mean hrs/ night)	***-.12***	***-.08***	***-.16***	***.06***	***.20†***	***-.13†***	***-.06†***	***-.13†***

†=rank correlations