Effectiveness of behavioral and psychosocial interventions for continuous positive airway pressure adherence in obstructive sleep apnea patients: a quantitative systematic review protocol

Jindarat Chaiard • Patraporn Tungpunkom

The Thailand Centre for Evidence Based Health Care: a Joanna Briggs Institute Centre of Excellence

Review question/objective: The objective of this review is to assess the effectiveness of behavioral and psychosocial interventions on adherence to continuous positive airway pressure among patients 18 years and over with obstructive sleep apnea.

Keywords behavioral intervention psychological intervention; continuous positive airway pressure adherence; obstructive sleep apnea


Introduction

Obstructive sleep apnea (OSA) is a condition in which the airway repeatedly collapses and reopens during sleep, leading to ventilation impairment and causing intermittent hypoxemia and hypercapnia.1 A full polysomnography is used to diagnose OSA, and the best diagnostic criteria are based on symptoms and an apnea hypopnea index (AHI) of ≥ 5 events/hour. According to the American Academy of Sleep Medicine Task Force, OSA severity can be classified as mild (AHI of 5 to 14), moderate (AHI of 15 to 30) and severe (AHI > 30).2 With increasing obesity and an aging population, the prevalence of OSA is likely increasing.3 In a population of employed Wisconsin adults, the prevalence of moderate to severe OSA (based on AHI ≥ 15) was 10% to 17% among men and 3% to 9% among women aged 30 to 70 years.4 A recent systematic review on OSA prevalence (based on AHI ≥ 5 events/hour) revealed an overall prevalence ranging from 9% to 38% in the general population. The prevalence was high in those of the male gender, advancing age and higher body mass index (BMI).3

Obstructive sleep apnea has various symptoms and severe negative impacts. Nighttime and daytime symptoms of OSA vary. Nighttime OSA symptoms include snoring, cessation of breathing observed by the bed partner, and sudden choking, while daytime symptoms include excessive sleepiness, morning headache and fatigue.5 Obstructive sleep apnea is associated with conditions of multiple body systems; these conditions include tachycardia, dysrhythmia, heart block, hypertension, heart failure, stroke, impaired memory and concentration, pulmonary hypertension, metabolic syndrome, nocturia, impotence, and polycythemia.6 Cardiovascular and metabolic morbidities, excessive daytime sleepiness and cognitive impairment associated with OSA may lead to increased mortality.7

Many treatment options are available for OSA, such as airway surgery, positional therapy, weight loss, mandibular advancement devices and continuous positive airway pressure (CPAP).8 Continuous positive airway pressure therapy is the treatment of choice for OSA syndrome.3,9 The fundamental principle of CPAP is to apply positive pressure via the nose (sometimes via the nose and mouth) in order to overcome the narrowing and collapse of the airway; consequently, the airway wall is stabilized and snoring is suppressed.6 Continuous positive airway pressure benefits cardiovascular patients by relieving symptoms of heart disease and hypertension patients by lowering blood pressure.10 In patients with resistant hypertension and OSA, a meta-analysis supported the finding that CPAP treatment has a

Correspondence: Patraporn Tungpunkom, patraporn.t@cmu.ac.th
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more beneficial effect on 24-hour blood pressure during follow-up compared to standard anti-hypertensive treatment.\textsuperscript{11} Moreover, CPAP significantly reduced the arousal index,\textsuperscript{5} and increased mean oxygen saturation during sleep.\textsuperscript{9,12} In addition, this treatment had beneficial effects on the occupational wellbeing and job productivity of patients with severe OSA\textsuperscript{13} and improved fatigue and depression, vigilance, simulated driving performance, and decreased the number of automobile accidents and near-accidents.\textsuperscript{14}

Although CPAP has been proven to have positive effects on the health of OSA patients, achieving optimal use of CPAP is still problematic. More specifically, adherence is low in CPAP treatment.\textsuperscript{15} Adherence to CPAP treatment involves regular use of CPAP.\textsuperscript{16} Many studies\textsuperscript{16-19} record and report hours of usage and percentage of nights of usage as criteria for adherence or non-adherence to CPAP, with optimal adherence of at least four hours per night and at least 70\% of total nighttime usage from initiation of treatment. However, several studies revealed low CPAP adherence rates with only approximately half of the OSA patients having used CPAP regularly.\textsuperscript{20-22} It was found that many OSA patients abandoned CPAP use within one year after initiation of treatment.\textsuperscript{23} One systematic review\textsuperscript{24} revealed that OSA patients used CPAP for 4.3 hours per night and had percentage of night used as 38.4\% for short term adherence (within the first six months) and for long term adherence, OSA patients used CPAP for 4.6 hours per night and had percentage of night used at 33.6\%. The low CPAP adherence rates observed are attributable to many factors.

Factors related to CPAP adherence include patient demographic characteristics, severity of OSA, side effects of CPAP such as mask leak, skin irritation, dry mouth, and psychological and social factors; however, research findings have been inconsistent.\textsuperscript{16} Psychological and social factors, such as perceived health benefit, support from spouse, and self-efficacy, have been shown to influence CPAP adherence.\textsuperscript{25-27} Therefore, interventions aimed at modifying behavioral or psychological factors have been implemented. Most of the interventions have focused on an education program.\textsuperscript{28-30} Other interventions such as cognitive behavioral therapy (CBT),\textsuperscript{31} motivation\textsuperscript{32} and intensive support\textsuperscript{33} have been evaluated. These interventions do not include pharmacological or physical treatment interventions, but rather focus on management of behavioral, psychological and social factors. However, these interventions have shown mixed results on CPAP adherence.

Our preliminary database search revealed one previous systematic review in Cochrane Library Database. Wozniak et al.\textsuperscript{34} evaluated educational, supportive and behavioral interventions intended to improve CPAP use. The evidence examined in this review was limited to studies published up to January 2013. The authors concluded that behavioral interventions led to substantial improvements in CPAP use, whereas educational and supportive interventions showed only modest improvements. However, the limitation of this systematic review was the low quality of the evidence. In our review, we will focus on behavioral and psychosocial interventions intended to increase CPAP adherence. We will include studies published from 1990 to the present. Some studies may overlap with those used in the Wozniak et al. study, but we will also include studies published after January 2013. There are several studies of behavioral/psychosocial interventions aimed to increase CPAP adherence after 2013. These studies include brief dietary monitoring,\textsuperscript{35} stage-matched intervention,\textsuperscript{36} application of a group social cognitive theory,\textsuperscript{37} adaptive treatment,\textsuperscript{38} visualization of raw graphic polysomnography,\textsuperscript{39} and motivational enhancement.\textsuperscript{32,40,41} The results of these studies have been mixed. To identify the effectiveness of behavioral and psychosocial interventions on CPAP adherence, a systematic review is needed.

\textbf{Inclusion criteria}

\textbf{Participants}

This review will consider studies that include adult OSA patients, aged 18 years and over, who currently use CPAP.

\textbf{Intervention}

This review will consider studies that evaluate any type of behavioral and/or psychosocial intervention. We will include interventions such as CBT, counselling, supportive psychotherapy, and social or family support. We will also include brief dietary monitoring; stage-matched intervention, which focuses on changing behaviors in each stage of change; adaptive treatment, which focuses on delivering interventions specific to each patients’ characteristics; visualization of raw graphic polysomnography; and motivational enhancement. The interventions may be...
implemented at a group or individual level for any length of time. Education programs which do not include strategies to change perceptions, attitudes or behaviors will be excluded.

Comparator
This review will consider studies that compare the intervention with the following: no psychosocial and/or behavioral intervention or pharmacological intervention.

Outcomes
This review will consider studies that include the following measures for the primary outcome of interest, which is CPAP adherence. Continuous positive airway pressure adherence is measured by hours of CPAP use per night at least four hours. The studies considered will have objectively measured these outcomes using data from a CPAP machine. The secondary outcomes will include subjective daytime sleepiness measured by the Epworth Sleepiness Questionnaire (ESS), quality of life measured by a subjective questionnaire, and physiological changes such as blood pressure.

Types of studies
This review will consider any experimental study design including randomized controlled trials, non-randomized controlled trials, quasi-experimental, before and after studies, for inclusion.

Methods
Search strategy
The search strategy aims to find both published and unpublished studies. A three-step search strategy will be utilized in this review. An initial limited search of PubMed and CINAHL will be undertaken, followed by analysis of the text words contained in the title and abstract, and of the index terms used to describe the article. A second search using all identified keywords and index terms will then be undertaken across all included databases. Third, the reference lists of all reports and articles identified will be searched for additional studies. Studies published in Thai and English languages will be considered for inclusion in this review. Studies published from 1990 to the present will be considered for inclusion in this review, as before 1990, no psychosocial interventions for improving CPAP use have been identified.

The databases to be searched include:
• Embase
• CINAHL
• PsycINFO
• Sciencedirect
• Scopus
• SpringerLink
• Web of Science.

The following sources will be searched for unpublished and grey literature:
• ProQuest Dissertations and Theses
• Google Scholar
• Thai thesis data base: http://tdc.thailis.or.th/tdc/
A full search strategy for each database is detailed in Appendix I.

Assessment of methodological quality
Papers selected for retrieval will be critically appraised by two independent reviewers for methodological validity prior to inclusion in the review using standardized critical appraisal instruments from the Joanna Briggs Institute for the following study types. Any disagreements that arise between the reviewers will be resolved through discussion, or with a third reviewer. The reviewers will contact the authors of research articles if the published articles have missing information or report only summary data. Following critical appraisal, studies that do not meet a certain quality threshold will be excluded. The decision to exclude will be based on the cutting off scores of less than 5 of 9 of JBI critical appraisal checklist for quasi-experimental studies and less than 9 of 13 of JBI critical appraisal checklist for randomized controlled trials.

Data extraction
Two reviewers will independently extract the data from papers included in the review using the standardized data extraction tool available in Joanna Briggs Institute System for the Unified Management, Assessment and Review of Information (JBI SUMARI). The data extracted will include specific details about the interventions, populations, study methods and outcomes of significance to the review question and specific objectives. Any disagreements that arise between the reviewers will be resolved.
through discussion, or with a third reviewer. Authors of papers will be contacted to request missing or additional data where required.

Data synthesis
Quantitative data will, where possible, be pooled in statistical meta-analysis using JBI SUMARI. All results will be subject to double data entry. Effect sizes expressed as odds ratio (for categorical data) and weighted mean differences (for continuous data) and their 95% confidence intervals will be calculated for analysis. Heterogeneity will be assessed statistically using the standard Chi-square. Where statistical pooling is not possible the findings will be presented in narrative form including tables and figures to aid in data presentation where appropriate.

Assessing certainty in the findings
The Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach for grading the quality of evidence will be used in this review. A Summary of Findings will be created using GRADEPro. The Summary of Findings will present the information where appropriate: absolute risks for treatment and control, estimates of relative risk, and a ranking of the quality of the evidence based on study limitations (risk of bias), indirectness, inconsistency, imprecision and publication bias.

References
### Appendix I: Search strategy

<table>
<thead>
<tr>
<th>Population</th>
<th>Intervention</th>
<th>Comparator</th>
<th>Outcome measures</th>
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<tr>
<td>Sleep apnea (apnoea) Obstructive sleep apnea (apnoea), OSA Sleep apnea (apnoea) syndrome Obstructive sleep apnea (apnea) syndrome, OSAS OSA with continuous positive airway pressure (CPAP) use OSA with positive airway pressure (PAP) treatment</td>
<td>Behavioral (behavioural) intervention Behavioral (behavioural) therapy Cognitive behavioral (behavioural) therapy, CBT Psychosocial intervention Psychosocial therapy Family support, Spousal support Supportive psychotherapy Brief dietary monitoring Motivational enhancement Raw graphic polysomnography Stage-matched intervention Adaptive treatment</td>
<td>Routine care Usual care Pharmacological therapy</td>
<td>CPAP adherence Adherence to CPAP CPAP compliance CPAP use, hours of CPAP use Continuous positive airway pressure adherence (compliance) Positive airway pressure (PAP) adherence PAP compliance</td>
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**MEDLINE (PubMed platform)**

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<th>Search</th>
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<tr>
<td># 1</td>
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</tr>
<tr>
<td># 2</td>
<td>“Continuous positive airway pressure” OR CPAP OR “CPAP use” OR “CPAP adherence” OR “CPAP compliance” OR “hour of CPAP use” OR “positive airway pressure” OR “PAP”</td>
</tr>
<tr>
<td># 3</td>
<td>OR behavioral therapy OR behavioral therapy psychosocial intervention OR CBT OR family support OR spousal support OR adaptive treatment OR brief dietary monitoring OR stage-matched intervention OR motivational enhancement OR raw graphic polysomnography OR supportive psychotherapy</td>
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<tr>
<td>#1 AND #2</td>
<td></td>
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<tr>
<td>#1 AND #2 AND #3</td>
<td>Limits: publication date from 1990 to the present English and Thai language.</td>
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