Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea (Review)

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[Intervention Review]

Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea

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ABSTRACT

Background

Although effective in the treatment of obstructive sleep apnoea (OSA), continuous positive airway pressure (CPAP) is not universally accepted by users. Educational, supportive and behavioural interventions may help people with OSA recognise the need for regular and continued use of CPAP.

Objectives

To assess the effectiveness of strategies that are educational, supportive or behavioural in encouraging people who have been prescribed CPAP to use their machines.

Search methods

Searches were conducted on the Cochrane Airways Group Specialised Register of trials. Searches are current to 17 January 2013.

Selection criteria

We included randomised parallel controlled trials that assessed an intervention designed to inform participants about CPAP or OSA, to support them in using CPAP or to modify their behaviour in increasing their use of CPAP machines. Studies of any duration were considered.

Data collection and analysis

Two review authors assessed studies to determine their suitability for inclusion in the review. Data were extracted independently and were entered into Review Manager software for analysis.

Main results

Thirty studies (2047 participants) were included. We categorised studies by intervention type: supportive interventions during follow-up, educational interventions and behavioural therapy. Across all three intervention classes, most studies incorporated elements of more than one intervention. For the purposes of this systematic review, we categorised them by the prevailing type of intervention, which we expected would have the greatest impact on the study outcome.

Baseline Epworth Sleepiness Scale (ESS) scores indicated that most participants experienced daytime sleepiness, and CPAP was indicated on the basis of sleep disturbance indices. A vast majority of recruited participants had not used CPAP previously. Most of the studies were at an unclear risk of bias overall, although because of the nature of the intervention, blinding of both study personnel and participants was not feasible, and this affected a number of key outcomes. Adverse events were not reported in these studies.

Low- to moderate-quality evidence showed that all three types of interventions led to increased machine usage in CPAP-naive participants with moderate to severe OSA syndrome. Compared with usual care, supportive ongoing interventions increased machine usage by about 50 minutes per night (0.82 hours, 95% confidence interval (CI) 0.36 to 1.27, N = 803, 13 studies; low-quality evidence), increased the number of participants who used their machines for longer than four hours per night from 59 to 75 per 100 (odds ratio (OR) 2.06, 95% CI 1.22 to 3.47, N = 268, four studies; low-quality evidence) and reduced the likelihood of study withdrawal (OR 0.65, 95% CI 0.44 to 0.97, N = 903, 12 studies; moderate-quality evidence). With the exception of study withdrawal, considerable variation was evident between the results of individual studies across these outcomes. Evidence of an effect on symptoms and quality of life was statistically imprecise (ESS score -0.60 points, 95% CI -1.81 to 0.62, N = 501, eight studies; very low-quality evidence; Functional Outcomes of Sleep Questionnaire 0.98 units, 95% CI -0.84 to 2.79, N = 70, two studies; low-quality evidence, respectively).

Educational interventions increased machine usage by about 35 minutes per night (0.60 hours, 95% CI 0.27 to 0.93, N = 508, seven studies; moderate-quality evidence), increased the number of participants who used their machines for longer than four hours per night from 57 to 70 per 100 (OR 1.80, 95% CI 1.09 to 2.95, N = 285, three studies; low-quality evidence) and reduced the likelihood of withdrawal from the study (OR 0.67, 95% CI 0.45 to 0.98, N = 683, eight studies; low-quality evidence). Participants experienced a small improvement in symptoms, the size of which may not be clinically significant (ESS score -1.17 points, 95% CI -2.07 to -0.26, N = 336, five studies).

Behavioural therapy led to substantial improvement in average machine usage of 1.44 hours per night (95% CI 0.43 to 2.45, N = 584, six studies; low-quality evidence) and increased the number of participants who used their machines for longer than four hours per night from 28 to 47 per 100 (OR 2.23, 95% CI 1.45 to 3.45, N = 358, three studies; low-quality evidence) but with high levels of statistical heterogeneity. The estimated lower rate of withdrawal with behavioural interventions was imprecise and did not reach statistical significance (OR 0.85, 95% CI 0.57 to 1.25, N = 609, five studies, very low-quality evidence).

Authors' conclusions

In CPAP-naive people with severe sleep apnoea, low-quality evidence indicates that supportive interventions that encourage people to continue to use their CPAP machines increase usage compared with usual care. Moderate-quality evidence shows that a short-term educational intervention results in a modest increase in CPAP usage. Low-quality evidence indicates that behavioural therapy leads to a large increase in CPAP machine usage. The impact of improved CPAP usage on daytime sleepiness, quality of life and long-term cardiovascular risks remains unclear. For outcomes reflecting machine usage, we downgraded for risk of bias and inconsistency. An additional limitation for daytime sleepiness and quality of life measures was imprecision. Trials in people who have struggled to persist with treatment are needed, as currently little evidence is available for this population. Optimal timing and duration and long-term effectiveness of interventions remain uncertain. The relationship between improved machine usage and effect on symptoms and quality of life requires further assessment. Studies addressing the choice of interventions that best match individual patient needs and therefore result in the most successful and cost-effective therapy are needed.

PLAIN LANGUAGE SUMMARY

Do supportive, educational and/or behavioural interventions improve usage of CPAP machines by adults with obstructive sleep apnoea (OSA)?

What is OSA and CPAP?

Obstructive sleep apnoea (OSA) is a condition that causes interrupted breathing during sleep. People with OSA spend more time in light sleep and less time in deep sleep and consequently feel very sleepy during the day, which may affect their work/family life. CPAP

(continuous positive airway pressure) is a treatment that provides a column of pressurised air that serves as a cushion to keep the airway splinted open. CPAP treatment involves a machine that has three main parts: a mask or other device that fits over nose or nose and mouth (straps keep the mask in place); a tube that connects the mask to the machine's motor; and a motor that blows air into the tube. Some CPAP machines have other features as well, such as heated humidifiers. CPAP machines are small, lightweight and fairly quiet.

Continuous positive airway pressure treats OSA effectively in most people. It can improve symptoms resulting from OSA, and in some adults, it can reduce the long-term risk of heart-related disease. However, the effectiveness of CPAP is limited by the fact that people do not use the machine in the best possible way. Support, education and modification of behaviour have been proposed to improve CPAP usage.

Review question

Our intention was to assess treatments designed to inform participants about CPAP or OSA, to support them in using CPAP or to modify their behaviour in improving use of CPAP machines. The main question addressed by this review is how effective these interventions are in improving compliance with CPAP.

Study characteristics

We looked at evidence from randomised, parallel-group studies. Following a comprehensive literature search and assessment of existing trials, we have included 30 studies with a total of 2047 participants. A vast majority of the participants suffered from excessive daytime sleepiness and severe OSA. Duration of studies ranged from four weeks to 12 months. The evidence is current to January 2013.

Results

In combining the results from all trials, we found that all three types of interventions increased CPAP usage to varying degrees. Ongoing supportive interventions were more successful than usual care in increasing CPAP usage by about 50 minutes per night. Educational interventions resulted in a modest improvement of about 35 minutes per night. Behavioural therapy increased machine usage by just under one and a half hours per night. Some inconsistency was noted between the results of individual studies, and this introduces some uncertainty about the size of the difference that might be anticipated in practice. It is unclear whether any of these interventions also led to meaningful improvement of daytime symptoms or quality of life. Studies generally recruited people who are new to CPAP, and currently little evidence is available on people who have struggled to persist with treatment. The cost-effectiveness of the interventions has not been explored, and it is unclear which intervention is best suited for individual patients.

Quality of the evidence

Overall, the quality of evidence presented is low because of issues with study design and some inconsistency in results across studies. The quality of evidence for symptoms and quality of life was affected by the low number of studies that measured these outcomes.

SUMMARY OF FINDINGS FOR THE MAIN COMPARISON *[Explanation]*

Increased practical support and encouragement for adults with sleep apnoea

Patient or population: adults with sleep apnoea
Intervention: increased practical support and encouragement and CPAP
Comparison: CPAP
Settings: community

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	Control	Increased practical support and encouragement				
Machine usage Hours per night Follow-up: median 12 weeks	Average CPAP machine usage ranged across control groups from **1.75 to 6.3 hours per night**	Mean machine usage in the intervention groups was **0.82 hours higher** (0.36 to 1.27 higher)		803 (13 studies)	⊕⊕◯◯ **low**[1,2]	
N deemed adherent (≥ four hours/night) Follow-up: median 12 weeks	**59 per 100**	**75 per 100** (64 to 83)	**OR 2.06** (1.22 to 3.47)	268 (4 studies)	⊕⊕◯◯ **low**[1,3]	
Symptoms of sleepiness Epworth Scale: zero to 24 Follow-up: median 12 weeks	Average Epworth symptom scores in control groups ranged from **4.5 to 13**	Mean symptoms of sleepiness in the intervention groups was **0.6 lower** (1.81 lower to 0.62 higher)		501 (8 studies)	⊕◯◯◯ **very low**[1,4,5]	

Quality of life Functional Outcomes of Sleep Questionnaire		Mean quality of life in the intervention groups was **0.98 higher** (0.84 lower to 2.79 higher)		70 (2 studies)	⊕⊕◯◯ **low**[1,6]	
Quality of life Sleep Apnoea Quality of Life Index (SAQLI)	See comment	See comment		108 (1 study)	⊕⊕◯◯ **low**[1,6]	Single study estimate
Withdrawals Follow-up: median 12 weeks	**17 per 100**	**11 per 100** (eight to 16)	**OR 0.65** (0.44 to 0.97)	903 (12 studies)	⊕⊕⊕◯ **moderate**[1]	

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
CI: Confidence interval; **OR:** Odds ratio.

GRADE Working Group grades of evidence.
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1]Risk of bias (-1): In the absence of blinding across studies, the study effect estimates are at risk of performance bias.
[2]Inconsistency (-1): Substantial variation was seen in the direction and magnitude of effect across studies (I^2 = 66%). Removal of studies when average machine use in control groups was high yielded a more consistent, larger effect in favour of intervention.
[3]Imprecision (-1): Low number of participants across studies was seen despite lower limit of the CI favouring intervention.
[4]Inconsistency (-1): Substantial variation was seen in the direction and magnitude of effect across studies.
[5]Imprecision (-1): Width of the confidence intervals does not exclude substantial improvement in deterioration of symptoms.
[6]Imprecision (-1): Low number of participants and very wide confidence intervals were compatible with benefit and harm.

BACKGROUND

Description of the condition

Obstructive sleep apnoea (OSA) is a common sleep-related breathing disorder characterised by transient interruption of ventilation caused by complete or partial occlusion of the upper airway. As a consequence, oxygen desaturation, increased inspiratory effort, sleep fragmentation and arousal from sleep occur. This in turn leads to excessive daytime sleepiness, mood alterations and impairment of cognition, memory and driving competence. Furthermore, OSA is associated with cardiovascular and metabolic comorbidities (Harsch 2004; Peppard 2000).

Description of the intervention

Continuous positive airway pressure (CPAP) involves the use of an airflow generator, which, via an interface, provides a constant stream of pressurised air to splint open and maintain patency of the upper airways during the inspiratory and expiratory phases of breathing. CPAP is very effective in abolishing obstructive nocturnal breathing, and since it was first introduced into clinical practice in 1981 (Sullivan 1981), CPAP has become a mainstay of OSA treatment.

Consistent application of CPAP therapy improves the quality of sleep, normalises sleep architecture, reduces daytime sleepiness, enhances neurobehavioural performance and prevents automobile accidents (Gay 2006; Giles 2006). Patients who are compliant with CPAP achieve better blood pressure control and have reduced risk of cardiovascular events (Dong 2013; Marin 2005; Martinez-Garcia 2012; Myhill 2012). Furthermore, emerging data indicate that CPAP may have a role in the treatment of acute stroke (Bravata 2011; Martinez-Garcia 2009).

In spite of the widespread recommendation of CPAP in the management of OSA (Giles 2006; SIGN 2003), concerns have arisen about its continued acceptance among people who have to use it on a long-term basis. Reported usage of CPAP ranges from 29% to 85% (Lewis 2004; Lindberg 2006; Pépin 1999; Weaver 2010). Eight per cent to 15%of patients refuse to accept the treatment after a single night's use, and some case series report an abandonment rate of up to 50% within one year (Bollig 2010; Krieger 1992). The definition of optimal CPAP usage is problematic (Lewis 2004), and attempts to ascertain patterns of usage among CPAP users can be affected by their altered behaviour in monitored settings (Pépin 1999; Sin 2002). Self-reported use is not reliable and overestimates actual use by an average of one hour (Kribbs 1993). The number of hours per night and the frequency of usage required to achieve and maintain therapeutic effectiveness are not well established. The threshold level for daily CPAP use may depend on the outcome measure used and may vary significantly between patients (Bollig 2010). Six to eight hours each night is the usual prescription, but in many studies, adequate CPAP adherence has been proposed as a minimum of four hours of daily use (Lewis 2004; Richard 2007). This threshold, although defined as arbitrary, has proved useful in clinical studies and has some validity. Weaver 2007 found that the greatest gain in improvement in the Epworth Sleepiness Scale (ESS) to a normal value occurred with at least four hours of use per night. Applying this criterion, Pépin 1999 and Lewis 2004 deemed between 71% and 85% of CPAP users 'compliant', but Kribbs 1993 identified only 46% as 'compliant'. The consequences of undertreating sleep-disordered breathing may include increased cardiovascular risk and mortality (Marin 2005; Mooe 2001; Yaggi 2005).

Side effects of CPAP include discomfort, nasal congestion, abdominal bloating, mask leaks, claustrophobia and inconvenience of regular usage, and these are frequently reported by patients who struggle to persevere with treatment. People commonly skip nights on CPAP or use it only for part of the night. Studies on CPAP usage predictors related to patient characteristics, disease characteristics and CPAP technology have yielded inconsistent results, but certain psychological and cognitive variables have been shown to correlate well with sustained and successful treatment (Stepnowsky 2007a; Wild 2004). Components of social cognitive theory, such as risk perception, treatment outcome expectations and self-efficacy, are attractive modifiable predictors of adherence. Similarly, social factors, including partner involvement in treatment and partner's sleep quality, have been shown to positively influence CPAP adherence (Lewis 2004). Following treatment initiation, the pattern of CPAP use within the first week can predict long-term use (Aloia 2007).

How the intervention might work

Various methods to improve initial acceptance and subsequent compliance have been proposed. Modifications of delivery of airway pressure, such as the use of automatically titrating CPAP (auto-CPAP), bi-level PAP and humidification therapy to decrease side effects in the upper airway due to cold and dry airflow, have not yielded convincing benefits in clinical trials (Smith 2009a). Ongoing support in resolving problems that occur during CPAP treatment and regular encouragement should enhance its proper use. According to various psychological and behavioural theories, knowledge is a precondition for health behaviour or change in health behaviour and determines adherence at the onset of treatment (Sawyer 2011; Wang 2011a). Other theoretical models emphasise that targeting psychological constructs such as decision balancing (relative weighing of the pros and cons of making changes) and self-efficacy (which describes the ability to make a behaviour change during times when such a change is expected to be difficult) can influence compliance with treatment. Therefore, educational and behavioural interventions have also been proposed. These interventions are based on a variety of theoretical models, emphasise the importance of persistence with therapy and target some of the

perceived barriers to successful continued usage (Bandura 2004; Olsen 2008).

Why it is important to do this review

Interventions directed at improving CPAP usage very greatly in methodology, complexity and effectiveness. Knowing what type of intervention is effective and potentially applicable in clinical practice would guide clinicians and health authorities in developing services aimed at helping patients adhere to treatment. Since the last Cochrane review, published in 2009, which assessed educational, supportive and behavioural interventions aimed at improving CPAP usage, a substantial number of new studies have been reported. This review updates the evidence.

OBJECTIVES

To assess the effectiveness of strategies that are educational, supportive or behavioural in encouraging people who have been prescribed CPAP to use their machines.

METHODS

Criteria for considering studies for this review

Types of studies

Randomised, parallel-group trials.

Types of participants

Participants were adults of either sex with a diagnosis of OSA that was based on history and results of sleep studies. Trials assessing interventions in people with central sleep apnoea were excluded. Participants must have received their diagnosis of OSA through a sleep study, that is, an oximetry study showing a desaturation index (DI) of at least five per hour or respiratory polygraphy yielding an apnoea hypopnoea index (AHI) of at least five per hour.

Types of interventions

Intervention and control groups must receive the same make of CPAP machine and the same pressure delivery mode (i.e. fixed, auto-titrating, bi-level, etc).

Intervention group

Any short-term (delivered at the time of diagnosis or CPAP titration) or sustained intervention consisting of an educational intervention (such as written, verbal or audiovisually delivered information) or enhanced support offered to participants in the form of regular meetings, telephone follow-up or interactive applications aimed at encouraging continued use of the CPAP machine and encouraging participants to report problems associated with its use. We also included behavioural interventions aimed at modifying and promoting adherence behaviours.

Control group

Participants in the control group could receive instruction that would be usual for the study centre in question, provided that the equivalent 'background' level of instruction was also offered to the intervention group.

Types of outcome measures

Primary outcomes

CPAP machine usage, measured as initial acceptance when data were available and subsequent usage as measured by:

- counter output that records the cumulative time that power is turned on for a CPAP machine (this does not provide information on actual time of day and duration of CPAP used during each 24-hour period);
- microprocessor and monitor that measurepressure at the mask for every minute of each 24-hour day; and
- subjective participant reports of the duration of CPAP use.

Secondary outcomes

- Symptom scores such as the Epworth Sleepiness Scale (ESS) and the Stanford Sleepiness Score and nasal symptoms.
- Disease-specific quality of life scores such as Functional Outcomes of Sleep Questionnaire (FOSQ) or Calgary Sleep Apnoea Quality of Life Index (SAQLI) scores.
- Mood (Hospital Anxiety and Depression (HAD) Scale).
- Withdrawals from the study.
- Desaturation index, apnoea hypopnoea index (AHI), respiratory disturbance index (RDI) and minimum arterial saturation (min SaO_2) during sleep.
- Maintenance of wakefulness test.
- Cardiovascular morbidity/mortality.
- Adverse events.

Search methods for identification of studies

Electronic searches

We identified trials using the Cochrane Airways Group Specialised Register of trials, which is maintained by the Trial Search Co-ordinator (TSC) for the Group. The Register is derived from systematic searches of bibliographic databases including the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE, EMBASE, CINAHL, AMED and PsycINFO, and from handsearching of respiratory journals and meeting abstracts (please see Appendix 1 for further details). The TSC searched all records in the Specialised Register coded as 'sleep apnoea' using the following terms:

((Humidif* OR CPAP OR Auto-CPAP OR APAP OR NCPAP OR PPR OR "positive pressure" OR positive-pressure OR "expiratory pressure" OR PEEP OR IPB OR IPPB) OR (continuous OR nasal OR inspiratory AND ("positive airway*"))) AND (educat* or self-manag* or "self manag*" or "self-car*" or "self car*" or train* or support* or instruct* or behav* or psychother* or adher* or interact* or telemed*)

The latest search was conducted in January 2013 with no restrictions on language or publication type.

Searching other resources

We undertook additional searching of the bibliographies of identified trials. We handsearched the 2003-2005 American Thoracic Society (ATS) meeting abstracts for the first version of this review. We handsearched the 2010-2012 ATS and the 2008-2012 European Respiratory Society (ERS) meeting abstracts for the 2013 review update.

Authors of studies were contacted to locate other unpublished or in progress studies that met the inclusion criteria.

Data collection and analysis

Selection of studies

Titles, abstracts and citations identified through electronic searching were independently reviewed by three review authors (DRW for the current update, TJL for the original review and IS for both) to assess potential relevance for full review. Following scrutiny of full text, review authors independently assessed studies for inclusion based on criteria for population, intervention and study design. Agreement was measured by simple agreement. A third review author would have resolved disagreements, but none arose.

Data extraction and management

Data were extracted from published and unpublished studies independently by DRW (for the current update), TJL (for the original review) and IS (for both), using data extraction sheets designed in Excel. Data in table or graphic form were used. When data were not available from the trial reports, we contacted study authors to determine whether data could be obtained directly. We sought additional clarification of study design and methods for the risk of bias assessment.

Assessment of risk of bias in included studies

The review authors assessed the risk of bias of included studies in terms of the processes of allocation of participants to treatment groups, blinding and subsequent handling of missing data.

Given the nature of the intervention, it is unlikely that blinding of participants is achievable, but data collectors and analysts could be blinded. We noted whether blinding of the study aim was maintained and sought information on whether participants were informed that machine usage would be monitored.

Two review authors (DRW and IS) independently assessed risk of bias for each study using the criteria outlined in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011). We resolved any disagreements by discussion or by involving another review author (TJL). We assessed the risk of bias according to the following domains.

- Random sequence generation.
- Allocation concealment.
- Blinding .
- Incomplete outcome data.

We graded each potential source of bias as high, low or unclear and provided a quote from the study report, together with justification for our judgement, in the risk of bias table.

Measures of treatment effect

For dichotomous outcomes, an odds ratio (OR) and 95% confidence intervals (CIs) were calculated on the basis of the number of participants with an event versus the number of participants without an event. Mean differences (MDs) and 95% CIs were calculated for continuous variables measured on identical metrics. We combined data with a standardised mean difference (SMD) for the same continuous variables measured with different metrics. We entered data presented as a scale with a consistent direction of effect.

Unit of analysis issues

Studies with multiple treatment groups

Some studies randomly assigned participants to more than one intervention group: Meurice 2007a, Meurice 2007b, Meurice 2007c and Meurice 2007d randomly assigned participants to one of four

different combinations of treatment. We extracted data for increased support and educational interventions by creating four intervention/control comparisons and considered the effects of each as a separate study. We adopted a similar approach to the study by Wang 2011a, Wang 2011b, Wang 2011c and Wang 2011d, which included three intervention arms and one control group. The educational intervention and supportive intervention groups served as a control for the group when a combination of both interventions was used. We created four pair-wise comparisons incorporated into an educational and supportive interventions analysis. Aloia 2012a and Aloia 2012b investigated two interventions-educational and behavioural-and used one control group. We considered these two arms paired with one control as separate studies.

Dealing with missing data

The authors of the following studies were contacted and responded to the request for additional data: Aloia 2001, Aloia 2012a, Aloia 2012b, Bartlett 2010, Basoglu 2011, Damjanovic 2009, Lewis 2006, Olsen 2012, Parthasarathy 2012, Schiefelbein 2005, Shaikh 2009, Smith 2006 and Stepnowsky 2007.

Assessment of heterogeneity

We used the I^2 statistic to measure heterogeneity among the trials in each analysis. If we identified substantial heterogeneity (> 20%), we pooled data using a random-effects model and explored possible causes through prespecified subgroup analysis.

Assessment of reporting biases

We assessed a funnel plot for the primary outcome for publication bias.

Data synthesis

Fixed-effect modelling was used to pool data for ORs unless heterogeneity was observed, in which case a random-effects model was used. Standard errors for generic inverse variance analyses were derived from reported 95% CIs of group differences or group standard deviations (SDs), using the RevMan calculator.

Subgroup analysis and investigation of heterogeneity

Subgroup comparisons considered to be defined a priori include the following.

- Participants with prior CPAP exposure versus CPAP-naive participants.
- Population (male vs female).
- Baseline AHI $\geq$ 20 versus < 20 per hour.

Sensitivity analysis

We removed studies in which study participants were aware that their usage data were collected. We also excluded studies wherein mean CPAP usage in the control group was equal to or greater than four hours per night.

Summary of findings tables

We included summary of findings tables for the three comparisons (supportive interventions vs usual care; educational interventions vs usual care; behavioural therapy vs usual care). We included information about the following key outcomes in the summary of findings tables.

- CPAP machine usage.
- Symptoms.
- Quality of life.
- Study withdrawal.

We applied methods outlined by the GRADE working group to rate the quality of evidence by considering the following domains.

- Risk of bias.
- Imprecision.
- Inconsistency.
- Indirectness.
- Publication bias.

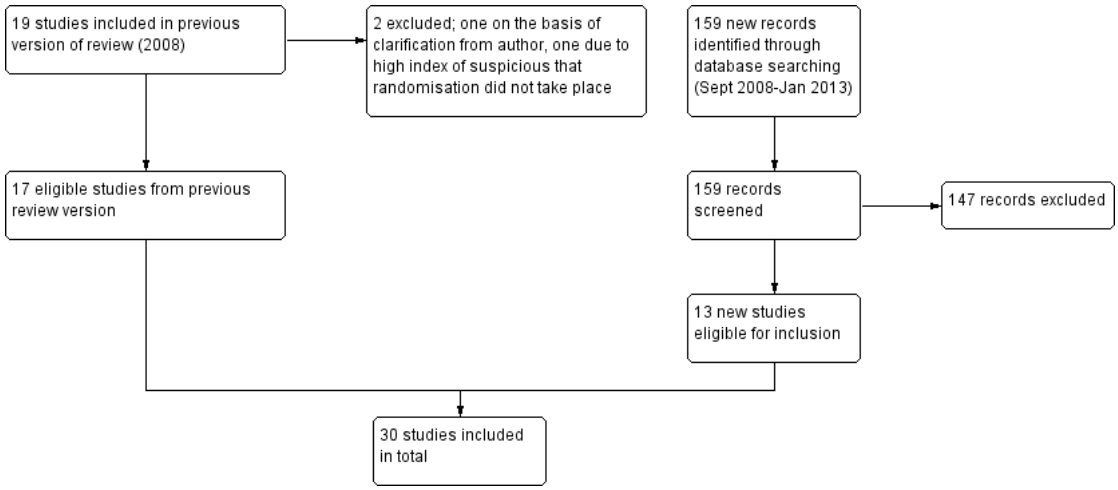
RESULTS

Description of studies

Results of the search

See Figure 1 for the study flow diagram. The original review, published in 2009, was split from a larger review of educational/psychological interventions and pressure delivery modifications in sleep apnoea (Haniffa 2004). From the original review, we have retained 17 studies (literature search dates: all years to September 2008). Based on new information provided by the study authors, one study previously included has now been excluded as not meeting randomisation criteria (Damjanovic 2009). One further study (Marshall 2003) has been excluded because of the high probability that randomisation did not take place. Update searches conducted to January 2013 yielded 159 citations, and 13 new studies met the inclusion criteria.

Figure 1. Study flow diagram.



This review summarises evidence from 30 studies reported in 28 references. For descriptions of each study, see Characteristics of included studies. Three trials judged as potentially relevant were not reported in full and are awaiting assessment pending information from the study investigators (Bartlett 2010; Fanfulla 2008; Peach 2003).

We have excluded 10 studies (see Characteristics of excluded studies).

Included studies

Study design

All studies were randomised, single-blind or unblinded parallel-group studies.

Participants

A total of 2047 participants were recruited to the studies (Table 1). When reported, in all studies, except for Fox 2012, baseline ESS indicated that participants suffered from excessive daytime somnolence. Sleep disturbance indices also indicated that CPAP therapy was a justified strategy in managing their condition. Only 3.6% of participants recruited had used CPAP previously (Aloia 2001; Chervin 1997; Smith 2006). The remainder were newly diagnosed with OSA or were initiating CPAP treatment.

Interventions

All studies were divided between three groups of supportive, educational and behavioural interventions. Across all three groups, some studies incorporated elements of more than one intervention (Table 2). For the purposes of meta-analysis, we have categorised them by the prevailing type of intervention, which, in our judgement, would be expected to have the greatest impact on the study outcome ('net' intervention).

Educational interventions were intended to impart information about CPAP treatment or about OSA more generally and were delivered using a variety of techniques, often in combination, including video (Basoglu 2011; Wang 2011a; Wang 2011c; Wiese 2005), face-to-face didactic sessions (Aloia 2012a; Meurice 2007d), group educational sessions (Epstein 2000; Wang 2011a; Wang 2011d), written materials (Meurice 2007c; Meurice 2007d; Wang 2011a; Wang 2011c), telephone calls (Aloia 2012a) and education at home during follow-up visits (Meurice 2007c).

Supportive interventions comprised intensive follow-up and monitoring by additional clinic reviews (Hui 2000; Lewis 2006), telephone calls (Chervin 1997; Hui 2000; Lewis 2006), telemedicine technology (including Internet-based applications, automated digitalised phone calls and wireless CPAP machine data downloading) (DeMolles 2004; Fox 2012; Schiefelbein 2005; Smith 2006; Stepnowsky 2007; Taylor 2006), home visits (Hoy 1999; Meurice 2007a; Meurice 2007b), additional titration nights in hospital (Hoy 1999) and meetings with peer CPAP users (Parthasarathy 2012). The common feature in this group was that participants were encouraged to provide feedback on their experience of CPAP treatment on an ongoing basis, so that barriers to or difficulties with treatment could be addressed in timely fashion. Relaxation before CPAP application and habit-promoting interventions were also utilised (Smith 2009; Wang 2011b; Wang 2011c).

Behavioural interventions targeted modifiable constructs originating from psychological theories of health behaviour change and preexisting health beliefs. Interventions were focused on promoting self-efficacy, assessing outcome expectations and influencing decisional balance in favour of CPAP. Again, various strategies and techniques were implemented. Most commonly, interventions designed around the concept of motivational interviewing delivered by face-to-face sessions (Aloia 2012b; Olsen 2012), personalised written feedback (Roecklein 2010) or Internet-based applications (Sparrow 2010) were used. Two studies used cognitive-behavioural therapy delivered in an individual session (Aloia 2001) or in a group session as part of a multimodality intervention, which, in addition, was composed of an educational slide presentation, a video, written information and demonstration of relaxation techniques (Richards 2007).

To make some sense of the heterogeneity of the interventions, we grouped them under the following three headings.

- Increased support and reinforcement: Chervin 1997; DeMolles 2004; Fox 2012; Hoy 1999; Hui 2000; Lewis 2006; Meurice 2007a; Meurice 2007b; Parthasarathy 2012; Schiefelbein 2005; Smith 2006; Smith 2009; Stepnowsky 2007; Taylor 2006; Wang 2011b; Wang 2011c.
- Increased education: Aloia 2012a; Basoglu 2011; Epstein 2000; Meurice 2007c; Meurice 2007d; Wang 2011a;Wang 2011d; Wiese 2005.
- Behavioural therapy: Aloia 2001; Aloia 2012b; Olsen 2012; Richards 2007; Roecklein 2010; Sparrow 2010.

Study duration

Study duration was four weeks (Richards 2007; Taylor 2006; Wiese 2005), eight weeks (Chervin 1997; DeMolles 2004; Stepnowsky 2007), 12 weeks (Aloia 2001; Fox 2012; Hui 2000; Parthasarathy 2012; Roecklein 2010; Smith 2006; Wang 2011a; Wang 2011b; Wang 2011c; Wang 2011d), 16 weeks (Schiefelbein 2005), 24 weeks (Basoglu 2011; Epstein 2000; Hoy 1999; Smith 2009) and 52 weeks (Aloia 2012a; Aloia 2012b; Lewis 2006; Meurice 2007a; Meurice 2007b; Meurice 2007c; Meurice 2007d; Olsen 2012; Sparrow 2010).

Outcomes

All studies reported outcome data related to machine usage or subsequent attendance at an outpatient clinic, with the exception of Schiefelbein 2005, for which only data pertaining to diary-recorded experiences of intervention between groups were available. A subset of the studies reported data on ESS (Chervin 1997; DeMolles 2004; Hoy 1999; Hui 2000; Olsen 2012; Wang 2011a; Wang 2011b; Wang 2011c; Wang 2011d; Wiese 2005), AHI (Fox 2012; Olsen 2012) and quality of life (DeMolles 2004; Hoy 1999; Hui 2000; Olsen 2012; Taylor 2006; Wiese 2005).

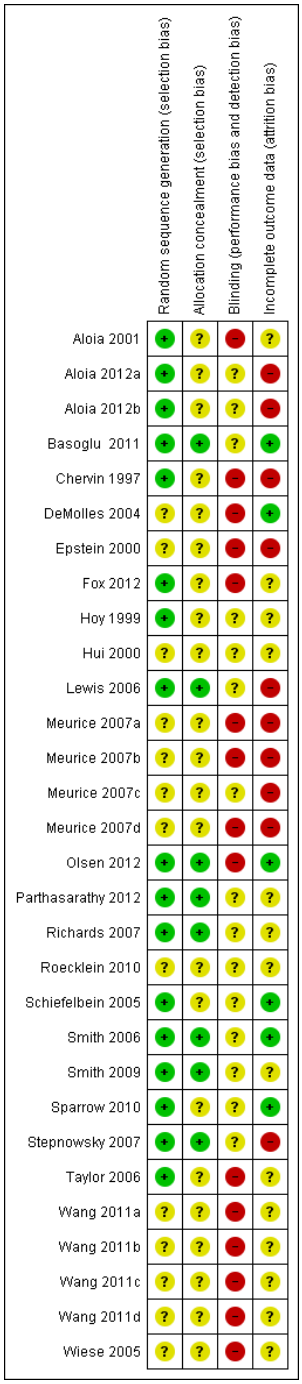
Excluded studies

We excluded 10 studies from this review. Reasons for their failure to meet review entry criteria are provided in Characteristics of excluded studies.

Risk of bias in included studies

An overview of our judgements of the risk of bias of included studies (allocation, blinding and missing data domains) is provided in Figure 2. The basis for each of these judgements is given in Characteristics of included studies.

Figure 2. Methodological quality summary: review authors' judgements about each methodological quality item for each included study.



Allocation

Following correspondence with study investigators, we were able to ascertain that allocation generation and concealment were adequate in eight studies (Basoglu 2011; Lewis 2006; Olsen 2012; Parthasarathy 2012; Richards 2007; Smith 2006; Smith 2009; Stepnowsky 2007). In a further nine studies, only allocation generation procedures were at low risk of bias (Aloia 2001; Aloia 2012a; Aloia 2012b; Chervin 1997; Fox 2012; Hoy 1999; Schiefelbein 2005; Sparrow 2010; Taylor 2006). For these studies, information regarding concealment of allocation could not be ascertained. For the remainder of the studies, insufficient information was available for review authors to determine the extent to which studies were at risk of bias from these sources.

Blinding

In seven studies, investigators made attempts to blind participants regarding the intensity or content of the intervention received: Hoy 1999; Lewis 2006; Schiefelbein 2005; Smith 2006; Roecklein 2010; Smith 2009; Sparrow 2010.

Participants were not made aware that machine use was being monitored in five studies: Aloia 2001; Aloia 2012a; Aloia 2012b; Lewis 2006; Richards 2007. For a number of studies, participants would have been aware that machine usage data were assessed by study investigators: Basoglu 2011; Chervin 1997; DeMolles 2004; Fox 2012; Hui 2000; Parthasarathy 2012; Roecklein 2010; Stepnowsky 2007; Taylor 2006. In the remainder of the studies, we were not able to assess how this feature of study design was addressed.

Incomplete outcome data

In three studies, data from all participants were collected and analysed (Basoglu 2011; DeMolles 2004; Smith 2006). Only incomplete data were available for the primary outcome for a number of studies: Aloia 2012a; Aloia 2012b; Chervin 1997; Epstein 2000; Fox 2012; Lewis 2006; Meurice 2007a; Meurice 2007b; Meurice 2007c; Meurice 2007d; Olsen 2012; Smith 2009; Sparrow 2010; Parthasarathy 2012; Roecklein 2010; Stepnowsky 2007. For the remaining studies, we could not ascertain how intention-to-treat populations were composed. A high attrition rate was noted in the control group following CPAP titration in Richards 2007, Wang 2011a and Wang 2011b. This may have affected the estimates for average machine usage.

Effects of interventions

See: **Summary of findings for the main comparison** Increased practical support and encouragement for adults with sleep apnoea; **Summary of findings 2** Educational interventions for adults with sleep apnoea; **Summary of findings 3** Behavioural therapy for adults with sleep apnoea who are using CPAP

We rated the quality of evidence for primary and important secondary outcomes for the three comparisons in Summary of findings for the main comparison; Summary of findings 2; and Summary of findings 3.

Primary outcome: machine usage

Mean hours/night

Increased practical support and encouragement during follow-up

Low-quality evidence shows that supportive interventions increased machine usage by about 50 minutes per night (0.82 hours, 95% CI 0.36 to 1.27; Figure 3; Summary of findings for the main comparison). This finding was based on data from 13 studies with 803 participants. This outcome exhibited a moderate to high level of statistical variation (I^2 = 53%) with outlying, discordant study estimates. Differences between our a priori subgroups could not be tested reliably, as gender-specific data were not available (with the exception of Parthasarathy 2012, who recruited male participants only), baseline AHI was above 20 in the trials and only one of the studies recruited prior users of CPAP. Two post hoc sensitivity analyses were undertaken. In the first, we excluded studies in which participants would have been aware that machine usage was monitored. The pooled result favoured intervention more positively by 1.07 hours/night (95% CI 0.61 to 1.52; Analysis 1.2). The second sensitivity analysis excluded trials with an average machine usage equal to or greater than four hours/night in the control group. The magnitude of the intervention effect in the remaining studies was greater (1.36 hours/night, 95% CI 0.96 to 1.76; Analysis 1.3; Figure 4), and the heterogeneity was eliminated (I^2 = 0%).

Figure 3. Forest plot of comparison: 1 Increased psychological and/or practical support during follow-up + CPAP versus usual care + CPAP, outcome: 1.1 Machine usage (hours/night)-first arm/parallel studies.

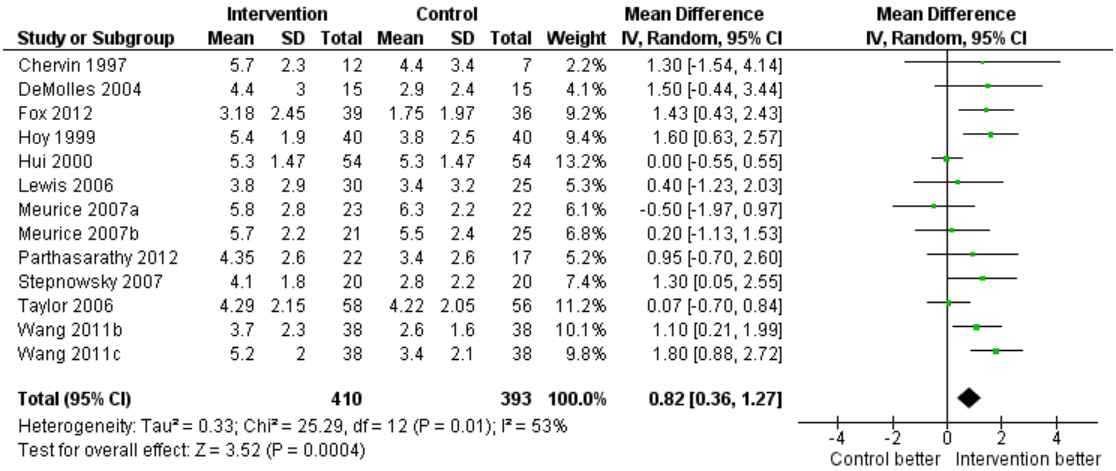
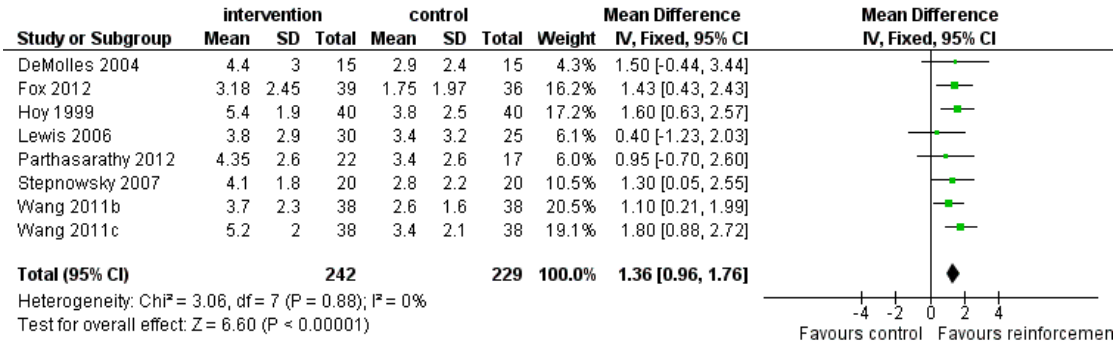
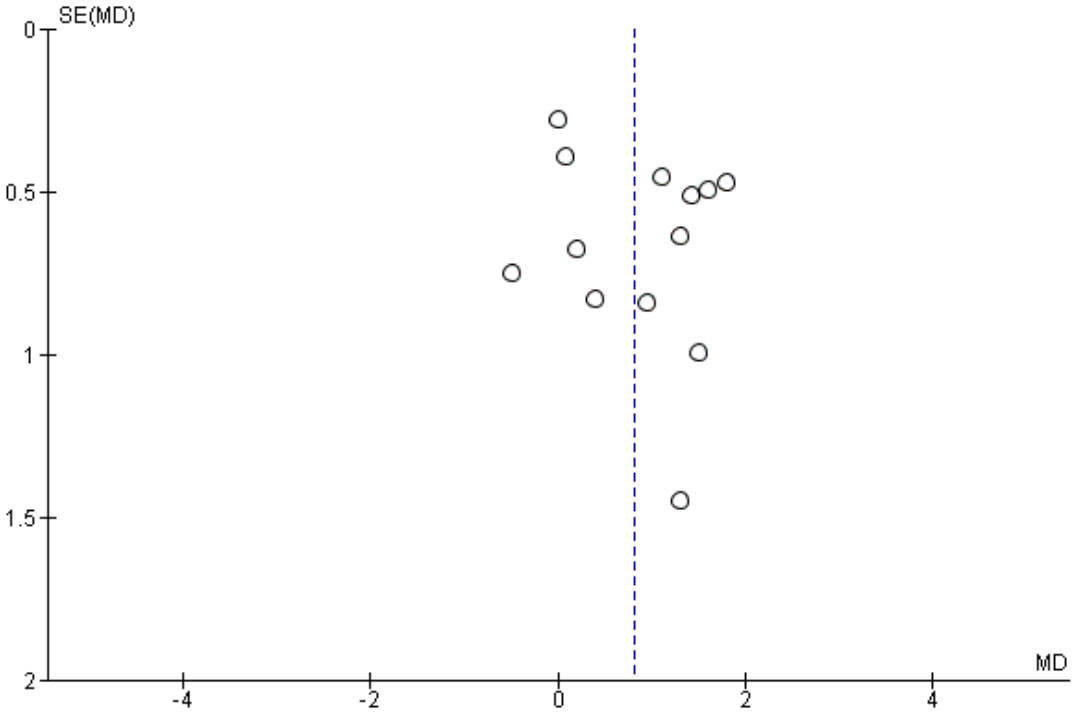


Figure 4. Forest plot of comparison: 1 Increased practical support and encouragement during follow-up + CPAP versus usual care + CPAP, outcome: 1.3 Machine usage, sensitivity analysis: adherence in control group =< four hours/night.



The funnel plot for this outcome indicates some asymmetry, with less precise studies showing a more positive effect than those near the top of the plot (Figure 5). However, because such high levels of statistical variation were noted between the study results, we are unable to conclude that publication bias explains the asymmetry .

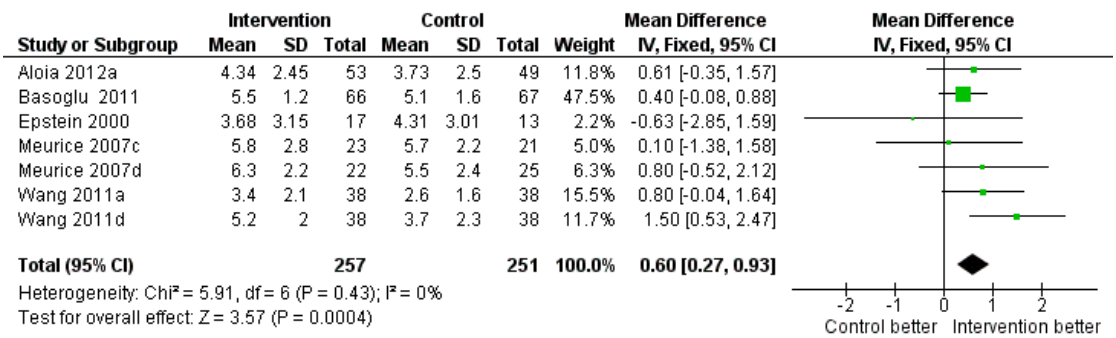
Figure 5. Funnel plot of comparison: 1 Increased practical support and encouragement + CPAP versus usual care + CPAP, outcome: 1.1 Machine usage (hours/night).



Educational interventions

Moderate-quality evidence indicates that educational interventions led to a small increase in average machine use of about 35 minutes per night (0.60 hours, 95% CI 0.27 to 0.93; Analysis 2.1; Summary of findings 2). Seven studies with a total of 503 participants were analysed (Figure 6). No statistical heterogeneity was observed (I^2 = 0%).

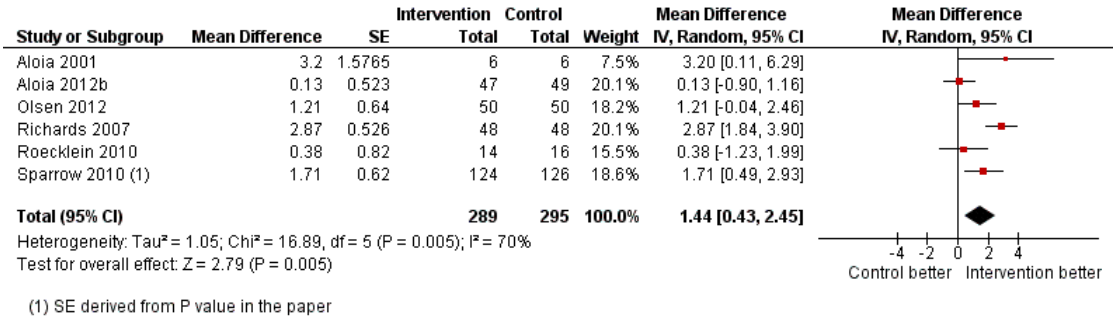
Figure 6. Forest plot of comparison: 2 Educational interventions + CPAP versus usual care + CPAP, outcome: 2.1 Machine usage (hours/night).



Behavioural interventions

Low-quality evidence shows that behavioural interventions increased average hours of CPAP use by 1.44 hours per night (95% CI 0.43 to 2.45; Figure 7; Summary of findings 3). Meta-analysis was based on six studies with a total of 584 participants. Considerable variation in the intervention effect for this outcome was observed between studies (I^2 = 70%). Because sufficient data were lacking, we were not able to conduct the predefined sensitivity analysis. Post hoc subgroup analysis excluding one study, in which participants were aware of machine usage monitoring, favoured the intervention group more strongly (1.54 hours/night, 95% CI 0.99 to 2.09; Analysis 3.2) but has not reduced heterogeneity. In all studies, average machine usage in the control group was less than four hours per night.

Figure 7. Forest plot of comparison: 4 Behavioural therapy + CPAP versus control + CPAP, outcome: 4.1 Machine usage.



The funnel plot indicates slight asymmetry, with only one outlying small study strongly in favour of intervention effect. Larger studies were distributed more symmetrically near the top of the graph. Based on this finding, we could not conclude that publication bias explains the heterogeneity.

Number of participants deemed compliant (average CPAP usage of ≥ four hours/night)

Increased practical support and encouragement during follow-up

Low-quality evidence from four studies indicates that more people were using CPAP for four hours or longer (OR 2.06, 95% CI 1.22 to 3.47; Analysis 1.4; Summary of findings for the main comparison). Based on average control group risk, this translates to an absolute increase from 59 to 75 people per 100.

Educational interventions

Low-quality evidence from three studies shows that a higher proportion of participants adhered to CPAP following short-term educational interventions (OR 1.80, 95% CI 1.1 to 2.95; Analysis 2.2; Summary of findings 2). Based on average control group risk,

this translates to an absolute increase from 57 to 70 people per 100.

Behavioural interventions

Very low-quality evidence suggests that behavioural interventions led to a greater likelihood of participants using CPAP for four hours or longer per night (OR 2.23, 95% CI 1.45 to 3.45; Analysis 3.3; Summary of findings 3). Based on average control group risk, this translates to an absolute increase from 28 to 47 people per 100.

Secondary outcomes

Data were not available for all of the secondary outcomes specified in the protocol. Those with available data are described below.

Symptoms

Only data on Epworth Sleepiness Score (ESS) were available.

Increased practical support and encouragement during follow-up

The estimated effect on symptoms from supportive interventions was small and statistically imprecise (-0.6 points, 95% CI -1.81 to 0.62, eight studies, 501 participants; Analysis 1.5; Summary of findings for the main comparison; very low-quality evidence).

Educational interventions

Moderate-quality evidence showed improved symptoms following educational interventions (-1.17 points, 95% CI -2.07 to -0.26, five studies, 336 participants; Analysis 2.3; Summary of findings 2). However, the magnitude of this difference is of questionable clinical significance.

Behavioural interventions

Low-quality evidence from a single study (Olsen 2012) showed a statistically significant difference between groups (-1.47 points, 95% CI -2.85 to -0.1; Analysis 3.4; Summary of findings 3).

Quality of life

Increased practical support and encouragement during follow-up

Evidence for an effect of increased support on quality of life, as measured by the Functional Outcomes of Sleep Questionnaire (FOSQ) in two small studies, was statistically imprecise (0.98, 95% CI -0.84 to 2.79; Analysis 1.6; Summary of findings for the main comparison).

The Sleep Apnoea Quality of Life Index (SAQLI) was reported by Hui 2000, who found significant differences in favour of augmented support compared with basic support at week 12 of treatment but with a wide confidence interval (MD 12.81, 95% CI 1.50 to 24.12; Analysis 1.7). In addition, this study demonstrated no improvement in CPAP usage, and results should be interpreted with caution.

Educational interventions

Wiese 2005 reported no significant difference between the two groups at four weeks with SAQLI (MD -0.27, 95% CI -0.9 to 0.36; Analysis 2.4).

Behavioural interventions

Olsen 2012 found no significant difference in FOSQ between Motivational Interviewing Therapy and usual care (MD 0.07, 95% CI -0.87 to 1.01; Analysis 3.5).

Mood

Increased practical support and encouragement during follow-up

HAD scale for anxiety: Hoy 1999 assessed this outcome but found no significant difference between treatment and control groups (MD -1.1, 95% CI -2.95 to 0.75; Analysis 1.8).

HAD scale for depression: Pooled data from three trials indicate significant differences in favour of intervention (MD -0.93, 95% CI -1.57 to -0.28; Analysis 1.8).

Educational interventions

HAD scale for depression: The intervention was not superior over the control in improving this outcome in studies by Wang 2011b and Wang 2011d (MD -0.52, 95% CI -1.25 to 0.22; Analysis 2.5).

Withdrawal from the study

Increased practical support and encouragement during follow-up

Participants in the support groups were less likely to withdraw from the studies (OR 0.65, 95% CI 0.44 to 0.97, 12 studies, 903 participants; Analysis 1.9).

Educational interventions

The odds of withdrawal favoured intervention (OR 0.67, 95% CI 0.45 to 0.98, eight studies, 683 participants; Analysis 2.6).

Behavioural interventions

The intervention had no effect on the likelihood of withdrawal (OR 0.85, 95% CI 0.57 to 1.25, five studies, 609 participants; Analysis 3.6).

AHI index

Increased practical support and encouragement during follow-up

This outcome was reported in only two studies, which found no significant differences between the two groups (MD -0.07, 95% CI -1.62 to 1.48; Analysis 1.10).

Maintenance of wakefulness test

Increased practical support and encouragement during follow-up

Hoy 1999 found no difference in objectively measured ability to stay awake between participants in the intervention and control groups (MD 1.50, 95% CI -3.09 to 6.09; Analysis 1.11).

Cardiovascular morbidity/mortality

None reported.

Adverse events

None reported.

ADDITIONAL SUMMARY OF FINDINGS *[Explanation]*

Educational interventions for adults with sleep apnoea

Patient or population: adults with sleep apnoea
Intervention: educational interventions and CPAP
Comparison: CPAP
Settings: community

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	Control	Educational interventions				
Machine usage Hours per night Follow-up: 12 to 24 weeks	Average CPAP machine usage ranged across control groups from **2.6 to 5.7 hours per night**	Mean machine usage in the intervention groups was **0.6 higher** (0.27 to 0.93 higher)		508 (7 studies)	⊕⊕⊕◯ **moderate**[1]	
N deemed adherent (≥4 hours/night) Follow-up: 12 to 24 weeks	**57 per 100**	**71 per 100** (59 to 80)	**OR 1.8** (1.09 to 2.95)	285 (3 studies)	⊕⊕◯◯ **low**[1,2]	
Symptoms of sleepiness Epworth Scale: 0 to 24 Follow-up: median 12 weeks	Mean Epworth Sleepiness Scale scores across control groups ranged from **5.4 to 10.8**	Mean Epworth Sleepiness Scale scores in the intervention groups was **1.17 lower** (2.07 to 0.26 lower)		336 (5 studies)	⊕⊕⊕◯ **moderate**[1]	
Quality of life: Sleep Apnoea Quality of Life Index (SAQLI) Follow-up: 4 weeks	See comment	See comment	Not estimable	89 (1 study)	⊕◯◯◯ **very low**[1,3]	Single study estimate

Withdrawal Follow-up: 4 to 24 weeks	**24 per 100**	**18 per 100** (13 to 24)	**OR 0.67** (0.45 to 0.98)	683 (8 studies)	⊕⊕◯◯ **low**[1,4]

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
CI: Confidence interval; **OR:** Odds ratio.

GRADE Working Group grades of evidence.
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1]Risk of bias (-1): In the absence of blinding across studies, effect estimates may be biased because of performance bias.
[2]Imprecision (-1): We downgraded because of the low number of participants in the analysis, in spite of the statistically significant increase in the number of participants deemed compliant.
[3]Imprecision (-2): In view of the very low number of participants and the wide confidence intervals, we downgraded by two points.
[4]Inconsistency (-1): The direction and magnitude of effect varied across studies.

Behavioural therapy for adults with sleep apnoea who are using CPAP

Patient or population: adults with sleep apnoea
Intervention: behavioural therapy and CPAP
Comparison: CPAP
Settings: community

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	Control	Behavioural therapy				
Machine usage Hours per night	See comment	Average machine usage in the intervention groups was **1.44 higher** (0.43 to 2.45 higher)		584 (6 studies)	⊕⊕◯◯ **low**[1,2]	Data analysed as generic inverse variance
N deemed adherent (≥4 hours/night) Follow-up: four to 52 weeks	**28 per 100**	**47 per 100** (36 to 58)	**OR 2.23** (1.45 to 3.45)	358 (3 studies)	⊕◯◯◯ **very low**[1,3]	
Symptoms Epworth scores	See comment	See comment		100 (1 study)	⊕⊕◯◯ **low**[1,4]	Single study estimate
Quality of life Functional Outcomes of Sleep Questionnaire	See comment	See comment		100 (1 study)	⊕⊕◯◯ **low**[1,4]	Single study estimate
Withdrawal Follow-up: 4 to 52 weeks	**23 per 100**	**20 per 100** (15 to 27)	**OR 0.85** (0.57 to 1.25)	609 (5 studies)	⊕◯◯◯ **very low**[1,2,5]	

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
CI: Confidence interval; **OR:** Odds ratio.

GRADE Working Group grades of evidence.
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1]Risk of bias (-1): In the absence of blinding across studies, effect estimates may be biased because of performance bias.
[2]Inconsistency (-1): Variation was seen in the magnitude and direction of effect across studies.
[3]Inconsistency (-2): Very substantial variation was seen between direction and results of studies.
[4]Imprecision (-1): Low number of participants contribute data to this outcome.
[5]Imprecision (-1): Confidence intervals were compatible with reduction and increase in likelihood of study withdrawal.

DISCUSSION

Summary of main results

This review identified 30 studies assessing supportive, educational and behavioural strategies for improving CPAP use in 2047 adults with OSA. We found that all three types of interventions had a positive impact on increasing average machine usage and the number of participants compliant with treatment over a limited time. The vast majority of participants suffered from moderate to severe disease and were symptomatic. We found that behavioural interventions delivered through various techniques resulted in the largest improvement in average hours of CPAP use. Ongoing support and intensive follow-up were also superior over standard care. Educational interventions at the outset produced modest but still statistically significant improvement in average machine usage.

Overall completeness and applicability of evidence

Duration of studies and follow-up varied from one to 12 months. Considerable differences in the median duration of studies were noted between the three groups: intensive support group 3.0 ± 4.0 months, educational group 6.0 ± 4.7 months and behavioural group 8.0 ± 5.4 months. The distribution of study duration within each group did not allow subgroup analysis. Therefore, we were not able to establish which interventions are likely to offer a durable effect and perform better over longer periods. This unanswered question is relevant to clinical practice, particularly when the cost-effectiveness of these interventions is considered.

It is plausible that interventions directed toward improving CPAP usage are less effective beyond a certain level of preexisting compliance. This is given some support by our post hoc sensitivity analysis based on control group machine usage. Removing studies in which average CPAP machine usage was high in control groups (mean of four hours or longer/night) nearly doubled the pooled effect estimate, indicating that people with very low compliance benefit most from the intervention. Although this analysis was selected post hoc, further supportive evidence for this hypothesis comes from the most successful behavioural interventions, for which in all control groups, average machine usage was less than four hours/night, although not all trials demonstrated benefit of the intervention. The same is true for two studies that drive positive results in the short-term educational group (Aloia 2012a; Wang 2011a).

Timing of intervention appears important, particularly for behavioural therapy, in which initial acceptance of CPAP is a promising target. Richards 2007 and Olsen 2012 applied intervention before CPAP initiation and demonstrated significant reduction in the proportion of participants refusing CPAP titration, whereas Aloia 2012b employed Motivational Enhancement Therapy one week after CPAP titration and showed no overall benefit of the intervention. Given that patterns of long-term CPAP compliance are usually developed during the first week of treatment (Aloia 2007), early intervention may be critical. It is unclear whether the same applies to educational interventions, although similar to psychological and health belief variables, knowledge is recognised as essential for effective health behaviours (Bandura 2004).

Most of the participants had high levels of sleep disturbance at baseline, exhibited symptoms of sleepiness and were new to CPAP therapy. Given the known impact of CPAP in correcting AHI and improving daytime sleepiness (Giles 2006), these characteristics could have predisposed the trial populations to perceive benefit from early stages of CPAP independently of the intervention (Pelletier 2001; Wells 2007; Zozula 2001). Only three studies included people who had used CPAP previously; therefore it would be of particular interest to see whether studies of supportive and educational interventions influence machine usage to a similar degree in prior CPAP users.

Hoy 1999 and Richards 2007 included partners of those with OSA in the intervention. Hoy 1999 reported self-referral as a predictor of successful continuation with treatment compared with participants who had been prompted to seek health care. It is feasible that self-referral correlates with a sense of motivation and control over health status and is predictive of uptake of and continuation with treatment (Wild 2004). Findings from observational research suggest a link between outcomes of treatment in people with sleep apnoea and their bed partners (Parish 2003; Weaver 2003). Future interventional research could explore more fully the effect of bed partner involvement on long-term CPAP adherence when this is relevant.

It seems evident that better adherence must be a favourable outcome, but the evidence base for improved health status as a consequence of increased hours of CPAP use is slight (Stepnowsky 2002). Recent observational data supporting this have come from a cohort of participants for whom high usage of CPAP accompanied improvement in symptoms (Weaver 2007). Although all three interventions assessed in our review led to better usage of CPAP machines, the amount of evidence for associated improvements in symptoms and quality of life is slight, and measuring these outcomes is a priority for future trials.

There remains a need to assess the impact of intervention on long-term outcome, in particular for patients whose disease is sufficiently severe to warrant intervention but who struggle to persist with positive airways pressure for a number of reasons. Qualitative research may assist in identifying common reasons for not persisting with CPAP, such as technical problems (discomfort, air leakage and mask interface; Schiefelbein 2005). Such studies are required to enable better understanding of the mechanisms associated with non-adherence, to elucidate the relationship between initial motivation and ongoing perception of benefit and to equip interventional researchers with the means to better determine whether targeting psychological and technical aspects of ongoing CPAP usage modifies long-term morbidity. The multidimensional nature of

CPAP adherence implies that one type of intervention is unlikely to suit all patients, and a personalised approach based on a patient's characteristic and identifiable factors predictive of compliance may be required. Factors that are both predictive and modifiable represent an appealing target. With this knowledge and with the goal of providing the most cost-effective treatment, subgroups of non-adherent patients could be targeted right at the outset of CPAP therapy.

Quality of the evidence

Several issues affect the reliability of our findings and their applicability to the general OSA population. We downgraded the evidence primarily for risk of bias and inconsistency across the summary of findings tables (Summary of findings for the main comparison; Summary of findings 2; Summary of findings 3). Performance bias due to lack of blinding is likely, given the nature of the interventions or the subjective nature of the outcomes of interest. This is likely to affect all the studies in this review; therefore quantifying the effect of this is not possible. Although we could partially explain the inconsistency of individual study results by performing a sensitivity analysis for the primary outcome under intensive support, this is not the case for behavioural interventions. Across all three groups, statistical variation between the results of studies may be attributable to one or more plausible causes, including different populations recruited, variation in the intensity and modalities of interventions provided or differences in the timing of interventions. Treatment fidelity, which can be defined as strategies that monitor and enhance the accuracy and consistency of an intervention provided, is of particular importance in behavioural studies. Assessment of treatment fidelity is required to ensure validity of study outcomes. Only Aloia 2012b and Olsen 2012 implemented treatment fidelity checks, and the lack of them in other studies is a potential source of inconsistency between studies. The quality of evidence for daytime sleepiness and quality of life outcomes was weakened by the size and the low number of studies that addressed this outcome.

Potential biases in the review process

Two potential sources of bias have been identified in our review process. First, the categorisation of studies in this review is based on the core attributes of the intervention and how it differed from the control group (the 'net' intervention). It is possible that our classification of studies by intervention type is itself a crude means of differentiating between the interventions. Furthermore, studies that incorporated attributes of more than one intervention type were arbitrarily categorised on the basis of the dominant intervention (Table 2). We did not assess how 'active' components of control interventions may have confounded the results of some of the studies. Many of the control group interventions in the included studies attempted to inform participants about OSA and the importance of treatment through written materials, videos or sessions with specialist staff. However, what constitutes usual care varied between treatment centres. Indeed the control groups of Hoy 1999 and Hui 2000 received education and support at least equivalent to that received by the intervention group in Chervin 1997. Some studies attempted to balance contact with participants between intervention and control groups or to provide 'placebo' in the control arms. In other studies, given the nature of the interventions, this was not practical. We did not consider how the differences in attention received by participants in individual studies may have impacted the outcomes. We assigned the treatment arms of Meurice 2007a, Meurice 2007c, Wang 2011c and Wang 2011d as control groups when it could be argued that they were assessed as providing different intensities of active follow-up. The varied intensity of the background or control intervention, in addition to the 'net intervention' within the studies (which included different ways of supporting study participants, such as regular telephone contact, telemedicine and intensive clinic review), could have influenced effect sizes in our analyses. Second, as noted above, low and high compliance levels in the study control arms were not defined a priori, and the post hoc definition of this study characteristic may be spurious.

Agreements and disagreements with other studies or reviews

To our knowledge, no other published reviews that meet the standard criteria of a systematic review have investigated the role of educational, supportive or behavioural interventions in improving adherence to CPAP.

AUTHORS' CONCLUSIONS

Implications for practice

In CPAP-naive people with severe sleep apnoea, low-quality evidence indicates that supportive interventions that encourage people to continue to use their CPAP machines increase usage compared with usual care. Moderate-quality evidence shows that a short-term educational intervention results in a modest increase in CPAP usage. Low-quality evidence suggests that behavioural therapy leads to a large increase in CPAP machine usage. The impact of improved CPAP usage on daytime sleepiness, quality of life and long-term cardiovascular risk remains unclear. Risk of bias due to lack of blinding and variation in the size and direction of effect of the studies included introduce some uncertainty over the size of the difference that might be anticipated in practice for CPAP machine usage outcomes. An additional limitation for daytime sleepiness and quality of life measures was imprecision. It is unclear which intervention is best suited for individual patients.

Implications for research

The evidence assembled in this review provides a useful framework for additional work. Investigators should bear in mind the following considerations in drawing up further studies of these interventions to address uncertainties.

- Results of our post hoc analysis indicate that further research to determine who would benefit most from these interventions is warranted. Recruitment of prior CPAP users, especially those who have not successfully persisted with treatment, is important.

- Patients with milder sleep apnoea should be recruited because they may be less likely to persist with treatment if they do not perceive symptomatic benefit.

- Reasons why participants leave studies should be recorded to obtain information on whether educational and behavioural interventions modify perception of benefit or the balance of benefit and side effects.

- How missing values have been incorporated into statistical analyses should be explicitly described to enable testing of the sensitivity of effect estimates through different approaches to adjust for the missing data.

- Validated instruments have been developed for assessing quality of life and symptoms in people with sleep apnoea. Trialists should consider using these measurements to explore whether improved adherence affects these outcomes.

- Long-term assessment should examine efficacy and whether these interventions lead to improvement in other important aspects of the management of this condition, such as sustained symptomatic benefit and improvement in quality of life, economic outcomes (e.g. return to work) and cardiovascular outcomes.

- Involvement of bed partners would help us to understand what role they may play in improving the use and long-term uptake of CPAP.

- It remains uncertain what intensity of intervention is required to effect behavioural change. Studies with educational and behavioural interventions of varying levels of intensity would be helpful in elaborating this area further. Also head-to-head comparisons of different educational approaches are needed.

- Cost-effectiveness research would help to establish how resources can best be allocated in implementing these interventions.

- Personalised interventions should be assessed on the basis of a participant's characteristics and factors predictive of compliance.

- Treatment fidelity should be measured in studies incorporating behavioural interventions to ensure the validity of treatment outcomes.

- Future systematic reviews could usefully consider the validity of intervention classes along the lines identified in this review.

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* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Aloia 2001

Methods	Randomised parallel-group trial. All randomly assigned participants accounted for
Participants	N = 12 Mean age: 65.5, AHI: 43.5, Desaturation: 77.05 ± 9.47 Inclusion criteria: > 55 years of age, RDI (AHI): > 10, Mini Mental Status Examination: > 25 Exclusion criteria: other ICSD, other treatment for apnoea, claustrophobia Participants had received prior treatment with CPAP
Interventions	*Intervention* Two sessions. Session 1: review of participants' sleep data; symptoms; review of performance of cognitive tests; review of importance of treatment; review of PSG and CPAP; discussion of advantages and disadvantages of treatment; development of goals for therapy. Session 2: examination of compliance data for week one; discussion of noticeable changes with treatment; discussion of changes not apparent (hypertension/cardiac problems); troubleshooting discomfort; discussion of realistic aims of treatment; review of treatment goals *Control* Two sessions: general discussion of sleep architecture and opinions on sleep clinic Study duration: 12 weeks
Outcomes	• Machine usage • Number of participants who were 'compliant' (> six hours per night of usage) • Vigilance testing
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomisation by 'urns', stratification by age, RDI, nadir O_2 pretreatment, vigilance
Allocation concealment (selection bias)	Unclear risk	Information not available
Blinding (performance bias and detection bias) All outcomes	High risk	Not done for treatment group assignment 'None of the subjects were told that their CPAP machines were measuring their compliance via internal microprocessors'
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Information not available

Aloia 2012a

Methods	Randomised parallel-group study
Participants	N = 154 Intervention group: Age: 47.0, Male sex: 48%, AHI: 46.1, ESS: 12.6, BMI: 35 Control group: Age: 52, Male sex: 57%, AHI: 48.2, ESS: 11.9, BMI: 35.8 Inclusion criteria: new diagnosis of moderate to severe OSA by full in-lab polysomnography, naive to CPAP Exclusion criteria: diagnosis by split night polysomnography, severe neurological or unstable psychiatric illness, congestive heart failure, end-stage renal disease
Interventions	*Intervention* Two 45-minute face-to-face education sessions delivered by a trained nurse one and two weeks after initiation of PAP treatment. One additional booster phone call at week three Education comprised pathophysiology, medical and behavioural consequences of OSA and benefits of treatment *Control* Standard care consisting of physician discussing the benefits of treatment before and after diagnosis. Regular follow-up visits with physicians, usually eight to 10 weeks after PAP initiation Study duration: 52 weeks
Outcomes	• Machine usage (hours/night) • Withdrawals • Decisional balance • Self-efficacy
Notes	The study comprised three treatment arms. We consider the effects of the two treatment arms and the one control arms as separate studies. Interventions were initiated one week after initiation of CPAP Unpublished study. Currently under review for publication

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Participants were urn randomly assigned in a 1:1 ratio
Allocation concealment (selection bias)	Unclear risk	No sufficient information provided
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Participants, physicians and other healthcare providers were blinded to whether participants were enrolled in the study. Research staff who downloaded adherence data were blinded to group membership. Participants were informed that machine would be accessed periodically to determine 'how the device was working at night'. Given the nature of the intervention, it is unlikely that true blinding of participants was achieved. Furthermore, the

Aloia 2012a (*Continued*)

		same nurse delivered two different interventions in the study arms
Incomplete outcome data (attrition bias) All outcomes	High risk	27 of 80 participants in intervention group and 25 of 74 participants in control group dropped out from the study. Non-completers were not included in outcome analysis

Aloia 2012b

Methods	Randomised parallel-group study
Participants	N = 147 Intervention group: Age: 52, Male sex: 45%, AHI: 45.7, ESS: 11.6, BMI: 35 Control group: Age: 52, Male sex: 57%, AHI: 48.2, ESS: 11.9, BMI: 35.8 Inclusion criteria: new diagnosis of moderate to severe OSA by full in-lab polysomnography, naive to CPAP Exclusion criteria: diagnosis by split night polysomnography, severe neurological or unstable psychiatric illness, congestive heart failure, end-stage renal disease
Interventions	*Intervention* Two 45-minute face-to-face Motivational Enhancement Therapy (MET) sessions delivered by a trained nurse one and two weeks after initiation of PAP treatment. One additional booster phone call at week three. MET consisted of individually tailored counselling focused on addressing ambivalence regarding consistent use of PAP, participant-specific information on OSA, symptom change, treatment expectations, goal development and refinement and enhancing participant's motivation *Control* Standard care involved the physician discussing the benefits of treatment before and after diagnosis. Regular follow-up visits with physicians, usually eight to 10 weeks after PAP initiation Study duration: 52 weeks
Outcomes	• Machine usage (hours/night) • Withdrawals • Decisional balance • Self-efficacy
Notes	The study comprised three treatment arms. We consider the effects of the two treatment arms and the one control arm as separate studies. Interventions were initiated one week after initiation of CPAP Unpublished study. Currently under review for publication

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**

Aloia 2012b (*Continued*)

Random sequence generation (selection bias)	Low risk	Participants were urn randomly assigned in a 1:1 ratio
Allocation concealment (selection bias)	Unclear risk	No sufficient information provided
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Participants, physicians and other healthcare providers were blinded to whether participants were enrolled in the study. Research staff who downloaded adherence data were blinded to group membership. Participants were informed that machine would be accessed periodically to determine 'how the device was working at night'. Given the nature of the intervention, it is unlikely that blinding of participants was achieved. Furthermore, the same nurse delivered two different interventions in the study arms
Incomplete outcome data (attrition bias) All outcomes	High risk	26 of 73 participants in intervention group and 25 of 74 participants in control group dropped out from the study. Non-completers were not included in outcome analysis

Basoglu 2011

Methods	Randomised, parallel-group study
Participants	N = 133 Intervention group: Age: 53.7, Male sex: 82%, AHI 61, ESS: 10.3, BMI: 33.2 Control group: Age: 54, Male sex: 70%, AHI: 57.4, ESS: 12.4, BMI: 33 Inclusion criteria: newly diagnosed, moderate to severe OSA, CPAP naive Exclusion criteria: use of sedatives, drug abuse, cardiac co-morbidities, COPD, other sleep disorders
Interventions	*Intervention* 10-Minute videotape on OSA, its consequences and CPAP therapy. In addition, routine information on diagnosis and treatment of OSA given by physician *Control* Standard information on OSA and CPAP therapy given by the same physician Study duration: 24 weeks
Outcomes	• N of adherent participants (CPAP use for at least four hours/night for at least 70% of nights) • CPAP usage per night • ESS • Factors predicting CPAP adherence
Notes	Unpublished information on study design and outcomes obtained from study authors

Basoglu 2011 (*Continued*)

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Randomisation by a set of numbers prepared and randomly assigned by a clinician not involved in the study
Allocation concealment (selection bias)	Low risk	Randomisation by a third party
Blinding (performance bias and detection bias) All outcomes	Unclear risk	The primary investigator and the statistician were blinded to the study group assignment. Participants were aware of machine usage monitoring. Given the nature of the intervention, it is unlikely that participant blinding was achieved
Incomplete outcome data (attrition bias) All outcomes	Low risk	All participants completed the study, and no data were missing

Chervin 1997

Methods	Randomised parallel-group trial
Participants	N = 40 Mean age: 51.7, Mean AHI: 49.4, ESS: 10.9 ± 5.1, Lowest 02, Sat: 75.6% ± 14.4, MSLT: 6 ± 3.9 Recruited from clinic
Interventions	*Intervention I* Telephone call each week during trial (max trial time of two months) *Intervention II* Two printed documents *Control* No additional support Study duration: eight weeks
Outcomes	• Machine usage
Notes	Two of 33 used Bi-PAP. Both CPAP-naive users and those who had been on CPAP before trial were studied. Reading done at enrolment and at between 1 to 2 months after enrolment Difference in AHI between active and control groups at baseline

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**

Chervin 1997 (*Continued*)

Random sequence generation (selection bias)	Low risk	Random numbers table
Allocation concealment (selection bias)	Unclear risk	Information not available
Blinding (performance bias and detection bias) All outcomes	High risk	Not done for treatment group assignment Participants' readout of CPAP machine usage data during telephone call to clinic
Incomplete outcome data (attrition bias) All outcomes	High risk	Non-completers excluded from analysis

DeMolles 2004

Methods	Randomised parallel-group study. Methods of randomisation not reported
Participants	N = 30 Mean age: 46, BMI: 38, AHI: 40, Functional Outcomes of Sleep Questionnaire: TLC: 15.3, Control: 13.8 Inclusion criteria: participants starting nasal CPAP therapy; > 18 years; English-speaking; > 15 episodes of apnoea or hypopnoea/h Exclusion criteria: not described
Interventions	Telephone-linked communications technology (TLC) versus usual care. TLC consisted of a computerised digitised human speech programme. TLC asks questions designed to elicit information from participant regarding adherence, education and reinforcement Study duration: eight weeks
Outcomes	• Machine usage • Sleep symptoms • Functional outcomes of sleep questionnaire • Number of calls per participant
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Described as randomised; other information not available
Allocation concealment (selection bias)	Unclear risk	Information not available
Blinding (performance bias and detection bias) All outcomes	High risk	Participants aware of treatment group assignment Intervention involved communication regarding participant's CPAP machine usage

DeMolles 2004 (*Continued*)

Incomplete outcome data (attrition bias) All outcomes	Low risk	All completed

Epstein 2000

Methods	Randomised, parallel-group study
Participants	N = 50 No baseline characteristics were reported. Participants recruited after diagnosis of OSA confirmed with polysomnography and before initiation with CPAP treatment. No information on withdrawals were reported Inclusion criteria: not specified
Interventions	Education course aim at desensitisation versus standard physician follow-up Study duration: 24 weeks
Outcomes	• Machine usage
Notes	Unpublished abstract

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Described as randomised; information not available
Allocation concealment (selection bias)	Unclear risk	Information not available
Blinding (performance bias and detection bias) All outcomes	High risk	No blinding undertaken Not enough information available to ascertain awareness of CPAP machine usage
Incomplete outcome data (attrition bias) All outcomes	High risk	Non-completers excluded

Fox 2012

Methods	Randomised parallel-group study
Participants	N = 75 Mean age: 53.5, Mean AHI: 41.6, ESS: Control group: 9.7, Intervention group: 9.9 Inclusion criteria: adult (≥ 19 years), moderate to severe OSA (AHI ≥ 15) Exclusion criteria: active cardiopulmonary or psychiatric disease, previously treated for OSA, no access to telephone line in bedroom, not able to return for follow-up

Fox 2012 (*Continued*)

Interventions	*Intervention* Physiological data (PAP adherence, applied PAP, mask leak, residual respiratory events) were downloaded using modem attached to the PAP device and sent across the telephone line each morning. Downloaded information was reviewed every weekday except holidays by the research coordinator, who contacted the participant if poor compliance or other problems with treatment (e.g. mask leak) were detected. Participants were advised over the phone or visited the PAP coordinator. Standard care identical to control group *Control* 20-Minute orientation to PAP session and mask fitting. Participants contacted after two days to check adherence and to troubleshoot problems, followed up at four to six weeks and at three months; each time, physiological data downloaded from machines and any problems with treatment addressed. In addition, data downloaded at eight weeks Study duration: 12 weeks
Outcomes	• Machine usage (minutes per day) • Adherence on nights PAP used • % days PAP used • Decrease in ESS • AHI on treatment • Length of time spent with participants • Overall sleep quality and side effects measured by visual analogue scales
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	'...sequential numbered envelopes'
Allocation concealment (selection bias)	Unclear risk	envelopes were prepared by one of the study investigators
Blinding (performance bias and detection bias) All outcomes	High risk	No blinding undertaken Intervention involved communication regarding participant's CPAP machine usage
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	'intention to treat approach', high discontinuation rate (control group: 10/36, telemedicine group: 11/39)

Hoy 1999

Methods	Randomised, parallel study. Method of randomisation not reported. ITT
Participants	N = 80 78:2 (M:F), Mean age: 51, Mean AHI: 58, ESS: 13 Inclusion criteria: AHI $\geq$ 15, plus daytime sleepiness or two other major symptoms of the syndrome; resident within 50 miles of Edinburgh Exclusion criteria: prior use of CPAP; coexisting COPD, asthma or neurological problems
Interventions	*Intervention* Full explanation of need for and benefits of CPAP by sleep physician, 20-minute video education programme, given mask to try for 20 minutes, titration of CPAP pressure overnight with following day discharge, nurses telephoned on days two and 21, reviewed in hospital at one, three and six months. Initial education at home with partner, two extra nights in hospital, sleep nurses' home visits to participant and partner at seven, 14 and 28 days and four months after starting CPAP *Control* Full explanation of need for and benefits of CPAP by sleep physician, 20-minute video education programme, given mask to try for 20 minutes, titration of CPAP pressure overnight with following day discharge, nurses telephoned on days two and 21, reviewed in hospital at one, three and six months Duration: 24 weeks
Outcomes	• Machine usage (hours/night) at six/12 • Cognitive function • Simple unprepared reaction time • Quality of life • Symptom score (in-house questionnaire) • Mood • Sleep factors • Epworth Sleepiness Scale score • Maintenance of Wakefulness Test
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Each participant was randomly assigned with predetermined balanced blocks generated by tossing a coin
Allocation concealment (selection bias)	Unclear risk	Information not available
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Single-blind: 'Patients were blinded to the group to which they were allocated' Not enough information available to ascertain awareness of CPAP machine usage

Hoy 1999 (*Continued*)

Incomplete outcome data (attrition bias) All outcomes	Unclear risk	'Data were analysed on an intention-to-treat basis'

Hui 2000

Methods	Randomised, parallel-group study
Participants	N = 108 Mean age: 45, Mean AHI: 48, All participants newly diagnosed with OSA Inclusion criteria: diagnosis of OSA (AHI > 10 and subjective daytime sleepiness)
Interventions	*Intervention* 10-Minute CPAP education programme by respiratory nurse, brochure on OSA and CPAP treatment in Chinese, short trial CPAP therapy with comfortable mask for 30 minutes, CPAP titration on second night of study by AutoSet, nursing support following day, follow-up by nursing staff and physician at 1 and 3 months. Locally produced 15-minute videotape, additional nurse led 15-minute educational session, review by physicians at weeks one and two, respiratory nurse telephone call on days one and two, weeks one, two, four, eight and 12 *Control* 10-Minute CPAP education programme by respiratory nurse, brochure on OSA and CPAP treatment in Chinese, short trial CPAP therapy with comfortable mask for 30 minutes, CPAP titration on second night of study by AutoSet, nursing support following day, follow-up by nursing staff and physician at 1 and 3 months Study duration: 12 weeks
Outcomes	• Mean pressure required • Machine usage (objective and participant reported) • At least four hours of CPAP use/night for at least 70% of nights/wk) • Quality of life • ESS • SAQLI • Cognitive function
Notes	91 participants had to purchase or rent their machines. 17 participants (10 in AS group and seven in BS group) qualified for state support

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Described as randomised; other information not available
Allocation concealment (selection bias)	Unclear risk	Information not available

Hui 2000 (*Continued*)

Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not specified. Participants provided subjective CPAP machine usage data
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Data were analysed on an intention-to-treat basis

Lewis 2006

Methods	Prospective, single-blinded interventional study
Participants	N = 72 M/F: 62/10, Mean age: 51.4, Mean AHI control group: 42, All participants newly diagnosed with OSA Inclusion criteria: diagnosis of OSA (based on home sleep study) and subjective daytime sleepiness
Interventions	*Intervention* 20-Minute educational video about SAHS. Telephone interview by research assistant between days two and five after CPAP issued to identify early problems and advise. Extra appointment to see sleep physician within seven to 14 days after being issued CPAP. Further appointment with sleep physician at one, six and 12 months *Control* Participants provided telephone number for support within office hours. Sleep physician reviewed participants at one, six and 12 months Study duration: 52 weeks
Outcomes	• Machine usage • Withdrawal • Side effects • Satisfactions
Notes	Only 20/36 participants in the intervention group watched the educational video tape Eight of the 17 defaulters returned machines at different times of the year and had negligible hours of use

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Randomly assigned using block tables
Allocation concealment (selection bias)	Low risk	'The sequence of group assignment was indeed concealed from the investigators undergoing the screening and assessments, especially those recording/analysing machine hours'

Lewis 2006 (*Continued*)

Blinding (performance bias and detection bias) All outcomes	Unclear risk	Single-blinded: participant unaware of what 'intensive' or standard support comprised 'The CPAP clock-timers were hidden with a plastic strip. Patients were not informed about the timers, and all covers were intact at each review; both patients and those recording clock-timers were unaware of group allocation'
Incomplete outcome data (attrition bias) All outcomes	High risk	Non-completers not included in analysis of usage data

Meurice 2007a

Methods	Randomised parallel-group trial
Participants	N = 57 Mean age: 58, Mean AHI: 58 Inclusion criteria: AHI > 30, no prior treatment for OSA
Interventions	*Intervention* Reinforced education by the homecare team: home visit by technician at installation and further visits for explanation at one week, one month and two and three months of treatment for repetition of education and problem solving Reinforced education by prescriber: written material on CPAP use; explanation of OSA and CPAP with side effects; emphasis on importance of compliance with CPAP and detailed demonstration *Control* Standard education by the homecare network. Homecare visit to supply the CPAP machine, fit the mask and explain the technique of using the apparatus. CPAP mechanism and method of using the machine and mask were explained. Participant was encouraged to ask questions and could phone at any time to resolve problems Reinforced education by prescriber: written material on CPAP use; explanation of OSA and CPAP with side effects; emphasis on importance of compliance with CPAP and detailed demonstration Study duration: follow-up to 52 weeks (intervention administered at outset of study). Data extracted at three months: 'During the remaining 9 months following the initial study design, there was no specific follow-up protocol and patients benefited from the standard homecare surveillance recommended in the ANTADIR network, with a review every 3 months'
Outcomes	• Machine usage • ESS • Quality of life (SF-36) • Withdrawals

Meurice 2007a (*Continued*)

Notes	The study comprised four arms. We created four intervention/control comparisons and considered the effects of each as a separate study	
Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Described as randomised; other information not available
Allocation concealment (selection bias)	Unclear risk	Information not available
Blinding (performance bias and detection bias) All outcomes	High risk	Not done
Incomplete outcome data (attrition bias) All outcomes	High risk	'One hundred thirty-three patients were initially scheduled. However, complete initial data were obtained in only 112 patients who were definitively included in the study'

Meurice 2007b

Methods	Randomised parallel-group trial
Participants	N = 55 Mean age: 58, Mean AHI: 58 Inclusion criteria: AHI > 30, no prior treatment for OSA
Interventions	*Intervention* Reinforced education by the homecare team: home visit by technician at installation and further visits for explanation at one week, one month and two and three months of treatment for repetition of education and problem solving Standard education by the prescriber *Control* Standard education by the homecare network. Homecare visit to supply the CPAP machine, fit the mask and explain the technique of using the apparatus. CPAP mechanism and method of using the machine and mask were explained. Participant was encouraged to ask questions and could phone at any time to resolve problems Standard education by the prescriber Study duration: follow-up to 52 weeks (intervention administered at outset of study). Data extracted at three months: 'During the remaining 9 months following the initial study design, there was no specific follow-up protocol and patients benefited from the standard homecare surveillance recommended in the ANTADIR network, with a review every 3 months'

Meurice 2007b (*Continued*)

Outcomes	• Machine usage • ESS • Quality of life (SF-36) • Withdrawals
Notes	The study comprised four arms. We created four intervention/control comparisons and considered the effects of each as a separate study

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Described as randomised; other information not available
Allocation concealment (selection bias)	Unclear risk	Information not available
Blinding (performance bias and detection bias) All outcomes	High risk	Not done
Incomplete outcome data (attrition bias) All outcomes	High risk	'One hundred thirty-three patients were initially scheduled. However, complete initial data were obtained in only 112 patients who were definitively included in the study'

Meurice 2007c

Methods	Randomised parallel-group trial
Participants	N = 55 Mean age: 58, Mean AHI: 58 Inclusion criteria: AHI > 30, no prior treatment for OSA
Interventions	*Intervention* Reinforced education by the homecare team: home visit by technician at installation and further visits for explanation at one week, one month and two and three months of treatment for repetition of education and problem solving Reinforced education by prescriber: written material on CPAP use; explanation of OSA and CPAP with side effects; emphasis on importance of compliance with CPAP and detailed demonstration *Control* Reinforced education by the homecare team: home visit by technician at installation and further visits for explanation at one week, one month and two and three months of treatment for repetition of education and problem solving Standard education by the prescriber Study duration: follow-up to 12 months (intervention administered at outset of study) . Data extracted at three months: 'During the remaining 9 months following the initial

Meurice 2007c (*Continued*)

	study design, there was no specific follow-up protocol and patients benefited from the standard homecare surveillance recommended in the ANTADIR network, with a review every 3 months'
Outcomes	• Machine usage • ESS • Quality of life (SF-36) • Withdrawals
Notes	The study comprised four arms. We created four intervention/control comparisons and considered the effects of each as a separate study

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Described as randomised; other information not available
Allocation concealment (selection bias)	Unclear risk	Information not available
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not done
Incomplete outcome data (attrition bias) All outcomes	High risk	'One hundred thirty-three patients were initially scheduled. However, complete initial data were obtained in only 112 patients who were definitively included in the study'

Meurice 2007d

Methods	Randomised parallel-group trial
Participants	N = 57 Mean age: 58, Mean AHI: 58 Inclusion criteria: AHI > 30, no prior treatment for OSA
Interventions	*Intervention* Standard education by the homecare network. Homecare visit to supply the CPAP machine, fit the mask and explain the technique of using the apparatus. CPAP mechanism and method of using the machine and mask were explained. Participant was encouraged to ask questions and could phone at any time to resolve problems Reinforced education by prescriber: written material on CPAP use; explanation of OSA and CPAP with side effects; emphasis on importance of compliance with CPAP and detailed demonstration *Control* Standard education by the homecare network. Homecare visit to supply the CPAP

Meurice 2007d (*Continued*)

	machine, fit the mask and explain the technique of using the apparatus. CPAP mechanism and method of using the machine and mask were explained. Participant was encouraged to ask questions and could phone at any time to resolve problems Standard education by the prescriber Study duration: follow-up to 12 months (intervention administered at outset of study) . Data extracted at three months: 'During the remaining 9 months following the initial study design, there was no specific follow-up protocol and patients benefited from the standard homecare surveillance recommended in the ANTADIR network, with a review every 3 months'
Outcomes	• Machine usage • ESS • Quality of life (SF-36) • Withdrawals
Notes	The study comprised four arms. We created four intervention/control comparisons and considered the effects of each as a separate study

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Described as randomised; other information not available
Allocation concealment (selection bias)	Unclear risk	Information not available
Blinding (performance bias and detection bias) All outcomes	High risk	Not done
Incomplete outcome data (attrition bias) All outcomes	High risk	'One hundred thirty-three patients were initially scheduled. However, complete initial data were obtained in only 112 patients who were definitively included in the study'

Olsen 2012

Methods	Randomised parallel-group study
Participants	N = 100 Intervention group: Age: 55.1, Male: 58.5%, ESS: 10.8, RDI: 36.2 Control group: Age: 57.8, Male: 71.7%, ESS: 11.1, RDI: 32.4 Inclusion criteria: OSA confirmed by polysomnography, age ≥ 18, naive to CPAP Exclusion criteria: need for bi-level ventilation, failed to complete CPAP titration, severe depression

Olsen 2012 (*Continued*)

Interventions	*Intervention* Three sessions of CPAP-specific Motivational Interview Nurse Therapy (MINT) one month apart. Each session lasted approximately 30 minutes. In addition, all participants received standard one-on-one 45-minute education session conducted on the day of CPAP titration. Participants were followed up at two to four weeks by physician and at two months by a nurse. A questionnaire and a machine meter data on adherence were obtained at one, three and 12 months *Control* Standard one-on-one 45-minute education session conducted on the day of CPAP titration. Participants were followed up at two to four weeks by physician and at two months by a nurse Study duration: 52 weeks
Outcomes	• CPAP acceptance and adherence • FOSQ • Self-efficacy measure for sleep apnoea • ESS
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomly assigned using envelopes with group allocation; no blocking or stratification used
Allocation concealment (selection bias)	Low risk	'...opaque, unlabelled envelopes...shuffled by a research assistant...placed into an allocation box held in a secured clinic area.' Administrative officers not otherwise involved in the study withdrew an envelope and booked the participant's future appointments accordingly
Blinding (performance bias and detection bias) All outcomes	High risk	Participants and intervention nurses were not blinded
Incomplete outcome data (attrition bias) All outcomes	Low risk	'The adherence analyses were by intent-to-treat... The multiple imputation method for substitution missing data was used...All univariate and bivariate statistical assumptions were met'

Parthasarathy 2012

Methods	Randomised parallel-group open-label
Participants	N = 39 All veterans Intervention group: N = 22, Age: 53 ± 14, Men: 100%, BMI: 35, AHI: 36.7 Control group: N = 17, Age: 50 ± 14, BMI: 33, Men: 100%, AHI: 37.5 Inclusion criteria: new diagnosis of OSA, AHI > five, full night or split night polysomnography, Age: 21 to 85, no sedative medications used Exclusion criteria: central or complex sleep apnoea, requirement of oxygen or Bi-PAP, unstable medical co-morbidities, irregular lifestyle pattern, excess alcohol use
Interventions	*Intervention* Peer-driven system (PBS); trained peers with OSA and good CPAP adherence record were paired with newly diagnosed participants over three months. During two face-to-face sessions and eight telephone-based conversations, trained peers shared their experiences on coping strategies with CPAP, knowledge of perceived vulnerabilities of untreated OSA, motivated participants and promoted methods for improving efficacy of CPAP *Control group* Usual care: CPAP initiation and education class, participants were asked to send CPAP adherence 'smart cards' and were followed up at one and three months Study duration: 12 weeks
Outcomes	• Participant ratings of acceptability of PBS • CPAP adherence • Functional Outcomes of Sleep Questionnaire (FOSQ) • Vigilance, self-efficacy and participant activation • Nasal congestion score
Notes	Additional information on study methods and mean CPAP adherence obtained from the study author These data were available from a pilot study. Larger trial is currently being undertaken

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomisation was accomplished by computer-generated assignment placed in sealed envelopes that were opened in a predetermined sequence of numbered and sealed envelopes
Allocation concealment (selection bias)	Low risk	See above
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Observers who evaluated outcomes and care providers were blinded to group allocation. Participants were not blinded to the intervention and were aware of CPAP adherence monitoring

Parthasarathy 2012 (*Continued*)

Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Two of 17 participants in the control group lost to follow-up versus zero in the intervention group No information on how this attrition was dealt with

Richards 2007

Methods	Randomised, parallel-group trial
Participants	N = 100 M/F: 86/15, Mean age: 56, RDI: 26, ESS: 10.5 Inclusion criteria: newly diagnosed with OSA All participants referred for CPAP treatment. 109 screened and nine refused to participate
Interventions	*Intervention* Cognitive-behavioural therapy. Two one-hour group sessions; slide presentation on sleep, OSA and treatment. CPAP machine on display and relaxation techniques in the event of anxiety caused by wearing CPAP mask Participants also benefited from video presentation with emphasis on perseverance with treatment and educational pamphlet made available *Control* Treatment as usual: one standardised group education session; explanation of CPAP titration process; familiarisation with equipment used and procedure to be followed on the titration night. Explanation of side effects, all participants strongly encouraged to contact staff to obtain relevant help and support. Participants assessed and fitted with comfortable mask to be worn during titration Study duration: CBT over course of one week before home treatment with CPAP. Assessment of CPAP made after four weeks
Outcomes	• Machine usage • Withdrawal
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	'...a sequence generated with a blocking factor of 4'
Allocation concealment (selection bias)	Low risk	'An investigator not involved with recruitment or provision of treatment independently randomised participants using a sequence generated with a blocking factor of 4. Allocation concealment was achieved with sequentially numbered, opaque, sealed envelopes'

Richards 2007 (*Continued*)

Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not possible/attempted for participants; assessors and technicians not informed of treatment groups 'Staff members were blinded to which group participants had been allocated and the 3 usual CPAP therapists strictly adhered to a script' Participants not informed that machine usage would be monitored
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	High attrition rate in control group (17/48 refused to take CPAP home) 'Analysis was by intention to treat, and we measured hours of usage of CPAP at 28 days'

Roecklein 2010

Methods	Randomised parallel-group study	
Participants	N = 30 Age: 46, Male sex: 30%, African Americans: 66.7%, AHI: 44, RDI: 56, ESS: 11.6, BMI: 42 Inclusion criteria: age 18 to 65, CPAP naive, reported intent to use CPAP; other sleep, psychiatric or health problems were not exclusion criteria	
Interventions	*Intervention* Written personalised feedback report, including detailed information on severity of the disease, self-reported daytime sleepiness, individually estimated risk of adverse health outcome and risk of motor vehicle accident, all compared with normative data. Feedback addressed barriers to using CPAP, ambivalence about treatment and difficulties of behaviour change and promoted self-efficacy and personal responsibility for choosing to use CPAP *Control* Written information from the American Academy of Sleep Medicine on OSA, Snoring and PAP therapy for OSA Study duration: three months	
Outcomes	• Objective CPAP usage (total hours, average hours/night, number of sessions) • Self-reported CPAP usage	
Notes	Participants were not provided machines but obtained them 'naturalistically', most commonly through insurance. Most participants were low-income African Americans	
Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**

Roecklein 2010 (*Continued*)

Random sequence generation (selection bias)	Unclear risk	Information not available
Allocation concealment (selection bias)	Unclear risk	Information not available
Blinding (performance bias and detection bias) All outcomes	Unclear risk	'Physicians were blind to study participation and participants were blind to their study condition.' Patients were aware that CPAP usage was monitored. Despite intended blinding, it is likely that participants would have been able to distinguish the two interventions
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Only two incidents of missing data in each group. However, in addition, participants who took longer to obtain machines (n = 5 in control group and n = 2 in intervention group did not obtain devices by two weeks) were included from the start and had CPAP usage recorded as 0 hours per session. It is possible that financial burden prevented some participants from acquiring CPAP machines in a timely fashion

Schiefelbein 2005

Methods	Randomised, parallel-group trial. The study presented was a secondary analysis on a subset of participants from the parent study (N = 122)	
Participants	N = 51 (intervention: 32; placebo: 19) 26 M Inclusion criteria: identified as non-adherent CPAP users from a parent study (N = 122) ; all used CPAP for < four hours per night	
Interventions	*Intervention* Internet-based application aimed at encouraging problem solving and preparedness in application of CPAP *Control* Internet-based application similar in format to intervention but directed activities in neutral health topics (vitamin intake) Study duration: 16 weeks	
Outcomes	• Problem-solving confidence • Preparedness for home care • Evaluation of website	
Notes		
Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**

Schiefelbein 2005 (*Continued*)

Random sequence generation (selection bias)	Low risk	Computer-generated randomisation schedule with gender as a stratification variable
Allocation concealment (selection bias)	Unclear risk	Information not provided
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Single-blind: Participants in the control group were given different content delivered in similar way to intervention Outcome assessors not aware of assignment of treatment groups No information on whether participants were aware that CPAP usage was being monitored
Incomplete outcome data (attrition bias) All outcomes	Low risk	Data for all participants presented

Smith 2006

Methods	Randomised parallel-group trial
Participants	N = 19 Mean age: 63 Inclusion criteria: non-adherent with CPAP for three months, after initial education on CPAP use and supplemental audiotaped/videotaped reinforcement at two and four weeks
Interventions	*Intervention* Two-way telehealth sessions mediated by video link-up through phone line. Research nurse emphasised nightly, bedtime routine for CPAP. After standardised protocols, nurse visually assessed participant, guided correct CPAP routine and determined whether the CPAP mask fits properly. Nurse described consequences of non-adherence and managing barriers to CPAP use. Benefits of nightly CPAP use for general health were emphasised *Control* Two-way telehealth sessions mediated by video link-up through phone line. Protocols drawn up to mimic content delivered to intervention group. Instead of CPAP-related information, participants given content on vitamin intake Study duration: 12 weeks of scheduled telehealth sessions
Outcomes	• N adhering to CPAP for longer than four hours/night • Participant satisfaction • Withdrawal
Notes	Non-adherence in the study defined as less than four hours of CPAP use per night for fewer than nine of 14 consecutive nights' use TJL emailed for details of randomisation and outcome data 12/09/2008. Carol Smith responded 15/09/2008

Smith 2006 (*Continued*)

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	'...randomised and done via computer software generated random assignment'
Allocation concealment (selection bias)	Low risk	'...allocation sequence and treatment group assignment concealed from investigators conducting the screening and ongoing assessments'
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Single-blind; nursing interventionist staff aware of different content delivered by video link-up Machine usage was measured via smart card by blinded sleep lab personnel. Information on participants' awareness of CPAP machine usage was insufficient for us to determine how this might have affected the study
Incomplete outcome data (attrition bias) All outcomes	Low risk	All participants finished follow-up and contributed to data on adherence. Two satisfaction surveys were not submitted (one from each group)

Smith 2009

Methods	Randomised parallel-group trial
Participants	N = 97 Mean age: 63.4, Male sex: 55%, Mean AHI: Intervention group: 52.3, Control group: 47.3 Inclusion criteria: new diagnosis of OSA, age $\geq$ 18, AHI $\geq$ 20 Exclusion criteria: positive screening for drug or alcohol abuse, depression requiring hospitalisation
Interventions	All participants received usual education on OSA and demonstration of CPAP equipment *Intervention* Audiotaped music along with softly spoken directions on relaxation techniques and habit-promoting instructions for using CPAP nightly. Participants received information packet, which included CPAP use reminder placard, handouts on benefits of CPAP adherence and health consequences of poor compliance, four-week diary for recording experience with CPAP *Control group* Audiotaped music along with spoken information about vitamins. Information packet was the same in format and length as the intervention group, but content was on vitamins Study duration: 24 weeks

Smith 2009 (*Continued*)

Outcomes	• N adhering to CPAP (≥ four hours/d and ≥ nine of 14 nights) • Self-reported audiotape/diary use • Participant satisfaction • Withdrawal
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Participants randomly assigned using computerised random assignment programme
Allocation concealment (selection bias)	Low risk	Participants recruited by 'nurses who had no knowledge of group assignment'
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Single-blind; '...placebo intervention was used to mimic the daily activities in the experimental treatment...' CPAP usage was measured via smart cards by blinded personnel Nurses administering experimental or placebo control interventions aware of different content of these interventions. Unclear whether participants were aware of machine usage monitoring. Personnel analysing data on compliance were blind to allocation of treatment
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Intention-to-treat analysis but imbalanced N of dropouts: Intervention group: 11/55 (20%), Control group: 13/42 (31%) at six months. Unclear whether reasons for dropouts were balanced across groups

Sparrow 2010

Methods	Randomised parallel-group trial
Participants	N = 250 Median age: 55.0 years, 82% Men, Median BMI: 35.1 Intervention group: AHI: 36, ESS: 10 Conrol group: AHI: 40.5, ESS: 11 Inclusion criteria: age 18 to 80 years, AHI > 10 Exclusion criteria: not reported
Interventions	*Intervention* Automated telephone-linked communication system adapted for CPAP (TLC-CPAP) , designed around the concepts of motivational interviewing. Digitised human speech was used, and participants were communicating with it via touch tone keypad of their

	telephones. The TLC-CPAP content included assessment of the participant's experience with CPAP, self-reported machine use, feedback and counselling to enhance adherence and side effect management. Participants were required to make weekly calls to TLC-CPAP during the first month and monthly thereafter. Printed reports were sent to the participant's physician. Participants were encouraged to contact physician directly if any excessive symptoms or side effects of treatment encountered *Control* 'Attention placebo control' group received general education on a variety of health topics via a telephone-linked communication (TLC) system. Participants were required to make calls on the same schedule as the intervention group Study duration: 52 weeks
Outcomes	• Machine usage (data downloaded from memory cards or by direct interrogation of CPAP devices) • Adherence to CPAP (> four hours/night) • Association between CPAP use and FOSQ, sleep symptoms, CES-D, visual reaction time • Self-efficacy index • Decisional balance index
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	'...randomisation stratified by sex, age and AHI using a randomised block design'
Allocation concealment (selection bias)	Unclear risk	No information provided
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Blinding of participants attempted by developing an 'attention placebo control group'. However, given the nature of the intervention, participants may have been aware of group assignment. Participants in the intervention group self-reported frequency and duration of CPAP usage. It is unclear whether participants in the control group were aware of CPAP usage monitoring '...all data were collected by research assistants blind to group assignment'. Unclear whether the same applied to outcome assessors
Incomplete outcome data (attrition bias) All outcomes	Low risk	Data were analysed by intention to treat. Multiple-imputation procedure was implemented to account for missing data in the outcome of CPAP use due to loss to follow-up. 20/124 in the intervention group and 15/126 in the control group lost to follow-up at 12 months

Stepnowsky 2007

Methods	Randomised parallel-group trial
Participants	N = 45 (40 presented as baseline and completed) Mean age: 59, Male: 98%, AHI: 39, ESS: 12.6 Inclusion criteria: AHI $\geq$ 15, no prior CPAP treatment, stable sleep environment Exclusion criteria: allergies/sensitivity to mask or mask material, previous use of any other PAP device (e.g. bi-level PAP, auto-adjusting PAP), current use of prescribed supplemental oxygen or significant comorbid medical conditions that could interfere with daily use of CPAP
Interventions	*Intervention* Review of compliance and efficacy data. Monitored information garnered as objective compliance data and subjective reports of usage. Follow-up tailored to how CPAP used by participants. Details on how many total hours the PAP unit was used each night at therapeutic pressure. Efficacy data consisted of the amount of mask leakage (L/s) and the AHI (total number of apnoeas and hypopnoeas per hour of sleep) *Control* Telephone call from staff one week after CPAP initiation and office follow-up visit at one month. Participants encouraged to call clinic any time with problems or concerns Study duration: eight weeks
Outcomes	• Machine usage • ESS • Withdrawals • Depression • Quality of life (Functional Outcomes of Sleep Questionnaire) • AHI
Notes	TJL emailed for randomisation 12/09/2008. Carl Stepnowsky responded 15/09/2008

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	'...we used the uniform random number generator in R to select all sequences of 4 randomly with equal probability so that the occurrence of 3 in a row being assigned to the same group would be extremely rare'
Allocation concealment (selection bias)	Low risk	'The randomisation scheme was concealed until the time at which the intervention was assigned. The randomisation scheme was generated by the project statistician and carried out by research staff immediately after the informed consent procedure and the completion of the baseline questionnaires'

Stepnowsky 2007 (*Continued*)

Blinding (performance bias and detection bias) All outcomes	Unclear risk	Participants in both groups received a monitoring unit All participants likely to be aware that CPAP usage was measured
Incomplete outcome data (attrition bias) All outcomes	High risk	'There were five CPAP "rejectors," or patients who decided within the first day or two that they did not want to pursue CPAP as the primary treatment for their OSA. Our study did not have a "run-in" period, which could have helped identify these patients prior to the intervention'

Taylor 2006

Methods	Randomised parallel-group trial
Participants	N = 133 Mean age: 45, ESS: 14, CPAP pressure: 8.9 All participants were service or ex-service personnel in USA Inclusion criteria: 18 to 64 years; RDI ≥ five; English speaking Exclusion criteria: acute illness, hospitalised participants, significant nocturnal hypoxaemia, ESS < eight, disorder interfering with ability to use computer at home (i.e. blindness), major mental illness, physical disability that interfered with optimal use of computer, prior use of CPAP, undergoing concurrent therapy for OSA (MAD, surgery)
Interventions	*Intervention* Education on first day; film on OSA and CPAP; instruction in use of CPAP; encouragement to attend sleep clinic. Computer programme (Health Buddy) delivering questions on a daily basis; responses were monitored by sleep medicine practitioners. If persistent high-risk answers given, this prompted a sleep practitioner to contact the participant within 24 hours *Control* Education on first day; film on OSA and CPAP; instruction in use of CPAP; encouragement to attend sleep clinic. Follow-up at one month with a scheduled clinic visit; telephone consultation Study duration: four weeks
Outcomes	• Machine usage • FOSQ • Participant satisfaction questionnaire • General perceived self-efficacy • Self-efficacy scale to use CPAP • Psychometric analysis
Notes	

Risk of bias

Taylor 2006 (*Continued*)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-generated random numbers. Participants stratified according to age, gender and severity of symptoms
Allocation concealment (selection bias)	Unclear risk	Information not available
Blinding (performance bias and detection bias) All outcomes	High risk	Not undertaken 'Each day, the patient was greeted with three questions regarding reported hours of nasal CPAP use...'
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Information not available

Wang 2011a

Methods	Randomised parallel-group study
Participants	N = 76 Intervention group: Male: 89.5%, AHI: 35.7, ESS: 13.4, Control group: Male: 81.6%, AHI: 38.5, ESS: 13.9 Incusion criteria: new diagnosis of OSA, AHI ≥ 10, above elementary school education, 'conscious mind and able to communicate clearly' Exclusion criteria: personal or family history of mental illness, drug or alcohol abuse, severe cognitive impairment, 'concurrent oncologic or psychiatric diseases'
Interventions	*Intervention* Three nights of CPAP titration in the first week, four-hour group education session on OSA and CPAP in the first week, participants were given a brochure describing benefits of CPAP and CD containing a 20-minute video demonstrating how to optimise CPAP treatment, 24-hour consultation telephone line to the sleep nurses was available *Control* One night of CPAP titration in the hospital in the first week Study duration: 12 weeks
Outcomes	• N adhering to CPAP (≥ four hours/d and ≥ nine of 14 nights) • CPAP usage (hours/d, hours/d used, % days with compliance ≥ four hours) • ESS • Sleep quality (Pittsburgh) • Anxiety (STAI) • HADS-D score
Notes	The study comprised four treatment arms: three intervention groups and one control group. We consider the effects of the three intervention arms as separate studies
Risk of bias	

Wang 2011a (*Continued*)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	'The patients were randomly assigned...by block randomisation'
Allocation concealment (selection bias)	Unclear risk	Information not available
Blinding (performance bias and detection bias) All outcomes	High risk	Not performed Information on participants' awareness of CPAP machine usage monitoring not available
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	'The patients' CPAP adherence rates and dropout rates were analysed on an intention-to-treat basis'

Wang 2011b

Methods	Randomised parallel-group study
Participants	N = 76 Intervention group: Male: 76.3%, AHI: 41.2, ESS: 14.7 Control group: Male: 81.6%, AHI: 38.5, ESS: 13.9 Incusion criteria: new diagnosis of OSA, AHI ≥ 10, above elementary school education, 'conscious mind and able to communicate clearly' Exclusion criteria: personal or family history of mental illness, drug or alcohol abuse, severe cognitive impairment, 'concurrent oncologic or psychiatric diseases'
Interventions	*Intervention* One night of CPAP titration in the hospital, 12 × 40 minute group Progressive Muscle Relaxation (PMR) practice sessions over 12 weeks, one per week. Self-practice of PMR before each CPAP treatment. Brochure and CD with a guide for PMR practice at home *Control* One night of CPAP titration in the hospital in the first week Study duration: 12 weeks
Outcomes	• N adhering to CPAP (≥ four hours/d and ≥ nine of 14 nights) • CPAP usage (hours/d, hours/d used, % days with compliance ≥ four hours) • ESS • Sleep quality (Pittsburgh) • Anxiety (STAI) • HADS-D score
Notes	The study comprised four treatment arms: three intervention groups and one control group. We consider the effects of the three intervention arms as separate studies

Risk of bias

Bias	Authors' judgement	Support for judgement

Wang 2011b (*Continued*)

Random sequence generation (selection bias)	Unclear risk	'The patients were randomly assigned...by block randomisation'
Allocation concealment (selection bias)	Unclear risk	Information not available
Blinding (performance bias and detection bias) All outcomes	High risk	Not performed Information on participants' awareness of CPAP machine usage monitoring not available
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	'The patients' CPAP adherence rates and dropout rates were analysed on an intention-to-treat basis'

Wang 2011c

Methods	Randomised parallel-group study
Participants	N = 76 Intervention group: Male: 81.6, AHI: 43.1, ESS: 14.5 Control group: Male: 89.5%, AHI-35.7, ESS: 13.4 Incusion criteria: new diagnosis of OSA, AHI ≥ 10, above elementary school education, 'conscious mind and able to communicate clearly' Exclusion criteria: personal or family history of mental illness, drug or alcohol abuse, severe cognitive impairment, 'concurrent oncologic or psychiatric diseases'
Interventions	*Intervention* Three nights of CPAP titration in the hospital. Combination of interventions as in Education and PMR group (see above) *Control* The control for this intervention was the intervention arm of Wang 2011a Study duration: 12 weeks
Outcomes	• N adhering to CPAP (≥ four hours/d and ≥ nine of 14 nights) • CPAP usage (hours/d, hours/d used, % days with compliance ≥ four hours) • ESS • Sleep quality (Pittsburgh) • Anxiety (STAI) • HADS-D score
Notes	The study comprised four treatment arms: three intervention groups and one control group. We consider the effects of the three intervention arms as separate studies. In this study, for the combined intervention, Education + PMR, the control group was Education

Risk of bias

Bias	Authors' judgement	Support for judgement

Wang 2011c (*Continued*)

Random sequence generation (selection bias)	Unclear risk	'The patients were randomly assigned...by block randomisation'
Allocation concealment (selection bias)	Unclear risk	Information not available
Blinding (performance bias and detection bias) All outcomes	High risk	Not performed Information on participants' awareness of CPAP machine usage monitoring not available
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	'The patients' CPAP adherence rates and dropout rates were analysed on an intention-to-treat basis'

Wang 2011d

Methods	Randomised parallel-group study
Participants	N = 76 Intervention group: Male: 81.6, AHI: 43.1, ESS: 14.5 Control group: 76.3%, AHI: 41.2, ESS: 14.7 Inclusion criteria: new diagnosis of OSA, AHI ≥ 10, above elementary school education, 'conscious mind and able to communicate clearly' Exclusion criteria: personal or family history of mental illness, drug or alcohol abuse, severe cognitive impairment, 'concurrent oncologic or psychiatric diseases'
Interventions	*Intervention* Three nights of CPAP titration in the hospital. Combination of interventions as in Education + PMR group (see above) *Control* The control for this intervention was the intervention arm of Wang 2011b Study duration: 12 weeks
Outcomes	• N adhering to CPAP (≥ four hours/d and ≥ nine of 14 nights) • CPAP usage (hours/d, hours/d used, % days with compliance ≥ four hours) • ESS • Sleep quality (Pittsburgh) • Anxiety (STAI) • HADS-D score
Notes	The study comprised four treatment arms: three intervention groups and one control group. We consider the effects of the three intervention arms as separate studies. In this study, for the combined intervention, Education + PMR, the control group was PMR

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**

Wang 2011d (*Continued*)

Random sequence generation (selection bias)	Unclear risk	'The patients were randomly assigned...by block randomisation'
Allocation concealment (selection bias)	Unclear risk	Information not available
Blinding (performance bias and detection bias) All outcomes	High risk	Not performed Information on participants' awareness of CPAP machine usage monitoring not available
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	'The patients' CPAP adherence rates and dropout rates were analysed on an intention-to-treat basis'

Wiese 2005

Methods	Randomised, unblinded parallel-group trial
Participants	N = 93 Mean age: 48, BMI: 38, Mean duration of symptoms: 5.4 years, % smokers (treatment: 26%; control: 49%), Mean AHI: 9, ESS: 13 Inclusion criteria: > 20 years; RDI > four; newly diagnosed OSAHS Exclusion criteria: not reported
Interventions	*Intervention* During initial visit, participants received explanations of OSA and CPAP by physician and respiratory therapist. Short instructional video (15-minute tape of interview between two 'blue collar' workers discussing what CPAP felt like and how it helped them) *Control* During initial visit, participants received explanations of OSA and CPAP by physician and respiratory therapist. Control group members were interviewed Both groups received instruction at outset on using CPAP Study duration: four weeks
Outcomes	• Machine usage • Attendance at outpatient clinic/withdrawal • ESS • SAQLI
Notes	Not able to assess machine usage, as 13 of the 57 participants who returned for their one-month clinic visit had unusable machine-recorded data

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Described as randomised; blocks of 10 to ensure balanced group design

Wiese 2005 (*Continued*)

Allocation concealment (selection bias)	Unclear risk	Information not available
Blinding (performance bias and detection bias) All outcomes	High risk	Not undertaken Information on participants' awareness of CPAP machine usage was insufficient for us to determine how this might have affected the study
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Information not available

AHI: Apnoea Hypopnoea Index; BiPAP: Bi-level positive airway pressure; CPAP: Continuous positive airway pressure; ESS: Epworth Sleepiness Scale; FOSQ: Functional Outcomes of Sleep Questionnaire (quality of life instrument); OSA: Obstructive sleep apnoea; RDI: Respiratory Disturbance Index; SAQLI: Sleep Apnoea Quality of Life Index.

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Damjanovic 2009	Allocation to the standard or intensive support group was based on proximity of participant's address to the sleep centre, and no randomisation occurred. Participants were randomly assigned only to APAP or CPAP treatment. This unpublished information was obtained from the study authors
Fletcher 1991	Cross-over study
Gupta 2011	Implemented intervention could not be classified as supportive, educational, psychological or behavioural
Hirschowitz 2006	Participants randomly assigned to CPAP treatment or no treatment
Kajaste 2004	CBT programme given before randomisation to CPAP
Klein 2010	Excluded for the same reasons as Damjanovic 2009
Marshall 2003	Based on description of the study, it is unlikely that randomisation took place. No contact details of study authors available; therefore not possible to obtain further clarification on the trial design
Shaikh 2009	Data for only 19 of 128 enrolled participants analysed and reported
Signes-Costa 2005	Clinical review conducted by different practitioners. No systematic intervention that is educational or behavioural in nature
Trupp 2011	No control group. Participants randomly assigned to positively or negatively framed education

(*Continued*)

Wenzel 2008	Participants randomly assigned to immediate or delayed CPAP prescription

Characteristics of studies awaiting assessment *[ordered by study ID]*

Bartlett 2010

Methods	Randomised parallel-group study
Participants	N = 206 Intervention group: Age: 49, Male sex: 70%, AHI: 30.4, ESS: 12.0, BM: 35.8 Control group: Age: 47, Male sex: 72%, AHI: 39.9, ESS: 12, BMI: 34.4 Exclusion criteria: poor fluency in English and previous use of CPAP
Interventions	*Intervention* 30-Minute group education session on sleep, OSA, risks of untreated OSA and CPAP treatment. CBT session including slides on health/social benefits of using CPAP and video of real-life successful CPAP users. CBT session was delivered to a group of three or four participants *Control* Same 30-minute group education session on sleep, OSA and CPAP usage. Social reciprocity consisting of afternoon tea served while participants watched a video of a patient undergoing diagnostic and CPAP studies Study duration: six months
Outcomes	• CPAP usage (hours/night and % using CPAP $\geq$ four hours/d) • Predictors of CPAP adherence • N of withdrawals
Notes	Inconsistency of preliminary data on CPAP adherence reported in an abstract form (e.g. SE of mean CPAP adherence difference derived from CI differs 100 times from that calculated from SD). Further characteristics of intervention and control groups required Information from the study authors that final withdrawal figures are different from those initially reported The study has been submitted for journal publication, and further information may be available

Fanfulla 2008

Methods	Randomised parallel-group
Participants	N = 20 Obese, OSA patients Other baseline details not available Inclusion criteria not available
Interventions	*Intervention* Tele-assisted rehabilitation programme consisting of individualised exercise programme to lose weight and monitor CPAP compliance. Regular phone call interview every two weeks to assess OSA symptoms, problems with CPAP, adherence to exercise programme and weight control *Control*

Fanfulla 2008 (*Continued*)

	Standard care, otherwise not specified Study duration: six months
Outcomes	• Machine usage: no data available • ESS: groups not matched • Reduction of BMI • Level of daily exercise
Notes	DRW emailed for further study information 30/06/2012

Peach 2003

Methods	Randomised parallel-group
Participants	N = not specified Baseline details not available Inclusion criteria: newly diagnosed OSA
Interventions	All participants underwent titration at baseline. Fixed-pressure CPAP was used throughout the study Intervention: self-monitoring group Control: non-self-monitoring group Study duration: not enough information presented on duration of study
Outcomes	• AHI • Machine usage
Notes	TJL emailed for study information 12/09/2008

DATA AND ANALYSES

Comparison 1. Increased practical support and encouragement during follow-up + CPAP versus usual care + CPAP

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Machine usage (hours/night)	13	803	Mean Difference (IV, Random, 95% CI)	0.82 [0.36, 1.27]
2 Machine usage, sensitivity analysis: excluding participants aware of machine usage monitoring	6	378	Mean Difference (IV, Fixed, 95% CI)	1.07 [0.61, 1.52]
3 Machine usage, sensitivity analysis: adherence in control group < four hours/night	8	471	Mean Difference (IV, Fixed, 95% CI)	1.36 [0.96, 1.76]
4 N deemed adherent (≥ four hours/night)	4	268	Odds Ratio (M-H, Fixed, 95% CI)	2.06 [1.22, 3.47]
5 Epworth Sleepiness Scale scores	8	501	Mean Difference (IV, Random, 95% CI)	-0.60 [-1.81, 0.62]
6 Quality of life: Functional Outcomes of Sleep Questionnaire	2	70	Mean Difference (IV, Fixed, 95% CI)	0.98 [-0.84, 2.79]
7 Quality of life: Sleep Apnoea Quality of Life Index (SAQLI)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
8 Mood	3	312	Mean Difference (IV, Fixed, 95% CI)	-0.94 [-1.55, -0.33]
8.1 HAD Scale for Anxiety	1	80	Mean Difference (IV, Fixed, 95% CI)	-1.10 [-2.95, 0.75]
8.2 HAD Scale for Depression	3	232	Mean Difference (IV, Fixed, 95% CI)	-0.93 [-1.57, -0.28]
9 Withdrawals	12	903	Odds Ratio (M-H, Fixed, 95% CI)	0.65 [0.44, 0.97]
10 AHI on treatment	2	115	Mean Difference (IV, Fixed, 95% CI)	-0.07 [-1.62, 1.48]
11 Maintenance of Wakefulness Test (MWT)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected

Comparison 2. Educational interventions + CPAP versus usual care + CPAP

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Machine usage (hours/night)	7	508	Mean Difference (IV, Fixed, 95% CI)	0.60 [0.27, 0.93]
2 N deemed adherent (≥ four hours/night)	3	285	Odds Ratio (M-H, Fixed, 95% CI)	1.80 [1.09, 2.95]
3 Epworth Sleepiness Scale scores	5	336	Mean Difference (IV, Fixed, 95% CI)	-1.17 [-2.07, -0.26]
4 Quality of life: Sleep Apnoea Quality of Life Index (SAQLI)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
5 HAD Scale for Depression	2	152	Mean Difference (IV, Fixed, 95% CI)	-0.52 [-1.25, 0.22]
6 Withdrawal	8	683	Odds Ratio (M-H, Fixed, 95% CI)	0.67 [0.45, 0.98]

Comparison 3. Behavioural therapy + CPAP versus control + CPAP

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Machine usage (hours/night)	6	584	Mean Difference (Random, 95% CI)	1.44 [0.43, 2.45]
2 Sensitivity analysis: excluding participants aware of machine usage monitoring	5		Mean Difference (Fixed, 95% CI)	1.54 [0.99, 2.09]
3 N deemed adherent (≥ four hours/night)	3	358	Odds Ratio (M-H, Fixed, 95% CI)	2.23 [1.45, 3.45]
4 Epworth Sleepiness Scale score	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
5 Quality of life: Functional Outcomes of Sleep Questionnaire	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
6 Withdrawal	5	609	Odds Ratio (M-H, Fixed, 95% CI)	0.85 [0.57, 1.25]

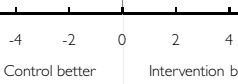
Analysis 1.1. Comparison 1 Increased practical support and encouragement during follow-up + CPAP versus usual care + CPAP, Outcome 1 Machine usage (hours/night).

Review: Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea

Comparison: 1 Increased practical support and encouragement during follow-up + CPAP versus usual care + CPAP

Outcome: 1 Machine usage (hours/night)

Study or subgroup	Intervention N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Chervin 1997	12	5.7 (2.3)	7	4.4 (3.4)		2.2 %	1.30 [-1.54, 4.14]
DeMolles 2004	15	4.4 (3)	15	2.9 (2.4)		4.1 %	1.50 [-0.44, 3.44]
Fox 2012	39	3.18 (2.45)	36	1.75 (1.97)		9.2 %	1.43 [0.43, 2.43]
Hoy 1999	40	5.4 (1.9)	40	3.8 (2.5)		9.4 %	1.60 [0.63, 2.57]
Hui 2000	54	5.3 (1.47)	54	5.3 (1.47)		13.2 %	0.0 [-0.55, 0.55]
Lewis 2006	30	3.8 (2.9)	25	3.4 (3.2)		5.3 %	0.40 [-1.23, 2.03]
Meurice 2007a	23	5.8 (2.8)	22	6.3 (2.2)		6.1 %	-0.50 [-1.97, 0.97]
Meurice 2007b	21	5.7 (2.2)	25	5.5 (2.4)		6.8 %	0.20 [-1.13, 1.53]
Parthasarathy 2012	22	4.35 (2.6)	17	3.4 (2.6)		5.2 %	0.95 [-0.70, 2.60]
Stepnowsky 2007	20	4.1 (1.8)	20	2.8 (2.2)		7.4 %	1.30 [0.05, 2.55]
Taylor 2006	58	4.29 (2.15)	56	4.22 (2.05)		11.2 %	0.07 [-0.70, 0.84]



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Study or subgroup	Intervention N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Wang 2011b	38	3.7 (2.3)	38	2.6 (1.6)		10.1 %	1.10 [0.21, 1.99]
Wang 2011c	38	5.2 (2)	38	3.4 (2.1)		9.8 %	1.80 [0.88, 2.72]
Total (95% CI)	**410**		**393**			**100.0 %**	**0.82 [0.36, 1.27]**

Heterogeneity: $Tau^2 = 0.33$; $Chi^2 = 25.29$, df = 12 (P = 0.01); $I^2 = 53\%$

Test for overall effect: Z = 3.52 (P = 0.00043)

Test for subgroup differences: Not applicable

Analysis 1.2. Comparison 1 Increased practical support and encouragement during follow-up + CPAP versus usual care + CPAP, Outcome 2 Machine usage, sensitivity analysis: excluding participants aware of machine usage monitoring.

Review: Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea

Comparison: 1 Increased practical support and encouragement during follow-up + CPAP versus usual care + CPAP

Outcome: 2 Machine usage, sensitivity analysis: excluding participants aware of machine usage monitoring

Study or subgroup	Intervention N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Hoy 1999	40	5.4 (1.9)	40	3.8 (2.5)		21.6 %	1.60 [0.63, 2.57]
Lewis 2006	30	3.8 (2.9)	25	3.4 (3.2)		7.7 %	0.40 [-1.23, 2.03]
Meurice 2007a	23	5.8 (2.8)	22	6.3 (2.2)		9.5 %	-0.50 [-1.97, 0.97]
Meurice 2007b	21	5.7 (2.2)	25	5.5 (2.4)		11.5 %	0.20 [-1.13, 1.53]
Wang 2011b	38	3.7 (2.3)	38	2.6 (1.6)		25.7 %	1.10 [0.21, 1.99]
Wang 2011c	38	5.2 (2)	38	3.4 (2.1)		24.0 %	1.80 [0.88, 2.72]
Total (95% CI)	**190**		**188**			**100.0 %**	**1.07 [0.61, 1.52]**

Heterogeneity: $Chi^2 = 10.24$, df = 5 (P = 0.07); $I^2 = 51\%$

Test for overall effect: Z = 4.63 (P < 0.00001)

Test for subgroup differences: Not applicable

Analysis 1.3. Comparison 1 Increased practical support and encouragement during follow-up + CPAP versus usual care + CPAP, Outcome 3 Machine usage, sensitivity analysis: adherence in control group < four hours/night.

Review: Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea

Comparison: 1 Increased practical support and encouragement during follow-up + CPAP versus usual care + CPAP

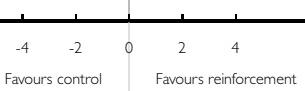
Outcome: 3 Machine usage, sensitivity analysis: adherence in control group < four hours/night

Study or subgroup	intervention		control		Mean Difference	Weight	Mean Difference
	N	Mean(SD)	N	Mean(SD)	IV,Fixed,95% CI		IV,Fixed,95% CI
DeMolles 2004	15	4.4 (3)	15	2.9 (2.4)		4.3 %	1.50 [-0.44, 3.44]
Fox 2012	39	3.18 (2.45)	36	1.75 (1.97)		16.2 %	1.43 [0.43, 2.43]
Hoy 1999	40	5.4 (1.9)	40	3.8 (2.5)		17.2 %	1.60 [0.63, 2.57]
Lewis 2006	30	3.8 (2.9)	25	3.4 (3.2)		6.1 %	0.40 [-1.23, 2.03]
Parthasarathy 2012	22	4.35 (2.6)	17	3.4 (2.6)		6.0 %	0.95 [-0.70, 2.60]
Stepnowsky 2007	20	4.1 (1.8)	20	2.8 (2.2)		10.5 %	1.30 [0.05, 2.55]
Wang 2011b	38	3.7 (2.3)	38	2.6 (1.6)		20.5 %	1.10 [0.21, 1.99]
Wang 2011c	38	5.2 (2)	38	3.4 (2.1)		19.1 %	1.80 [0.88, 2.72]
Total (95% CI)	**242**		**229**			**100.0 %**	**1.36 [0.96, 1.76]**

Heterogeneity: Chi^2 = 3.06, df = 7 (P = 0.88); I^2 =0.0%

Test for overall effect: Z = 6.60 (P < 0.00001)

Test for subgroup differences: Not applicable



Analysis 1.4. Comparison 1 Increased practical support and encouragement during follow-up + CPAP versus usual care + CPAP, Outcome 4 N deemed adherent (≥ four hours/night).

Review: Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea

Comparison: 1 Increased practical support and encouragement during follow-up + CPAP versus usual care + CPAP

Outcome: 4 N deemed adherent (≥ four hours/night)

Study or subgroup	Intervention n/N	Control n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Smith 2006	9/10	4/9		2.1 %	11.25 [0.97, 130.22]
Smith 2009	41/55	30/42		44.2 %	1.17 [0.47, 2.89]
Wang 2011b	26/38	18/38		29.0 %	2.41 [0.95, 6.13]
Wang 2011c	30/38	23/38		24.7 %	2.45 [0.89, 6.75]
Total (95% CI)	**141**	**127**		**100.0 %**	**2.06 [1.22, 3.47]**

Total events: 106 (Intervention), 75 (Control)

Heterogeneity: $Chi^2 = 3.56$, df = 3 (P = 0.31); $I^2 = 16\%$

Test for overall effect: Z = 2.71 (P = 0.0067)

Test for subgroup differences: Not applicable

Analysis 1.5. Comparison 1 Increased practical support and encouragement during follow-up + CPAP versus usual care + CPAP, Outcome 5 Epworth Sleepiness Scale scores.

Review: Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea

Comparison: 1 Increased practical support and encouragement during follow-up + CPAP versus usual care + CPAP

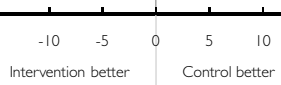
Outcome: 5 Epworth Sleepiness Scale scores

Study or subgroup	Intervention N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
DeMolles 2004	15	9.4 (6)	15	13.4 (6.6)		5.6 %	-4.00 [-8.51, 0.51]
Hoy 1999	40	5.5 (3.79)	40	6.3 (5.06)		15.2 %	-0.80 [-2.76, 1.16]
Hui 2000	54	8.1 (5.88)	54	7.4 (5.88)		13.7 %	0.70 [-1.52, 2.92]
Meurice 2007a	23	6.3 (4.7)	22	4.5 (3.6)		12.5 %	1.80 [-0.64, 4.24]
Meurice 2007b	21	6.7 (4.9)	25	5.4 (4.4)		11.1 %	1.30 [-1.41, 4.01]
Stepnowsky 2007	20	9.2 (6.6)	20	9.9 (5.2)		7.6 %	-0.70 [-4.38, 2.98]
Wang 2011b	38	9.4 (3.7)	38	10.8 (4.2)		16.3 %	-1.40 [-3.18, 0.38]
Wang 2011c	38	7.3 (3.2)	38	9.7 (3.5)		18.1 %	-2.40 [-3.91, -0.89]
Total (95% CI)	**249**		**252**			**100.0 %**	**-0.60 [-1.81, 0.62]**

Heterogeneity: $Tau^2 = 1.54$; $Chi^2 = 15.11$, df = 7 (P = 0.03); $I^2 = 54\%$

Test for overall effect: Z = 0.96 (P = 0.34)

Test for subgroup differences: Not applicable



Analysis 1.6. Comparison 1 Increased practical support and encouragement during follow-up + CPAP versus usual care + CPAP, Outcome 6 Quality of life: Functional Outcomes of Sleep Questionnaire.

Review: Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea

Comparison: 1 Increased practical support and encouragement during follow-up + CPAP versus usual care + CPAP

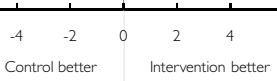
Outcome: 6 Quality of life: Functional Outcomes of Sleep Questionnaire

Study or subgroup	Intervention N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
DeMolles 2004	15	18.1 (2.8)	15	17 (3.7)		59.8 %	1.10 [-1.25, 3.45]
Stepnowsky 2007	20	15.2 (5)	20	14.4 (4.2)		40.2 %	0.80 [-2.06, 3.66]
Total (95% CI)	**35**		**35**			**100.0 %**	**0.98 [-0.84, 2.79]**

Heterogeneity: Chi² = 0.03, df = 1 (P = 0.87); I² =0.0%

Test for overall effect: Z = 1.06 (P = 0.29)

Test for subgroup differences: Not applicable



Analysis 1.7. Comparison 1 Increased practical support and encouragement during follow-up + CPAP versus usual care + CPAP, Outcome 7 Quality of life: Sleep Apnoea Quality of Life Index (SAQLI).

Review: Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea

Comparison: 1 Increased practical support and encouragement during follow-up + CPAP versus usual care + CPAP

Outcome: 7 Quality of life: Sleep Apnoea Quality of Life Index (SAQLI)

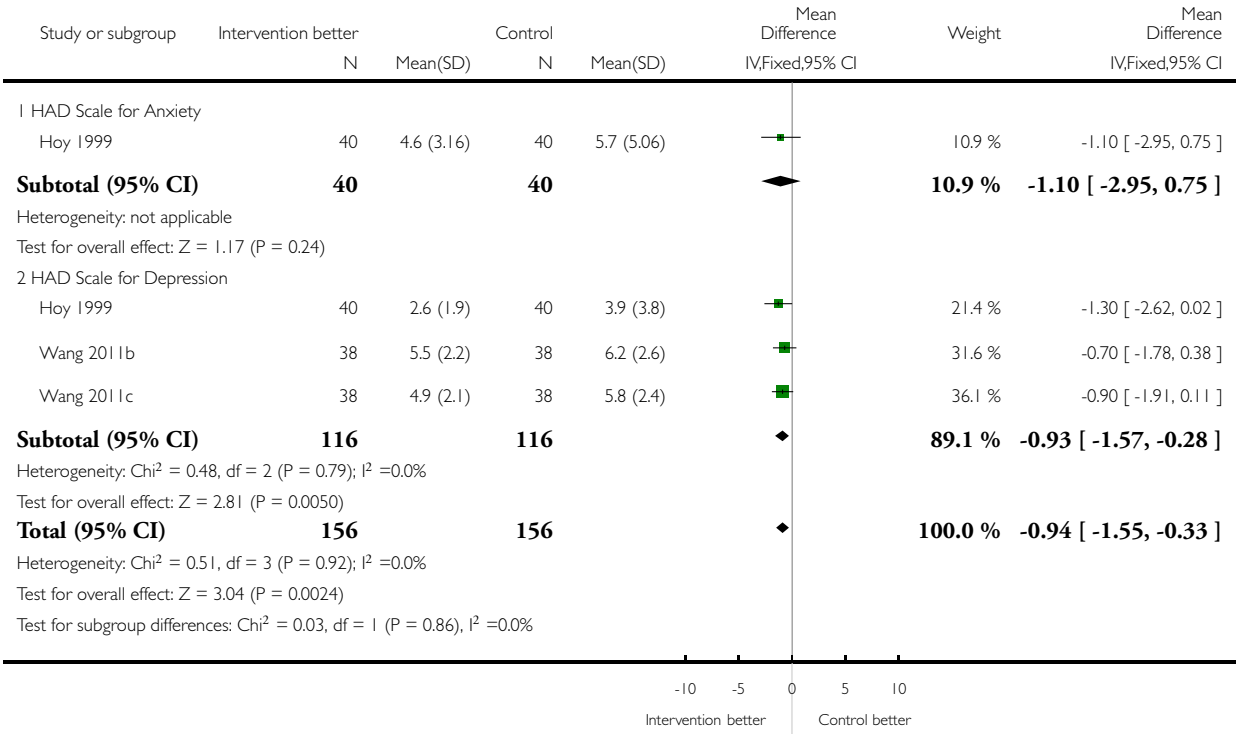
Study or subgroup	Intervention N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Hui 2000	54	21.91 (38.2)	54	9.1 (18.37)		12.81 [1.50, 24.12]

Analysis 1.8. Comparison 1 Increased practical support and encouragement during follow-up + CPAP versus usual care + CPAP, Outcome 8 Mood.

Review: Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea

Comparison: 1 Increased practical support and encouragement during follow-up + CPAP versus usual care + CPAP

Outcome: 8 Mood



Analysis 1.9. Comparison 1 Increased practical support and encouragement during follow-up + CPAP versus usual care + CPAP, Outcome 9 Withdrawals.

Review: Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea

Comparison: 1 Increased practical support and encouragement during follow-up + CPAP versus usual care + CPAP

Outcome: 9 Withdrawals

Study or subgroup	Intervention n/N	Control n/N	Odds Ratio M-H,Fixed,95% CI	Odds Ratio M-H,Fixed,95% CI
DeMolles 2004	0/15	0/15		0.0 [0.0, 0.0]
Fox 2012	11/39	10/36		1.02 [0.37, 2.80]
Hoy 1999	1/40	4/40		0.23 [0.02, 2.16]
Hui 2000	0/54	0/54		0.0 [0.0, 0.0]
Lewis 2006	4/36	9/36		0.38 [0.10, 1.35]
Meurice 2007a	4/27	8/30		0.48 [0.13, 1.82]
Meurice 2007b	7/28	2/27		4.17 [0.78, 22.25]
Smith 2009	11/55	13/42		0.56 [0.22, 1.41]
Stepnowsky 2007	1/21	4/24		0.25 [0.03, 2.44]
Taylor 2006	9/65	9/67		1.04 [0.38, 2.80]
Wang 2011b	5/38	11/38		0.37 [0.12, 1.20]
Wang 2011c	2/38	4/38		0.47 [0.08, 2.75]
Total (95% CI)	**456**	**447**		**0.65 [0.44, 0.97]**

Total events: 55 (Intervention), 74 (Control)

Heterogeneity: Chi^2 = 9.85, df = 9 (P = 0.36); I^2 =9%

Test for overall effect: Z = 2.14 (P = 0.032)

Test for subgroup differences: Not applicable

Analysis 1.10. Comparison 1 Increased practical support and encouragement during follow-up + CPAP versus usual care + CPAP, Outcome 10 AHI on treatment.

Review: Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea

Comparison: 1 Increased practical support and encouragement during follow-up + CPAP versus usual care + CPAP

Outcome: 10 AHI on treatment

Study or subgroup	Intervention N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Fox 2012	39	4.7 (3.8)	36	6.6 (4.8)		61.9 %	-1.90 [-3.87, 0.07]
Stepnowsky 2007	20	7.9 (4.1)	20	5 (4)		38.1 %	2.90 [0.39, 5.41]
Total (95% CI)	**59**		**56**			**100.0 %**	**-0.07 [-1.62, 1.48]**

Heterogeneity: Chi² = 8.69, df = 1 (P = 0.003); I² =88%

Test for overall effect: Z = 0.09 (P = 0.93)

Test for subgroup differences: Not applicable

Analysis 1.11. Comparison 1 Increased practical support and encouragement during follow-up + CPAP versus usual care + CPAP, Outcome 11 Maintenance of Wakefulness Test (MWT).

Review: Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea

Comparison: 1 Increased practical support and encouragement during follow-up + CPAP versus usual care + CPAP

Outcome: 11 Maintenance of Wakefulness Test (MWT)

Study or subgroup	Intervention N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Hoy 1999	40	32.3 (9.49)	40	30.8 (11.38)		1.50 [-3.09, 6.09]

Analysis 2.1. Comparison 2 Educational interventions + CPAP versus usual care + CPAP, Outcome 1 Machine usage (hours/night).

Review: Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea

Comparison: 2 Educational interventions + CPAP versus usual care + CPAP

Outcome: 1 Machine usage (hours/night)

Study or subgroup	Intervention N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Aloia 2012a	53	4.34 (2.45)	49	3.73 (2.5)		11.8 %	0.61 [-0.35, 1.57]
Basoglu 2011	66	5.5 (1.2)	67	5.1 (1.6)		47.5 %	0.40 [-0.08, 0.88]
Epstein 2000	17	3.68 (3.15)	13	4.31 (3.01)		2.2 %	-0.63 [-2.85, 1.59]
Meurice 2007c	23	5.8 (2.8)	21	5.7 (2.2)		5.0 %	0.10 [-1.38, 1.58]
Meurice 2007d	22	6.3 (2.2)	25	5.5 (2.4)		6.3 %	0.80 [-0.52, 2.12]
Wang 2011a	38	3.4 (2.1)	38	2.6 (1.6)		15.5 %	0.80 [-0.04, 1.64]
Wang 2011d	38	5.2 (2)	38	3.7 (2.3)		11.7 %	1.50 [0.53, 2.47]
Total (95% CI)	**257**		**251**			**100.0 %**	**0.60 [0.27, 0.93]**

Heterogeneity: Chi^2 = 5.91, df = 6 (P = 0.43); I^2 =0.0%

Test for overall effect: Z = 3.57 (P = 0.00036)

Test for subgroup differences: Not applicable

Analysis 2.2. Comparison 2 Educational interventions + CPAP versus usual care + CPAP, Outcome 2 N deemed adherent (≥ four hours/night).

Review: Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea

Comparison: 2 Educational interventions + CPAP versus usual care + CPAP

Outcome: 2 N deemed adherent (≥ four hours/night)

Study or subgroup	Intervention n/N	Control n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Basoglu 2011	47/66	38/67		46.3 %	1.89 [0.92, 3.88]
Wang 2011a	23/38	18/38		30.3 %	1.70 [0.69, 4.23]
Wang 2011d	30/38	26/38		23.4 %	1.73 [0.61, 4.88]
Total (95% CI)	**142**	**143**		**100.0 %**	**1.80 [1.09, 2.95]**

Total events: 100 (Intervention), 82 (Control)

Heterogeneity: $Chi^2 = 0.04$, df = 2 (P = 0.98); $I^2 = 0.0\%$

Test for overall effect: Z = 2.31 (P = 0.021)

Test for subgroup differences: Not applicable

Analysis 2.3. Comparison 2 Educational interventions + CPAP versus usual care + CPAP, Outcome 3 Epworth Sleepiness Scale scores.

Review: Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea

Comparison: 2 Educational interventions + CPAP versus usual care + CPAP

Outcome: 3 Epworth Sleepiness Scale scores

Study or subgroup	Intervention N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Meurice 2007c	23	6.3 (4.7)	21	6.7 (4.9)		10.1 %	-0.40 [-3.24, 2.44]
Meurice 2007d	22	4.5 (3.6)	25	5.4 (4.4)		15.6 %	-0.90 [-3.19, 1.39]
Wang 2011a	38	9.7 (3.5)	38	10.8 (4.2)		27.0 %	-1.10 [-2.84, 0.64]
Wang 2011d	38	7.3 (3.2)	38	9.4 (3.7)		33.7 %	-2.10 [-3.66, -0.54]
Wiese 2005	47	8.9 (5.35)	46	8.78 (6.56)		13.7 %	0.12 [-2.32, 2.56]
Total (95% CI)	**168**		**168**			**100.0 %**	**-1.17 [-2.07, -0.26]**

Heterogeneity: Chi^2 = 2.79, df = 4 (P = 0.59); I^2 =0.0%

Test for overall effect: Z = 2.54 (P = 0.011)

Test for subgroup differences: Not applicable

Analysis 2.4. Comparison 2 Educational interventions + CPAP versus usual care + CPAP, Outcome 4 Quality of life: Sleep Apnoea Quality of Life Index (SAQLI).

Review: Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea

Comparison: 2 Educational interventions + CPAP versus usual care + CPAP

Outcome: 4 Quality of life: Sleep Apnoea Quality of Life Index (SAQLI)

Study or subgroup	Intervention N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Wiese 2005	45	4.85 (1.62)	44	5.12 (1.4)		-0.27 [-0.90, 0.36]

Analysis 2.5. Comparison 2 Educational interventions + CPAP versus usual care + CPAP, Outcome 5 HAD Scale for Depression.

Review: Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea

Comparison: 2 Educational interventions + CPAP versus usual care + CPAP

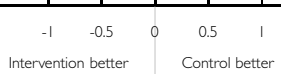
Outcome: 5 HAD Scale for Depression

Study or subgroup	Intervention N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Wang 2011a	38	5.8 (2.4)	38	6.2 (2.6)		42.5 %	-0.40 [-1.53, 0.73]
Wang 2011d	38	4.9 (2.1)	38	5.5 (2.2)		57.5 %	-0.60 [-1.57, 0.37]
Total (95% CI)	**76**		**76**			**100.0 %**	**-0.52 [-1.25, 0.22]**

Heterogeneity: Chi^2 = 0.07, df = 1 (P = 0.79); I^2 =0.0%

Test for overall effect: Z = 1.38 (P = 0.17)

Test for subgroup differences: Not applicable



Analysis 2.6. Comparison 2 Educational interventions + CPAP versus usual care + CPAP, Outcome 6 Withdrawal.

Review: Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea

Comparison: 2 Educational interventions + CPAP versus usual care + CPAP

Outcome: 6 Withdrawal

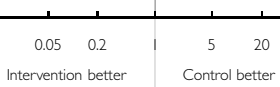
Study or subgroup	Intervention n/N	Control n/N	Odds Ratio M-H,Fixed,95% CI	Odds Ratio M-H,Fixed,95% CI
Aloia 2012a	27/80	25/74		1.00 [0.51, 1.95]
Basoglu 2011	0/66	0/67		0.0 [0.0, 0.0]
Epstein 2000	6/23	7/20		0.66 [0.18, 2.42]
Meurice 2007c	4/27	7/28		0.52 [0.13, 2.04]
Meurice 2007d	8/30	2/27		4.55 [0.87, 23.72]
Wang 2011a	4/38	11/38		0.29 [0.08, 1.01]
Wang 2011d	2/38	5/38		0.37 [0.07, 2.02]
Wiese 2005	13/45	24/44		0.34 [0.14, 0.81]
Total (95% CI)	**347**	**336**		**0.67 [0.45, 0.98]**

Total events: 64 (Intervention), 81 (Control)

Heterogeneity: Chi^2 = 11.20, df = 6 (P = 0.08); I^2 =46%

Test for overall effect: Z = 2.04 (P = 0.042)

Test for subgroup differences: Not applicable



Analysis 3.1. Comparison 3 Behavioural therapy + CPAP versus control + CPAP, Outcome 1 Machine usage (hours/night).

Review: Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea

Comparison: 3 Behavioural therapy + CPAP versus control + CPAP

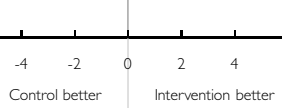
Outcome: 1 Machine usage (hours/night)

Study or subgroup	Intervention N	Control N	Mean Difference (SE)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Aloia 2001	6	6	3.2 (1.5765)		7.5 %	3.20 [0.11, 6.29]
Aloia 2012b	47	49	0.13 (0.523)		20.1 %	0.13 [-0.90, 1.16]
Olsen 2012	50	50	1.21 (0.64)		18.2 %	1.21 [-0.04, 2.46]
Richards 2007	48	48	2.87 (0.526)		20.1 %	2.87 [1.84, 3.90]
Roecklein 2010	14	16	0.38 (0.82)		15.5 %	0.38 [-1.23, 1.99]
Sparrow 2010 (1)	124	126	1.71 (0.62)		18.6 %	1.71 [0.49, 2.93]
Total (95% CI)					**100.0 %**	**1.44 [0.43, 2.45]**

Heterogeneity: $Tau^2 = 1.05$; $Chi^2 = 16.89$, df = 5 (P = 0.005); $I^2 = 70\%$

Test for overall effect: Z = 2.79 (P = 0.0053)

Test for subgroup differences: Not applicable



(1) SE derived from P value in the paper

Analysis 3.2. Comparison 3 Behavioural therapy + CPAP versus control + CPAP, Outcome 2 Sensitivity analysis: excluding participants aware of machine usage monitoring.

Review: Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea

Comparison: 3 Behavioural therapy + CPAP versus control + CPAP

Outcome: 2 Sensitivity analysis: excluding participants aware of machine usage monitoring

Study or subgroup	Mean Difference (SE)	Weight	Mean Difference IV,Fixed,95% CI
Aloia 2001	3.2 (1.5765)	3.2 %	3.20 [0.11, 6.29]
Aloia 2012b	0.13 (0.523)	28.8 %	0.13 [-0.90, 1.16]
Olsen 2012	1.21 (0.64)	19.2 %	1.21 [-0.04, 2.46]
Richards 2007	2.87 (0.526)	28.4 %	2.87 [1.84, 3.90]
Sparrow 2010	1.71 (0.62)	20.5 %	1.71 [0.49, 2.93]
Total (95% CI)		**100.0 %**	**1.54 [0.99, 2.09]**

Heterogeneity: Chi^2 = 15.11, df = 4 (P = 0.004); I^2 =74%

Test for overall effect: Z = 5.48 (P < 0.00001)

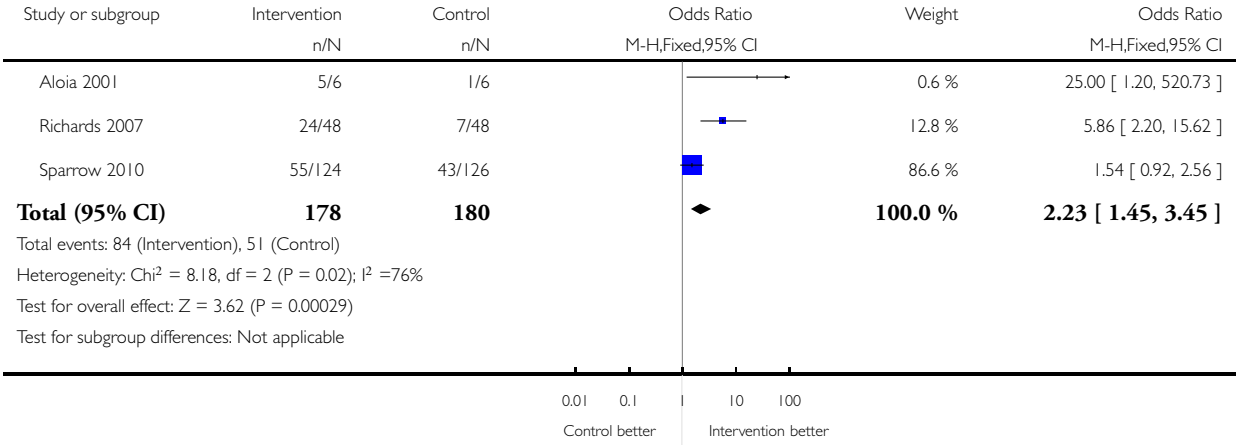
Test for subgroup differences: Not applicable

Analysis 3.3. Comparison 3 Behavioural therapy + CPAP versus control + CPAP, Outcome 3 N deemed adherent (≥ four hours/night).

Review: Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea

Comparison: 3 Behavioural therapy + CPAP versus control + CPAP

Outcome: 3 N deemed adherent (≥ four hours/night)

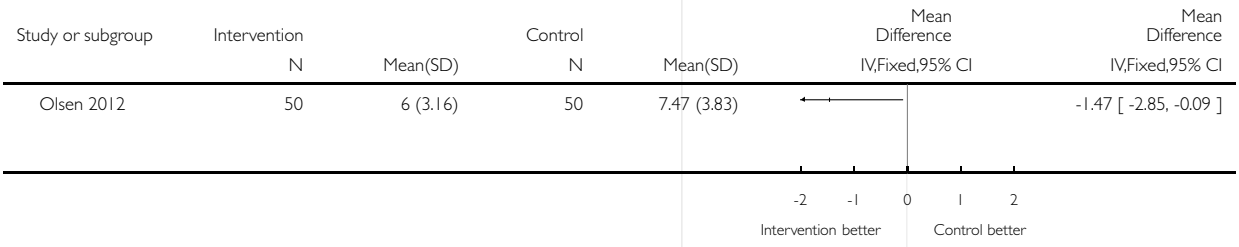


Analysis 3.4. Comparison 3 Behavioural therapy + CPAP versus control + CPAP, Outcome 4 Epworth Sleepiness Scale score.

Review: Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea

Comparison: 3 Behavioural therapy + CPAP versus control + CPAP

Outcome: 4 Epworth Sleepiness Scale score



Analysis 3.5. Comparison 3 Behavioural therapy + CPAP versus control + CPAP, Outcome 5 Quality of life: Functional Outcomes of Sleep Questionnaire.

Review: Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea

Comparison: 3 Behavioural therapy + CPAP versus control + CPAP

Outcome: 5 Quality of life: Functional Outcomes of Sleep Questionnaire

Study or subgroup	Intervention N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Olsen 2012	50	17.78 (2.61)	50	17.71 (2.15)		0.07 [-0.87, 1.01]

Analysis 3.6. Comparison 3 Behavioural therapy + CPAP versus control + CPAP, Outcome 6 Withdrawal.

Review: Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea

Comparison: 3 Behavioural therapy + CPAP versus control + CPAP

Outcome: 6 Withdrawal

Study or subgroup	Intervention n/N	Control n/N	Odds Ratio M-H,Fixed,95% CI	Odds Ratio M-H,Fixed,95% CI
Aloia 2001	0/6	0/6		0.0 [0.0, 0.0]
Aloia 2012b	26/73	25/74		1.08 [0.55, 2.14]
Olsen 2012	12/50	14/50		0.81 [0.33, 1.99]
Richards 2007	4/50	17/50		0.17 [0.05, 0.55]
Sparrow 2010	20/124	15/126		1.42 [0.69, 2.93]
Total (95% CI)	**303**	**306**		**0.85 [0.57, 1.25]**

Total events: 62 (Intervention), 71 (Control)

Heterogeneity: Chi^2 = 9.72, df = 3 (P = 0.02); I^2 =69%

Test for overall effect: Z = 0.83 (P = 0.40)

Test for subgroup differences: Not applicable

ADDITIONAL TABLES

Table 1. Number screened, entered and completed

Study	N Screened	Entered	Completed	% Screened	% Entered
Aloia 2001	NA	12	12	NA	100
Aloia 2012a, Aloia 2012b	339	227	149	44	66
Basoglu 2011	246	133	133	54	100
Chervin 1997	NA (75% of those approached agreed to participate)	40	33	NA	82.5
DeMolles 2004	NA	30	30	NA	100
Epstein 2000	NA	50	43	NA	86
Fox 2012	NA	75	54	NA	72
Hoy 1999	NA	80	75	NA	94
Hui 2000	NA	108	108	NA	100
Lewis 2006	74	72	55	74	76
Meurice 2007a, Meurice 2007b, Meurice 2007c, Meurice 2007d	133	112	91	68	81
Olsen 2012	132	100	73	55	73
Parthasarathy 2012	49	39	37	76	95
Richards 2007	109	100	79	72	79
Roecklein 2010	NA	30	28	NA	93
Schiefelbein 2005	NA	51	51	NA	100
Smith 2006	NA	19	19	NA	100
Smith 2009	NA	97	73	NA	75
Sparrow 2010	423	250	115	27	46
Stepnowsky 2007	91	45	40	44	88

Table 1. Number screened, entered and completed (*Continued*)

Taylor 2006	160	132	114	71	86
Wang 2011a, Wang 2011b, Wang 2011c, Wang 2011d	NA	152	130	NA	86
Wiese 2005	NA	93	56	NA	60

Table 2. Study characteristics

Intervention group	Study	Intervention			Control	Study duration (weeks)
		Increased support and reinforcement components	Increased educational components	Behavioural therapy		
Increased support and reinforcement	Chervin 1997	Weekly telephone calls to monitor progress and troubleshoot	Written information on OSA and CPAP		Usual care	Eight
	DeMolles 2004	Computer-based telecommunication system allowing for monitoring and reinforcing compliance	Education provided by the computer-based telecommunication system		Usual care	Eight
	Fox 2012	Telecomunication system allowing for daily monitoring of CPAP usage, timely detection and troubleshooting of problems			Usual care	12
	Hoy 1999	2 additional titration nights in hospital, 4 additional visits at home by sleep nurses	Initial education at home with partner		Usual care	24

Table 2. Study characteristics (*Continued*)

	Hui 2000	2 additional early reviews by sleep physician and frequent telephone calls by sleep nurses	Videotape and additional education session		Usual care	12
	Lewis 2006	1 additional early review by sleep physician and 1 early telephone interview with sleep nurse	Educational video		Usual care	52
	Meurice 2007a	4 additional home visits in the first 3 months by sleep practitioner for problem solving	Written information and detailed explanation by the prescriber, additional education during home visits		Written information and detailed explanation by the prescriber + usual care	52
	Meurice 2007b	4 additional home visits in the first 3 months by sleep practitioner for problem solving	Additional education during home visits		Usual care	52
	Parthasarathy 2012	2 individual sessions and 8 telephone conversations with trained peer CPAP users providing support and sharing their positive experience with CPAP	Peers shared their knowledge on CPAP and OSA	Interventions delivered by peer contained elements of promoting self-efficacy, risk perception, participant activation and motivation	Usual care	12
	Schiefelbein 2005	Internet-based application aimed at encouraging CPAP use and problem solving			Internet-based application similar in format to intervention but di-	16

Table 2. Study characteristics (*Continued*)

					rected activities in neutral health topics (vitamin intake)	
	Smith 2006	Home video-link sessions delivered by nurse, who guided correct CPAP use and provided problem solving	Nurse provided education on CPAP and OSA		Home video-link sessions similar in form to intervention but directed activities in neutral health topics (vitamin intake)	12
	Smith 2009	Audiotaped music along with softly spoken directions on relaxation techniques and habit-promoting instructions for using CPAP, user reminder placard	Handouts on benefits of CPAP adherence and health consequences of poor compliance		Audiotaped music along with spoken information about vitamins. Information packet similar in format to intervention, but content was on vitamins	24
	Stepnowsky 2007	Wireless telemonitoring of compliance and treatment efficacy on daily basis and acting on the data via prespecified clinical pathways			Usual care	Eight
	Taylor 2006	Internet-based application aimed at monitoring self-reported compliance, acting on the information in timely fashion			Usual care	Four
	Wang 2011b	Progressive muscle relaxation			Usual care	12

Table 2. Study characteristics (*Continued*)

	Wang 2011c	Progressive muscle relaxation + 2 additional nights of CPAP titration	4hour group education session, written information, video CD		Two additional nights of CPAP titration + four-hour group education session, written information, video CD + usual care	12
Increased education	Aloia 2012a		Two 45-minute individual didactic sessions and one booster phone call by sleep nurse		Usual care	52
	Basoglu 2011		10-Minute educational video session on OSA and CPAP		Usual care	24
	Epstein 2000		Educational and desensitisation course		Usual care	24
	Meurice 2007c	4 additional home visits in the first 3 months by sleep practitioner for problem solving	Written information and detailed explanation by the prescriber, additional education during home visits		Four additional home visits in the first three months by sleep practitioner for problem solving and additional education + usual care	52
	Meurice 2007d		Written information and detailed explanation by the prescriber		Usual care	52
	Wang 2011a	2 additional nights of CPAP titration	Four-hour group education session, written information, video CD		Usual care	12
	Wang 2011d	Progressive muscle relaxation + 2	Four-hour group education ses-		Progressive muscle relaxation +	12

Table 2. Study characteristics (*Continued*)

		additional nights of CPAP titration	sion, written information, video CD		usual care	
	Wiese 2005		15-Minute educational video addressing misconception about OSA and barriers to effective CPAP treatment		Usual care	Four
Behavioural therapy	Aloia 2001		Elements of education on consequences of OSA and efficacy of CPAP	Two 45-minute sessions of cognitive-behavioural therapy interventions	Two 45-minute sessions involving discussion on sleep architecture and sleep clinic	12
	Aloia 2012b			Two 45-minute sessions of Motivational Enhancement Therapy, one booster phone call	Usual care	52
	Olsen 2012		45-Minute individual education session	Three 30-minute sessions of Motivational Interviewing Therapy	45-Minute educational session + usual care	52
	Richards 2007		Slide presentation and written information on OSA and CPAP	Two one-hour group sessions of cognitive-behavioural therapy	Usual care	Four
	Roecklein 2010			Written personalised feedback report framed according to Motivational Enhancement Theory	Written information from the American Academy of Sleep Medicine	12

Table 2. Study characteristics (*Continued*)

	Sparrow 2010	Side effects management module incorporated in the automated telephone-linked communication system	Information exchange on OSA and CPAP incorporated in the automated telephone-linked communication system	Automated telephone-linked communication system designed around the concept of Motivational Interviewing, which allowed one to assess and enhance CPAP compliance	General education on unrelated health topics via automated telephone-linked communication system	52

APPENDICES

Appendix 1. Sources and search methods for the Cochrane Airways Group Specialised Register (CAGR)

Electronic searches: core databases

Database	Frequency of search
CENTRAL (*The Cochrane Library*)	Monthly
MEDLINE (Ovid)	Weekly
EMBASE (Ovid)	Weekly
PsycINFO (Ovid)	Monthly
CINAHL (EBSCO)	Monthly
AMED (EBSCO)	Monthly

Handsearches: core respiratory conference abstracts

Conference	Years searched
American Academy of Allergy, Asthma and Immunology (AAAAI)	2001 onwards
American Thoracic Society (ATS)	2001 onwards
Asia Pacific Society of Respirology (APSR)	2004 onwards
British Thoracic Society Winter Meeting (BTS)	2000 onwards
Chest Meeting	2003 onwards
European Respiratory Society (ERS)	1992, 1994, 2000 onwards
International Primary Care Respiratory Group Congress (IPCRG)	2002 onwards
Thoracic Society of Australia and New Zealand (TSANZ)	1999 onwards

MEDLINE search strategy used to identify trials for the CAGR

Sleep apnoea search

1. exp Sleep Apnea Syndromes/
2. (sleep$ adj3 (apnea$ or apnoea$)).mp.
3. (hypopnoea$ or hypopnoea$).mp.
4. OSA.mp.
5. SHS.mp.
6. OSAHS.mp.
7. or/1-6

Filter to identify RCTs

1. exp "clinical trial [publication type]"/
2. (randomised or randomised).ab,ti.
3. placebo.ab,ti.
4. dt.fs.
5. randomly.ab,ti.
6. trial.ab,ti.
7. groups.ab,ti.
8. or/1-7
9. Animals/
10. Humans/
11. 9 not (9 and 10)
12. 8 not 11

The MEDLINE strategy and the RCT filter are adapted to identify trials in other electronic databases.

WHAT'S NEW

Last assessed as up-to-date: 17 January 2013.

Date	Event	Description
17 January 2013	New search has been performed	Literature searches rerun
17 January 2013	New citation required and conclusions have changed	13 new studies added. Changes made in review conclusions in relation to short course interventions. Summary of findings table added

HISTORY

Protocol first published: Issue 1, 2002

Review first published: Issue 2, 2009

Date	Event	Description
10 March 2009	Amended	Spelling correction
5 September 2008	Amended	Converted to new review format.
12 October 2006	New citation required and conclusions have changed	Substantive amendment

CONTRIBUTIONS OF AUTHORS

DRW: Study assessment (2013); data extraction, data entry and analysis (2013); write-up (2013).

TJL: Study assessment (2009); data extraction, data entry and analysis (2009); write-up (2013).

IS: Study assessment; data extraction and analysis, write-up (2009 and 2013).

Previous author(s) no longer contributing to this version of the review:

Vidya Nadig (2009): study assessment; data extraction; write-up.

DECLARATIONS OF INTEREST

None known.

SOURCES OF SUPPORT

Internal sources

- St George's, University of London, UK.
- Papworh NHS Trust, UK.

External sources

- No sources of support supplied

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

This review incorporates a risk of bias table for eligible studies, and we performed post hoc subgroup analysis based on awareness of machine monitoring and average compliance with CPAP in the control arm using four hours/night as the cutoff.

We have incorporated summary of findings tables for the three comparisons in this review.

INDEX TERMS

Medical Subject Headings (MeSH)

*Patient Compliance; Cognitive Therapy [*methods]; Continuous Positive Airway Pressure [instrumentation; *utilization]; Motivation; Patient Education as Topic [*methods]; Randomized Controlled Trials as Topic; Reinforcement (Psychology); Sleep Apnea, Obstructive [psychology; *therapy]

MeSH check words

Humans