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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

Kathleen Askland[1a], Lauren Wright[1,2b], Dariusz R Wozniak[3], Talia Emmanuel[1], Jessica Caston[1], Ian Smith[3]

[1]Waypoint Research Institute, Waypoint Centre for Mental Health Care, Penetanguishene, Canada. [2]AstraZeneca Canada Inc., Mississauga, Canada. [3]Respiratory Support and Sleep Centre, Royal Papworth Hospital, Cambridge, UK

[a]These authors contributed equally to this work.. [b]These authors contributed equally to this work.

Contact: Jessica Caston, Waypoint Research Institute, Waypoint Centre for Mental Health Care, Penetanguishene, Canada. jcaston@waypointcentre.ca.

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ABSTRACT

Background

Although highly 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 initiate and maintain regular and continued use of CPAP.

Objectives

To assess the effectiveness of educational, supportive, behavioural, or mixed (combination of two or more intervention types) strategies that aim to encourage adults who have been prescribed CPAP to use their devices.

Search methods

Searches were conducted on the Cochrane Airways Group Specialised Register of trials. Searches are current to 29 April 2019.

Selection criteria

We included randomised controlled trials (RCTs) that assessed intervention(s) designed to inform participants about CPAP/OSA, to support them in using CPAP, or to modify their behaviour to increase use of CPAP devices.

Data collection and analysis

We assessed studies to determine their suitability for inclusion in the review. Data were extracted independently and were entered into RevMan for analysis. 'Risk of bias' assessments were performed, using the updated 'Risk of bias 2' tool, for the primary outcome, CPAP usage. Study-level 'Risk of bias' assessments were performed using the original 'Risk of bias' tool. GRADE assessment was performed using GRADEpro.

Main results

Forty-one studies (9005 participants) are included in this review; 16 of these studies are newly identified with updated searches. Baseline Epworth Sleepiness Scale (ESS) scores indicate that most participants suffered from excessive daytime sleepiness. The majority of recruited

participants had not used CPAP previously. When examining risk of bias for the primary outcome of hourly machine usage/night, 58.3% studies have high overall risk (24/41 studies), 39.0% have some concerns (16/41 studies), and 2.4% have low overall risk (1/41 studies).

We are uncertain whether educational interventions improve device usage, as the certainty of evidence was assessed as very low. We were unable to perform meta-analyses for number of withdrawals and symptom scores due to high study heterogeneity.

Supportive interventions probably increase device usage by 0.70 hours/night (95% confidence interval (CI) 0.36 to 1.05, N = 1426, 13 studies, moderate-certainty evidence), and low-certainty evidence indicates that the number of participants who used their devices ≥ 4 hours/night may increase from 601 to 717 per 1000 (odds ratio (OR), 1.68, 95% CI 1.08 to 2.60, N = 376, 2 studies). However, the number of withdrawals may also increase from 136 to 167 per 1000 (OR 1.27, 95% CI 0.97 to 1.66, N = 1702, 11 studies, low-certainty evidence). Participants may experience small improvements in symptoms (ESS score -0.32 points, 95% CI -1.19 to 0.56, N = 470, 5 studies, low-certainty evidence), and we are uncertain whether quality of life improves with supportive interventions, as the certainty of evidence was assessed as very low.

When compared with usual care, behavioural interventions produce a clinically-meaningful increase in device usage by 1.31 hours/night (95% CI 0.95 to 1.66, N = 578, 8 studies, high-certainty evidence), probably increase the number of participants who used their machines ≥ 4 hours/night from 371 to 501 per 1000 (OR 1.70, 95% CI 1.20 to 2.41, N = 549, 6 studies, high-certainty evidence), and reduce the number of study withdrawals from 146 to 101 per 1000 (OR 0.66, 95% CI 0.44 to 0.98, N = 939, 10 studies, high-certainty evidence). Behavioural interventions may reduce symptoms (ESS score -2.42 points, 95% CI -4.27 to -0.57, N = 272, 5 studies, low-certainty evidence), but probably have no effect on quality of life (Functional Outcomes of Sleep Questionnaire (FOSQ), standardised mean difference (SMD) 0.00, 0.95% CI -0.26 to 0.26, N = 228, 3 studies, moderate-certainty evidence). We are uncertain whether behavioural interventions improve apnoea hypopnoea index (AHI), as the certainty of evidence was assessed as very low.

We are uncertain if mixed interventions improve device usage, increase the number of participants using their machines ≥ 4 hours/night, reduce study withdrawals, improve quality of life, or reduce anxiety symptoms, as the certainty of evidence for these outcomes was assessed to be very low. Symptom scores via the ESS could not be measured due to considerable heterogeneity between studies.

Authors' conclusions

In CPAP-naïve people with OSA, high-certainty evidence indicates that behavioural interventions yield a clinically-significant increase in hourly device usage when compared with usual care. Moderate certainty evidence shows that supportive interventions increase usage modestly. Very low-certainty evidence shows that educational and mixed interventions may modestly increase CPAP usage. The impact of improved CPAP usage on daytime sleepiness, quality of life, and mood and anxiety scores remains unclear since these outcomes were not assessed in the majority of included studies. 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 behavioural interventions improve usage of continuous positive airway pressure in adults with obstructive sleep apnoea?

What is obstructive sleep apnoea (OSA) and continuous positive airway pressure (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 experience daytime sleepiness, which may affect their daily life.

Continuous positive airway pressure (CPAP) is a treatment that delivers pressurised air to keep the airway open. CPAP treatment involves a machine with three main parts: a device that fits over nose and mouth, a tube that connects the mask to the device's motor; and a motor that blows air into the tube.

Review question

We already know that CPAP treats OSA effectively in most people by improving symptoms resulting from OSA. However many people do not use their CPAP machine as much as is recommended. We wanted to look at interventions designed to educate and motivate people with OSA to use their CPAP machines more.

Study characteristics

We looked at evidence from randomised, parallel-group, controlled studies. Following a comprehensive literature search and assessment of trials, we included 41 studies (number of participants = 9005). Most people experienced excessive daytime sleepiness and had newly diagnosed OSA. Duration of studies ranged from 28 days to two years.

Results

We grouped the trials into those that gave people a) education, b) a supportive intervention, c) behavioural intervention, and d) a mixed intervention (using all thee techniques).

We found that all types of interventions increase CPAP usage with varying levels of certainty. Behavioural therapy increases machine usage by 79 minutes per night, and ongoing supportive interventions probably increase machine use by about 42 minutes per night. Educational and mixed interventions may potentially improve machine usage, however the certainty of this evidence is very low.

We also wanted to look at other outcomes such as daytime sleepiness using the Epworth Sleepiness Scale (ESS), quality of life, depression, and apnoea hypopnoea index (measurement of pauses in breathing and slow or shallow breathing). Not all included studies consistently examined these other outcomes, however behavioural interventions may reduce daytime sleepiness.

Studies generally recruited people who were new to CPAP.

Quality of the evidence

The quality of evidence for improved CPAP adherence varied considerably across studies and study types. We were confident that the behavioural interventions improve adherence for around 70 minutes per night. The quality of evidence for educational, supportive, and mixed interventions was not as strong. The quality of evidence for OSA-related symptoms including daytime sleepiness, quality of life, anxiety or depression was affected by the low number of studies that measured these outcomes.

SUMMARY OF FINDINGS

Summary of findings for the main comparison. Educational intervention versus control

Educational interventions + CPAP compared to usual care + CPAP in adults with obstructive sleep apnoea

Patient or population: adults with obstructive sleep apnoea
Setting: community
Intervention: educational interventions + CPAP
Comparison: usual care + CPAP

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with usual care + CPAP	Risk with Educational interventions + CPAP				
1.1 CPAP device usage (hours/night)	The mean CPAP device usage ranged from 1.97 to 5.1 hours/night	MD 0.85 hours/night higher (0.32 higher to 1.39 higher)	-	1128 (10 RCTs)	⊕⊖⊖⊖ VERY LOW [1 2 3 4]	
1.2 CPAP device usage (hours/night), sensitivity analysis: adherence in control group < four hours/night	The mean CPAP device usage , sensitivity analysis: adherence in control group < four hours/night ranged from 1.97 to 3.8 hours/night	MD 0.85 hours/night higher (0.06 higher to 1.64 higher)	-	698 (6 RCTs)	⊕⊖⊖⊖ VERY LOW [3 4 5 6]	
1.3 N deemed adherent (≥ four hours/night)	558 per 1,000	765 per 1,000 (654 to 849)	OR 2.58 (1.50 to 4.44)	1019 (7 RCTs)	⊕⊖⊖⊖ VERY LOW [3 4 7 8]	
1.4 Withdrawal - NO META-ANALYSIS PERFORMED			-	1745 (9 studies)	-	
1.5 ESS - Comparison of values at endpoint- NO META-ANALYSIS PERFORMED	-		-	355 (3 studies)	-	

***The risk in the intervention group** (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; **CPAP**: Continuous positive airways pressure;**ESS**: Epworth Sleepiness Scale; **GRADE**: Grades of Recommendation, Assessment, Development and Evaluation; **MD:** mean difference; **OR:** Odds ratio; **RCT:** randomised controlled trial.

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect.

[1] Overall risk of bias for this comparison was 'High' for 7/10 and 'some concerns' for the remaining 3/10. In those with high risk, risk derived from randomisation (1), missing outcome data (5), protocol deviation (1) and selective reporting (1). The combined weight of the studies with high risk is 59.2%. Therefore, risk of bias for this comparison was downgraded by 2 levels to 'very serious.'
[2] There was minimal or no variability in direction of effect, with all (or nearly all) studies favouring the intervention arm. Magnitude of effect varied substantially (4 studies with CIs excluding null). CIs have reasonable overlap. Substantial statistical heterogeneity P = 0.002, I^2 = 66%. Therefore, inconsistency was downgraded by one level to 'serious.'
[3] Studies retrieved and analysed for this review directly compare the population, interventions and outcomes of interest, as predefined, in our review protocol.
[4] Performed optimal information size (OIS) (sample size) calculation, as per GRADE Handbook recommendations, which indicated OIS criterion was met for this outcome. Confidence interval does not include null and includes potential for important benefit.
[5] There was minimal or no variability in direction of effect, with all (or nearly all) studies favouring the intervention arm. Magnitude of effect varied substantially (1 study with CI excluding null). Substantial statistical heterogeneity P = 0.0008, I^2 = 76%. Therefore, inconsistency was downgraded by one level to 'serious.'
[6] Overall risk of bias for this comparison was 'High' for 3/6 and 'some concerns' for the remaining 3/6. In those with high risk, risk derived from missing outcome data (3). The combined weight of the studies with high risk is 44.8%. Therefore, risk of bias for this comparison was downgraded by 2 levels to 'very serious.'
[7] There was no variability in direction of effect, with all (or nearly all) studies favouring the intervention arm. Magnitude of effect varied substantially (3 studies with CI excluding null). Substantial statistical heterogeneity P = 0.003, I^2 = 70%. Therefore, inconsistency was downgraded by one level to 'serious.'
[8] Overall risk of bias for this comparison was 'High' for 5/7 and 'some concerns' for the remaining 2/7. In those with high risk, risk derived from randomisation (1), missing outcome data (3), and selective reporting (1). The combined weight of the studies with high risk is 68.2%.Therefore, risk of bias for this comparison was downgraded by 2 levels to 'very serious.'

Summary of findings 2. Supportive intervention versus control

Increased practical support and encouragement during follow-up + CPAP compared to usual care + CPAP in adults with obstructive sleep apnoea

Patient or population: adults with obstructive sleep apnoea
Setting: community
Intervention: increased practical support and encouragement during follow-up + CPAP
Comparison: usual care + CPAP

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with usual care + CPAP	Risk with Increased practical support and encouragement during follow-up + CPAP				

2.1 CPAP device usage (hours/night)	The mean CPAP device usage ranged from 1.75 to 4.9 hours/night	MD 0.70 hours/night higher (0.36 higher to 1.05 higher)	-	1426 (13 RCTs)	⊕⊕⊕⊖ MODERATE [1 2 3 4]
2.2 CPAP device usage, sensitivity analysis: adherence in control group < four hours/night	The mean CPAP device usage, sensitivity analysis: adherence in control group < four hours/night ranged from 1.75 to 3.8 hours/night	MD 0.91 hours/night higher (0.57 higher to 1.25 higher)	-	735 (7 RCTs)	⊕⊕⊕⊕ HIGH [3 4 5]
2.3 N deemed adherent (≥ four hours/night)	601 per 1,000	717 per 1,000 (619 to 797)	OR 1.68 (1.08 to 2.60)	376 (2 RCTs)	⊕⊕⊖⊖ LOW [3 6 7]
2.4 Withdrawals	136 per 1,000	167 per 1,000 (133 to 208)	OR 1.27 (0.97 to 1.66)	1702 (11 RCTs)	⊕⊕⊖⊖ LOW [3 8]
2.5.2 ESS: Comparison Endpoint or Change from Baseline Values - ESS: Change from Baseline	The mean ESS - Comparison Endpoint or Change from Baseline Values - ESS: Change from Baseline ranged from -0.7 to -5.1	MD 0.32 lower (1.19 lower to 0.56 higher)	-	470 (5 RCTs)	⊕⊕⊖⊖ LOW [3 7 9]
2.7 Quality of llfe: Comparison of Change from Baseline Values	The mean Quality of llfe: Comparison of Change from Baseline Values was 0	SMD 0.22 higher (0.01 lower to 0.45 higher)	-	294 (3 RCTs)	⊕⊖⊖⊖ VERY LOW [3 9 10 11]

*__The risk in the intervention group__ (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).

CPAP: Continuous positive airways pressure; **CI:** Confidence interval; **ESS**: Epworth Sleepiness Scale; **FOSQ**: Functional Outcomes of Sleep Questionnaire; **GRADE**: Grades of Recommendation, Assessment, Development and Evaluation; **MD:** mean difference; **OR:** Odds ratio; **RCT:** randomised controlled trial; **SMD:** standardised mean difference.

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect.

[1] Overall risk of bias for this comparison was 'High' for 8/13 and 'some concerns' for the remaining 5/13. In those with high risk, risk derived from randomisation (1), missing outcome data (6), protocol deviation (1) and selective reporting (2). The combined weight of the studies with high risk is 51.2%. Therefore, risk of bias for this comparison was downgraded by 1 level to 'serious.'

[2] Direction of effect had some variability (one study, weight = 6.8%, favoured control), while remaining studies favoured experimental arms. Magnitude of effect varied across studies and CIs had fair overlap. Heterogeneity P = 0.05, I^2 = 42%. Heterogeneity explained: attributable to single study with opposite direction of effect (Mendelson 2014). See sensitivity analysis with this study excluded (Analysis 2.13).

[3] Studies retrieved and analysed for this review directly compare the population, interventions and outcomes of interest, as predefined, in our review protocol.

[4] Performed optimal information size (OIS) (sample size) calculation, as per GRADE Handbook recommendations, which indicated OIS criterion was met for this outcome. Confidence interval does not include null and includes potential for important benefit.

[5] Overall risk of bias for this comparison was 'High' for 3/7 and 'some concerns' for the remaining 4/7. In those with high risk, risk derived from missing outcome data (1) and selective reporting (2). The combined weight of the studies with high risk is 14.2%.

[6] Overall risk of bias for this comparison was 'High' for 1/2 and 'some concerns' for the remaining 1/2. Hisk risk derived from missing outcome data. The weight of high risk study is 24.8%. Therefore, risk of bias for this comparison was downgraded by 1 level to 'serious.'

[7] OIS (sample size) calculation, as per GRADE Handbook recommendations, which indicated OIS criterion not met for this outcome. Therefore, Imprecision for this comparison was downgraded by 1 level to 'serious.'

[8] Performed OIS (sample size) calculation, as per GRADE Handbook recommendations, which indicated OIS criterion not met for this outcome. Additionally, CI includes null and potential for important difference in withdrawals. Therefore, Imprecision for this comparison was downgraded by 2 levels to 'very serious.'

[9] Overallrisk of bias for this outcome is 'high' for all, or nearly all, included studies because, for all or nearly all studies assessed for this outcome, the following were true: a) outcome assessors (whether participant or investigator) were aware of the intervention received by study participants, b) the outcome assessment could have been influenced by knowledge of the intervention received (because each involves some judgement by the assessor, whether participant or investigator) and c) we have no further information that would permit further adjudication of the likelihood that outcome assessment was influenced by knowledge of the intervention received. Therefore, risk of bias for this comparison was downgraded by 1 level to 'serious.'

[10] OIS likely insufficient.Therefore, Imprecision for this comparison was downgraded by 1 level to 'serious.'

[11] Our review included a comprehensive search for published reports conducted. All (or nearly all) studies, including all small studies, for this comparison found a benefit for the intervention. Thus, due to suspicion for publication bias, this outcome was downgraded by one level.

[12] Overall risk of bias for this comparison was 'High' for 7/12 and 'some concerns' for the remaining 5/12. In those with high risk, risk derived from randomisation (1), missing outcome data (5), protocol deviation (1) and selective reporting (2). The combined weight of the studies with high risk is 46.1%.

Summary of findings 3. Behavioural intervention versus control

Behavioural therapy + CPAP compared to control + CPAP in adults with obstructive sleep apnoea

Patient or population: adults with obstructive sleep apnoea
Setting: community
Intervention: behavioural therapy + CPAP
Comparison: control + CPAP

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with control + CPAP	Risk with Behavioural therapy + CPAP				
3.1 CPAP Device Usage (hours/night)	The mean CPAP Device Usage ranged from 1.48 to 5.1 hours/night	MD 1.31 hours/night higher (0.95 higher to 1.66 higher)	-	578 (8 RCTs)	⊕⊕⊕⊕ HIGH [1 2 3]	

3.2 CPAP Device Usage, sensitivity analysis: adherence in control group < four hours/night	The mean CPAP Device Usage, sensitivity analysis: adherence in control group < four hours/night ranged from 1.48 to 3.65 hours/night	MD 1.32 hours/night higher (0.93 higher to 1.72 higher)	-	525 (6 RCTs)	⊕⊕⊕⊖ MODERATE [1 2 4 5]
3.3 N deemed adherent (≥ four hours/night)	Study population		OR 1.70 (1.20 to 2.41)	549 (6 RCTs)	⊕⊕⊕⊕ HIGH [1 6 7]
	371 per 1,000	501 per 1,000 (414 to 587)			
3.4 Withdrawal	146 per 1,000	101 per 1,000 (70 to 143)	OR 0.66 (0.44 to 0.98)	939 (10 RCTs)	⊕⊕⊕⊕ HIGH
3.5 ESS (Endpoint scores)	The mean ESS (Endpoint scores) ranged from 7.1 to 12.5	MD 2.42 lower (4.27 lower to 0.57 lower)	-	271 (5 RCTs)	⊕⊕⊖⊖ LOW [1 8 9]
3.6 AHI on treatment - Endpoint	The mean AHI at endpoint ranged from 3.7 to 4.3 events/hour	MD 0.95 events/hour lower (2.25 lower to 0.34 higher)	-	89 (2 RCTs)	⊕⊖⊖⊖ VERY LOW [1 10 11]
3.7 Quality of Life - Comparison of Values at Endpoint	The mean Quality of Life - Comparison of Values at Endpoint was 0	SMD 0 (0.26 lower to 0.26 higher)	-	228 (3 RCTs)	⊕⊕⊕⊖ MODERATE [1 8]
3.7.1 Quality of Life - Comparison of Values at Endpoint - QoL: FOSQ - Endpoint	The mean Quality of Life - Comparison of Values at Endpoint - QoL: FOSQ - Endpoint was 0	SMD 0.01 higher (0.26 lower to 0.29 higher)	-	200 (2 RCTs)	-

*__The risk in the intervention group__ (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).

AHI: apnoea hypopnoea index; **CI:** Confidence interval; **CPAP**: Continuous positive airways pressure;**ESS**: Epworth sleepiness scale; **FOSQ**: Functional Outcomes of Sleep Questionnaire; **GRADE**: Grades of Recommendation, Assessment, Development and Evaluation; **MD:** mean difference; **OR:** Odds ratio; **RCT:** randomised controlled trial; **SMD:** standardised mean difference.

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect.

[1] Studies retrieved and analysed for this review directly compare the population, interventions and outcomes of interest, as predefined, in our review protocol.

[2] Performed optimal information size (OIS) (sample size) calculation, as per GRADE Handbook recommendations, which indicated OIS criterion was met for this outcome. Confidence interval does not include null and includes potential for important benefit (1 hour more use/night).
[3] Overall risk of bias for this comparison was 'Some concerns' for 4/8 and 'high' for the remaining 4/8. In those with high risk, risk derived from randomisation (1), missing outcome (1), protocol deviation/missing outcome data (1) and selective reporting (1). The combined weight of the four studies with high risk is 45.1%.
[4] Overall risk of bias for this comparison was 'Some concerns' for 3/6 and 'high' for the remaining 3/6. In those with high risk, risk derived from missing outcome (1), protocol deviation/missing outcome data (1) and selective reporting (1). The combined weight of the two studies with high risk is 54.4%. Therefore, risk of bias for this comparison was downgraded by 1 level to 'serious.'
[5] Direction of effect did not vary. Magnitude of effect varied somewhat and CIs had good overlap. Heterogeneity P = 0.38, I^2 = 6%.
[6] Overall risk of bias for this comparison was 'Some concerns' for 2/6 and 'high' for the remaining 4/6. In those with high risk, risk derived from randomisation process (1), missing outcome data (1), protocol deviation/missing outcome data (1) and selective reporting (1). The combined weight of the two studies with high risk is 32.4%.
[7] One (second highest-weighted) study found opposite direction of effect (favoured control). The remaining studies had similar magnitude of effect and showed reasonable overlap of CIs. Heterogeneity P = 0.46, I^2 = 0%.
[8] Overall risk of bias for this outcome is 'high' for all, or nearly all, included studies because, for all or nearly all studies assessed for this outcome, the following were true: a) outcome assessors (whether participant or investigator) were aware of the intervention received by study participants, b) the outcome assessment could have been influenced by knowledge of the intervention received (because each involves some judgement by the assessor, whether participant or investigator) and c) we have no further information that would permit further adjudication of the likelihood that outcome assessment was influenced by knowledge of the intervention received. Therefore, risk of bias for this comparison was downgraded by 1 level to 'serious.'
[9] Direction of effect had some variability (one study, weight =17.9%, modestly favoured control), while remaining studies favoured experimental arms. Magnitude of effect varied significantly and CIs had moderate overlap. Heterogeneity P = 0.008, I^2=71%.Therefore, inconsistency was downgraded by one level to 'serious.'
[10] Only two studies provided information for this comparison. Overall risk of bias for this comparison was 'Some concerns' for 1/2 and 'high' for the remaining 1/2 (Diaferia 2017). High-risk derived from protocol deviation/missing outcome data. Additionally, the other study (Dantas 2015) had 'some concerns' for domain 1 (study level), randomisation process. Therefore, risk of bias for this comparison was downgraded by 1 level to 'serious.'
[11] Performed OIS (sample size) calculation, as per GRADE Handbook recommendations, which indicated OIS criterion not met for this outcome. Additionally, CI contained null effect and potential for important benefit.Therefore, Imprecision for this comparison was downgraded by 2 levels to 'very serious.'

Summary of findings 4. Mixed (BEH/EDU/SUP) intervention versus control

Mixed (SUP/EDU/BEH) Intervention + CPAP compared to Usual Care + CPAP in adults with obstructive sleep apnoea

Patient or population: adults with obstructive sleep apnoea
Setting: community
Intervention: mixed (SUP/EDU/BEH) Intervention + CPAP
Comparison: usual Care + CPAP

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with Usual Care + CPAP	Risk with Mixed (SUP/EDU/BEH) Intervention + CPAP				
4.1 CPAP Device Usage (hours/night)	The mean CPAP Device Usage ranged from 2.6 to 5.5 hours/night	MD 0.82 hours/night higher	-	4509 (11 RCTs)	⊕⊖⊖⊖ VERY LOW [1 2 3 4]	

		(0.20 higher to 1.43 higher)			
4.2 CPAP Device Usage, sensitivity analysis: adherence in control group < four hours/night	The mean CPAP Device Usage, sensitivity analysis: adherence in control group < four hours/night ranged from 2.6 to 3.8 hours/night	MD 1.77 hours/night higher (0.21 higher to 3.34 higher)	-	343 (2 RCTs)	⊕⊖⊖⊖ VERY LOW [4 5 6]
4.3 N deemed adherent (≥ four hours/night)	741 per 1,000	830 per 1,000 (755 to 886)	OR 1.71 (1.08 to 2.72)	4015 (9 RCTs)	⊕⊖⊖⊖ VERY LOW [4 7 8]
4.4 Withdrawal	129 per 1,000	83 per 1,000 (40 to 161)	OR 0.61 (0.28 to 1.30)	4956 (11 RCTs)	⊕⊖⊖⊖ VERY LOW [9 10 11]
4.5 Quality of LIfe: Comparison of Change from Baseline Values	The mean Quality of LIfe: Comparison of Change from Baseline Values was 0	SMD 0.45 higher (0.12 higher to 0.78 higher)	-	3012 (2 RCTs)	⊕⊕⊖⊖ LOW [12 13 14]
4.7 Anxiety Symptom Rating - Comparison of Values at Endpoint	The mean Anxiety Symptom Rating - Comparison of Values at Endpoint was 0	SMD 0.19 lower (0.47 lower to 0.09 higher)	-	333 (3 RCTs)	⊕⊖⊖⊖ VERY LOW [12 15 16]

*__The risk in the intervention group__ (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; **CPAP**: Continuous positive airways pressure; **GRADE**: Grades of Recommendation, Assessment, Development and Evaluation; **MD:** mean difference; **OR:** Odds ratio; **RCT:** randomised controlled trial; **SMD:** standardised mean difference.

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect.

[1] Overall risk of bias for this comparison was 'Some concerns' for 4/11 and 'high' for the remaining 6/11. In those with high risk, risk derived from randomisation (2), missing outcome data (2), and selective reporting (3). The combined weight of the studies with high risk is 61.8%. (1 high risk study. Lewis 2006, has no weight contribution because mean difference not estimable.) Therefore, risk of bias for this comparison was downgraded by 1 level to 'serious.'

[2] Direction of effect had some variability (two studies, combined weight =18.8%, favoured control), while remaining studies favoured experimental arms. Magnitude of effect varied significantly and CIs had relatively poor overlap. Heterogeneity $P < 0.00001$, $I^2 = 92\%$ suggesting very substantial statistical heterogeneity of effect. Therefore, inconsistency was downgraded by two levels to 'very serious.'

[3] Studies retrieved and analysed for this review directly compare the population, interventions and outcomes of interest, as predefined, in our review protocol.

[4] Performed optimal information size (OIS) (sample size) calculation, as per GRADE Handbook recommendations, which indicated OIS criterion was met for this outcome. Confidence interval does not include null and includes potential for important benefit.

[5] Overall risk of bias for this comparison was 'Some concerns' for 1/2 and 'high' for the remaining 1/2. In those with high risk, risk derived from missing outcome data. The weight of the high risk study is 48.3%.Because there were only two studies for this comparison and both were either high or 'some concerns,' risk of bias for this comparison was downgraded by 1 level to 'serious.'

[6] There was no variability in direction of effect, both studies favoured experimental arms. Magnitude of effect varied substantially and CIs had no overlap. Heterogeneity P = 0.002, I^2 = 90% suggesting very substantial statistical heterogeneity of effect. Therefore, inconsistency was downgraded by two levels to 'very serious.'

[7] Overall risk of bias for this comparison was 'high' for 4/9. In those with high risk, risk derived from randomisation (1), missing outcome data (1), and selective reporting (2). The combined weight of the studies with high risk is 51.3%. Therefore, risk of bias for this comparison was downgraded by 1 level to 'serious.'

[8] There was variability in direction of effect (three studies, combined weight=31,6%, favoured control), while remaining studies favoured experimental arms. Magnitude of effect varied substantially and CIs had modest overlap. Heterogeneity P < 0.00001, I^2 = 79% suggesting very substantial statistical heterogeneity of effect.Therefore, inconsistency was downgraded by two levels to 'very serious.'

[9] Performed OIS (sample size) calculation, as per GRADE Handbook recommendations, which indicated OIS criterion was met for this outcome. Confidence interval includes null and includes potential for important benefit.Therefore, imprecision was downgraded by 1 level to 'serious.'

[10] There was variability in direction of effect (five studies, combined weight = 35.4%, favoured control), while remaining studies favoured experimental arms. Magnitude of effect varied substantially and CIs had modest overlap. Heterogeneity P < 0.00001, I^2 = 85% suggesting very substantial statistical heterogeneity of effect.Therefore, inconsistency was downgraded by two levels to 'very serious.'

[11] Overall risk of bias for this comparison was 'high' for 6/11 studies. In those with high risk, risk derived from randomisation (2), missing outcome data (2), and selective reporting (2). The combined weight of the studies with high risk is 52.80%. Therefore, risk of bias for this comparison was downgraded by 1 level to 'serious.'

[12] Overall risk of bias for this outcome is 'high' for all, or nearly all, included studies because, for all or nearly all studies assessed for this outcome, the following were true: a) outcome assessors (whether participant or investigator) were aware of the intervention received by study participants, b) the outcome assessment could have been influenced by knowledge of the intervention received (because each involves some judgement by the assessor, whether participant or investigator) and c) we have no further information that would permit further adjudication of the likelihood that outcome assessment was influenced by knowledge of the intervention received.Therefore, risk of bias for this comparison was downgraded by 1 level to 'serious.'

[13] There was no variability in direction of effect, both studies favoured experimental arms. Magnitude of effect varied substantially and CIs had minimal overlap. Heterogeneity P = 0.03, I^2 = 79% suggesting considerable heterogeneity of effect.Therefore, inconsistency was downgraded by 1 level to 'serious.'

[14] Sample size likely sufficient. Confidence interval does not include null, but also likely does not include potential for important benefit (i.e. standardised mean difference of at least 1). No downgrade.

[15] Overall risk of bias for this outcome is 'high' for all, or nearly all, included studies because, for all or nearly all studies assessed for this outcome, the following were true: a) outcome assessors (whether participant or investigator) were aware of the intervention received by study participants, b) the outcome assessment could have been influenced by knowledge of the intervention received (because each involves some judgement by the assessor, whether participant or investigator) and c) we have no further information that would permit further adjudication of the likelihood that outcome assessment was influenced by knowledge of the intervention received. Additionally, a different anxiety symptom rating scale was used for each and they targeted different dimensions of anxiety (e.g. state vs. trait). Therefore, risk of bias for this comparison was downgraded by 2 levels to 'very serious.'

[16] Sample size for this comparison relatively small, OIS probably not met (approximated based on comparison of means for study with highest weight). CI includes null but likely does not include important benefit/harm.Therefore, imprecision was downgraded by 1 level to 'serious.'

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. Prolonged airway occlusion may lead to oxygen desaturation, which reduces vascular elasticity, increases coagulability and blood pressure, and predisposes to atherosclerosis (Gagnon 2014). The hypoxia and subsequent reoxygenation caused by OSA can increase blood brain barrier permeability, resulting in neurotoxicity and both medical and neuropsychiatric consequences (Bucks 2013; Canessa 2011; Devita 2017; Lochhead 2010; Olaithe 2013; Osorio 2015; Pan 2014; Stranks 2016; Verstraeten 2004; Yaffe 2011). Additionally, recurrent hypoxia and increased inspiratory effort lead to sleep fragmentation and frequent arousals from sleep.

For many individuals, these physiological changes and sleep fragmentation collectively lead to a range of symptoms: excessive daytime sleepiness (Schwab 2013), mood alterations (Garbarino 2018; Jackson 2018), impairment of cognition and memory (Delhikar 2019; Gagnon 2019; Olaithe 2013; Olaithe 2018), and changes in driving competence (Gagnon 2014; Karimi 2015; Phillipson 1993; Schwab 2013; Tregear 2009). Furthermore, OSA is associated with cardiovascular, cerebrovascular and metabolic co-morbidities (Dong 2018; Gami 2005; Hashmi 2014; Harsch 2004; Marin 2005; Mokhlesi 2016; Peppard 2000; Punjabi 2009; Schwab 2013; Senaratna 2016; Young 2002; Young 2002a; ; ;), as well as increased mortality (Gami 2005; Marin 2005; Marshall 2008; Marshall 2014; Punjabi 2009; Yaggi 2005; Young 2008).

Phenotyping of OSA severity (mild, moderate and severe) is commonly designated by apnoea hypopnoea index (AHI) (> 5 and ≤15, 15 to 30, > 30). However, OSA is a heterogeneous disorder with different risk factors, clinical presentations, pathophysiology and morbidity (Sutherland 2018). AHI is not the only parameter characterising OSA severity. Recently developed measures of hypoxic burden may better predict cardiovascular mortality associated with OSA (Azarbarzin 2019). Patients with excessive daytime sleepiness are not only at a higher risk of cardiovascular complications, but also have significantly diminished quality of life (Mazzotti 2019). Finally, degree of daytime symptom is not tightly correlated with AHI, so patients with AHI in the mild range may experience significant impairment and patients with high AHI may be relatively asymptomatic (Garbarino 2018b; Zinchuk 2017).

Description of the intervention

The usual first line treatment for moderate to severe OSA is continuous positive airway pressure (CPAP) (Schwab 2013; Kennedy 2019), which involves the use of an airflow generator to provide a constant stream of pressurised air to splint open and maintain patency of the upper airway during the inspiratory and expiratory phases of breathing. When used throughout the entirety of sleep, CPAP eliminates nearly 100% of obstructive apneas/hypopnoeas for the majority of treated patients (Reeves-Hoche 1994; Sawyer 2011; Sullivan 1981).

Consistent application of CPAP therapy improves the quality of sleep, normalises sleep architecture (Canessa 2011; Baker 2016), reduces daytime sleepiness, enhances neurobehavioural performance (Ancoli-Israel 2008; Bucks 2013; Canessa 2011; Dalmases 2014; Dalmases 2015; Olaithe 2013; Zimmerman 2006); and reduces the risk of motor vehicle crashes (Findley 2000; Giles 2006; Gurubhagavatula 2017t; Hack 2000; Karimi 2015; Tregear 2009). Longitudinal studies have indicated that CPAP treatment has a protective effect on cardiovascular outcomes; patients who are compliant with CPAP achieve better blood pressure control (Haentjens 2007; Marin 2012; Martinez-Garcia 2012; Pedrosa 2013; Pepperell 2002; Thunstrom 2016), and have reduced the risk of cardiovascular events (Campos-Rodriguez 2014; Marin 2005; Martinez-Garcia 2012; Myhill 2012; Wang 2017). Furthermore, adequate adherence to CPAP may slow cognitive decline (Richards 2019), and have a role in the prevention and treatment of acute stroke (Bravata 2011; Faheem 2018; Martinez-Garcia 2009). However, it should be noted that this evidence has yet to be corroborated through randomised controlled trials (RCTs). The largest and most recent systematic review and meta-analysis (Yu 2017) of the effect of CPAP on cardiovascular outcomes found no significant association. Notably CPAP usage was < 4 hours/night in the majority of (and all large) included RCTs. Similar nonsignficant findings were found by the SAVE trial (McEvoy 2016); both of these studies, as well as their proposed implications, are discussed at length in Appendix 1.

Despite the widespread recommendation of CPAP in the management of OSA (Fleetham 2011; Giles 2006; Patil 2019; Schwab 2013), concerns have arisen about its initial and continued acceptance among people who have to use it on a long-term basis (i.e. the majority of patients diagnosed with OSA). Reported adherence to CPAP ranges from 17% to 85% (Crawford 2014; Finkel 2009; Lewis 2004; Libman 2017; Lindberg 2006; Pépin 1999; Rotenberg 2016; Somers 2008; Weaver 2010; Young 2009). 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). Frequently cited side effects leading to CPAP refusal include general discomfort, nasal congestion, abdominal bloating, mask leaks, claustrophobia, and inconvenience of regular usage (Pepin 1995). Poor adherence may also be related to the fact that CPAP requires a substantial and long-term behavioural change. The difficulty of accomplishing such change may be further compounded by the high rates of comorbid depressive and anxiety symptoms found among patients with OSA (Chirinos 2017; Jackson 2018; Ohayon 2003; Saunamaki 2007). Moreover, CPAP therapy is not reimbursed in many countries (particularly for those with less severe OSA symptoms), further discouraging initiation of treatment, despite proven effectiveness.

Previously, CPAP use was measured through subjective self-report or observations made within a clinical setting, each presenting its own bias. Self-reported adherence is often overestimated and inaccurate, and how a patient behaves in a clinical setting is not generalisable to real world behaviour (Kribbs 1993). Technological advances have dramatically improved the accuracy of, and removed bias from adherence measurement through internalised digital counters or electronic microchip, now standard within CPAP devices. Despite this, the number of hours per night and the frequency of usage required to achieve and maintain therapeutic effectiveness are not well established.

Thresholds for "effective" CPAP usage may depend on the desired health benefit, which vary significantly between patients and relative to baseline severity of OSA (Bollig 2010; Campos-Rodriguez

2005; Sawyer 2011;Stradling 2000; Wang 2017; Weaver 2007; Zimmerman 2006; ;). Six to eight hours each night is a common clinical prescription for CPAP, but many studies use a threshold of four hours/night to define 'adherence' (Lewis 2004; Richards 2007). This threshold likely emerged from early seminal studies (Reeves-Hoche 1994; Kribbs 1993; Engleman 1994), in which average use was reported in the range of four hours/night, although the authors did not suggest this represented adequate or effective use. Unfortunately, not only has this threshold been widely employed in clinical trials, but it has directly impacted clinical practice in ways likely unintended by original or subsequent investigators. For example, several commonly-used CPAP devices automatically display a happy face (or other positive feedback) on the user interface once they have reached a use threshold of four hours in a 24-hour cycle. Additionally, some 'payors' will only cover the costs associated with CPAP for patients who use their device at or above an arbitrary (Schwab 2013) minimum of four hours per night on 70% of nights during an initiation period (e.g. Centers for Medicare and Medicaid Services; Mehrtash 2019). These practices, meant to encourage use, may have serious consequences for those aiming to address longstanding symptoms, risk factors or conditions.

Evidence suggests effectiveness of CPAP follows a dose-response curve with benefit accruing at different thresholds for different outcomes. For example, Wang 2017 found that CPAP use < 4 hours/night improved daytime sleepiness, four to six hours/night improved all measured symptoms (sleep quality, daytime sleepiness, fatigue and depressive symptoms) while use of ≥ 6 hours produced significantly still greater improvements in all measured domains. Average nightly AHI is reduced by any CPAP use, but whether it reduces AHI to 'subthreshold' severity (AHI < 5) will depend upon baseline AHI, duration of CPAP use, and duration of sleep without CPAP (i.e. unrecorded time). However, increased use surpassing four hours/night has been associated with improvement in sleep architecture and arousal outcomes, reductions in blood pressure (Yang 2015), and reductions in the risk of cardiovascular and cerebrovascular events, while improved cognition and memory and decreased mortality (from the limited data available) likely require greater than six hours/night (Campos-Rodriguez 2005; Zimmerman 2006). As such, maximising total CPAP use (i.e. to the full amount of recommended nightly sleep for adults, ˜8 hours/night) is optimal and preferred.

How the intervention might work

A substantial amount of studies have investigated predictors of CPAP adherence related to patient characteristics, disease characteristics, and CPAP technology. Research has demonstrated that perceived self-efficacy, confidence, and motivation are both targetable and modifiable (Bandura 1982; Bandura 1986; Bandura 2004; Miller 1994), and correlate well with sustained and successful treatment (Mehrtash 2019). Moreover, social factors, including marital status, partner involvement and attitudes towards treatment, and partner's sleep quality, have been shown to positively influence CPAP adherence (Mehrtash 2019; Lewis 2004). Lastly, early adoption of CPAP treatment (i.e. within the first week to month of CPAP prescription) has been shown to predict long-term adherence behaviour (Aloia 2007; Chervin 1997).

From these predictors, various interventions to improve initial acceptance and subsequent CPAP adherence have been proposed, each varying in duration, intensity, frequency and modality. Some approaches emphasise that increasing knowledge of OSA, CPAP and associated health outcomes may directly promote CPAP adherence. Targeting social and supportive factors, other interventions aim to quickly troubleshoot problems that occur during CPAP treatment and provide regular feedback and encouragement from automated prompts, peers, or healthcare providers. Alternatively, more interactive interventions, designed in accordance with various cognitive and behavioural models, seek to modify motivation, confidence, goal setting behaviours, and other psychological constructs in an effort to improve CPAP adherence. Often, a combination of approaches is used (Aloia 2013; Bartlett 2013; Bouloukaki 2014; Hui 2000; Hwang 2017; Lewis 2006; Meurice 2007; Sawyer 2017; Sedkaoui 2015; Shapiro 2017; Smith 2006; Wang 2012). On the technological domain, modifications of delivery of airway pressure, such as the use of automatically titrating CPAP (auto-CPAP), bi-level PAP (BPAP) and humidification therapy, claim to decrease side effects in the upper airway due to cold and dry airflow and thus improve the comfort of treatment, but have not yielded convincing benefits in clinical trials to date (Smith 2009).

Why it is important to do this review

Despite the apparent efficacy of CPAP and its therapeutic benefits extending beyond amelioration of OSA symptoms to other functional and potential health outcomes, treatment adherence has been persistently low (Rotenberg 2016). Interventions directed at improving CPAP usage vary in methodology, complexity and effectiveness. Knowing what type of intervention is efficacious and potentially effective in clinical practice would guide clinicians and health authorities in developing services and guidelines aimed at improving treatment adherence. Since the last Cochrane Review, published in 2014 (Wozniak 2014), 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 interventions that employ educational, supportive, behavioural, or mixed approaches to encourage adults who have been prescribed continuous positive airway pressure (CPAP) to use their devices.

METHODS

Criteria for considering studies for this review

Types of studies

Randomised, parallel-controlled trials of any duration.

Types of participants

Participants were adults of either sex with a diagnosis of obstructive sleep apnoea (OSA) using a recognised sleep diagnostic tool giving an Oxygen Desaturation Index (ODI) of ≥ 5 per hour or an apnoea hypopnoea index (AHI) ≥ 5 per hour. Trials that explicitly recruited patients with central sleep apnoea were not eligible for inclusion.

Types of interventions

Intervention group

Any short-term or sustained intervention aimed at encouraging uptake, acclimation, improvement or maintenance of continuous positive airway pressure (CPAP) adherence among individuals

with a diagnosis of OSA. Examples of modalities that our review intended to capture include educational, supportive, group-based, mindfulness-based, cognitive, behavioural, motivational or approaches utilising a combination of these strategies.

Control group

Participants in the control group may receive instruction that would be used by the study centre in question, provided that the equivalent 'background' level of instruction was also offered and delivered to the intervention group. Intervention and control groups must have also either 1) received the same make of CPAP machine and pressure delivery mode (i.e. fixed, auto-titrating, bi-level PAP (BPAP), etc.) or 2) receive PAP devices in a randomly distributed manner, such that device make remained independent of group assignment.

Types of outcome measures

Primary outcomes

CPAP device usage (hours/night) as measured by:

- microprocessor and monitor that measure pressure at the mask for every minute of each 24-hour day;
- 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);
- subjective participant reports of the duration of CPAP use.

Secondary outcomes

The following secondary outcomes were considered:

- proportion of participants adherent (≥ 4 hours/night);
- sleepiness symptom scores such as the Epworth Sleepiness Scale (ESS);
- disease-specific quality of life scores such as Functional Outcomes of Sleep Questionnaire (FOSQ) or Calgary Sleep apnoea Quality of Life Index (SAQLI) scores;
- any standardised depression or anxiety symptom scale measurement;
- withdrawals from the study;
- oxygen desaturation index (ODI), apnoea hypopnoea index (AHI);
- cost-effectiveness.

Search methods for identification of studies

Electronic searches

We identified studies from the Cochrane Airways Trials Register, which is maintained by the Information Specialist for the Group. The Cochrane Airways Trials Register contains studies identified from several sources.

1. Monthly searches of the Cochrane Central Register of Controlled Trials (CENTRAL), through the Cochrane Register of Studies Online (crso.cochrane.org)
2. Weekly searches of MEDLINE Ovid SP 1946 to April 2019
3. Weekly searches of Embase Ovid SP 1974 to April 2019
4. Monthly searches of PsycINFO Ovid SP 1967 to April 2019
5. Monthly searches of CINAHL EBSCO (Cumulative Index to Nursing and Allied Health Literature) 1937 to April 2019
6. Monthly searches of AMED EBSCO (Allied and Complementary Medicine) all years to April 2019
7. Hand searches of the proceedings of major respiratory conferences.

Studies contained in the Trials Register were identified through search strategies based on the scope of Cochrane Airways. Details of these strategies, as well as a list of handsearched conference proceedings are in Appendix 2. See Appendix 3 for search terms used to identify studies for this review.

Searches in the Cochrane Airways Trials Register and additional sources were completed from inception to April 2019, with no restrictions on language or publication type. Review authors attempted to contact authors to locate potential unpublished or in-progress studies that met the inclusion criteria. When seeking further information of studies represented by trial registries or conference proceedings abstracts, the review authors contacted the trial authors for clarification if 1) the study was deemed to be potentially relevant according to inclusion criteria, 2) if the study appeared to be complete based on the information documented on ClinicalTrials.gov, 3) if no full publication was listed on the trial registry records, 4) and if no full publication was identified via an author/title/element PubMed search.

Searching other resources

We searched Epistemonikos (International database of systematic reviews) all years to April 2019 to identify other relevant systematic reviews, and checked their reference lists. We completed additional handsearching of the bibliographies of identified trials. The 2013-2018 ATS and the 2013-2018 European Respiratory Society (ERS) meeting abstracts were also handsearched for the current review update.

Data collection and analysis

Selection of studies

Review authors (KDA and LW) independently reviewed the titles, abstracts and citations identified through electronic searching to assess potential relevance for full review. Conflicting decisions on inclusion were resolved through discussion and consensus. Records eligible for full-text review were scrutinised independently (KDA and LW) for inclusion based on a priori criteria for population, study design, intervention and outcome. Agreement was measured by simple agreement and conflicting decisions on study inclusion were resolved through discussion and consensus (KDA, LW, DRW, IS). See Figure 1 Study Flow Diagram. Reasons for study exclusion at the full-text review stage were agreed upon by review authors (KDA, LW, DRW, IS) and recorded in the Characteristics of excluded studies table. For included studies, descriptive information for studies and study populations is presented in tabular form (Table 1; Table 2; Table 3;Table 4; Table 5; Table 6; Table 7).

Figure 1. Study flow diagram.

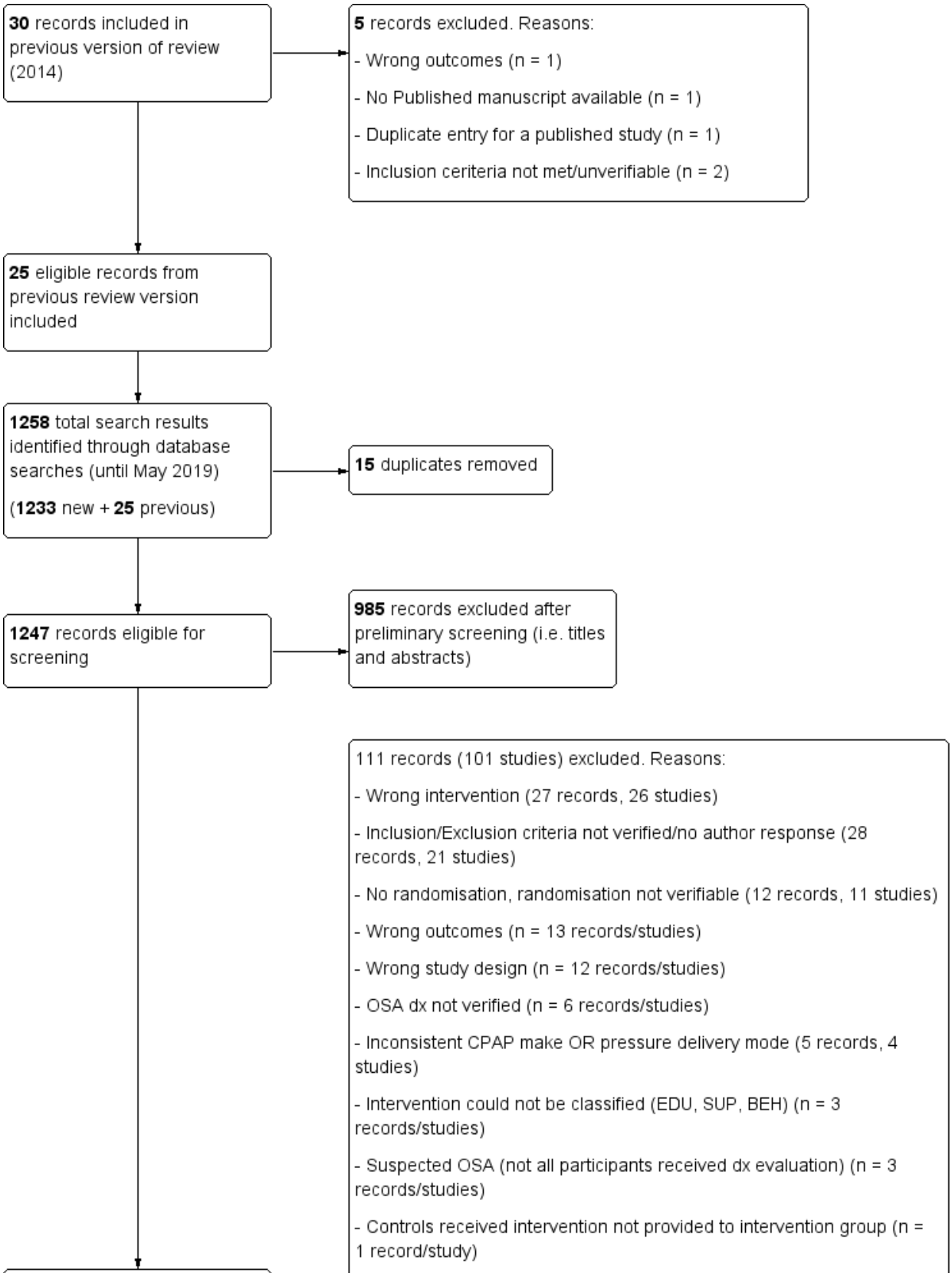
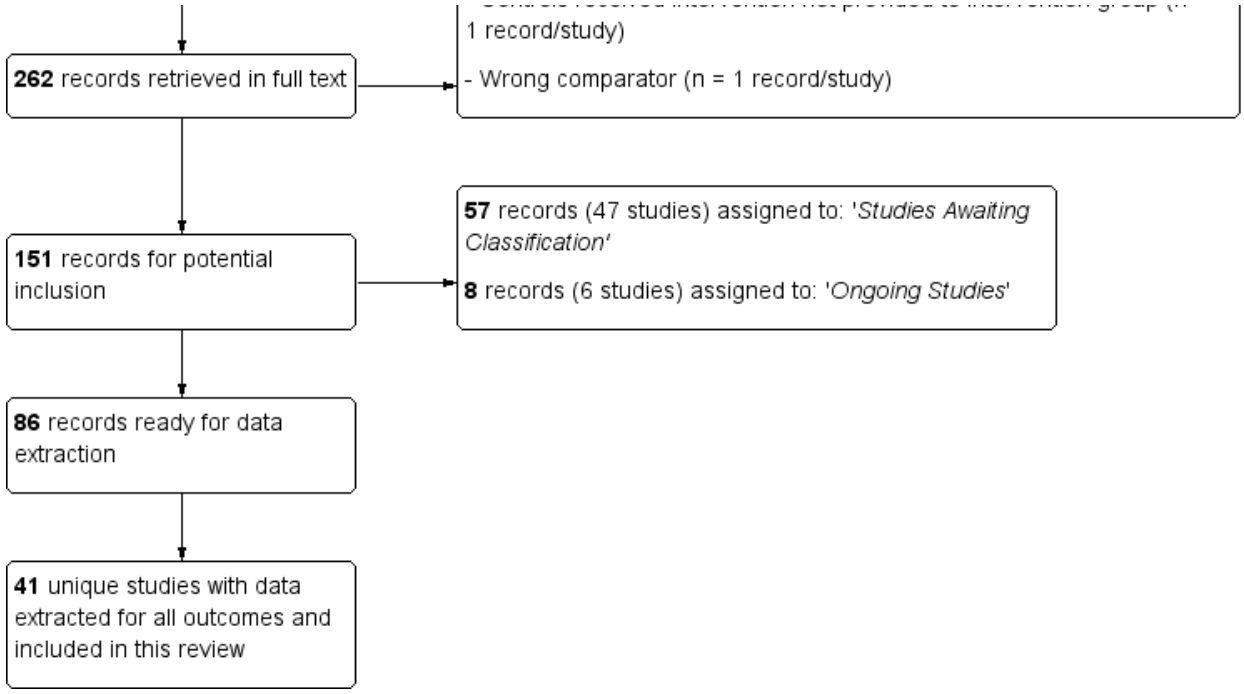


Figure 1. (Continued)



Data extraction and management

Data from published studies were extracted (KDA and TE) and checked (KDA, TE, LW) independently. Data were extracted first to an excel database and then to RevMan. After completion of RevMan data input from excel database, data in RevMan were checked for errors by comparison of RevMan tables to original published reports (LW). When data were unavailable from trial registries or conference abstracts, study authors were contacted (TE) to determine if data may be obtained directly. Information from authors was also sought to validate study design and methods for 'Risk of bias' and GRADE assessments. Manuscripts published in languages other than English were translated by volunteers co-ordinated by Cochrane Airway's Assitant Managing Editor using a standardised form.

Categorisation of studies

In an attempt to limit the heterogeneity that arises when studies are combined into one overarching comparison, studies were classified into one of four comparisons based on the prevailing nature of the active intervention. Classifications were determined by detailed review of study authors' intervention descriptions, rather than the label applied to the intervention by study authors (e.g. in title or abstract). In most cases, the authors' designation was consistent with our judgement.

- ***Educational versus control*** – Interventions imparting information about CPAP treatment or about OSA more generally, delivered through face-to-face didactic sessions, group educational sessions, written materials, video format, or any combination of these. Interventions that did not involve a component of active engagement from the participants other than reading written materials or observing a presentation or demonstration, even if the content derived from a behavioural change model, were classified as educational.
- ***Supportive versus control*** - Interventions in which participants were provided with additional clinical follow-up (e.g. additional office- or home-based visits or phone check-ins by clinical staff), or with telemonitoring equipment that facilitated either self-monitoring of CPAP usage or monitoring by clinical staff to prompt 'as needed' clinical follow-up (e.g. a phone call made to participants when CPAP usage fell below a predetermined threshold) for the purpose of addressing barriers or difficulties with CPAP usage in a timely manner (e.g. telemedicine systems, digitised phone calls or audio messages, and home visits). Thus, supportive interventions either encouraged participants to provide feedback on their experience of CPAP treatment on an ongoing basis or employed automated assessment of transmitted CPAP data to trigger clinician review/intervention.
- ***Behavioural versus control*** - Interventions employing psychotherapeutic techniques deriving from behavioural, cognitive or related models of health behaviour change (e.g. specific models within this broad genre include motivational enhancement therapy (Miller 1994), Social Cognitive Theory (Bandura 1982; Bandura 1986), Transtheoretical/Stages of Change Model (Prochaska 1983), and cognitive behavioural therapy (CBT) (Beck 1975)). By definition, behavioural interventions under any of these related models involves at least a minimal degree of direct participant engagement or interaction (as opposed to purely educational, in which information is merely imparted to participants, even if the educational content or style of presentation was based on a behavioural model). Thus, behavioural interventions targeted a modifiable and measurable construct known or hypothesised to influence health beliefs about OSA and CPAP therapy and CPAP adherence behaviour. The objectives of such interventions might include enhancing behavioural action, motivation for change, self-efficacy, outcome expectations and decisional balance in favour of CPAP.

- ***Mixed versus control*** – Interventions that combined elements of two or more previously listed intervention-types (e.g. educational video + telemedicine follow-up), and therefore met criteria for belonging to more than one of the above-described classes.

For studies that employed multiple intervention arms, the active interventions arms were separated and included in the appropriate comparison class depending exclusively on the content of that arm (i.e. each arm was independently classified as educational, supportive, behavioural or mixed).

Assessment of risk of bias in included studies

The review authors (KDA, LW, TE) assessed the risk of bias of included studies for the primary outcome, CPAP usage, according to the revised Cochrane 'Risk of bias 2' tool (Sterne 2019) Cochrane's recommended 'Risk of bias' tool for randomised trials as of 15 March 2019, which includes the following five domains:

- randomisation processes;
- deviations from intended interventions;
- missing outcome data;
- measurement of outcome;
- selective outcome reporting.

Following detailed guidance provided in the revised Cochrane 'Risk of bias 2' full guidance document (Higgins 2019) and utilising the 'Risk of bias 2' excel tool (downloaded 04 April 2019), we graded each potential source of bias as 'low', 'some concerns', or 'high' and provided justification for item- and domain-level judgements.

Given the nature of interventions, we did not anticipate blinding of participants in studies; however we attempted to determine if data collectors and analysts were blinded until the end of study data collection for 'Risk of bias' assessment.

Review authors (KDA, LW, TE) used the 'Risk of bias2' tool to perform additional 'Risk of bias' assessments as part of GRADE assessments. See Data collection and analysis section, 'Summary of findings' sub-section for details of GRADE 'Risk of bias' assessments.

We used the 'Risk of bias1' tool to provide study-level judgement for each new study under the following domains: random sequence generation; allocation concealment; blinding (performance and detection bias); incomplete outcome data; selective outcome reporting; other bias.Studies included in the previous review update were independently assessed by two review authors (DRW, IS) using the criteria outlined in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011), and included in the previous report. Studies new to this review update were independently assessed by two review authors (LW, TE) using the criteria outlined in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011), and added to the previous assessments. We graded each potential source of bias as high, low, or unclear and provided our rationale based on information from the study report and our judgement.

Measures of treatment effect

Effect measures

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 in which all studies employed the same outcome measure or instrument (e.g. CPAP usage measured by device; sleepiness measured by ESS). Standardised mean differences (SMDs) were calculated for continuous variables in which studies employed different outcome measures or instruments (e.g. Functional Outcomes of Sleep Questionnaire (FOSQ) and Calgary Sleep apnoea Quality of Life Index (SAQLI) as metrics for quality of life).

Handling skewed data

Our protocol specified that when either medians or interquartile ranges were reported for treatment effects, this would serve as an indicator of skewed outcome distributions. In these cases, analysis based on means were not possible or appropriate. For outcomes where the lowest or highest possible value is known to exist (and not for values such as change from baseline measures), we planned to conduct a rough check for skew as follows: The observed mean would be subtracted from the highest possible (known) value (or the lowest possible (known) value subtracted from the observed mean), and this quantity would be divided by the standard deviation (SD). If the resulting ratio was < 2, this would suggest skew and a ratio < 1 would be considered strong evidence of a skewed distribution. In cases of strong evidence of skew, we would seek to collect appropriate data from the trialists. Appropriate data summaries and analytic strategies would depend on the situation and consultation with a knowledgeable statistician would be sought when necessary.

Unit of analysis issues

The unit of analysis was the patient.

Studies with multiple treatment groups

In most cases, intervention arms of multiple-arm studies fell under distinct intervention classes (e.g. one arm was educational and another behavioural). In such cases (Aloia 2013; Chervin 1997; Hwang 2017; Wang 2012), the intervention arms were considered within their appropriate class and the full control arm was included in each class-specific comparisons.

For multiple-arm studies in which separate intervention arms fell under the same class (Meurice 2007; Pengo 2018), all relevant experimental arms were combined to conduct a single pair-wise comparison to the full control arm (Higgins 2011).

Dealing with missing data

Where studies had missing data (e.g. means reported without SD), we contacted trial authors by email with a request for complete data. Data that were still missing after efforts to secure it were handled as follows. Data assessed to be missing at random are unlikely to bias results, so analysis proceeded with available data in those instances. For data determined to be not missing at random, an imputation strategy that accounts for uncertainty in the imputed values and results was employed. Per our protocol, sensitivity analyses were conducted if necessary to determine the potential impact of these assumptions.

Assessment of heterogeneity

We used the Inconsistency statistic (I^2) to measure heterogeneity among the trials in each outcome analysis. For outcomes without evidence of heterogeneity (I^2 = 0%) a fixed-effect model was used. For outcomes with non-zero measures of inconsistency (I^2 > 0%), potential sources of heterogeneity were explored, including examination of small-study effects and differences in magnitude or direction of effect. In outcomes for which heterogeneity was explained after examination, the nature of the explanations uncovered were used to make decisions regarding whether to proceed with the meta-analysis of that outcome, the analysis model to be used, and whether further sensitivity analyses were warranted (Higgins 2011). In outcomes for which heterogeneity remained unexplained but meta-analysis still warranted, we employed a random-effects model.

Assessment of reporting biases

We assessed publication bias using funnel plot estimate when criteria to apply asymmetry tests were met (i.e. ≥10 studies in the outcome, heterogeneity I^2≤ 50%, ratio of maximal to minimal variance across studies > 4 (Ioannidis 2017). When these criteria were not met, assessment of publication bias was based on guidelines provided in the GRADE handbook, Section 5.2.5 Publication Bias, and published online tutorials provided by Cochrane and GRADEpro online software (Schunemann 2013; GRADEpro 2015)

Data synthesis

See Measures of treatment effect section for description of the effect measures used by review authors to describe effect sizes in included studies and meta-analyses. Results were combined across studies for meta-analysis, subgroup and sensitivity analyses using RevMan software. Heterogeneity assessment was also conducted in RevMan for each comparison.

Subgroup analysis and investigation of heterogeneity

Subgroup comparisons planned a priori included the following.

- Participants with prior CPAP exposure versus CPAP-naive participants
- Sex (male versus female)
- Baseline AHI: mild (AHI ≥ 5 to < 15), moderate (AHI ≥ 15 to < 30), severe (AHI ≥ 30)
- Baseline Epworth Sleepiness Scale Score (ESS: 0 to 10 versus 11 to 24)

Sensitivity analysis

For our main outcome of CPAP usage, we planned (a priori) sensitivity analyses to analyse studies in which CPAP usage in the control arm was < 4 hours per night and studies in which participants were unaware that their CPAP usage was being recorded.

'Summary of findings' tables

We included 'Summary of findings' tables for the four comparison categories (behavioural versus control, educational versus control, supportive versus control, mixed versus control). Information about the following key outcomes is presented in the tables where possible.

- CPAP machine usage
- Sleepiness, depressive and anxiety symptoms
- Quality of life
- Study withdrawal
- Cost-effectiveness

We additionally applied methods outlined by the GRADE working group (Schunemann 2013; GRADEpro 2015) to rate the confidence in estimates by considering the following domains.

- Risk of bias
- Imprecision
- Inconsistency
- Indirectness
- Publication bias
- Large effects

In downgrading risk of bias within GRADE assessments, we followed the guidance provided in the GRADE Handbook section on guidelines for authors of systematic reviews. When assessing a group of studies (e.g. within an intervention class), risk of bias was downgraded by one level if the combined weight of studies with high risk of bias was > 50%. It was downgraded by an additional level if, in addition, the remaining studies had 'Risk of bias' ratings that were predominantly ‘some concerns’.

RESULTS

Description of studies

Results of the search

See Figure 1 for the study flow diagram. From the previous update of this review, we retained 25 studies (literature search dates: all years to January 2013). Five previously included studies were excluded in the present review for the following reasons: study analysed wrong outcomes (Schiefelbein 2005), not all inclusion criteria met (Taylor 2006; Wiese 2005), no full published report currently available (Epstein 2000), and study record was a duplicate entry for a published report (NCT01715194). Updated searches conducted to May 2019 yielded 16 new studies that met the review's inclusion criteria.

This review summarises the evidence from all 41 included studies. For descriptions of each study, refer to the Characteristics of included studies of this paper. Forty-seven additional studies were judged to be potentially relevant but could not be assessed for inclusion until additional information is obtained; these were assigned to Studies awaiting classification. Six additional studies were identified as relevant but are currently ongoing (i.e. data and results are not yet publicly available) and were therefore assigned to Ongoing studies (Abreu 2013; Bakker 2017; Castronovo 2017; Crawford 2016; Kotzian 2018; Seixas 2018).

We excluded 101 studies from this review; please see Characteristics of excluded studies for reasons for exclusion.

Included studies

Study design

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

Participants

A total of 9005 participants were included and randomised in the studies (Table 1). Mean (SD) age across all studies was 54.3 (5.3). Mean of apnoea hypopnoea index (AHI), Epworth Sleepiness Scale (ESS) and body mass index (BMI) across studies reporting these values was 40.6 (9.9), 11.9 (2.4) and 33.1 (2.7), respectively. Among included studies reporting ESS at baseline, average ESS scores at baseline indicated that 75% of participants suffered from excessive daytime somnolence (ESS 11 to 24). Overall mean baseline AHI among included studies reporting AHI was 40.6 (median 40.7) events/hour, corresponding to severe obstructive sleep apnoea (OSA). Additionally, average AHI measurements at baseline indicated that 82% of participants had severe OSA (AHI > 30). Twenty-seven studies included participants that were naive to continuous positive airway pressure (CPAP) therapy; 13 did not specify CPAP naivete, and one study included participants who were previously exposed to CPAP therapy. See Table 2 for a breakdown of mean participant characteristics by intervention class.

Included randomised controlled trials (RCTs) were conducted between 1997 and 2018 in 14 countries: Australia (3), Belgium (1), Brazil (1), Canada (1), China (2), Hong Kong (2), France (4), Greece (1), Italy (2), Portugal (2), Spain (1), Turkey (2), UK (2), Scotland (1), and USA (16).

Sample sizes ranged from 12 (Aloia 2001) to 3100 (Bouloukaki 2014). Most studies included in this review were small: 17 studies randomised < 100 participants, 13 randomised 100 to 199 participants, and 11 randomised > 200 participants.

Gender distribution ranged from 0% (Diaferia 2017; Parthasarathy 2013) to 75.3% (Scala 2012) female, with a mean of 28.42% female. Gender distribution was not reported in five studies, but it is likely that these studies were 100% male, both because gender was not reported and because many appear to have been conducted in Vetarans Affairs (VA) hospitals or by investigators with primary VA affiliation.

The majority of study authors did not report outcomes segregated by sex, baseline AHI or baseline ESS. Thus, while our protocol pre-specified possible subgroup analyses on these bases, there were insufficient data available for such analyses. Additionally, the vast majority of studies recruited participants with newly-diagnosed OSA or obstructive sleep apnoea syndrome (OSAS), and a small number either included participants with previous diagnosis or did not report whether participants with previous treatment were excluded. Thus, subgroup analysis on the basis of prior CPAP treatment was also not performed.

Interventions

All included studies were classified into one of four types: educational, supportive, behavioural, and mixed intervention. In cases where a study would qualify for classification in more than one class, the study was classified as mixed. For a quick overview of included studies (and their active components) by intervention class, refer to Table 4 (Educational); Table 5 (Supportive); Table 6 (Behavioural); Table 7 (Mixed). Among studies with multiple active intervention arms, each arm was classified separately and included in the respective class meta-analysis. More detailed descriptions of our classification are provided in Data collection and analysis, Data extraction and management.

Educational interventions were delivered using a variety of techniques, including educational/situational videos (Basoglu 2011; Richards 2007), group education sessions (Soares-Pires 2013), extended and personalised explanation of polysomnography (PSG) reports (Falcone 2014; Roecklein 2010; Sarac 2017), and positive/negative risk message framing (Pengo 2018).

Supportive interventions included telemonitoring under various formats and platforms (DeMolles 2004; Fox 2012; Hoet 2017; Mendelson 2014; Munafo 2016; Pepin 2019; Stepnowsky 2007; Turino 2017), in-home tutorials and extended follow-up visits (Hoy 1999), peer support (Parthasarathy 2013), phone support (Chervin 1997) and personalised web-based support platforms (Stepnowsky 2013).

Various strategies were employed across included behavioural studies, including Motivational Enhancement Therapy (MET) aimed at resolving ambivalence towards treatment (Aloia 2001; Bakker 2016; Lai 2014; Olsen 2012; Sparrow 2010), a combination of various motivational strategies (Dantas 2015; Scala 2012), habit-promoting audiotapes (Smith 2009), and myofunctional therapy (Diaferia 2017).

The majority of studies in the mixed class used a combination of educational materials (videos, brochures, tutorials) and support systems (telemedicine or extended follow-up) in their active intervention (Bouloukaki 2014; Chen 2015; Hui 2000; Hwang 2017; Lewis 2006; Meurice 2007; Sedkaoui 2015; Shapiro 2017). Other studies incorporated behavioural with educational intervention components (Bartlett 2013; Wang 2012), behavioural and supportive (Smith 2006), or components from all three classes (Sawyer 2017).

Detailed information pertaining to control interventions can be found in Characteristics of included studies.

Study duration, number of intervention episodes, total contact time

Total study duration varied greatly: four weeks (Richards 2007; Shapiro 2017), six weeks (Pengo 2018), two months (Dantas 2015; Chervin 1997; DeMolles 2004; Stepnowsky 2007), three months (Aloia 2001; Diaferia 2017; Fox 2012; Hoet 2017; Hui 2000; Hwang 2017; Lai 2014; Munafo 2016; Parthasarathy 2013; Roecklein 2010; Sawyer 2017; Smith 2006; Smith 2009; Turino 2017; Wang 2012), four months (Mendelson 2014; Sedkaoui 2015; Stepnowsky 2013), six months (Bartlett 2013; Basoglu 2011; Hoy 1999; Pepin 2019; Sarac 2017; Soares-Pires 2013), 12 months (Aloia 2013; Bakker 2016; Chen 2015; Falcone 2014; Lewis 2006; Meurice 2007; Olsen 2012; Scala 2012; Sparrow 2010), and 24 months (Bouloukaki 2014). The number of intervention episodes (i.e. number of discrete episodes of contact with study personnel) among studies specifying varied from one (Bartlett 2013; Basoglu 2011; Dantas 2015; Falcone 2014; Roecklein 2010; Soares-Pires 2013) to 36 (Diaferia 2017). The total intervention contact time was not specified for many studies (DeMolles 2004; Fox 2012; Hoet 2017; Hoy 1999; Hwang 2017; Mendelson 2014; Meurice 2007; Munafo 2016; Parthasarathy 2013; Pepin 2019; Roecklein 2010; Scala 2012; Sparrow 2010; Stepnowsky 2007; Stepnowsky 2013; Turino 2017); among the 25 studies reporting such information, contact time varied from five (Falcone 2014) to 720 (Diaferia 2017) minutes. See Table 3 for summary

descriptions of these intervention characteristics by intervention class.

Outcomes

The majority of studies reported hours of machine usage at one or more time points, with the exception of three studies (Basoglu 2011; Smith 2006;) who reported only proportions of participants who were adherent (yes/no) based on authors' pre-determined threshold definition. The majority of studies also reported ESS data and participant withdrawals. A subset of studies reported quality of life using a variety of measurement instruments (Bartlett 2013; Bouloukaki 2014; Chen 2015; DeMolles 2004; Hoy 1999; Hwang 2017; Lai 2014; Mendelson 2014; Meurice 2007; Parthasarathy 2013; Pepin 2019; Scala 2012; Stepnowsky 2007; Stepnowsky 2013), depressive or anxiety symptom ratings using a variety of measurement instruments (Bartlett 2013; Bouloukaki 2014; Chen 2015; Hoy 1999; Shapiro 2017; Stepnowsky 2007; Stepnowsky 2013; Wang 2012) oxygen desaturation index (ODI)/AHI measurements (Dantas 2015; Diaferia 2017; Fox 2012; Stepnowsky 2007), and cost-effectiveness (Bouloukaki 2014; Turino 2017). Finally, Bouloukaki 2014 reported average hours of CPAP usage *per night used*, rather than the standard values of average hours used per night, overall. Calculations based on per night used would result in potentially significant upward bias in mean usage values relative to studies reporting average use per total intervention time period. However, since the same statistics are reported for intervention and control arms, the mean differences may not be biased. Bouloukaki 2014 data were included in CPAP usage meta-analysis despite this discrepancy.

Endpoints reported

Due to the tremendous variability and difficulty in interpreting meta-analytic results for temporally-disparate endpoints, we elected to use an endpoint of three months (or the measured endpoint closest to three months), which was both the modal endpoint across studies and the most clinically-relevant among those commonly reported.

Outcomes: exclusion of specific studies from selected meta-analyses

Sparrow 2010 met our inclusion criteria, however, we were not able to include this study in our primary CPAP usage meta-analysis because trialists presented their results as a mean difference (MD) and 95% confidence intervals (CIs) derived from a regression of log-transformed CPAP usage data, and could therefore not be combined with data from the other studies (note: analysis by generic inverse variance (GIV) was also not suitable). Nonetheless, the direction of effect supports the general findings of Analysis 3.1 (CPAP usage 2.40 hours/night in intervention arm (N = 110) and CPAP usage 1.48 hours/night (N = 112) in the control arm). In Sparrow 2010, data were suitable for inclusion in meta-analyses of other outcomes (N deemed adherent, withdrawal).

Lewis 2006 met our inclusion criteria and available data are shown in some outcome tables (e.g. Analysis 6.10). However, no SDs were available for reported mean CPAP usage and review authors were unable to obtain these data from the trial authors, so MDs could not be calculated. Therefore, this study was retained in the analysis table but SD values are entered as zero. Thus, it is excluded from the meta-analysis of this outcome. Lewis 2006 data were suitable for inclusion in withdrawal meta-analysis.

Scala 2012 met our inclusion criteria, but CPAP usage data were not included in our analysis tables, or in our meta-analysis because the data provided in the published report contained discrepancies that could not be resolved (i.e. reported mean, SD and P values were incompatible and review authors were unable to determine which values were incorrect). Scala 2012 was included in meta-analyses for other outcomes (withdrawal, ESS and quality of life (QoL)).

Soares-Pires 2013 was excluded from CPAP usage meta-analysis because trial authors reported medians only. Review authors were unable to obtain information from authors necessary to implement planned skewed data handling procedures. Therefore, this study was excluded from our analysis tables and the meta-analysis of this outcome. Soares-Pires 2013 was included in meta-analyses for other outcomes (N deemed adherent, withdrawal).

Excluded studies

We excluded 101 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

It should be noted that full 'Risk of bias' assessments (evaluating each 'Risk of bias 2' domain using 'Risk of bias 2' tool) were performed for primary outcome (CPAP device usage, hours/night) only. Overall 'Risk of bias' assessments were additionally conducted for other outcomes as part of the GRADE assessment process, but the GRADE 'Risk of bias' assessment procedures were often more limited than that involved in the application of the full 'Risk of bias 2' tool, as the GRADE tool is outcome- (and not study-) specific. Therefore, our procedures for GRADE risk of bias varied by outcome, as follows.

GRADE 'Risk of bias' judgements for CPAP usage and N deemed adherent were based on our 'Risk of bias 2' assessment judgements.

GRADE 'Risk of bias' ratings for all subjective, non-adherence outcomes (i.e. ESS, QoL, depressive symptoms, anxiety symptoms) were judged to be 'serious' or 'very serious' because all, or nearly all, included studies had no masking (of participants or investigators) and such subjective/observational measures would be subject to measurement bias without blinding. Therefore, for these outcomes, domain 4 would be rated as 'high' risk of bias for all studies and result in a GRADE 'Risk of bias' rating of 'high' without the need to evaluate the other domains.

For the remaining outcomes (AHI, study withdrawal, cost-effectiveness) GRADE 'Risk of bias' ratings were made based on examination of all 'Risk of bias 2' domains unless a 'high' rating was evident based on a preponderance (by weight) of 'high' ratings in study-level 'Risk of bias 2' domains 1 or 2. (Because 'Risk of bias 2' domains 1 and 2 are study- and not outcome-dependent, judgements of risk for domains 1 and 2 would be the same for all outcomes for a given study). The only outcome for which a high rating was not evident based upon a preponderance of high ratings in 'Risk of bias 2' domains 1 or 2 was 'study withdrawals' within supportive, behavioural and mixed classes. Thus, all 'Risk of bias 2' domains were evaluated for study withdrawals in these classes. Based on the definition of 'withdrawals' employed in our review (see Effects of interventions: Secondary outcomes, Withdrawals, below), 'Risk of bias 2' domain 3 (missing outcome data), domain 4

(bias in outcome measurement), and domain 5 (selective reporting) yielded the same judgement as for our primary outcome, CPAP usage. Because withdrawal was based on the absence of CPAP usage data, the proportions of participants withdrawing from the study would be the same as the proportion with missing CPAP usage data. Similarly, because our definition of withdrawal was based on objective data acquired from the CPAP device (i.e. either a zero usage value transmitted wirelessly or a device in the possession of study personnel and clearly not being used by the participant), judgement regarding the potential for measurement bias or selective reporting bias was the same as that rendered for the CPAP usage outcome in this domain.

Risk of bias 2: CPAP device usage

Risk of bias in included studies

An overview of our 'Risk of bias' judgements for our primary outcome for included studies (randomisation processes, deviations from intended interventions, missing outcome data, measurement of outcome, selective outcome reporting) is provided in Figure 2. The basis for each of these judgements is given in Characteristics of included studies. All of the studies were assessed according to assignment to intervention (the 'intention-to-treat' effect) using the 'Risk of bias 2' tool and according to the risk posed on measuring our primary outcome of hourly CPAP device usage. Half of the studies presented as having a high overall risk of bias.

Figure 2. 'Risk of bias' summary: review authors' judgements about each risk of bias item for each included study.

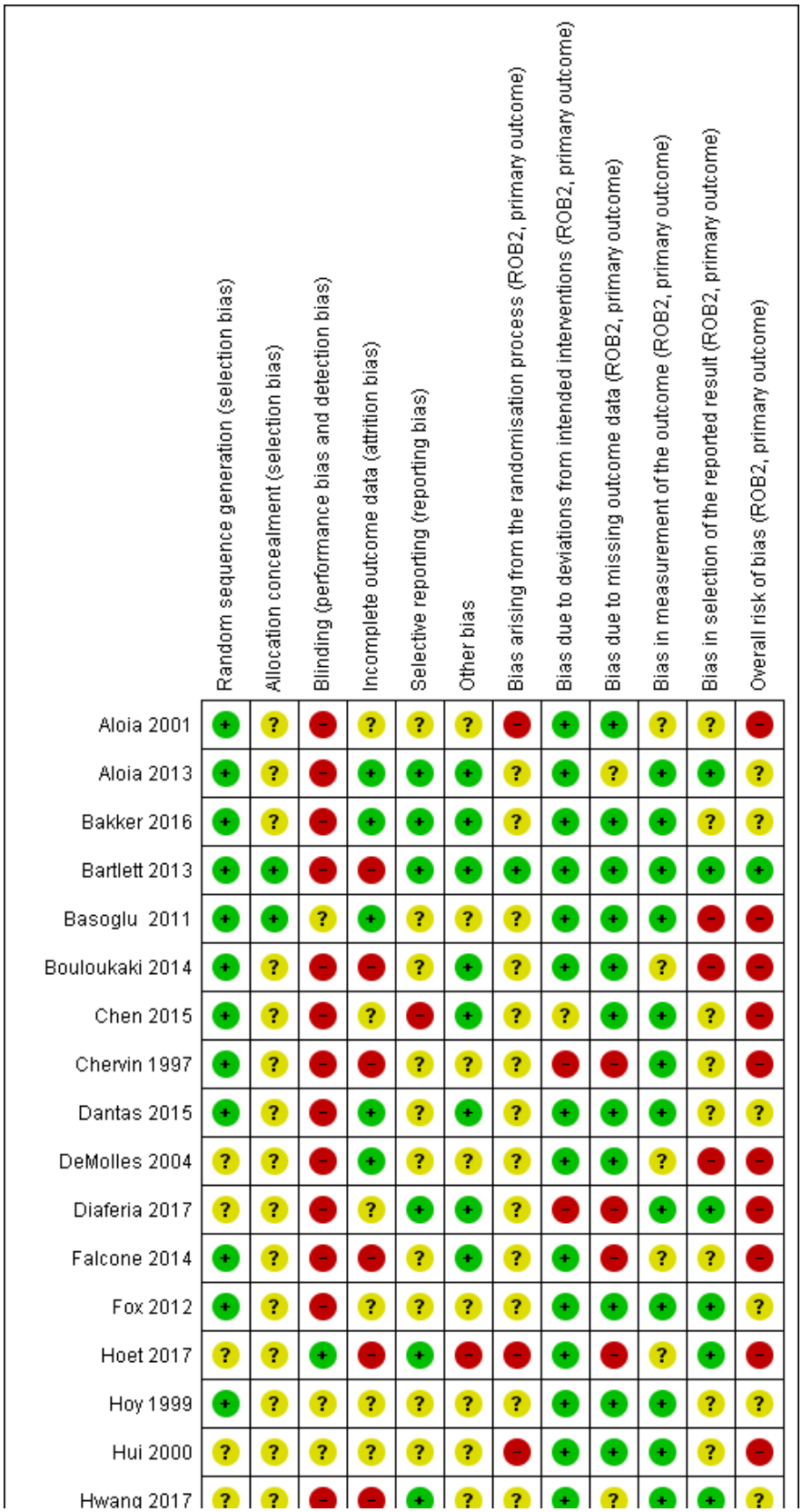
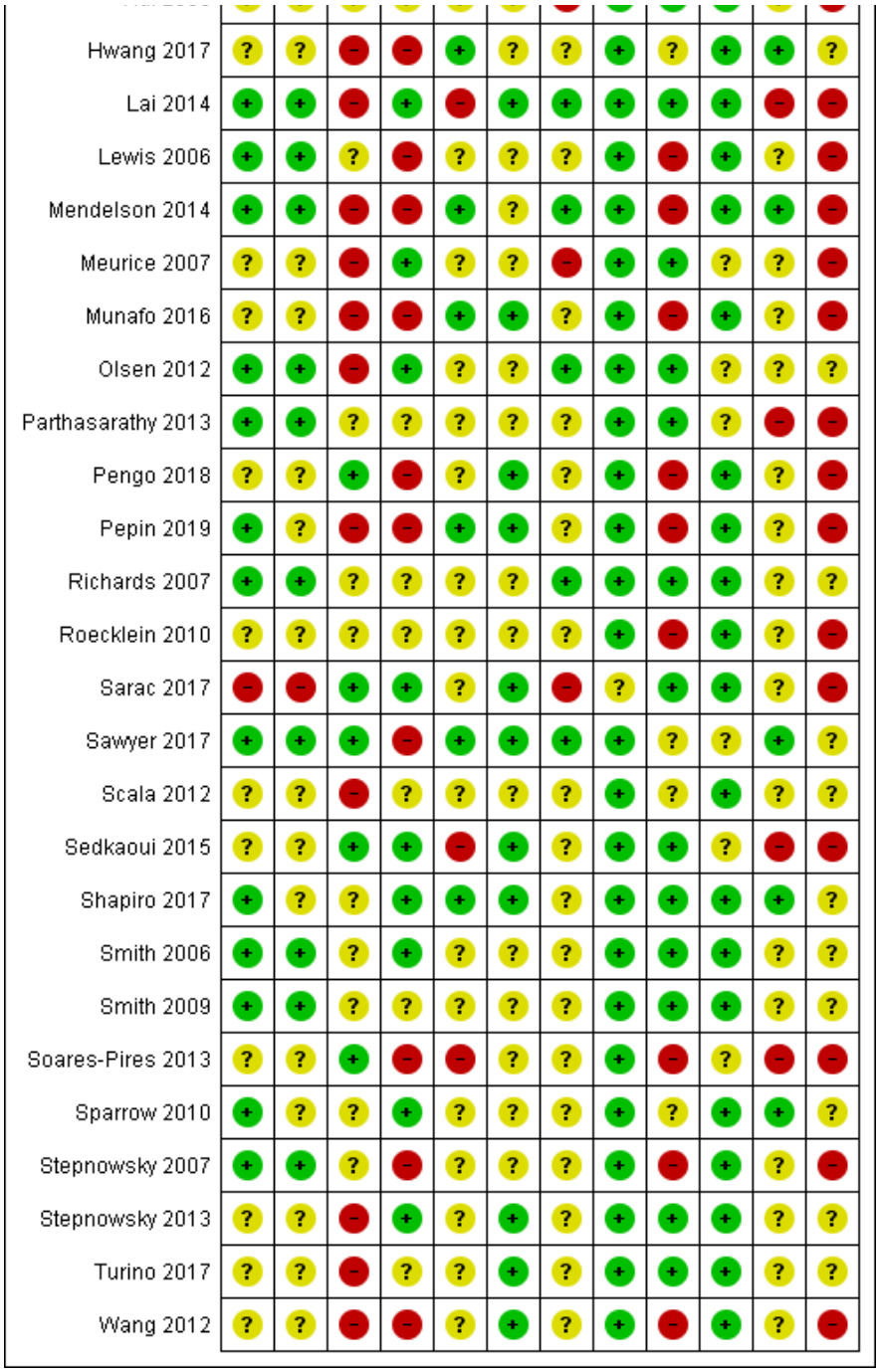


Figure 2. (Continued)



Randomisation processes

The majority of studies presented as having "some concerns" regarding risk of bias arising from randomisation procedures; this was mostly due to inadequate descriptions of allocation sequence generation and allocation sequence concealment. Despite this, only a handful of studies presented significant baseline differences in key demographic characteristics (age, sex, BMI, and AHI), suggesting a potential problem with the study's randomisation procedures (Aloia 2001; Hoet 2017; Hui 2000; Meurice 2007; Sarac 2017). Six studies present low risk of bias in this domain (Bartlett 2013; Lai 2014; Mendelson 2014; Olsen 2012; Richards 2007; Sawyer 2017).

Deviations from intended interventions

Two studies presented "high" risk of bias in this domain (Chervin 1997; Diaferia 2017) due to the combination of the following factors: participants and trialists were aware of group assignment, a 'per-protocol' analysis was employed (participants were analysed according to the treatment they received instead of the treatment to which they were randomised). Three studies presented as having "some concerns" regarding risk of bias in this domain (Chen

2015; Sarac 2017; Scala 2012). This was either due to inadequate information regarding the intervention group to which study "drop-outs" belonged (i.e. only overall withdrawals were reported) (Chen 2015; Scala 2012) or potential deviations from the study protocol (Sarac 2017 - phone call reminders were given to participants who did not show up for follow-up appointments, regardless of group assignment).

Missing outcome data

Thirteen studies presented "high" risk of bias in this domain (Chervin 1997; Diaferia 2017; Falcone 2014; Hoet 2017; Lewis 2006; Mendelson 2014; Munafo 2016; Pengo 2018; Pepin 2019; Roecklein 2010; Soares-Pires 2013; Stepnowsky 2007; Wang 2012), largely due to data being unavailable for ≥10% of participants at the time point analysed (Higgins 2011). Risk increased when considerable differences in proportions of missing outcome data between intervention and control groups were detected, indicating that loss to follow-up was likely to be related to participant health status.

Measurement of the outcome

The majority of studies presented "low" risk of bias in this domain. Signalling questions addressed appropriateness of outcome measurement, differences in measurements between study groups, and whether outcome assessors were aware of group assignment. All of the studies included in this review measured hourly CPAP machine usage through an internalised digital counter or data microchip, thereby limiting the risk that could arise in this domain. Eleven studies did show "some concerns" (Aloia 2001; Bouloukaki 2014; DeMolles 2004; Falcone 2014; Hoet 2017; Meurice 2007; Olsen 2012; Parthasarathy 2013; Sawyer 2017; Sedkaoui 2015; Soares-Pires 2013) as the review authors were unable to confirm with trialists if the distribution of CPAP devices (i.e. makes, models) differed significantly between groups.

Selective outcome reporting

Twenty-three studies presented as having "some concerns" regarding risk of bias arising from selection of reported outcome. This was largely due to limited availability of pre-specified study protocols or analysis plans, preventing review authors from comparing with published manuscripts to confirm that outcomes and outcome end points were determined prior to data analysis. Moreover, seven studies presented a "high" risk in this domain as a result of: using adherence thresholds or end points that are not commonly reported in literature, e.g. ≥ 3 hours per night instead of ≥ 4 hours per night, reporting at four months instead of three months (Basoglu 2011; Sedkaoui 2015), differences between intended end points in the 'Methods and Results' section of paper (Chen 2015; DeMolles 2004), modification of end points from that originally-reported in study's trial registry archive (Lai 2014), reporting of adherence only in graphical format (NCT03345524), or reporting mean usage per *effective* days instead of per *total* days resulting in an upward bias of estimates (Soares-Pires 2013; Bouloukaki 2014). See 'Risk of bias' tables for further details on our judgement rationale.

Risk of bias 1: study-level 'Risk of bias' assessments

The review authors assessed the risk of bias of included studies using the risk of bias tool (Higgins 2011) (for an overall snapshot of our judgements, see Figure 2).

Allocation

The majority of studies (59%) were assessed as having low risk of bias for random sequence generation. Only one study (Sarac 2017) was found to have high risk of bias because, according to author's report, "participants were randomly assigned in order of appearance (random number table...) with exception for patients scheduled for weekend treatment, who were included in the [standard support] group." A judgement of 'Unclear' risk of bias under this domain was generally rendered because authors provided no or insufficient information regarding the random component used in sequence generation or other information regarding how randomisation was achieved.

The vast majority of studies were assessed as having unclear (68%) or low (29%) risk of bias for allocation concealment. One study (Sarac 2017) was found to have high risk of bias because the report permitted confirmation that allocation sequence was not concealed. Those determined to have unclear risk of bias under this domain were most often because the trialists provided no, or insufficient, information to permit assessment of allocation concealment method.

Blinding

The vast majority of studies were assessed as having high (56%) or unclear (29%) risk of bias in this domain because the majority of studies had at least one subjective outcome. Given the nature of the intervention, it is unlikely that blinding of participants is achievable and the majority of studies did not attempt to do so. Six studies (Hoet 2017; Pengo 2018; Sarac 2017; Sawyer 2017; Sedkaoui 2015; Soares-Pires 2013) were assessed as having low risk of bias in this domain because these studies had only objectively-measured outcomes, so a lack of blinding would unlikely affect those outcomes.

Incomplete outcome data

For this domain, 39% of studies were assessed as having high risk of bias, primarily due to either a very substantial proportion (> 10%) of participants with missing data and a substantial imbalance in missing across outcome classes. A judgement of 'Unclear' risk of bias (29%) in this domain was most often due to the absence of sufficient information to determine proportion of withdrawals or to compare class-specific withdrawal rates. Data were available for all or nearly all randomised participants in 32% of studies, warranting a judgement of low risk of bias in this domain.

Selective reporting

For this domain, 63% of studies had 'Unclear' risk of bias primarily because no protocol or ClinicalTrials.gov entry was available to determine if analysis plan was finalised before unblinded outcome data were available for analysis. Those assessed to have 'low' risk of bias (27%) in this domain had a protocol, ClinicalTrials.gov entry or early abstract that permitted adequate verification that the analysis plan was finalised prior to analysis of unblinded data. For those studies judged to be at 'high' risk of bias, review authors found evidence that the outcomes reported were inconsistent with the methods section of the published report, were changed from those originally planned without clear rationale or were atypical (e.g. endpoint measurement, threshold cut-off) without clear rationale, suggesting that the reported outcome may have been selected after analyses performed.

Other potential sources of bias

Each study was assessed for other potential risks of bias including deviations from intended interventions and baseline imbalances in important demographic or clinical characteristics (age, sex, BMI, AHI) across outcome classes. Reasons for a judgement of 'high' risk of Other bias (7%) were: failure to report selected baseline gender (Aloia 2013; Meurice 2007) and BMI data (Aloia 2013), and substantial baseline differences in gender distribution that was large enough to result in biased effect estimation (Hoet 2017). Studies for which a judgement of 'Unclear' was made were those that did not report baseline data or did not report a statistical comparison for important baseline characteristics across outcome classes.

Effects of interventions

See: **Summary of findings for the main comparison** Educational intervention versus control; **Summary of findings 2** Supportive intervention versus control; **Summary of findings 3** Behavioural intervention versus control; **Summary of findings 4** Mixed (BEH/EDU/SUP) intervention versus control

Please refer to the 'Summary of findings' tables for each comparison group.

- Summary of findings for the main comparison Educational support for adults with obstructive sleep apnoea who are using CPAP
- Summary of findings 2 Increased support and encouragement for adults with obstructive sleep apnoea
- Summary of findings 3 Behavioral therapy and encouragement for adults with obstructive sleep apnoea
- Summary of findings 4 Mixed interventions for adults with obstructive sleep apnoea

Several post hoc sensitivity analyses were also conducted (Table 8; Table 9; Table 10; Table 11; Table 12), and are described in Quality of the evidence .

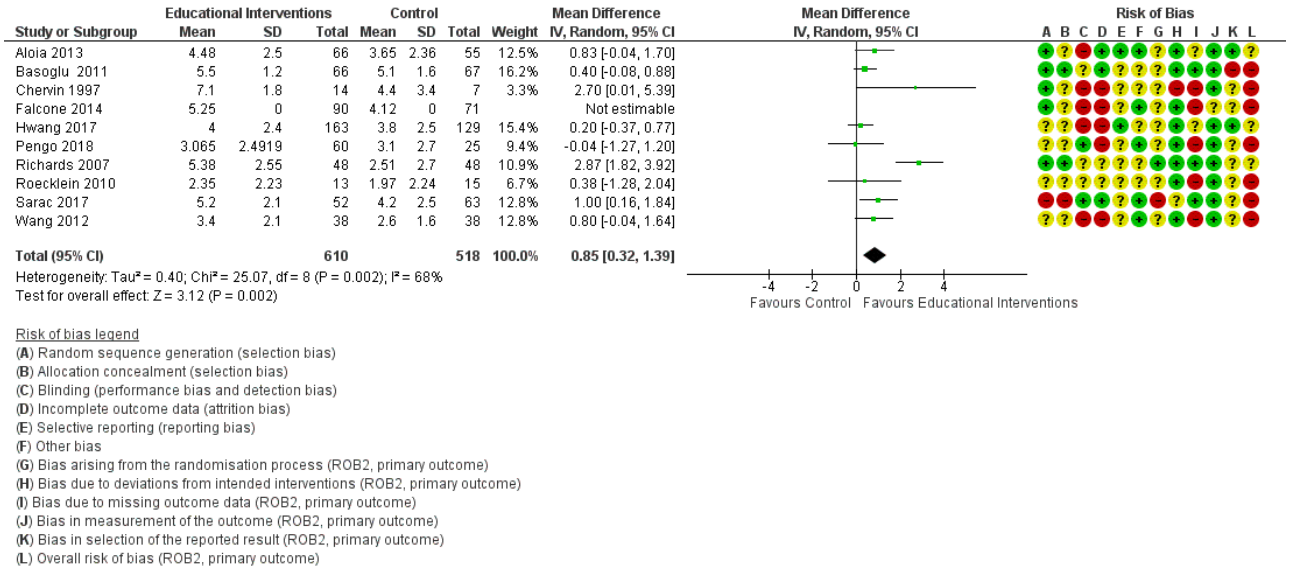
Primary outcome: CPAP usage

Mean hours/night

Educational interventions

Very low-certainty evidence showed that educational interventions increased average hours of CPAP use (mean difference (MD) 0.85, 95% confidence interval (CI) 0.32 to 1.39; participants = 1128; studies = 10; I^2 = 68%), Analysis 1.1; Figure 3). Substantial statistical heterogeneity was detected (I^2 = 68%, P = 0.002) due to poor overlap of estimates and CIs, most notably, the increased effects presented by two studies (Falcone 2014; Richards 2007), leading to a downgrading of certainty by one level. Moreover, the standard deviations (SDs) reported by Falcone 2014 were considerably smaller than the other studies in this comparison (and the reported SDs were inconsistent with reported P values for the comparison), suggesting the possibility of spurious confidence in the estimate. Therefore, Falcone 2014 SDs were therefore entered as zero values, so the Falcone 2014 data did not contribute to overall meta-analysis and does not appear in the forest plot. However heterogeneity remained significant (resulting in downgrading in this domain). Further downgrading by two levels was also applied in the 'Risk of bias' domain, as the combined weight of studies with "high" risk was 70%, and was due to bias in randomisation procedures (Sarac 2017), missing outcome data (Chervin 1997; Falcone 2014; Pengo 2018; Roecklein 2010; Wang 2012), deviations from intended interventions (Chervin 1997), and selective reporting (Basoglu 2011). Therefore, the overall certainty of the evidence for this outcome was downgraded by three levels, yielding a 'very-low' rating.

Figure 3. Forest plot of comparison: 1 Educational intervention versus control on primary outcome: CPAP Device Usage (hours/night).



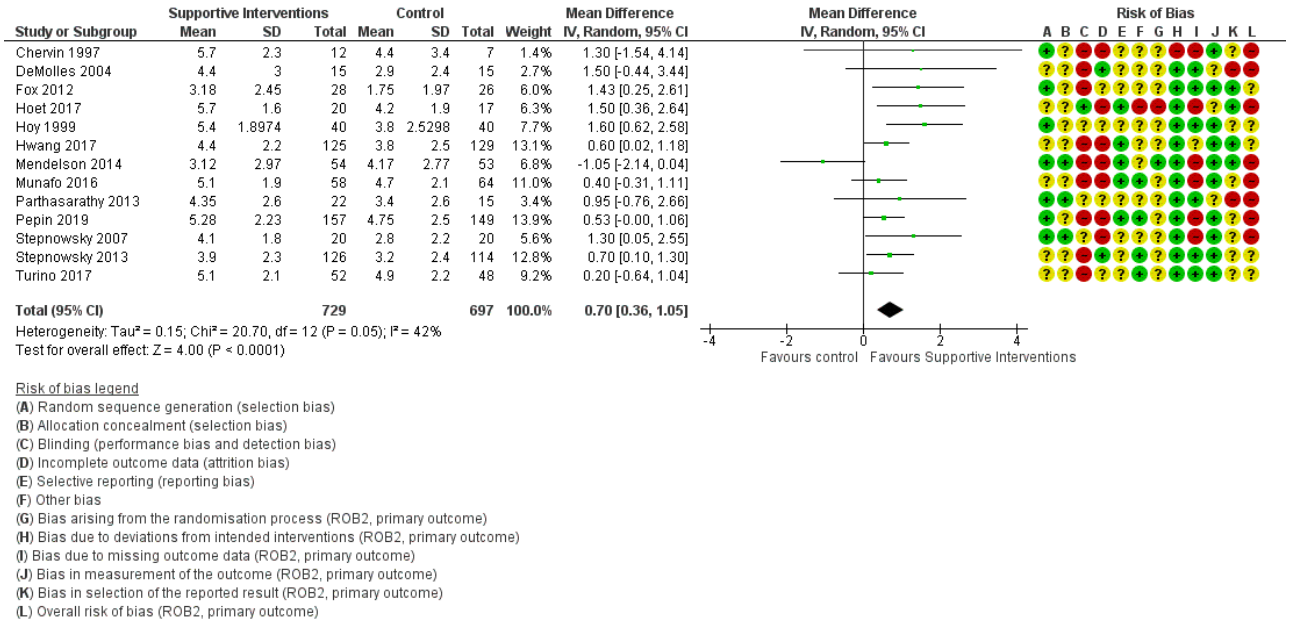
A sensitivity analysis was performed, where studies with average usage in the control group > 4 hours/night were excluded (Basoglu 2011; Chervin 1997; Falcone 2014; Sarac 2017). Very low-certainty evidence demonstrated that educational interventions increased

usage (MD 0.85, 95% CI 0.06 to 1.64), based on 6 studies with 698 participants. Heterogeneity in this sensitivity analysis remained high (I^2 = 76%), due to the inclusion of Richards 2007's larger effect estimate, leading to poor overlap of CIs. Certainty of evidence was further downgraded by two levels as the combined weight of studies high risk of bias (3/6 studies) was 44.8%, with the remaining studies having some risk concerns.Therefore, overall certainty for this outcome was reduced by three levels, yielding a 'very low-certainty' rating.

Supportive interventions

Moderate-certainty evidence showed that supportive interventions increased average hours of CPAP use (MD 0.70, 95% CI 0.36 to 1.05; participants = 1426; studies = 13; I^2 = 42%) (Analysis 2.1; Figure 4). Moderate heterogeneity (I^2 = 42%, P = 0.05) was accounted for by the opposite direction of effect observed in Mendelson 2014, where the mean difference favoured the control group. In studies that had "high" overall risk of bias, risk derived from randomisation procedures (Hoet 2017), missing outcome data (Chervin 1997; Hoet 2017; Mendelson 2014; Munafo 2016; Pepin 2019; Stepnowsky 2007), protocol deviation (Chervin 1997), selective outcome reporting (DeMolles 2004; Parthasarathy 2013), and had a combined analysis weight of 51.2%, warranting downgrading by one level in this domain. Therefore, the overall certainty of the evidence was downgraded by one level, yielding a 'moderate' rating.

Figure 4. Forest plot of comparison: 2 Supportive intervention versus control on primary outcome: CPAP Device Usage (hours/night).



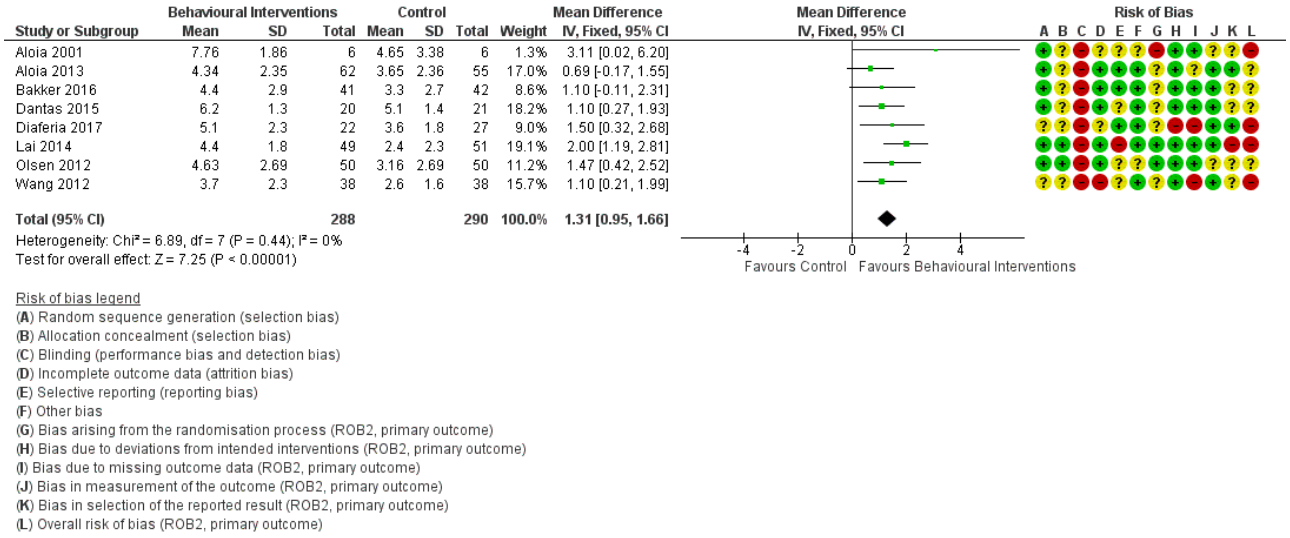
A sensitivity analysis Analysis 2.2 was conducted to determine the influence of studies that had an average usage > 4 hours per night in the control group. High-certainty evidence demonstrated that supportive intervention increased average hours of CPAP use (MD 0.91, 95% CI 0.57 to 1.25; participants = 735; studies = 7; I^2 = 0%).

An additional post-hoc sensitivity analysis was conducted (Analysis 2.9), excluding the single study with opposite direction of effect (Mendelson 2014). In their conclusions, trialists indicated that their findings in favour of the control arm may have derived specifically from the "additional burden associated with the self-management of BP and CPAP by patients randomised to this group," a study component and outcome not germane to our review. Exclusion of this study resulted in a slight increase in the effect estimate (and narrower CIs) as well as the elimination of heterogeneity (MD 0.74, 95% CI 0.49 to 0.98; participants = 1319; studies = 12; I^2 = 0%).

Behavioural interventions

High-certainty evidence showed that behavioural interventions increased average hours of CPAP use (MD 1.31, 95% CI 0.95 to 1.66; participants = 578; studies = 8; I^2 = 0%) (Analysis 3.1; Figure 5). No heterogeneity was detected for this outcome indicating that magnitude and direction of effect estimates were similar. Certainty of this effect estimate for this outcome (as per GRADE assessment procedures) was judged to be high.

Figure 5. Forest plot of comparison: 3 Behavioural intervention versus control on primary outcome: CPAP Device Usage (hours/night).



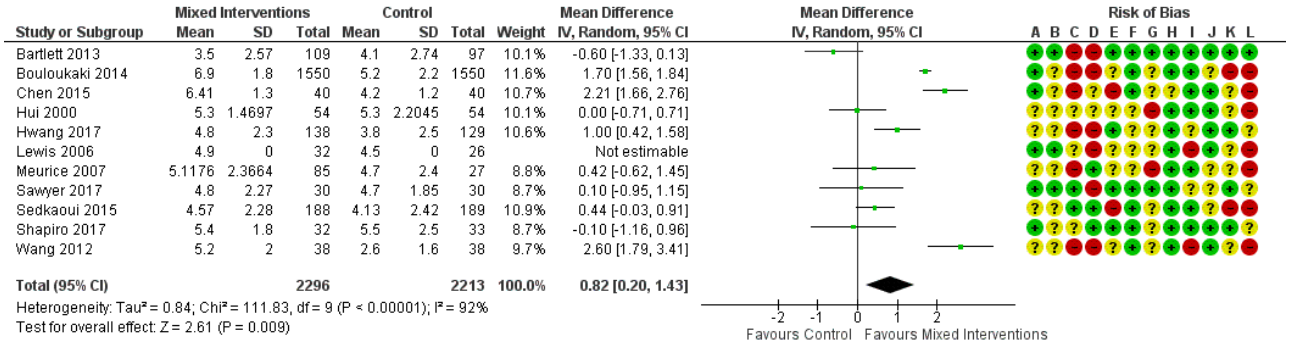
Risk of bias legend
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding (performance bias and detection bias)
(D) Incomplete outcome data (attrition bias)
(E) Selective reporting (reporting bias)
(F) Other bias
(G) Bias arising from the randomisation process (ROB2, primary outcome)
(H) Bias due to deviations from intended interventions (ROB2, primary outcome)
(I) Bias due to missing outcome data (ROB2, primary outcome)
(J) Bias in measurement of the outcome (ROB2, primary outcome)
(K) Bias in selection of the reported result (ROB2, primary outcome)
(L) Overall risk of bias (ROB2, primary outcome)

A pre-defined sensitivity analysis Analysis 3.2 was conducted to exclude studies where average CPAP adherence in the control group was more than four hours per night (excluded Aloia 2001; Dantas 2015). Moderate-certainty evidence showed that behavioural interventions increased average hours of CPAP use (MD 1.32, 95% CI 0.93 to 1.72; participants = 525; studies = 6; I^2 = 6%). Confidence in this effect estimate was downgraded by one level due to high risk of bias in studies accounting for 54.4% of estimate weight.

Mixed interventions

Very low-certainty evidence showed that mixed interventions increased average hours of CPAP used (MD 0.82, 95% CI 0.20 to 1.43; participants = 4509; studies = 11; I^2 = 92%) (Analysis 4.1; Figure 6). Substantial statistical heterogeneity was due to variability in direction of effect (Bartlett 2013 and Shapiro 2017 favoured the control group), variability in magnitude of effects, and poor overlap of CIs, warranting a downgrading of certainty by two levels. Studies in this comparison presented as having a "high" risk of bias, deriving from risk in randomisation procedures (Hui 2000; Meurice 2007), missing outcome data (Wang 2012), and selective reporting (Chen 2015; Sedkaoui 2015). The combined weight of these studies was 50.2%, warranting further downgrading of certainty in this domain.Therefore, the overall certainty of the evidence for this outcome was downgraded by three levels, yielding a 'very-low ' rating.

Figure 6. Forest plot of comparison: 4 Mixed (SUP/EDU/BEH) intervention versus control on primary outcome: CPAP Device Usage (hours/night).



Risk of bias legend
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding (performance bias and detection bias)
(D) Incomplete outcome data (attrition bias)
(E) Selective reporting (reporting bias)
(F) Other bias
(G) Bias arising from the randomisation process (ROB2, primary outcome)
(H) Bias due to deviations from intended interventions (ROB2, primary outcome)
(I) Bias due to missing outcome data (ROB2, primary outcome)
(J) Bias in measurement of the outcome (ROB2, primary outcome)
(K) Bias in selection of the reported result (ROB2, primary outcome)
(L) Overall risk of bias (ROB2, primary outcome)

When excluding studies where average usage was greater than four hours per night in the control group (Bartlett 2013; Bouloukaki 2014; Chen 2015; Hui 2000; Meurice 2007; Sawyer 2017; Sedkaoui 2015; Shapiro 2017), the two remaining mixed interventions (Hwang 2017; Wang 2012) increased hours of use (MD 1.77, 95% CI 0.21 to 3.34; participants = 343; studies = 2; I^2 = 90%), however this evidence was also very low in certainty due high heterogeneity (I^2 = 90%, P = 0.002), warranting downgrading by two levels, as well as high risk associated with missing outcome data (Wang 2012, study weight = 48.3%), warranting downgrading by a further level.

Secondary outcomes

Data were not available for all of the secondary outcomes specified in the protocol. Those with available data are described below. For some secondary outcomes, some studies reported change-from-baseline measurements, whereas other studies reported endpoint values only. In these cases, values were combined in a single meta-analysis using MD as the effect measure. In cases where a study reported both change-from-baseline with SD and endpoint values for a given outcome, only change-from-baseline data were used in the meta-analysis. If an outcome was evaluated using different measures across studies, and, therefore, required use of standardised mean difference (SMD) as the effect measure, separate meta-analyses were performed for studies reporting change-from-baseline and for those reporting only endpoint comparisons.

Number of participants deemed adherent (average CPAP usage ≥ 4 hours/night)

Very low-certainty evidence from 7 studies and 1019 participants (Summary of findings for the main comparison; Analysis 1.3) showed that educational interventions increased the number of people deemed adherent when compared to control (odds ratio (OR) 2.58, 95% CI 1.50 to 4.44, P = 0.003), translating to an absolute risk increase from 558 to 765 (95% CI: 654 to 849) people per 1000. Certainty of evidence in this comparison was downgraded by two levels due to high risk of bias in seven studies (Basoglu 2011; Falcone 2014; Sarac 2017; Soares-Pires 2013; Wang 2012), deriving from randomisation procedures, missing outcome data and selective outcome reporting with a combined analysis weight of 68.1%. Further downgrading by one level was performed due detection of considerable statistical heterogeneity (I^2= 76%). Therefore, the overall certainty of the evidence for this outcome was downgraded by three levels, yielding a 'very low ' rating.

Low-certainty evidence from 2 studies and 376 participants (Summary of findings 2; Analysis 2.3) showed that supportive interventions increased the number of people deemed adherent when compared to control (OR 1.68, 95% CI 1.08 to 2.60, P = 0.02), translating to an absolute risk increased from 601 to 717 (95% CI: 619 to 797) people per 1000. Evidence in this comparison was downgraded by one level due to the low sample size, as defined by GRADE's recommendations on optimal information size (OIS) (Schunemann 2013). Evidence was further downgraded by one level due to high risk of bias from one study (24.8% weight) and some risk concerns in the other study. Therefore, the overall certainty of the evidence was downgraded by two levels, yielding a 'low ' rating.

High-certainty evidence from 6 studies and 549 participants (Summary of findings 3; Analysis 3.3) indicated that behavioural interventions increased the number of people deemed adherent (based on author-defined nightly CPAP use threshold) when compared to control (OR 1.70, 95% CI 1.20 to 2.41, P = 0.003). Based on average control group risk, this translates to an absolute risk increase from 371 to 501 (95% CI: 414 to 587) people per 1000.

Very low-certainty evidence from 9 studies and 4015 participants (Summary of findings 4; Analysis 4.3) indicated that mixed interventions increased the number of people deemed adherent when compared to control (OR 1.71, 95% CI 1.08 to 2.72, P < 0.001), translating to an absolute risk increased from 741 to 830 (95% CI: 755-886) people per 1000. Evidence in this comparison was downgraded by one level as the combined weight of studies with high risk was 51.3%, and was downgraded another two levels level due to substantial heterogeneity (I^2 = 79%, P < 0.001). Therefore, the overall certainty of the evidence was downgraded by three levels, yielding a 'very-low' rating.

Withdrawals

One of our pre-specified secondary outcomes was "study withdrawals." Generally, the primary objective in reporting study withdrawals, and conducting meta-analysis on this outcome, is to assess the potential impact of attrition bias on reported effect estimates. Studies with lower attrition (and attrition bias) should produce more valid effect estimates. Across included studies in our review, trialists varied substantially in: a) whether study withdrawal was assessed/reported as an outcome, b) if "withdrawal" was explicitly defined (and the term applied by trialists – e.g. "drop-outs," "withdrawal," "lost-to-follow-up," "unable to make contact," etc....), and c) among those providing an explicit definition, how withdrawal (or other comparable term) was defined. Due to this substantial variability, we concluded that no single author-employed term or definition would have permitted consistent accounting across studies. We therefore decided to employ a definition that permitted a common, objective measure that is not dependent on author definition and is less dependent on author reporting decisions: we counted as a withdrawal any participant who, subsequent to randomisation withdrew from the *study,* such that their actual CPAP device usage could not be determined. Participants who withdrew from participation in the *intervention* only (i.e. a) returned their CPAP device prior to the start of the intervention or at any subsequent point, or b) whose CPAP device usage was transmitted wirelessly; in both cases, device data for the period of the intervention were accessible to trialists for analysis) were not counted as study withdrawals because their CPAP usage data were not missing (i.e. CPAP usage of 0 hours/night was objectively evident).

A meta-analysis examining rates of withdrawals in studies with educational interventions was not performed due to considerable difference in magnitude and direction of effect across the nine studies, preventing meaningful interpretation of study effects (as per section 9.1.4. of the *Cochrane Handbook for Systematic Reviews of Intervention*) (Summary of findings for the main comparison).

Low-certainty evidence (11 studies n = 1702) showed that participants in active supportive interventions were more likely to withdraw from studies when compared to control (OR 1.27, 95% CI 0.97 to 1.66, P = 0.08). This odds ratio translated to an absolute

risk increase from 136 to 167 (95% CI: 133 to 208) people per 1000. Evidence in this comparison was downgraded by two levels for imprecision, as OIS criteria were not met, and because the estimate's confidence interval included null (Summary of findings 2; Analysis 2.4). Therefore, the overall certainty of the evidence was downgraded by two levels, yielding a 'low' rating.

High-certainty evidence (10 studies, n = 939) showed that participants in active behavioural interventions were less likely to withdraw from studies when compared to control (OR 0.66, 95% CI 0.44 to 0.98, P = 0.04), translating to an absolute risk reduction from 146 to 101 (95% CI: 70 to 143) people per 1000 (Summary of findings 3; Analysis 3.4).

Very low-certainty evidence (11 studies, n = 4956) showed that participants in active mixed interventions were less likely to withdraw from studies when compared to control (OR 0.61, 95% CI 0.28 to 1.30, P = 0.20). This translated to an absolute risk reduction from 129 to 83 (95% CI: 40 to 161) people per 1000. Evidence in this comparison was downgraded by three levels due to heterogeneity (I^2 = 85%), imprecision (confidence interval includes null and potential for important benefit), and high risk of bias in six studies with a combined analysis weight of 52.0% (Summary of findings 4;Analysis 4.4).

Daytime sleepiness

Low-certainty evidence (5 studies, n = 470) demonstrated a non-significant, decrease in ESS scores (endpoint versus baseline) for participants receiving supportive interventions when compared to control participants (MD -0.32, 95% CI -1.19 lower to 0.56, P = 0.48). Evidence in this comparison was downgraded by two levels due to high risk of bias associated with non-masking and subjective outcome measures, in addition to imprecision (OIS criterion not met) (Summary of findings 2; Analysis 2.5).

Low-certainty evidence (5 studies, n = 272) demonstrated a reduction in ESS scores for participants receiving behavioural interventions when compared to control at study endpoints (MD -2.42, 95% CI -4.27 to -0.57, P = 0.01). Evidence in this comparison was downgraded by two levels due to the high risk of bias (associated with unmasked participants and assessors reporting/evaluating subjective outcome measures) and heterogeneity (I^2 = 71%) (Summary of findings 3; Analysis 3.5).

Meta-analyses examining ESS scores in studies with educational and mixed interventions were not performed due to considerable difference in magnitude and direction of effect across eligible studies, preventing meaningful interpretation of study effects.

Quality of life

Meta-analyses examining quality of life scores in studies with educational interventions were not performed as none of the studies included in this comparison used/measured quality of life as a primary or secondary outcome.

Very low-certainty evidence (3 studies, n = 294) showed that supportive interventions had small positive effect on quality of life scores when measured with the Functional Outcomes of Sleep Questionnaire (FOSQ), FOSQ-10, Short Form Survey (SF-36) (change from baseline) (SMD 0.22, 95% CI -0.01 to 0.45, P = 0.06). Evidence in this comparison was downgraded by three levels due to high risk of bias associated with subjective outcomes in non-masked studies, imprecision (OIS criterion not met), as well as due to suspicion of publication bias. (Summary of findings 2; Analysis 2.7).

Moderate-certainty evidence (3 studies, n = 228) demonstrated that behavioural interventions had no apparent effect on quality of life scores when measured with the FOSQ, or the physical health portion of the 36-item Short Form Survey (SF-36 (PH)) at study endpoints (SMD 0.00, 95% CI -0.26 to 0.26, P = 0.98) (Summary of findings 3; Analysis 3.7). Evidence in this comparison was downgraded by one level due to high risk of bias associated with non-masking and subjective outcome measures, yielding a 'moderate' rating.

Low-certainty evidence (2 studies, n = 3012) also showed that mixed interventions had a small and positive effect on quality of life scores when measured with the FOSQ-10 and SF-36 (PH) (change from baseline) (SMD 0.45, 95% CI 0.12 to 0.78, P = 0.008). Similarly, when measuring quality of life with the same measures at endpoints only, very low-quality evidence (4 studies, n = 3191) showed that mixed interventions had a small and positive effect (SMD 0.45, 95% CI 0.06 to 0.83, P = 0.02). Both of these outcomes were downgraded by two levels due to high risk of bias associated with subjective outcome measures in non-masked studies as well as heterogeneity (I^2 = 79%) (Summary of findings 4; Analysis 4.5; Analysis 4.6).

Depressive and anxiety symptom measures

One study (Hoy 1999) showed that a supportive intervention with brief education, two nights of additional titration, and extended home visits decreased anxiety symptom scores when measured with the Hospital Anxiety and Depression Scale (HADS-A) at six months against control participants (MD -1.1, 95% CI -2.95 to -0.75, P = 0.24). A GRADE assessment was not performed for this outcome as it is a single-study estimate (Summary of findings 2).

Meta-analyses examining depressive or anxiety symptom scores were not performed for behavioural and educational interventions as none of the studies included in these comparisons reported depression or anxiety as a primary or secondary outcome.

Very low-certainty evidence (3 studies, n = 333) demonstrated that mixed interventions slightly decreased anxiety scores when compared to control at endpoints when measured with the Depression-Anxiety Stress Scale (DASS), the Beck Anxiety Inventory (BAI), and the State and Trait Anxiety Inventory (STAI) (SMD =-0.19, 95% CI -0.47 to 0.09, P = 0.18). Evidence in this outcome was downgraded by two levels due to high risk of bias associated with subjective outcome measures in non-masked studies, and also because a different anxiety symptom scale was used to measure different dimensions of anxiety (e.g. state versus trait). Certainty of evidence was further downgraded by one level due to sub OIS (Summary of findings 4; Analysis 4.7). Therefore, the overall certainty of the evidence was downgraded by three levels, yielding a 'very low ' rating.

Apnoea hypopnoea index (AHI) on treatment

Two studies reported on AHI (events/hours) following treatment via behavioural interventions (Dantas 2015; Diaferia 2017). Very low-certainty evidence found a reduction by just under one event per hour when compared to the control group (MD -0.95, 95% CI -2.25 to 0.34, P = 0.15). Evidence was downgraded by one level due to risk of bias arising from protocol deviation and missing outcome data.

Evidence was downgraded by another two levels due to sub optimal information sizes (2 studies, n = 90) and because the estimate's confidence interval included null. No other studies included in this review reported on this outcome (Summary of findings 3; Analysis 3.6). Therefore, the overall certainty of the evidence was downgraded by three levels, yielding a 'very low ' rating.

DISCUSSION

Summary of main results

This review identified 41 studies assessing behavioural, educational, supportive or mixed strategies for improving continuous positive airway pressure (CPAP) use in 9005 adults with obstructive sleep apnoea (OSA). As a group, behavioural interventions yielded the largest improvements in average nightly CPAP usage when compared to the other intervention classes. Moreover, this class of intervention was the only class to suggest a high degree of certainty and confidence in the estimate, according to our GRADE assessments. Not surprisingly, the mixed interventions were most heterogeneous in design and in effect on CPAP device usage.

Overall completeness and applicability of evidence

Study sites, sample sizes, demographic and clinical characteristics

There was very little variation in participant age, baseline apnoea hypopnoea index (AHI) or baseline Epworth Sleepiness Scale (ESS) across intervention classes (Table 2). The distribution across these demographic and clinical measures likely reflects typical clinical populations.

The behavioural class had a slightly larger proportion of female participants (mean 34.4% female) compared to the other classes (range 24.7% for supportive to 32.4% for mixed). If 0% female assumed for the studies that did not report gender distribution, mean % female ranged from 20.9% (supportive) to 31.3% (behavioural). Importantly, while male gender is an oft-noted risk factor for OSA and OSA severity, previous authors have suggested that differences in prevalence across genders may be overestimated, and these differences may actually reflect differences in reporting of symptoms across genders and unintentional bias in screening (which is often due to perception of vastly different prevalence rates in itself). Thus, it is difficult to determine an appropriate gender distribution for clinical trials and whether the studies included in this review are reflective of actual clinical populations likely to be targeted by adherence interventions.

It is plausible that interventions directed toward improving CPAP usage are less effective beyond a certain level of pre-existing compliance. This is supported in part by our planned sensitivity analyses based on control group device usage for some intervention classes. Omitting studies in which average CPAP machine usage was high in control groups (mean ≥ 4 hours/night) had no effect on behavioural educational effect estimates (based on moderate- and very low-quality evidence, respectively), more than doubled the pooled effect estimate for mixed intervention types (very low-quality evidence), and improved the effect of supportive interventions more modestly, but based on high-quality evidence. This pattern of findings may suggest that the impact of behavioural and educational interventions may be independent of baseline adherence levels, while mixed and supportive intervention types may be most useful for individuals with low background use. Alternatively, these findings may relate to some other unmeasured difference between studies, study populations or study environments among those with higher versus lower 'background' CPAP usage or may simply be spurious, reflecting the more limited number and lower quality of studies with low use among controls.

See Appendix 1 for further discussion of current evidence pertaining to the impact of CPAP treatment on cardiovascular, cerebrovascular and functional outcomes and the role of CPAP adherence in measuring that impact.

Study duration, intervention duration, contact episodes, contact time

The distribution of intervention duration within each class did not allow subgroup analysis. Therefore, we were not able to establish whether intervention duration is likely to impact CPAP adherence over the short or long term. This unanswered question is relevant to clinical practice, particularly when the cost-effectiveness of these interventions is considered.

Class-specific findings

Considerable differences in intervention duration, number of contact episodes, total contact time and study (follow-up) duration were noted across intervention classes (See Table 3). Supportive and mixed interventions tended to be of longer duration. Number of contact episodes (interquartile range (IQR)) varied from 2 (1 to 5) for educational to 7 (5 to 10) for mixed. Median (IQR) contact time ranged from 45 (12 to 98) for educational to 90 (80 to 240) minutes for behavioural interventions. There was little variability in average study (follow-up) duration across outcome classes.

There remains a need to assess the impact of intervention on long-term adherence and outcomes, particularly for patients whose disease is sufficiently severe to warrant intervention but who struggle to persist with CPAP for a number of reasons. More specifically, in addition to assessing the differential impact of interventions based on their class or content, there is a need to better understand which aspects of the intervention structure are most important in assisting patients to initiate CPAP and to become active and engaged partners in their ongoing health care to facilitate long-term maintenance of treatment. As we discuss in the following sections, it will be important for trialists to: thoughtfully select and report on critical aspects of intervention structure (e.g. duration, number, frequency and duration of clinical contact, timing and sequencing of intervention relative to diagnosis, CPAP titration and CPAP prescription/dispensing). This will improve overall completeness of our corpus of evidence and will permit users of the literature to more adequately assess applicability to their clinical population or setting. It will also enable better cost-effectiveness estimates.

Qualitative research may assist in identifying common reasons for not persisting with CPAP (e.g. technical problems, insufficient knowledge or understanding of risk and treatment or issues related to motivation, self-efficacy, or other psychological factors) and quantify their frequency in diverse populations. Such studies will enable better understanding of the mechanisms associated with non-adherence, elucidate the relationship between initial motivation and ongoing perception of benefit and 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 adherence may be required for some patients. However, such studies may also suggest that a relatively finite set of common factors account for sizeable proportion of variability in adherence. 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, a schedule of adherence interventions may be developed. At one end, low-intensity, time-limited, low-cost and effective interventions may be incorporated into standard management while, at the more intensive end, well-defined subgroups of non-adherent patients could be targeted at the outset of CPAP therapy (e.g. after one week of standard care) for more comprehensive or sustained interventions. Between these extremes, more detailed mechanistic information might permit a rational selection of intervention type and duration based on demographic, community or individual clinical factors.

Some of our findings reflect those of previous systematic reviews (Haynes 1996; Haynes 2002a; Haynes 2002b; Haynes 2005; Haynes 2008; Nieuwlaat 2014) of interventions for medication adherence. That is, despite a substantial increase in the number of published studies related to CPAP adherence, the interventions are highly variable and increasingly complex, making it difficult to tease out and evaluate the individual components that may relate most directly to effectiveness. Additionally, the findings of the newer randomised controlled trials (RCTs) only slightly alter the conclusions of the previous version of our review (Wozniak 2014).

Reported endpoints

Interventions also varied substantially in the outcome endpoint measured/reported. Most (29) studies reported CPAP usage outcomes at several endpoints, and only seven studies explicitly identified a primary measurement endpoint. Reported endpoints ranged from one week to two years. A three-month (or 90-day) endpoint measurement was available for 20 studies. For the remaining studies, the following endpoints were either the only endpoint reported or the closest to three months: one month (Richards 2007; Shapiro 2017), "1-2 months" (Chervin 1997), six weeks (Pengo 2018), two months (Dantas 2015; DeMolles 2004; Stepnowsky 2007;), four months (Mendelson 2014; Sedkaoui 2015; Smith 2006; Stepnowsky 2013; Wang 2012), six months (Bakker 2016; Bartlett 2013; Hoy 1999; Lewis 2006; Pepin 2019; Sarac 2017; Scala 2012; Soares-Pires 2013; Sparrow 2010),and 24 months (Bouloukaki 2014).

Timing of intervention relative to CPAP titration

Not all study authors reported precise timing of CPAP initiation relative to first intervention. Moreover, among those reporting order of CPAP and intervention initiation, many did not specify duration of time between.

Secondary outcomes: health status

Although this review included a number of secondary outcomes related to health status, they were not assessed in the majority of included studies. The most commonly-measured secondary outcome across intervention classes was daytime sleepiness using ESS. Due to heterogeneity in direction of effect for some classes (educational and mixed), meta-analyses could not be performed. Among classes for which analysis was appropriate, meta-analysis included: five behavioural interventions reporting baseline/endpoint scores (Dantas 2015; Diaferia 2017; Olsen 2012; Scala 2012; Wang 2012), and five supportive interventions reporting change from baseline scores (Fox 2012; Hwang 2017; Mendelson 2014; Munafo 2016; Parthasarathy 2013).

Quality of the evidence

Several issues affect the reliability of our findings and their applicability to the general OSA population. Across classes, we downgraded the evidence primarily for risk of bias (behavioural, educational, supportive, mixed) and inconsistency (educational, mixed) ('Summary of findings' tables 1 to 4). Performance bias due to lack of blinding is likely for subjective- and observer-rated outcomes and is likely to affect all the studies in this review. Across all four classes, statistical variation between studies may be attributable to one or more plausible causes, including different populations recruited, variation in the modalities of interventions provided or differences in the timing or intensity of interventions.

Educational interventions were downgraded for both risk of bias and inconsistency across all outcomes. Among supportive interventions, most outcomes were downgraded for risk of bias and several (N deemed adherent, withdrawals, ESS, quality of life (QoL)) for imprecision. Among behavioural interventions, we downgraded the evidence primarily for high risk of bias. ESS was additionally downgraded for inconsistency and AHI for imprecision. Among mixed interventions, nearly all outcomes were downgraded for risk of bias and consistency and some for imprecision.

With the exception of behavioural interventions (where I^2 = 0%), there was substantial statistical heterogeneity in CPAP usage effect estimates across studies within each class: I^2 = 66% for educational, I^2 = 42% for supportive and I^2 = 92% among mixed interventions. In both supportive and educational interventions, heterogeneity was attributable to effects of one or two studies. In the supportive intervention class, heterogeneity derived from the single study with results favouring the control arm (Mendelson 2014). Among educational interventions, heterogeneity may be largely attributable to differences in magnitude of effect. Among mixed interventions, heterogeneity could not be easily accounted for, which is not surprising given the heterogeneous nature of the interventions within the 'mixed' category.

Post-hoc subgroup analyses

Given the extensive variability observed in intervention duration, number of intervention episodes, and intervention contact time across studies, we conducted exploratory post hoc subgroup analyses comparing subgroups of studies based on these dimensions, which may collectively relate to intervention intensity. In post hoc exploration of results, we hypothesised that intervention intensity may help to predict effectiveness. Specifically, for the behavioural, educational, and mixed classes, we examined each of the following subgroups: intervention duration > 4 weeks, intervention episodes > 1 and intervention contact time > 60 minutes. For each, we observed any change in effect estimate and, where relevant, heterogeneity (I^2). For supportive interventions, only intervention duration was

consistently reported, but we also elected to examine another putative aspect of intensity for that class of intervention: the extent to which the supportive contacts were administered by computer/automated messaging (versus by human contact) and whether the contact frequency/interval was pre-determined. As such, for the supportive intervention class, we examined a subgroup comprising interventions in which the intervention involved human (rather than purely automated) support and a subgroup comprising interventions that involved scheduled (as opposed to ad hoc) human support. Below, we report the effect estimates (95% CIs), heterogeneity (I^2) values for each post hoc subgroup analysis, and tests for subgroup differences.

In summary, we did not find evidence of substantial and consistent effects of any proposed dimension of intervention intensity on CPAP usage across intervention classes in post hoc exploratory subgroup analyses. For behavioural interventions (Analysis 6.8) and educational interventions (Analysis 6.2), the difference between a single contact episode and more than one contact episode (irrespective of duration) was not substantial, while mixed interventions that included greater than one contact episode showed a larger estimated effect on CPAP usage (Analysis 6.11). Importantly though, only one mixed intervention study (Bartlett 2013) had a single contact episode (Hwang 2017 number of contact episodes unknown; Lewis 2006 did not report SDs), so this must be interpreted conservatively. The respective treatment effects were (MD 0.98, 95% CI 0.32 to 1.63; participants = 4036; studies = 9; I^2 = 91%) for those with > 1 episode (Bouloukaki 2014; Chen 2015; Hui 2000; Lewis 2006; Meurice 2007; Sawyer 2017; Sedkaoui 2015; Shapiro 2017; Wang 2012) versus (MD -0.60, 95% CI -1.33 to 0.13; participants = 206; studies = 1; I^2 = 0%) for the single study with only a single contact episode (Bartlett 2013), with a demonstrated subgroup difference (Chi^2 = 9.94, df = 1 (P = 0.002), I^2 = 89.9%).

Intervention duration > 4 weeks appeared to have similar effect to shorter (≤ 4 week) duration among behavioural interventions (Analysis 6.7). Educational interventions > 4 weeks (Hwang 2017; Pengo 2018; Wang 2012, mean 10 weeks) and supportive interventions > 12 weeks (Hoy 1999; Mendelson 2014; Parthasarathy 2013; Pepin 2019, mean 17.8 weeks) showed no certain improvements in adherence. Shorter duration subgroups in these classes appeared to have a larger effect estimates, however testing for subgroup differences in both intervention categories showed no certain difference; educational (Aloia 2013; Basoglu 2011; Chervin 1997; Falcone 2014; Richards 2007; Roecklein 2010; Sarac 2017, mean 1 week): (MD 1.20, 95% CI 0.39 to 2.01; participants = 675; studies = 7; I^2 = 75%), (Chi^2 = 3.36, df = 1 (P = 0.07), I^2 = 70.2%) (Analysis 6.1), supportive (Chervin 1997; DeMolles 2004; Fox 2012; Hoet 2017; Hwang 2017; Munafo 2016; Stepnowsky 2007; Stepnowsky 2013; Turino 2017, mean 9.9 weeks): (MD 0.72, 95% CI 0.43 to 1.01; participants = 896; studies = 9; I^2 = 0%), Chi^2 = 0.17, df = 1 (P = 0.68), I^2 = 0%) (Analysis 6.4). For mixed interventions, longer duration (Bouloukaki 2014; Chen 2015; Hui 2000; Hwang 2017; Lewis 2006 (not included in estimate); Meurice 2007; Sedkaoui 2015; Wang 2012) may have illicited a larger effect estimate (MD 1.22 (0.60-1.83)), compared to shorter duration (Bartlett 2013; Sawyer 2017; Shapiro 2017) (MD -0.31, 95%CI -0.83 to 0.21; participants = 331), (Chi^2 = 13.79, df = 1 (P = 0.0002), I^2 = 92.7%) (Analysis 6.10).

While behavioural interventions with contact time > 60 minutes had lower effect estimates than those with shorter contact times, only two small studies were in the former subgroup and confidence intervals overlapped substantially (Analysis 6.9) . For educational interventions, three studies had > 60 minutes of contact time and the estimated effect for this subgroup appeared to be larger than interventions with ≤ 60 minutes of contact, however a subgroup difference was not shown (Analysis 6.3). For mixed interventions, there may be a difference between subgroups (Hwang 2017 excluded due to unknown contact time) (MD 1.45, 95% CI 0.73 to 2.16; participants = 3751; studies = 6; I^2 = 91%) for those with > 60 minutes contact time (Bouloukaki 2014; Chen 2015; Sawyer 2017; Sedkaoui 2015; Wang 2012) versus (MD -0.15, 95% CI -0.56 to 0.27; participants = 491; studies = 4; I^2 = 0%) for those with ≤ 60 minutes (Bartlett 2013; Hui 2000; Meurice 2007; Shapiro 2017), (Chi^2 = 14.14, df = 1 (P = 0.0002), I^2 = 92.9%) (Analysis 6.12).

Finally, our post hoc analysis examining differences in delivering supportive interventions through human interaction versus automated intervention demonstrated uncertain results (Analysis 6.5). It appeared however,supportive interventions prescheduled human support appeared to have a greater effect estimate (MD 1.43 (0.61 to 2.24) I^2 = 0%) compared to interventions with no scheduled human support (MD 0.58 (0.33 to 0.83) I^2 = 45%), (Chi^2 = 3.82, df = 1 (P = 0.05), I^2 = 73.8%) (Analysis 6.6.) Moreover, limiting to interventions involving human support substantially reduced the observed heterogeneity of effects among supportive interventions.

Post-hoc sensitivity analyses

To assess effect of excluding studies with high risk of bias

We performed sensitivity analyses (Table 8), excluding studies with high risk of bias from each class to determine the extent to which our effect estimates may have been influenced by lower quality studies. Omission of studies with high risk of bias resulted in a reduction of the estimated improvement in CPAP usage for behavioural interventions, but statistical significance was retained (MD 1.05, 95% CI 0.57 to 1.53; participants = 340; studies = 4; I^2 = 0%). Interestingly, for educational (MD 0.98, 95% CI 0.07 to 1.89; participants = 642; studies = 4; I^2 = 86%) and supportive (MD 0.75, 95% CI 0.42 to 1.09; participants = 728; studies = 5; I^2 = 34%) interventions, omission of high risk of bias improved effect estimates slightly while retaining statistical and clinical significance. Due to high heterogeneity and more pronounced differences in direction (two of five studies with mean differences favouring controls, I^2 = 92%) and magnitude of effect, this sensitivity analysis was not performed for mixed intervention class.

To assess effect of differences in updated review intervention classification

We also performed sensitivity analyses (Table 11) to determine if the approach employed for classifying interventions in the current review update, relative to the original classification decisions (Wozniak 2014), substantially affected the results obtained for the original three intervention classes (i.e. behavioural, educational and supportive). To perform these sensitivity analyses, any study that was included in the original review was assigned to the class assigned in the original review. Any study that was new to the updated review retained the class assigned in the update. For behavioural interventions, three studies were differentially classified (Wang 2012 classified as behavioural in our update but as educational in original review; Richards 2007 and Roecklein

2010 classified as educational in our update but as behavioural in the original review). Results showed (MD 1.47, 95% CI 1.12 to 1.83; participants = 625; studies = 9; I^2 = 48%) that the original classification schema would have improved the estimated effect relative to our reported results.

Sensitivity analysis of educational interventions according to the original class allocation (MD 0.48, 95% CI 0.21 to 0.76; participants = 1095; studies = 8; I^2 = 0%) resulted in a reduction of the effect estimate, but retained significance. Relative to our classification, the original classification reduced the number of studies in the educational class from 10 to 8, entailed differential allocation of three studies and reduced the heterogeneity to 0%.

Classification of supportive interventions according to the original review (MD 0.58, 95% CI 0.36 to 0.81; participants = 1534; studies = 14; I^2 = 45%) resulted in a reduction in the estimated effect and also retained significance, favouring the intervention. Heterogeneity was essentially unchanged.

To assess effect of endpoint selection

Sensitivity analyses to examine whether the endpoint measured/reported by study authors (closest endpoint to three months post-intervention, the modal endpoint) affected the effect estimates. A summary of results is provided (Table 12).

Treatment fidelity

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. In the current review,six6 studies (Aloia 2013; Bakker 2016; Lai 2014; Sawyer 2017; Shapiro 2017; Olsen 2012) implemented treatment fidelity checks, and the lack of checks in other studies is a potential source of inconsistency between studies.

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 our assessment of the core attributes of the intervention, based on the authors' descriptions within Methods sections of the published reports, and how it differed from the control group (i.e. the 'net' intervention). It is possible that our classification of studies by intervention type is itself a crude mean of differentiating between the interventions or other differentiating features (e.g. intervention intensity) may ultimately prove more important in defining and comparing classes of interventions. Furthermore, the addition of a 'mixed' intervention type to this updated review reduced the imprecision of assigning interventions with mixed components to one class arbitrarily, but also introduced a new highly-heterogeneous category. We found no evidence to suggest that our classification procedures biased our most important results in favour of the intervention. Sensitivity analysis examining results for behavioural interventions using the original versus our updated classification scheme showed that, if anything, our classification approach was more conservative for this outcome. Differences in classification for educational and supportive interventions did produce nominally more favourable results in the current review and does suggest that classification decisions can impact results. Overall, our classification procedures did not appear to impact heterogeneity. Relative to the allocation implied under original classification procedures, our behavioural class was less heterogeneous (0% versus 48%), our educational class was more heterogeneous (66% versus 0%) and our supportive class heterogeneity was essentially equivalent (42% versus 45%).

Second, 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. For example, 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 attempt to mitigate the effect of active controls by including only studies in which the intervention arm(s) received the same 'background' level of intervention as the control. However, the varied intensity of the background or control intervention, in addition to the 'net intervention' within the studies, could have influenced effect sizes in our analyses.

Agreements and disagreements with other studies or reviews

To our knowledge, other than the previous version of this review (Wozniak 2014), 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

Any type of educational, supportive or behavioural intervention (beyond usual care) is likely to improve continuous positive airway pressure (CPAP) usage by approximately one hour. In CPAP-naive people with severe sleep obstructive sleep apnoea (OSA), very low-quality evidence indicates that supportive and mixed-type interventions increase usage compared with usual care. Moderate-quality evidence shows that a short-term educational intervention results in a modest increase in CPAP usage. High-quality evidence suggests that interventions employing active, motivational, cognitive and behavioural strategies, requiring interactive engagement by participants (i.e. those interventions broadly categorised as 'behavioural' in the current review) leads to a relatively large and clinically-significant increase in CPAP machine usage (hours per night).

For all but behavioural interventions, risk of bias and inconsistency in size or direction of effect across studies introduced moderate (supportive) to substantial (educational, mixed) uncertainty in the size of the difference that might be anticipated in practice for CPAP usage outcomes. We acknowledge that our assessment of risk of bias was based primarily on published reports and, only infrequently, on additional information obtained from study authors. Thus, it is possible that some judgements were based on incomplete information. However, we believe it is most prudent to

rely on the published record of study procedures rather than on recollections of authors, often many years after study completion, particularly as such information was not subject to peer review.

Implications for research

The evidence assembled in this review provides a useful framework for additional research. Investigators should bear in mind the following considerations in developing further studies of CPAP adherence 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 patients with previous OSA diagnosis, especially those who have not successfully persisted with treatment, is important.
- Patients with milder OSA should be recruited to future trials because they may be less likely to persist with treatment if they do not perceive symptomatic benefit and, without treatment, they may ultimately progress to more severe OSA.
- Reasons why participants leave studies should be documented to obtain information on whether and how different types of interventions modify perception of benefit or the balance of benefit and side effects.
- How missing values are handled or 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. Many authors report that analyses were by, for example, intent-to-treat (ITT) analysis, but did not specify whether missing data values were excluded or imputed.
- Validated instruments have been developed for assessing quality of life and symptoms in people with OSA. Trialists should consider using these measurements to explore whether improved adherence affects these outcomes within the time frame of the intervention. Depending upon duration of the study or follow-up period, consideration should be given to incorporating measures of potentially related health outcomes (e.g. cardiovascular, cerebrovascular, cognitive functional measures, motor vehicle incidents).
- Long-term assessment should examine the duration and durability of improvements in CPAP adherence, as well as cost-effectiveness.
- Few studies measured quality of life, depressive or anxiety symptoms. There is growing evidence from cohort studies (Chirinos 2017; Ohayon 2003; Saunamaki 2007) as well as randomised controlled trials (RCTs) and RCT meta-analyses (McEvoy 2016; Zheng 2019) demonstrating that CPAP use is associated with improvements in quality of life, depressive and anxiety symptoms.
- 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 and this should be a focused area of study. A common metric for intervention intensity should be derived in which various parameters of intensity (e.g. duration of intervention, number and frequency of contact episodes, total intervention contact time, contact time per contact episode) are defined, and used to develop, characterise and report on interventions. Studies with educational and behavioural interventions with variation across such well-defined parameters would be helpful in elaborating this area further.
- More head-to-head comparisons of different approaches are needed.
- Cost-effectiveness research would help to establish how resources can best be allocated in implementing these interventions. Ideally, studies with multiple intervention arms that vary in level of intensity across well-defined parameters (and that incorporate baseline measures of participant OSA/CPAP knowledge, motivation, self-efficacy and outcome expectations) would address several important remaining questions:
- ◦ whether there is a minimal baseline intensity of intervention that the majority of patients are likely to require, regardless of individual knowledge, motivation or self-efficacy,
  ◦ which parameters of intervention intensity are most relevant to improving CPAP adherence, and
  ◦ whether baseline knowledge, motivation and self-efficacy is related to the intensity of intervention required for improvements in CPAP adherence.
- Personalised interventions may be appropriate for some individuals but may not be required for all new CPAP users. Given the effectiveness of behavioural interventions, it may be most cost-effective to consider personalised interventions only for those patients who are treatment-resistant after behavioural interventions fail to optimise adherence.
- 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.
- It is not clear whether RCTs of CPAP adherence interventions will be the best study design for assessing the impact of improved CPAP adherence on downstream health outcomes. However, high-quality, long-term studies are needed to rigorously assess the impact of nightly CPAP *dosage and treatment duration* on the nature and time course of improvements across many symptom domains (sleepiness, psychological symptoms, quality of life, and social and occupational functioning), and other clinically-important health outcomes (cardiovascular markers, cognitive/neurological impairment and functioning). Very importantly, particularly for studies attempting to measure the impact of CPAP usage on reversing chronic disease risk and sequelae: such studies will not only need to be of sufficient length such that reversal of disease/functional markers would be rationally expected, but these studies need to ensure that participants in the intervention arms achieve sufficient nightly CPAP usage to warrant robust conclusions. By way of analogy, if, in the majority of pharmaceutical trials, participants in the intervention arms received, on average, only half of the therapeutic dose of medication, we would be reluctant to draw conclusions as to the effectiveness of the medication. (See section below for further discussion). Future RCTs seeking to evaluate the impact of CPAP on health outcomes should consider including interventions to optimise CPAP adherence (i.e. to achieve nightly use of six to eight hours/night) as an integral part of their protocols so as not to waste valuable resources to assess the impact of sub optimal dosing.

See Appendix 1 for further discussion of current evidence pertaining to the impact of CPAP treatment on cardiovascular, cerebrovascular and functional outcomes and the role of CPAP adherence in measuring that impact.

Final considerations: other potential confounding factors and conclusions derived from RCTs

Though the advent of technology to directly measure hours of adherence has been invaluable to the field, any study seeking to evaluate the short- and long-term health impact of CPAP will need to simultaneously measure *total sleep duration* in order to draw accurate conclusions from the results. For the same reason that early studies relying on subjective CPAP usage reports are known to be biased, reliance on CPAP device recordings also has an implicit bias: the duration of sleep *without CPAP* is generally unknown. It may be reasonably safe to assume that the closer the CPAP device-recorded sleep time is to eight hours, the lower the likely duration of unrecorded sleep time. That said, confirmation would require direct observation or other means of sleep recording. For recorded sleep durations less than eight hours, there are several additional factors that may confound the interpretation of results.

First, the fewer hours recorded, the greater the likelihood and duration of unrecorded sleep time. As such, the mean CPAP usage (e.g. mean 3.67 across published RCTs in a recent review (Yu 2017)) suggests that a substantial proportion, if not the majority, of sleep time across studies was unrecorded (and therefore, untreated). Under these conditions, the sleep during which OSA remains untreated is, on average, exerting a greater influence on the measured health outcomes than the smaller proportion of the night in which the OSA is treated. For example, a patient diagnosed with 'mild' OSA based on an average apnoea hypopnoea index (AHI0 = 10 who uses CPAP at optimal pressure for six of eight hours of sleep (achieving an AHI = 0 for 6 of 8 hours), will still have an AHI=10 during the remaining two hours. Assuming apnoeic/hypopnoeic events are evenly-distributed throughout all sleep stages and positions, this would reduce overall AHI to 2.5, but will not change the AHI during any period of non-use. A patient with more severe OSA (e.g. AHI = 35) would need to use CPAP at effective pressure for seven of eight hours per night in order to reduce overall AHI below diagnostic threshold and would need to adhere for > 4.5 hours/night to result in an overall (i.e. full night) AHI within the 'mild' range of severity (AHI < 15).

Second, the device records time that the mask is on and does not distinguish between wake, sleep or specific sleep stages. This has several potential implications for interpreting results of CPAP-effectiveness studies. To the extent that a patient's OSA is sleep stage-related or positional, the actual AHI during the latter hours of sleep may be markedly worse than earlier hours. And, because patients are more likely to comply during earlier as opposed to later segments of sleep, unrecorded sleep time may comprise a disproportionate amount of REM (rapid eye movement sleep) and, depending on the total duration of sleep and sleep onset latency, a substantial proportion of deep (i.e. slow wave) sleep. Therefore, to the extent that unrecorded sleep time comprises REM, deep sleep or supine position, CPAP usage time may be poorly associated with a variety of important health outcomes in studies wherein most participants have low CPAP adherence.

Third, without knowing the duration of unrecorded/untreated sleep, the total sleep duration among participants is unknown and unaccounted for in most studies. Even apart from the deleterious health consequences of untreated OSA, the health effects of chronic sleep deficiency or insufficiency are well-established. Thus, failure to achieve recommended nightly sleep duration among some (perhaps many) study participants within these RCTs could contribute to the absence of apparent benefits of CPAP on cardiovascular (CV) outcomes.

Finally, accumulated RCT evidence addressing the role of CPAP on CV risk derives from studies of short and intermediate duration (i.e. majority of studies are < 1 year follow-up duration). This may be an insufficient time frame, particularly at sub therapeutic treatment dosages, to draw meaningful conclusions about the impact of CPAP treatment on CV risk.

In conclusion, while current evidence strongly suggests that there are limited (if any) cardiovascular benefits of CPAP when used at or below commonly-employed research thresholds of adherence, extant evidence does not address the potential for improvement in CV risk at CPAP usage thresholds beyond four hours/night or beyond one year of CPAP treatment. Moreover, these studies do not control for the confounding effects of total sleep duration or duration of untreated sleep. Each of these factors has the potential to substantially influence conclusions about the health benefits of CPAP use and, therefore, about the importance of optimising CPAP adherence. As such, it is difficult to determine how best to allocate resources for expanding or improving CPAP adherence interventions at this time. At a minimum, such decisions will require that studies be undertaken to establish the health benefits of CPAP, when used at optimal therapeutic dosage (i.e. throughout sleep). Without this information, we run the risk of erroneous conclusions regarding the reversibility of OSA sequelae or of the effectiveness of our current gold-standard OSA treatment. Should such studies demonstrate substantial cardiovascular, cerebrovascular or other health benefits, this would suggest that rather considerable resources should be devoted to developing interventions to optimise CPAP adherence. On the other hand, should such studies show that even optimal CPAP usage is insufficient to reverse these important OSA-linked health risks and outcomes, resource expenditures should be differentially allocated. To optimise CPAP use for improvement of OSA symptoms, depressive symptoms and quality of life (QoL), a small number of additional studies may be warranted to determine how different CPAP adherence intervention classes may be better targeted or personalised for different patient subgroups. On the other hand, to address OSA-related cardio/cerebrovascular health outcomes, such findings would suggest that resources would be more optimally targeted at chronic disease prevention.

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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.
Participants	**N = 12** existing patients at investigator sleep centre with OSA. Participants had received prior treatment with CPAP Inclusion criteria: > 55 years of age, RDI (AHI): > 10, Mini Mental Status Examination: > 25 Exclusion criteria: other ICSD, other treatment for apnoea, claustrophobia **Baseline characteristics:** mean age: 63.4, AHI: 43.5, Desaturation: 77.05 ± 9.47. Baseline characteristics not reported: gender, BMI, ESS. **Country:** USA
Interventions	Participants were randomised into experimental intervention (n = 6) or control (n = 6). **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 (hours/night) at 1 week, 4 weeks, 3 months*. • N of adherent participants (≥ 6 hours per night of usage) • Vigilance testing
Notes	* Indicates primary outcome analysed in this review

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)	High risk	Not done for treatment group assignment

Aloia 2001 *(Continued)*

All outcomes		'None of the participants 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
Selective reporting (reporting bias)	Unclear risk	Information not available
Other bias	Unclear risk	Information not available
Bias arising from the randomisation process (ROB2, primary outcome)	High risk	Authors describe randomisation procedures in METHODS: "...participants were randomised into one of two groups (experimental or control) based on their age, RDI, and nadir oxygen level pretreatment. This type of randomisation involves placing participants into groups based on the current group averages for variables to be randomised. For example, if the average age of group 1 is 50 years and the average age of group 2 is 60 years, the new 40-year-old subject would be placed in group 2 to approximate the first group's average age. Accordingly, the two groups were not significantly different on age, education, RDI, or nighttime oxygen saturation." Based upon cited reference (Stout et al, 1994) for these procedures, this suggests a form of urn randomisation was used. Urn randomisation may be adequate (Cochrane Risk of bias 2 reference manual) and even recommended to ensure balance with small sample sizes, where major imbalance could occur with higher probability. (Hedden, et al, 2006 Randomisation in substance abuse clinical trials; Wei & Lachin, Properties of the urn randomisation in clinical trials. Controlled Clinical Trials 1998;9(4):345-64). No reference to allocation concealment method.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	No deviations documented; none suspected based upon review. Authors report, "Machines were switched unexpectedly in the middle of the study for three participants for reasons unrelated to treatment. Calculating cumulative run time at the 12-week follow-up instead of night-by-night figures accommodated this event. participants' cumulative data were then divided by the number of nights with the machine to obtain average daily run time." This deviation was likely unrelated to experimental context.
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Low risk	Information not available
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Unclear risk	Outcome measured using objective CPAP usage data. Insufficient information. All participants received the same CPAP device at the start of the trial. However, authors report, "Machines were switched unexpectedly in the middle of the study for three participants for reasons unrelated to treatment. Calculating cumulative run time at the 12-week follow-up instead of night-by-night figures accommodated this event. Participants' cumulative data were then divided by the number of nights with the machine to obtain average daily run time." The group assignment of these three participants was not reported and the meaning of 'machines were switched' is unclear. If this implies a switch to a different device make or model, it is possible that outcome measurement could have differed between the intervention group. Given the small N and depending upon the distribution of the 'switches' between groups, this could have impacted effect size estimates. Outcome "assessor" is CPAP device: no knowledge of allocation possible.

Aloia 2001 *(Continued)*

Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Unclear risk	No protocol, abstract, clinical trials entry available for comparison. Results presented were in accordance with the plan specified in the Methods section of the publication. Methods section indicates multiple outcome time points (for primary adherence outcome) were planned. Results section reports each planned time point. No threshold-defined adherence outcomes were specified in Methods; one was reported in results.
Overall risk of bias (ROB2, primary outcome) Machine usage	High risk	-

Aloia 2013

Methods	Randomised parallel-group trial.
Participants	**N= 227** with OSA. **Inclusion criteria:** age 25-85 years, moderate to severe OSA (AHI > 15) by full in-laboratory overnight polysomnography, naive to PAP therapy. **Exclusion criteria:** Diagnosis by split-night PSG; evidence of severe neurological condition or unstable psychiatric illness; sleep disorder other than OSA (including primary central sleep apnoea), CHF, ESRD. **Baseline characteristics:** 34% female. **Mean age** 50.2 (±11.1). **Mean AHI** 46.7. **Mean ESS** 12.1. **Mean BMI** 35.3. **Country:** USA
Interventions	Participants were urn randomised in a 1:1:1 ratio into one of three groups - standard care (n = 74), education (n = 80) and motivational enhancement therapy (n =73) - balancing for age, sex, education, apnoea severity, and ESS score. Individuals in the MET and ED groups each received two, 45-minute, face-to-face individual counselling sessions by a trained nurse 1 week (7 ± 2 days) and 2 weeks (14 ± 2 days) after initiating PAP treatment. Intervention sessions were delivered after 1 week of PAP use. One additional booster phone call was made to each participant in the motivational enhancement therapy and education groups at week 3 of PAP use. **MET:** manualised MET intervention aimed at helping patients resolve their ambivalence regarding consistent PAP use, tailored based on assessment of each participants readiness for change. **ED:** education regarding pathophysiology of apnoea, its medical and behavioural consequences, and the benefits of treatment; presented in standardised formats, with no tailoring to participant readiness. **SC:** provided to all participants, consisted of standard clinical care delivered by the authors' sleep disorders centre. **Study duration:** 12 months
Outcomes	• CPAP usage (hours/night) at 1, 2, 3*, 6, 12 months. • Declisional balance, self-efficacy at 3, 6 and 12 months. • Withdrawals Adherence was measured nightly during the course of the year-long study. Participant average adherence from the beginning of the experiment up to 1, 2, 3, 6 and 12 months were used in analyses, i.e. cumulative mean responses were used).

Aloia 2013 *(Continued)*

	Decisional balance measure consists of both pro items, which assess the benefits of engaging in a particular behaviour, and con items, which assess the costs to the patient of engaging in PAP adherence. A five-point Likert scale was used to rate each item, with 1 being "not important at all" and 5 being "extremely important." The self-efficacy scale was constructed using assess the extent to which patients believed that they could do the required tasks. Decisional balance and self-efficacy measurements were taken concurrent with the 3-, 6-, and 12-month PAP adherence measurements
Notes	Trialists included two intervention arms, one educational and one behavioural. MET vs. Control included in behavioural meta-analysis. ED vs. control included in Educational meta-analysis. * Indicates primary outcome analysed in this review.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"...participants were randomised into one of two groups (experimental or control) based on their age, RDI, and nadir oxygen level pretreatment"
Allocation concealment (selection bias)	Unclear risk	No reference to allocation concealment method.
Blinding (performance bias and detection bias) All outcomes	High risk	No evidence of blinding of participants, personnel or outcome assessors. Study had subjective outcomes, so knowing group assignment could influence these outcomes.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Data were available for all, or nearly all, participants randomised.
Selective reporting (reporting bias)	Low risk	The study protocol is not available, but it is clear that the published reports include all expected outcomes.
Other bias	Low risk	Although there was an imbalance in age, it is unlikely to impact the outcome.
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	"Urn randomisation (Wei & Lachin, 1988) is conducted by tossing a (possibly biased) coin each time a patient is to be allocated. Heads indicates active treatment, and tails indicates control." (Berger & Christophi, 2003). Trialists provided no information regarding random component used in sequence generation or on how sequence concealment was achieved. Authors report "Participants were urn randomised in a 1:1:1 ratio into one of three groups (MET, ED, or SC) balancing for age, sex, education, apnoea severity, and Epworth Sleepiness Scale score." Baseline characteristics for randomised participants did show imbalance ($P < 0.005$). However, sample sizes may have made balancing across multiple factors difficult to achieve. Moreover, the difference does not appear to be large enough for the resulting confounding to bias the intervention effect estimate, particularly as the observed differential age distribution is unlikely to be clinically-significant. That is, the mean ages across groups were 52.4 (SC), 47.0 (ED) and 51.7 (MET). Clinically, a large difference in compliance would not be reliably predicted based on differences in adherence behaviours between participants aged 47 and those aged 52.4. There is some evidence that age < 49 may predict worse (medication) adherence across disorders (Rolnick 2013), but confounding on the basis of age in this direction would have resulted in lower adherence in the ED group; the results of this study found nominally higher adherence in the ED group. Most studies examining CPAP adherence specifically, focus on differences between adults and 'older adults,' usually defining the latter as > 60 years. Thus, these studies are not relevant to the age differentials observed between groups in this study. Moreover, the age-related differences in CPAP adherence found in those stud-

Aloia 2013 *(Continued)*

		ies varied in direction by study - some finding higher and others finding lower adherence among older adults. (See Sawyer 2011, Sleep Med Rev for review).
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	Neither participants nor those delivering interventions were blinded to intervention assignment. Physicians and other healthcare providers (non-research staff) were blind to enrolment. No deviations documented; none suspected based upon review. Only observed deviations from planned intervention is non-compliance with behavioural intervention which is typical of routine care, so unrelated to the experimental context. Likely mITT. Protocol deviation was unlikely to have contributed to biased effect estimates as it was balanced across intervention arms and likely unrelated to outcome.
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Unclear risk	The authors did not use analysis methods that correct for bias nor did they perform sensitivity analyses showing that results are little changed under a range of plausible assumptions about relationship between missingness and outcome true value. Reasons for missing outcome were not documented in the study report (or NCT listing), so could not be assessed for potential relation to outcome. The authors report that they found no differences in dropout rates between groups. The authors also report that they compared dropouts and completers on demographic and severity variables and found no between-group differences.
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Low risk	Primary outcome measures submitted to clinicaltrials.gov (NCT00623246) included adherence to CPAP measured at months 3, 6, 12. These time points as well as two additional time points (1 and 2 months) were included in published report. All planned time points results were reported. Multiple analyses (e.g. variable adherence 'thresholds') not conducted.
Overall risk of bias (ROB2, primary outcome) Machine usage	Unclear risk	-

Bakker 2016

Methods	Open-label, parallel-arm, RCT.
Participants	**N = 83** participants with OSA Inclusion criteria: AHI 4%, ≥ 10 or AHI 3%, ≥ 15; 45 to 75 years with established CVD or cardiometabolic disease (established coronary artery disease (≥ 70% stenosis in at least one major coronary artery), prior myocardial infarction, coronary artery revascularisation procedure, Ischaemic stroke, or diabetes) OR 55 to 75 years with at least three CVD risk factors (male sex, BMI ≥ 30, hypertension, dyslipidaemia, and ≥ 10 pack-years of smoking). **Exclusion criteria:** cardiovascular event < 4 months before enrolment, prior CPAP, ESS > 14 of 24, drowsy driving within 2 years, commercial driving, or an uncontrolled medical condition (including CSA, heart failure, uncontrolled hypertension, severe hypoxaemia, anaemia, and renal insufficiency). **Baseline characteristics:** 33% female. **Mean age** 63.8 (NR). **Mean AHI** 22.8. **Mean ESS** NR. **Mean BMI** 31.1. **Country:** USA

Bakker 2016 *(Continued)*

Interventions	Eligible participants entered a run-in phase before randomisation, consisting of 14 days wearing a nasal CPAP mask during sleep (without a CPAP device). Participants who reported using the mask during the majority of the run-in and who were willing to continue using the mask were eligible for randomisation. Randomisation took place in a 1:1:1:1 ratio with a block size of 4, based on three stratification factors: diagnostic study (full night or split night with titration), site, CVD status (established or risk factors) to one of four study arms (two control conditions, two treatment conditions): conservative medical therapy (n = 44), sham CPAP (n = 42), active CPAP (n = 42), or active CPAP +ME (n = 41). Bakker 2016 reported only the active CPAP and CPAP + ME arms. **Intervention (Active CPAP + ME):** overall goal of each ME session was to resolve the participants' ambivalence toward establishing consistent CPAP usage patterns and increase their confidence toward using CPAP regularly. Each participant was encourage to set concrete goals regarding their future CPAP use and identify rewards that they could provide themselves when those goals were achieved. ME was delivered during 1-hour in-person sessions at baseline and week 1, which included an educational video, and during phone calls of 10 to 30 minutes with the same psychologist at weeks 3, 4, 8, 12, 20, and 32. **Control (Active CPAP):** CPAP **Study duration:** 12 months.
Outcomes	• CPAP usage (hours/night) at 6*, 12 months
Notes	* Indicates primary outcome analysed in this Review.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"Randomization took place in a 1:1:1:1 ratio with a block size of 4, based on three stratification factors: diagnostic study (full night or split night with titration), site (BWH, BIDMC, or Joslin), CVD status (established or risk factors). Randomization was performed using a data-entry system linked to an off-site server holding the sequences."
Allocation concealment (selection bias)	Unclear risk	Insufficient information to determine sufficiency of sequence concealment: Sequences were concealed at off-site location. Block sizes were fixed, so last assignment to each block could be predicted, but only likely to occur if investigators were aware of block sizes.
Blinding (performance bias and detection bias) All outcomes	High risk	No evidence of blinding of participants, personnel or outcome assessors. Study had subjective outcomes, so knowing group assignment could influence these outcomes.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Data were available for all, or nearly all, participants randomised.
Selective reporting (reporting bias)	Low risk	Study protocol is not available, but thorough analysis of information presented in study's NCT archive does not suggest that outcomes of interest were chosen after data analysis already commenced.
Other bias	Low risk	No baseline imbalances or reported deviations from intended intervention.
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Authors report, "Analyses in this paper compare the active CPAP and CPAP + ME arms only. Randomization took place in a 1:1:1:1 ratio with a block size of 4, based on three stratification factors: diagnostic study (full night or split night with titration), site (BWH, BIDMC, or Joslin), CVD status (established or risk factors). Randomization was performed using a data-entry system linked

Bakker 2016 *(Continued)*

		to an off-site server holding the sequences. Participants randomly assigned to a CPAP group immediately underwent secondary randomisation to use a device by one of two manufacturers (Philips Respironics or ResMed), using a randomisation sequence with a block size of 2." From Protocol (Yaggi 2016): 255 patients with TIA or stroke are randomly assigned using a 1:1:1 (control:standard PAP: enhanced PAP) randomisation scheme to either usual care or a home-based diagnosis and treatment approach that includes ambulatory polysomnography and initiation of PAP for patients with sleep apnoea (Figure 1). Control patients could undergo diagnosis and treatment of sleep apnoea if suspected as part of usual clinical care. The randomisation is stratified by centre (Connecticut or Indiana) and neurologic event type (TIA or stroke)...." Random component used for sequence generation not explicitly described. Insufficient information to determine sufficiency of sequence concealment: Sequences were concealed at off-site location. Block sizes were fixed, so last assignment to each block could be predicted, but only likely to occur if investigators were aware of block sizes. Authors provide a tabular summary of baseline characteristics for participants randomised to CPAP+ME and CPAP-only intervention arms, and report in text: "The two groups were comparable at baseline in terms of age, sex, anthropometrics, race or ethnicity, and cardiovascular risk factors (Table 1)."
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	Yaggi 2016 report that participants were unblinded. (p. 5) Deviation from protocol documented by authors: The original trial design included follow-up for 12 months; however, participants randomly assigned after January 2013 were restricted to 6 months of follow-up. Our primary analysis of CPAP adherence therefore took place for 6 months, rather than 12." This deviation is unlikely to have affected the outcome. Authors report, "All analyses were intention-to-treat." Additionally, all outcome measures appear to derive from all randomised participants in the two relevant treatment arms. Protocol deviation was unlikely to have contributed to biased effect estimates as it was balanced across intervention arms and likely unrelated to outcome.
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Low risk	Six-month outcome data available for nearly all randomised participants. In addition to having primary outcome (CPAP usage) data for nearly all participants, authors documented reasons for missing adherence data and conducted sensitivity analyses, determining that the finding of no differences in adherence between groups was robust when a value of zero was assigned to missing usage data and when examining complete data only.
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome measured using objective CPAP usage data. Published report notes, "All participants were provided with either a REMstar Pro CPAP (Respironics Inc. Murrysville PA) device with a data-storage SmartCard, or a Sandman Goodnight 420 Series Auto HH (Covidien, Mansfield, MA) which allowed usage data to be directly downloaded from the machine or via a memory key. Reviewers contacted authors to request information as to the distribution of CPAP device make across intervention arms. Authors responded (email) reporting, "Our CPAP machines were provided for the study by Respironics – REMstar Auto with C Flex or REMstar Pro M Series." Thus, the information provided by authors in personal correspondence suggests that no participants received the Sandman Goodnight 420 Series Auto HH and, therefore, that outcome measurement should not have differed between intervention groups. Outcome "assessor" is CPAP device: no knowledge of allocation possible.

Bakker 2016 *(Continued)*

Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Unclear risk	NCT01261390: Original primary outcome measures of BestAir trial (submitted 15 Dec 2010) was "Effectiveness of continuous positive airway pressure therapy on cardiovascular disease, using mean 24 hour systolic blood pressure as the trial's primary endpoint. [Time Frame: 3 years]". Current primary outcome measures (submitted 18 Apr 2017) include those of interest in this review: "Difference in CPAP Adherence by Active Treatment Arm [Time Frame: 6-months] Original secondary outcome measure (submitted 15dec2010): "Recruitment and retention rates of patients with moderate to severe obstructive sleep apnoea and cardiovascular disease risk factors or established CVD participating in a controlled trial. [Time Frame: 3 years]" "Adherence to CPAP therapy was tracked remotely by modem transmission. Outcome reported is mean hours of PAP use per night at the 6-month time point. Comparison is between those with and without assignment to Motivational Enhancement as part of treatment randomisation." Current secondary outcome measures of relevance to our review (submitted 18 Apr 2017): Change in ESS, SAQLI, SF-36, PHQ-8 [6 & 12 months. Though it appears that CPAP adherence was a target of the intervention from the outset (i.e. it is repeatedly mentioned as a focus of attention in description of the active treatment arms), it does not appear to have been an outcome of interest at the time of design. Rather, as described in the protocol (described in Yaggi 2016), adherence was a primary process measure (and one likely to impact the primary physiological outcome of interest). Study primary completion date (March 2014, final collection date for primary outcome measure) occurred before current primary/secondary outcome measures posted to clinicaltrials.gov. However, the time stamps provided in NCT entry are merely the date that these outcomes were entered into the electronic system and likely do not represent the date that decisions about additional outcome measures were made. Thus, it is possible that all primary/secondary outcomes were finalised before unblinded outcome data were available for analysis. Decision to change primary CPAP adherence outcome from 12-month to 6-month endpoint likely a consequence of a change in design/follow-up necessitated by factors unrelated to the outcome that required follow-up to shorten for participants enrolled after January, 2013. Moreover, for those participants with outcome data at 12 months, the results were similar.
Overall risk of bias (ROB2, primary outcome) Machine usage	Unclear risk	-

Bartlett 2013

Methods	Randomised parallel-group trial.
Participants	**N = 206** participants with moderate-severe OSA referred to CPAP therapy. **Inclusion criteria:** none reported other than moderate-severe OSA. **Exclusion criteria:** unable to understand fluent English, any previous use of CPAP. **Baseline characteristics:** 32% female. **Mean age** 48.1 (±13.2). **Mean AHI** 34.9. **Mean ESS** 11.9. **Mean BMI** 30.4. **Country:** Australia

Bartlett 2013 *(Continued)*

Interventions	Prior to recruitment, a randomisation sequence by group using random permuted blocks with a 1:1 allocation ratio to control arm, Social Interaction (n = 97) or intervention arm, Social Cognitive Therapy (n = 109). **Social Cognitive Therapy:** intervention was based on social cognitive theory factors, including perceived self-efficacy, outcome expectations, and social support. Participants were encouraged to list goals, given slide presentations to discourage unhelpful thoughts of CPAP side effects, taught relaxation strategies, and given additional booklets containing information about sleep OSA/CPAP, and general health. **Social interaction:** a basic social intervention was given to ensure that equal time was spent with all study participants; SI group was shown a 15-minute video that followed a patient's journey from their baseline diagnostic sleep study to being diagnosed with OSA and undergoing a CPAP titration study. **Study duration:** 6 months
Outcomes	• CPAP usage (hours/night) at 6 months. • N of adherent participants (usage ≥ 4 hours per night) • Sleepiness (ESS) • QoL (FOSQ) • Mood/Anxiety (DASS) • withdrawals • Fatigue (FSS) CPAP usage was assessed at 7 nights, then 1, 3, and 6 months. Though these endpoints were reported as intended secondary outcomes, only 6-month endpoint was presented in published report. The two primary outcomes were adherence, usage ≥ 4 hours per night at 6 months, and uptake of CPAP (measured through the SCT questionnaire). Questionnaires, including ESS, DASS, FSS, PSQI, and FOSQ, were also administered at baseline, 1 month, and 6 months.
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"Prior to recruitment, a randomisation sequence by group using random permuted blocks with a 1:1 allocation ratio to SI and SCT interventions was generated by an independent investigator.... the psychologist responsible for the interventions opened a sequentially numbered, opaque, sealed envelope containing the randomisation allocation."
Allocation concealment (selection bias)	Low risk	As per trial registry entry, ACTRN12607000424404: "Allocation was concealed using sealed opaque envelopes which were opened following participant consent and prior to treatment as usual session."
Blinding (performance bias and detection bias) All outcomes	High risk	No evidence of blinding of participants, personnel or outcome assessors. Study had subjective outcomes, so knowing group assignment could influence these outcomes.
Incomplete outcome data (attrition bias) All outcomes	High risk	19/97 and 10/109 patients in the SI and CBT groups withdrew from the study at 6 months, respectively. Number of withdrawals is unbalanced between groups and is >10% in one group.
Selective reporting (reporting bias)	Low risk	The study protocol is available (NCT entry) and all of the study's pre-specified outcomes that are of interest in the review have been reported in the pre-specified way.

Bartlett 2013 *(Continued)*

Other bias	Low risk	No baseline imbalances or reported deviations from intended intervention.
Bias arising from the randomisation process (ROB2, primary outcome)	Low risk	Authors report, "Prior to recruitment, a randomisation sequence by group using random permuted blocks with a 1:1 allocation ratio to SI and SCT interventions was generated by an independent investigator.... the psychologist responsible for the interventions opened a sequentially numbered, opaque, sealed envelope containing the randomisation allocation." As per trial registry entry, ACTRN12607000424404: "Allocation was concealed using sealed opaque envelopes which were opened following participant consent and prior to treatment as usual session. Following treatment as usual for CPAP participants were randomised to CBT or Social Reciprocity (SR). Sealed opaque envelopes containing treatment allocation were opened following completion of treatment as usual." Key baseline characteristics (age, gender, BMI, AHI) were reported for all randomised participants and these differences were insignificant (P values reported), except for AHI (P = 0.02), with AHI in control arm higher than that in intervention arm. Authors report a minimum of 16 (but table suggests as many as 20) comparisons of baseline characteristics, and two were found to be statistically significant at a 5% level. This suggests a slight excess in the number of baseline characteristics expected to have chance differences. However, the two characteristics found to differ significantly (AHI, arousal index) are expected to be strongly correlated. Moreover, the P values were nominally-significant, suggesting the between-group differences in baseline characteristics are possibly due to chance. Moreover, the between-group difference in mean AHI is probably insufficient for the resulting confounding to bias the intervention effect estimate.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	Authors report, "...Participants were then presented with the SCT or SI protocol. Staff administering the SCT or SI were not blinded to the intervention, but did not have ongoing clinical contact with the patients. Other staff members interacting with the patients in subsequent visits were blinded to group allocation." No deviations documented; none suspected based upon review. ITT. Authors report, " The analysis was by intention to treat. Participants who withdrew from the study were asked to attend the 6-month follow-up visit to collect outcome data. In cases where CPAP usage data from device download were missing, usage was imputed to be zero hours/night if it was confirmed with the participant that had they had refused or abandoned CPAP therapy, or else missing values were imputed by carrying forward the last observation. Because this strategy might lead to an overestimate of CPAP usage, sensitivity analyses were conducted, specifically by imputing zero usage to all missing data, or confining analysis to cases with complete data. Predictors of CPAP adherence at 6 months were explored by logistic regression, and the effect of the SCT intervention was also evaluated, adjusting for significant predictors of adherence or variables found to be different between the intervention groups at baseline. P values < 0.05 were considered significant."
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Low risk	9 of 97 (9.2%) and 5 of 109 (4.6%) of participants in the control and intervention arms, respectively, had no outcome data at primary endpoint and had their previous adherence data carried forward for outcome measures. In addition to having primary outcome (CPAP usage) data for nearly all participants, authors documented reasons for missing adherence data and conducted sensitivity analyses, determining that the finding of no differences in adherence between groups was robust when a value of zero was assigned to missing usage data and when examining complete data only.

Bartlett 2013 *(Continued)*

Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome measured using objective CPAP usage data. Published report notes, "All participants were provided with either a REMstar Pro CPAP (Respironics Inc., Murrysville PA) device with a data-storage Smart-Card, or a Sandman Goodnight 420 Series Auto HH (Covidien, Mansfield, MA) which allowed usage data to be directly downloaded from the machine or via a memory key." Reviewers contacted authors to request information as to the distribution of CPAP device make across intervention arms. Authors responded (email) reporting, "Our CPAP machines were provided for the study by Respironics – REMstar Auto with C Flex or REMstar Pro M Series." Thus, the information provided by authors in personal correspondence suggests that no participants received the Sandman Goodnight 420 Series Auto HH and, therefore, that outcome measurement should not have differed between intervention groups. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Low risk	ACTRN12607000424404 (https://www.anzctr.org.au/Trial/Registration/TrialReview.aspx?id=82216&showHistory=true&isReview=true) Trial registered 22 Aug 2007 and all planned outcomes submitted at that time. Updated on 9 August 2012 4:38:27 PM to indicate that data collection is now complete. Trial information (ACTRN12607000424404) and Methods section of published report indicates that multiple time points planned; each planned outcome reported. There were multiple analyses of CPAP adherence outcomes planned and all were reported.
Overall risk of bias (ROB2, primary outcome) Machine usage	Low risk	-

Basoglu 2011

Methods	Randomised, parallel-group study
Participants	**N = 133** newly diagnosed moderate-to-severe OSAS patients **Inclusion criteria:** newly diagnosed, moderate to severe OSA, CPAP-naive **Exclusion criteria:** use of sedatives, drug abuse, cardiac co-morbidities, COPD, other sleep disorders **Baseline characteristics, by group:** Intervention group*: a*ge: 53.7, Male sex: 82%, AHI 61, ESS: 10.3, BMI: 33.2. Control group*:* age: 54.4, Male sex: 70%, AHI: 57.4, ESS: 12.4, BMI: 33 **Country:** Turkey
Interventions	Participants were randomised into video education intervention (n = 66) or control (n = 67). **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 at 1, 3*, 6 months

Basoglu 2011 *(Continued)*

- Sleepiness (ESS)
- Factors predicting CPAP adherence
- Withdrawals

Notes	Unpublished information on study design and outcomes obtained from study authors

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
Selective reporting (reporting bias)	Unclear risk	No Information.
Other bias	Unclear risk	No Information.
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Only information provided as to the randomisation procedures used was within METHODS: "The study used a randomised two-group design. Out of 133 patients, 66 were informed about OSAS and CPAP therapy by the same doctor and also received visual education by videotape (video group), whereas only information was given to 67 of them (control group). All the patients in the video group received video education after CPAP titration, and the duration between video education and initiation of CPAP treatment was approximately 1 week." No reference to random component or allocation concealment method. Key baseline characteristics (age, gender, BMI, AHI) were reported for all randomised participants and differences were insignificant (P values reported), consistent with chance.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	No deviations documented; none suspected based upon review. Authors report "There was no dropout during the follow-up period as the patients were called up in case of missing an appointment." Additionally, results are reported for all randomised participants.
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Low risk	
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring; devices identical or sufficiently similar (i.e. similar distributions of CPAP device make) across groups. Outcome "assessor" is CPAP device: no knowledge of allocation possible.

Basoglu 2011 *(Continued)*

Bias in selection of the reported result (ROB2, primary outcome) All outcomes	High risk	No protocol, abstract, clinical trials entry available for comparison. Results presented were in accordance with the plan specified in the METHODS section of the publication. No information as to whether analysis plan was finalized before unblinded outcome data were available for analysis. Methods section indicates that multiple time points planned; each planned outcome reported. Methods indicate one threshold definition. However, the decision to use only a threshold definition, and not present average usage upon which that threshold was calculated, is inconsistent with standard reporting practices in the field and suggests that the numerical result being assessed is likely to have been selected based on the results.
Overall risk of bias (ROB2, primary outcome) Machine usage	High risk	-

Bouloukaki 2014

Methods	Randomised, parallel-group study.
Participants	**N= 3100** patients with newly diagnosed sleep apnoea randomised to either the standard group (usual follow-up care) or the intensive group (additional visits, telephone calls, and education). **Inclusion criteria:** newly diagnosed with OSAHS by PSG, moderate-to-severe OSAHS, no history of previous CPAP therapy, and above-elementary school education. **Exclusion criteria:** refusal to participate, refusal of CPAP therapy, CSA syndromes, obesity hypoventilation syndrome, restrictive pulmonary and restrictive chest wall diseases, severe CHF, a history of life-threatening arrhythmias, severe cardiomyopathy, LTOT, family or personal history of mental illness, drug or alcohol abuse, severe cognitive impairment, concurrent oncological diseases, and a history of narcolepsy or restless legs syndrome. **Baseline characteristics:** 25% female. **Mean age** 55.6 (±10.2). **Mean AHI** 52. **Mean ESS** 12.1. **Mean BMI** 37.8. **Country:** Greece
Interventions	Eligible patients (n = 3100) were randomly assigned in a 1:1 ratio to receive either the standard intervention (n = 1550), of usual follow-up care, or the intensive intervention (n = 1550), with augmented follow-up care based on additional appointments at the CPAP clinic, telephone calls and education. **Intensive intervention:** patients received the same features as standard group, with the addition of follow-up visits involving patients' partners or family. All patients attended a 15-minute video education session cover OSAHS-related topics, including the syndrome itself, treatment options, and the benefits of adherence to therapy. This was followed by a 10-to 15-minute lecture used to reinforce key concepts. During the first week of CPAP set-up, patients were contacted by the nurse, on the second and seventh day, via telephone in order to discuss any concerns they might have regarding air pressure, mask fitting, leaks and other issues as they arose. During the first month of treatment, patients were instructed to keep a sleep diary, and were reviewed by a sleep specialist on the 15th and 30th day of treatment. **Standard care:** patients were reviewed in the outpatient sleep clinic at 1-month, at 3-month intervals during the first years, and every 6 months afterwards. During these appointments, a clinical assessment was made and patients were further encouraged to use the device. If there were doubts about compliance, the referring physician made personal contact with the patient in order to resolve barriers to adequate compliance. **Study duration:** 2 years
Outcomes	• CPAP usage (hours/night) at 1 month, 2 years*

Bouloukaki 2014 *(Continued)*

- N of adherent participants (≥ 4 hours/night for ≥ 70% of nights)
- Sleepiness (ESS)
- QoL (SF-36)
- Depressive symptoms (BDI)
- Withdrawals
- Hospitalisations
- CVD-related deaths
- Cost-effectiveness

Chronological data were obtained from the CPAP machine at each follow-up appointment. Self-reported number of nights per week and hours per night were obtained for comparison against data obtained from CPAP machine. Regular CPAP compliance was defined as using the therapy for an average of 4 hours per night on at least 70% of the nights.The estimated costs of each intervention were calculated and compared between groups.

Notes		

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Eligible patients (n = 3100) were randomly assigned in a 1:1 ratio to receive either the standard intervention (n = 1550), of usual follow-up care, or the intensive intervention (n = 1550), with augmented follow-up care based on additional appointments at the CPAP clinic, telephone calls and education. Randomisation was performed using a computer-generated list of random numbers.
Allocation concealment (selection bias)	Unclear risk	No reference to allocation concealment method.
Blinding (performance bias and detection bias) All outcomes	High risk	No evidence of blinding of participants, personnel or outcome assessors. Study had subjective outcomes, so knowing group assignment could influence these outcomes.
Incomplete outcome data (attrition bias) All outcomes	High risk	1349/1550 and 1501/1550 in the standard and intensive groups (respectively) either discontinued the intervention or were "lost to follow-up". Considerably more people dropped out of the standard intervention group (therefore missing outcome data are unbalanced in numbers across intervention groups). This would not affect adherence data (which can be predicted to be 0 for those who "discontinued intervention"), but would affect subjective outcomes.
Selective reporting (reporting bias)	Unclear risk	No information as to whether analysis plan was finalised before unblinded outcome data were available for analysis.
Other bias	Low risk	No baseline imbalances or reported deviations from intended intervention.
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Authors report, "Eligible patients (n=3100) were randomly assigned in a 1:1 ratio to receive either the standard intervention (n=1550), of usual follow-up care, or the intensive intervention (n=1550), with augmented follow-up care based on additional appointments at the CPAP clinic, telephone calls and education. Randomisation was performed using a computer-generated list of random numbers." No reference to allocation concealment method. Key baseline characteristics (age, gender, BMI, AHI) were reported and differences were insignificant (P values reported), consistent with chance.

Bouloukaki 2014 *(Continued)*

Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	Authors report, "Patients were blinded to the group to which they were allocated and were followed for a minimum of 2 years." Methods for blinding were not described. Authors specify only that the PSG scorer was blinded to 'the origin of the data." No deviations documented; none suspected based upon review. AUthors report, "Data were normally distributed. Numerical variables are presented as mean SD. Intention-to-treat analysis was carried out, in which all patients receiving the allocated interventions were included in the analysis." Authors do not report on missing data or how missing endpoint values were accounted for (e.g. LOCF, imputation, substitution of 0 hours use).
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Low risk	Authors report, "155 of the 3100 patients, 124 receiving standard support and 31 intensive support, were lost to follow-up: 77 (4.9%) patients in the standard group and 18 (1.1%) in the intensive group had stopped using CPAP, and 10 patients in the standard group and four in the intensive support group died after randomisation (fig. 1). All 3100 patients were included in the final analysis." Authors do not report on missing data, so it is unclear if data were missing for those who did not complete the study and, if so how these missing endpoint values were accounted for (e.g. LOCF, imputation, substitution of 0 hours use).
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Unclear risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring. Unable to confirm with study author that distribution of CPAP device makes did not differ between intervention arms. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	High risk	ClinicalTrials.gov entry (NCT02016339) indicates that the original primary outcome measure was the same as the current primary outcome measure, "Effect of intensive intervention on CPAP adherence [Time Frame: 24 months]" (submitted 13 Dec 2013). Final data collection date for primary outcome was June 2013. NCT outcome is the same as that presented in published report. No information as to whether analysis plan was finalized before unblinded outcome data were available for analysis. Methods section (but not NCT entry) indicates that multiple analyses of CPAP adherence outcomes were planned and all were reported in Results. Though the authors report 24-month outcomes as specified in NCT trial listing, their choice of definitions for CPAP usage rates is atypical. Specifically, authors define the CPAP usage/night outcome as "Hours per night, on nights CPAP was used." This definition of the CPAP usage/adherence outcome was not pre-specified (in NCT entry) and may substantially overestimate CPAP usage (in both groups) because all nights not used are excluded from numerator and denominator. Since mean use per day was likely also calculated, the decision to report mean use per effective day suggests that the numerical result being assessed was selected on the basis of the results from multiple outcome measurements.
Overall risk of bias (ROB2, primary outcome) Machine usage	High risk	-

Chen 2015

Methods	Randomised, parallel-group study.

Chen 2015 *(Continued)*

Participants	**N = 85** participants with new SAHS diagnosis. **Inclusion criteria:** AHI >15, daytime sleepiness, two major symptoms of the syndrome, lived within 100 miles from Zhejiang. **Exclusion criteria:** previously received CPAP therapy, suffering with COPD, asthma, or neurological problems. **Baseline characteristics:** 38.3% female. **Mean age** 50.4 (NR). **Mean AHI** 54.5. **Mean ESS** 13. **Mean BMI** 32.5. **Country:** China
Interventions	85 participants were randomised to nurse-led intensive vs standard support, of which 5 refused to participate (group allocation of refusals not reported), resulting in n = 40 receiving intervention and n = 40 receiving control condition. **Intervention: hospital health education,** consisting of pre-treatment 30-minute educational video that explained the pathogen, mechanism, risks, benefit, and treatment methods for SAHS; personalised guidance from a nurse; and an SAHS Health education Manual. In addition, several **patient self-management interventions** were delivered including: 15-minute interview with nurse for troubleshooting within 5 days of receiving CPAP treatment, nurse home visits after CPAP treatment was initiated, healthy lifestyle (diet, exercise) guidance, and a psychological intervention, informing patients of the importance of maintaining a good mental state for disease rehabilitation, and teaching the patients methods and techniques on how to respond to anxiety and depression. Finally, each participant in the intervention arm received a ˜30-minute consultation with sleep physician within 1 month of CPAP initiation. **Control:** ˜30-minute consultation with sleep physician at 1, 3, 6 and 12 months. **Study duration:** 12 months.
Outcomes	• CPAP usage (hours/night) at 1, 3, 6, 12 months. • Sleepiness (ESS) • QoL (SF-36) • Depressive Symptoms (HADS) • OSA symptoms The data regarding the usage of CPAP by the patients were recorded and handled with professional software) at each clinical visit. All participants underwent a daytime function testing at the beginning and after 12 months of the initiation of CPAP treatment. Function testing included the following steps: an in-house questionnaire was given to assess the severity of sleep apnoea symptoms.
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"This study was designed as a randomised, single-blinded, prospective trial of nurse-led intensive vs standard support.... The included patients were randomised into two groups via a predetermined balanced block which was generated by tossing a coin: standard support group and intensive support group."
Allocation concealment (selection bias)	Unclear risk	No reference to block sizes to or other allocation concealment methods.
Blinding (performance bias and detection bias)	High risk	No evidence of blinding of personnel or outcome assessors. Study had subjective outcomes, so knowing group assignment could influence these outcomes.

Chen 2015 *(Continued)*

All outcomes		Study says that "patients were blinded to the allocation and did not know to which group they were assigned", but did not explain how this was performed or maintained.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Data available for 80 of 85 (94%) of randomised participants. However, it is not clear to which group these 5 missing participants belonged to - there is the possibility that all 5 came from one group, which would results in 12.5% (5/40) withdrawals. This would not be critical for measuring CPAP adherence (as it is objective and can be predicted to be 0 for those who refuse to participate), but it would be critical for subjective outcomes.
Selective reporting (reporting bias)	High risk	No protocol, abstract, clinical trials entry available for comparison. Results presented were not consistent with the plan specified in the Methods section of the publication.
Other bias	Low risk	No baseline imbalances or reported deviations from intended intervention. Although there is the issue of the 5 missing participants, this is already covered in the "Incomplete Outcome Data" domain (do not want to double count).
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Regarding the randomisation procedures, authors report: "This study was designed as a randomised, single-blinded, prospective trial of nurse-led intensive vs standard support.... The included patients were randomised into two groups via a predetermined balanced block which was generated by tossing a coin: standard support group and intensive support group." No reference to block sizes to or other allocation concealment methods.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Unclear risk	Authors report: "Patients were blinded to the allocation and did not know to which group they were assigned." No information was provided as to how blinding was performed/maintained. After randomisation, n = 5 participants 'refused to participate.' No further information was provided, including: group allocation of dropouts, reasons for refusal. This suggests the possibility that the deviation arose because of experimental context/expectation of differences between groups (e.g. disappointment about assignment). mITT used.
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Low risk	Data available for 80 of 85 (94%) of participants.
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring; devices identical or sufficiently similar (i.e. similar distributions of CPAP device make) across groups. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Unclear risk	No protocol, abstract, clinical trials entry available for comparison. Results presented were not consistent with the plan specified in the Methods section of the publication. Description of intended outcome measurements (time points) was very limited: "All participants underwent a daytime function testing at the beginning and after 12 months of the initiation of CPAP treatment. Function testing included the following steps: an in-house questionnaire was given to assess the severity of sleep apnoea symptoms; Epworth and Stanford sleepiness scales were calculated to assess sleepiness; mood was evaluated using the Hospital Anxiety and Depression Scale; and quality of life was measured by the Short Form-36." This suggests 12-month CPAP usage is intended primary outcome. Results section (text) for CPAP usage reported: "The average compliance was

Chen 2015 *(Continued)*

		2.2 hours (51%) longer among participants in the intensive support group than those in the standard support group; this difference was statistically significant between the two groups (Table 13 and Figure 2)." Authors provide no time point reference for this single outcome value, but based on results table, this corresponds to the 3-month outcome point. The full results table presents CPAP usage outcome data at 1, 3, 6 and 12 month time points. Taken together, this report suggests there was no pre-determined outcome assessment plan (particularly with regard to time points).
Overall risk of bias (ROB2, primary outcome) Machine usage	High risk	-

Chervin 1997

Methods	Randomised parallel-group trial
Participants	**N = 40** participants with OSA (about to start or already receiving CPAP) recruited from clinic. **Baseline characteristics: Mean age** 51.7. **Mean AHI** 49.4. **ESS** 10.9 ± 5.1. **Lowest 0_2 Sat** 75.6% (± 14.4). **MSLT** 6 (± 3.9) **Country:** USA
Interventions	No information provided as to the group allocation of all randomised participants. Allocation Ns only available for the 33 participants who completed the study: Intervention group 1 (n = 12), Intervention group 2 (n = 14), control (n = 7). **Intervention 1:** telephone call each week during trial (max trial time of two months) **Intervention 2:** two printed documents **Control:** no additional support **Study duration:** 8 weeks
Outcomes	• Machine usage (hours/night) at 1 to 2 months • Dropouts/Lost-to-follow-up
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. Trialists included two intervention arms, one educational and one supportive. Intervention 1 (telephone support) vs. Control included in Supportive meta-analysis. Intervention 2 (educational documents) vs. control included in educational meta-analysis.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random numbers table
Allocation concealment (selection bias)	Unclear risk	Information not available

Chervin 1997 *(Continued)*

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
Selective reporting (reporting bias)	Unclear risk	No Information.
Other bias	Unclear risk	No Information.
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Authors report, "On the basis of a random number table, each subject was assigned to one of three intervention groups." No reference to allocation concealment method. Key baseline characteristics (age, gender, AHI) were reported for all randomised participants and differences were reported to be non-significant (no P values presented). BMI comparisons were not reported.
Bias due to deviations from intended interventions (ROB2, primary outcome)	High risk	No deviations documented; none suspected based upon review. According to the report, 40 participants signed informed consent and were enrolled. Though not explicitly stated by authors, it appears these 40 participants were randomised. However, as noted by authors, "Of the 40 enrolled subjects, five were impossible to reach by phone to establish counter readings and two reported counter readings that were physically impossible, leaving 33 participants (21 men) aged 51.7 +/- 11.0 years [mean +/- standard deviation (SD)] who completed the protocol and formed the basis for this report." Therefore, it appears that a per-protocol analysis was used and no information was presented as to which group(s) the lost participants had been allocated. 17.5% of likely randomised participants were not included in the report.
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	High risk	Outcome data were not available for 17.5% of likely randomised participants. Neither analyses to correct for bias nor sensitivity analyses were conducted. Yes, reported reasons for exclusion were five were "impossible to reach by phone to establish counter readings" and "reported counter readings that were physically impossible." Authors did not report the group allocation of the seven participants who did not complete the study. Therefore, we do not know if there were differences between intervention groups in proportions of missing outcome data or differences in reasons for missing outcome data. The reported reasons for study non-completion (and therefore missingness) are suggestive that missingness in the outcome depends on the true value of the outcome. Taken together, it is likely that missingness depended on its true value.
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome measured using objective CPAP usage data. Authors reference that phone reports were compared against objective CPAP usage data, "Discrepancies we found between compliance reported during weekly phone calls and compliance measured by built-in counters." Each intervention group outcome data ascertained via automated CPAP device monitoring. Authors report that device makes were sufficiently similar (i.e. similar distributions of CPAP device make) across groups. Outcome "assessor" is CPAP device: no knowledge of allocation possible. However, participants reported these counter values by phone, which does introduce the possibility of false reporting.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Unclear risk	No protocol, abstract, clinical trials entry available for comparison. Results presented were in accordance with the plan specified in the Methods section of the publication. No information as to whether analysis plan was finalised before unblinded outcome data were available for analysis. Methods section

Chervin 1997 *(Continued)*

		indicates one outcome time point (range 1-2 months) was planned. Results section reports one outcome time point. No evidence that multiple analyses (e.g. variable adherence 'thresholds') were conducted. No threshold-based adherence outcomes reported.
Overall risk of bias (ROB2, primary outcome) Machine usage	High risk	-

Dantas 2015

Methods	Randomised parallel-group trial.
Participants	**N = 41** patients diagnosed with OSAS, meeting the criteria for APAP therapy, were randomly allocated to one of two groups: Intervention Group (IG) brief educational intervention (n = 20) using motivational strategies or control group 1 (CG1, n = 21). ('Control Group 2' (CG2) comprised a convenience sample selected from the sleep lab's initial consultations but were not part of the randomisation procedures.). **Inclusion criteria:** >18 years old, AHI ≥ 15, diagnosis that indicates ventilator therapy, willingness to participate in the study. **Exclusion criteria:** COPD, neuromuscular disease, heart disease, neurological disease, and patients taking psychotropic drugs. **Baseline characteristics:** 23% female. **Mean age** 56.5 (±10). **Mean AHI** NR. **Mean ESS** 9.9. **Mean BMI** 32.9. **Country:** Portugal
Interventions	In the Intervention Group (IG) and control group (CG1), two questions were used to gauge the patient's conviction and confidence: "How important to you is the use of the device in your treatment?" and "How confident are you that you can use the device?" The degree of conviction and confidence permitted to establish the stage of change in each patient, which guided selection of specific strategies to be applied in an individual 10-minute-long interview. **IG:** patient's beliefs, expectations, and feelings were assessed and used as guidance for what motivation strategies were utilised. At the end of the intervention, a new interview was scheduled and written information was delivered about OSAS disease and treatment. **CG1:** participants received only standardised information about APAP (the device and interface) during the 10-minute interview, regardless of their confidence and conviction scores. "Control Group 2" (CG2) is a convenience sample submitted to standard procedures, which was not part of the randomisation procedures. CG2 is excluded from review. **Study duration:** 2 months
Outcomes	• CPAP Usage (hours/night) at 1 and 2* months. • % Days of APAP use (>4 hours per night on 70 % of the nights during a period of 30 consecutive days) • Sleepiness (ESS) • AHI • Withdrawals • Conviction and Confidence regarding CPAP use
Notes	
Risk of bias	

Dantas 2015 *(Continued)*

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"Using a list of random codes generated by the Excel 2007 program…"
Allocation concealment (selection bias)	Unclear risk	Published report does not mention allocation concealment.
Blinding (performance bias and detection bias) All outcomes	High risk	No evidence of blinding of participants, personnel or outcome assessors. Study had subjective outcomes, so knowing group assignment could influence these outcomes.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Study had one "drop-out" from CG1, therefore outcome data was available for nearly all randomised participants.
Selective reporting (reporting bias)	Unclear risk	The study protocol is not available, but it is clear that the published reports include all expected outcomes. No evidence that multiple analyses (e.g. different adherence 'thresholds') were conducted.
Other bias	Low risk	No baseline imbalances or reported deviations from intended intervention.
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Authors report: "Using a list of random codes generated by the Excel 2007 program..." Published report does not mention allocation concealment. Key baseline characteristics (age, gender, BMI, AHI) were reported and differences were insignificant (P values reported), consistent with chance.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	No deviations documented; none suspected based upon review. Probably mITT: Only 1 dropout reported, in control group 1. Results table Ns are the same as randomised Ns, but unclear if dropout data was included (ITT) in outcome calculation or excluded (mITT).
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Low risk	Outcome data reported for either all randomised participants (n = 61) or all but one (n = 60).
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring; devices identical or sufficiently similar (i.e. similar distributions of CPAP device make) across groups. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Unclear risk	No protocol, abstract, clinical trials entry available for comparison. Results presented were in accordance with the plan specified in the Methods section of the publication. Methods section indicates that multiple time points planned; each planned outcome reported. Methods section indicates that one, commonly-employed threshold adherence definition was planned; this outcome was reported in Results. No evidence that multiple analyses (e.g. variable adherence 'thresholds') were conducted.
Overall risk of bias (ROB2, primary outcome) Machine usage	Unclear risk	The primary potential concern is that allocation concealment methods were not described by the authors. Thus, selective enrolment cannot be definitively excluded.

DeMolles 2004

Methods	Randomised parallel-group study. Methods of randomisation not reported
Participants	**N = 30** patients being started on CPAP for OSAS. **Inclusion criteria:** starting nasal CPAP therapy; > 18 years; English-speaking; AHI > 15 **Exclusion criteria:** prior CPAP use. **Baseline characteristics: Mean age** 46. **Mean BMI** 38. **Mean AHI** 40. Functional Outcomes of Sleep Questionnaire: TLC: 15.3, Control: 13.8 **Country:** USA
Interventions	Participants were randomised to telephone-linked communications technology (TLC, n = 15) versus usual care (UC, n = 15). **UC:** Described as usual medical care, patient education and demonstration of equipment use. **TLC:** UC plus computerised digitised human speech programme. TLC asks questions designed to elicit information from participant regarding adherence, education and reinforcement. **Study duration:** 8 weeks
Outcomes	• CPAP usage (hours/night) at 2 months • Sleep symptoms • QoL (FOSQ) • 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
Incomplete outcome data (attrition bias) All outcomes	Low risk	All completed
Selective reporting (reporting bias)	Unclear risk	Information not available
Other bias	Unclear risk	Information not available
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Only information provided as to the randomisation procedures used was within Methods: "At the conclusion of a baseline examination (see the description of study measures subsequently), eligible participants were randomised to either TLC and usual medical care or usual medical care alone....A total of 30

DeMolles 2004 *(Continued)*

		participants were enrolled (15 in each group). All participants completed a 2-month follow-up evaluation." No reference to random component or allocation concealment method. Key baseline characteristics (age, BMI, AHI) were reported for all randomised participants and differences were non significant (P values reported), consistent with chance. Gender was not reported, but study appears to have taken place at a VA medical centre in early 2000s, which suggests strong possibility that all participants were male.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	No reference to blinding. No deviations documented; none suspected based upon review. Authors report that all participants completed 2-month follow-up evaluation and did not report any dropouts, withdrawals, or loss-to-follow-up. Ns not provided for outcome tables, but available information suggests ITT or mITT analyses were used.
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Low risk	Authors report, "All participants completed a 2-month follow-up evaluation."
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Unclear risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring. Unable to confirm with study author that distribution of CPAP device makes did not differ between intervention arms. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	High risk	No protocol, abstract, clinical trials entry available for comparison. Results presented were in accordance with the plan specified in the Methods section of the publication. No information as to whether analysis plan was finalised before unblinded outcome data were available for analysis. Methods section indicates one outcome time point was planned. Results section reports one outcome time point. However, the authors suggest (in results) that the trial may have been longer in the following statement: "The 15 patients in the TLC-CPAP group participated in the trial for a mean of 9.2 weeks." No evidence that multiple analyses (e.g. variable adherence 'thresholds') were conducted. No threshold-based adherence outcomes reported.
Overall risk of bias (ROB2, primary outcome) Machine usage	High risk	-

Diaferia 2017

Methods	Randomised parallel-group study.
Participants	For this review, only the**N = 49** (male) participants with OSAS **Inclusion criteria:** men aged 25-65 years, BMI < 35 kg/$m^{2,}$ confirmed OSAS diagnosis (via polysomnographic criteria). **Exclusion criteria:** female gender (excluded "since hormonal decline in the menopausal phase could lead to loss of muscle mass, causing a bias in the study"), other sleep disorders, previous treatment for OSAS, serious or decompensated clinical or psychiatric medical illnesses, such as CHF, cardiomyopathy, chronic obstructive pulmonary disease, chronic active hepatitis, liver cirrhosis with severe symptoms, myasthenia gravis, demyelinating disease, motor neuron disease, depression, schizophrenia, ob-

Diaferia 2017 *(Continued)*

	sessive compulsive disorder, disorder anxiety, bipolar disorder, eating disorder, attention deficit disorder, and hyperactivity; patients who used alcohol, stimulants or sedatives; and patients with grade III or IV palatine tonsils, grade II or III septal deviation, or evident micrognathia. **Baseline characteristics:** 0% female. **Mean age** 46.9 (±9.9). **Mean AHI** NR. **Mean ESS** 12. **Mean BMI** 28.3. **Country:** Brazil
Interventions	Participants were randomised to 2 of 4 study groups were considered: CPAP only (n = 27) or CPAP + myofunctional therapy (MT, n = 22). Full study had 2 additional arms: placebo myofunctional therapy (n = 24) and myofunctional therapy (n = 27) in addition to those noted above for this review. ***CPAP only:** standard care, including attending a PSG to determine optimal pressure of CPAP ***CPAP + MT:** combination of orofacial muscle training and standard CPAP treatment. [Placebo: consisted of exercises without therapeutic function (relaxation and stretching of the neck muscles). MT alone: includes soft palate, tongue, and facial muscle exercises and stomatognathic function exercises. Aimed at toning the oropharynx muscles groups, optimising muscle tension mobility, and adjusting the position of the soft tissues and movements including chewing, sucking swallowing and breathing.] **Study duration:** patients underwent evaluations before and after 3 months of treatment, and after 3 weeks wash-out period.
Outcomes	• CPAP usage (hours/night) at 1 week, 1 and 3 months • N of adherent participants (usage ≥ 4 hours per night on 70% of nights) • Sleepienss (ESS) • Myofunctional evaluation (adherence to myofunctional therapy was assessed via the percentage of time spend performing exercises during the 3 months of treatment
Notes	* Only CPAP only and CPAP + Myofunctional therapy groups included in Review/meta-analysis.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	"Prior to treatment, the patients were divided randomly into four groups." Trialists provided no information regarding random component used in sequence generation or on how sequence concealment was achieved.
Allocation concealment (selection bias)	Unclear risk	Trialists provided no information regarding how sequence concealment was achieved.
Blinding (performance bias and detection bias) All outcomes	High risk	No evidence of blinding of participants, personnel or outcome assessors. Study had subjective outcomes, so knowing group assignment could influence these outcomes.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	The numbers of participants randomised to each study arm are not reported
Selective reporting (reporting bias)	Low risk	NCT brief summary indicates that assessments at baseline, after treatment and after 21-day washout would include 'use of CPAP.' Published report (Diaferia 2017) does report 1 week, 1 month and 3 month CPAP usage.
Other bias	Low risk	No baseline imbalances or reported deviations from intended intervention.

Diaferia 2017 *(Continued)*

Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Authors report: "Prior to treatment, the patients were divided randomly into four groups." Trialists provided no information regarding random component used in sequence generation or on how sequence concealment was achieved. No baseline differences in age, age, BMI, ESS. AHI not included in baseline characteristics table or in textual description of baseline comparison across groups. The results table (5) does report AHI before and after treatment for each group. Baseline differences are present, but statistical significance was not tested. For the intervention arms of interest for our review (CPAP only, CPAP + Myofunctional therapy), those baseline differences are likely consistent with chance. Baseline differences are larger in the other two arms (control, myofunctional therapy only), but likely still consistent with chance. Minimal information provided regarding randomisation procedures. No explicit documentation regarding random component or allocation concealment.
Bias due to deviations from intended interventions (ROB2, primary outcome)	High risk	NCT01289405 trial information indicates double masking (participant, investigator). Published report indicates only, "During the clinical assessment, the evaluators were blinded." Thus, no evidence that participants or research staff were blind to intervention assignment. Morever, blinding would be difficult given the nature of the interventions. No deviations documented; none suspected based upon review. No information as to whether participants were analysed in the groups to which they were originally assigned since no information was provided as to the original randomisation Ns.
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	High risk	The numbers of participants randomised to each study arm are not reported. In Results, authors write: "The flowchart of patient selection during this study started with 140 patients with 40 patients failing to complete the study. The 100 patients who finished the study protocol had been distributed to placebo group (N = 24), myofunctional therapy group (N = 27),CPAP group (N = 27), and combined group (N = 22)." There is no flowchart. Assuming 140 participants were randomised (most likely/rational scenario), a substantial proportion (28.6%) are missing outcome data. Authors provided no information regarding reasons for missing outcome data. Therefore, missingness could depend on true outcome value. The numbers of participants randomised to each study arm are not reported. Therefore, the proportions of participants with missing outcome data in each group cannot be calculated or compared to determine if differences in proportions are significant.
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Low risk	NCT01289405 description did not list CPAP adherence under planned primary or secondary outcomes at 90 day endpoint. NCT brief summary indicates that assessments at baseline, after treatment and after 21-day washout would include 'use of CPAP.' Published report (Diaferia 2017) does report 1 week, 1 month and 3 month CPAP usage. All planned time points reported. Multiple analyses (e.g. variable adherence 'thresholds') not conducted.
Overall risk of bias (ROB2, primary outcome) Machine usage	High risk	-

Falcone 2014

Methods	Randomised, parallel-group study.
Participants	**N = 206** newly diagnosed patients with OSA **Inclusion criteria:** newly diagnosed OSA, AHI ≥15 events/hour, with or without daytime symptoms. **Exclusion criteria:** COPD, any global respiratory failure, central sleep apnoea syndrome, previous diagnosis of congestive heart failure or cardiomyopathy, any chronic neurological disorder, any severe mental or psychological impairment. **Baseline characteristics:** 25% female. **Mean age** 61.3. **Mean AHI** 54. **Mean ESS** 11.2. **Mean BMI** 32.1. **Country:** Italy
Interventions	Participants were randomised into educational support (ES, n = 103) or standard support group (SS, n = 103). **SS:** sleep medicine physician provided each participant with a full explanation (˜10 minutes) of the need for and benefits of CPAP. Prior to CPAP titration the participants received education regarding CPAP operation, mask placement, and a 20-minute period of auto-CPAP exposure. **ES:** in addition to standard support, each educational support group subject viewed 2 consecutive PSGs on the computer screen: the first recorded during a standard diagnostic overnight polysomnography, and the second during a full-night polysomnography with nasal CPAP. The participant's attention was drawn only to the flow and oxyhaemoglobin saturation curves. **Study duration:** 12 months
Outcomes	• CPAP usage (hours/night) at 1, 3*, 12 months. • Sleepiness (ESS) • Retention rate (number of participants returning for follow-up divided by total N)
Notes	* Indicates primary outcome analysed in this review.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomisation was via predetermined balanced blocks, generated by tossing a coin.
Allocation concealment (selection bias)	Unclear risk	No reference to allocation concealment method and block size not reported.
Blinding (performance bias and detection bias) All outcomes	High risk	The participants were blinded to the group to which they were allocated, however no details provided as to means by which blinding was carried out/maintained. Moreover, subjective outcome assessors were likely aware of group assignment.
Incomplete outcome data (attrition bias) All outcomes	High risk	71 of 103 (69%) and 90 of 103 (87%) participants had outcome data at 3-month endpoint.
Selective reporting (reporting bias)	Unclear risk	The study protocol is not available, but it is clear that the published reports include all expected outcomes.
Other bias	Low risk	No baseline imbalances or reported deviations from intended intervention.

Falcone 2014 *(Continued)*

Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Authors report: "Randomization was via predetermined balanced blocks, generated by tossing a coin." No reference to allocation concealment method and block size not reported. Key baseline characteristics (age, gender, BMI, AHI) were reported for all randomised participants and differences were insignificant (P values reported), consistent with chance.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	Authors report: "The participants were blinded to the group to which they were allocated." No details provided as to means by which blinding was carried out/maintained. Authors report study is single-blind. No deviations documented; none suspected based upon review. Authors report they performed ITT analysis. However, they also report, "participants who did not return for a follow-up visit were considered nonadherent and dropped-out the study, so the Epworth Sleepiness Scale scores and CPAP use data in the Results section are only for the adherent CPAP users." Thus, this appears to represent a mITT analysis.
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	High risk	71 of 103 (69%) and 90 of 103 (87%) participants had outcome data at 3-month endpoint. Neither analyses to correct for bias nor sensitivity analyses were conducted. Authors did not report reasons for missingness (dropouts), thus missingness could depend on true values. There are non-significant differences in the proportion of missing outcome data between intervention groups. There are no reasons reported for missing outcome data other than "did not return for a follow-up visit" so uncertain as to whether these reasons differ across groups. Per Cochrane Handbook, 8.13.2.2, "Even if incomplete outcome data are balanced in numbers across groups, bias can be introduced if the reasons for missing outcomes differ." Without specific reasons for missing data, the potential for bias cannot be adequately assessed.
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Unclear risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring. Unable to confirm with study author that distribution of CPAP device makes did not differ between intervention arms. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Unclear risk	No protocol, abstract, clinical trials entry available for comparison. Results presented were in accordance with the plan specified in the Methods section of the publication. No information as to whether analysis plan was finalised before unblinded outcome data were available for analysis. Methods section indicates that multiple time points planned; each planned outcome reported. Methods did not describe intention to assess threshold-based adherence outcomes; these were reported for each primary endpoint.
Overall risk of bias (ROB2, primary outcome) Machine usage	High risk	-

Fox 2012

Methods	Randomised parallel-group study
Participants	**N = 75** adults with moderate-severe OSA by PSG. **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 **Baseline characteristics:** 20.1% **female. Mean age** 53.5 (±11.2). **Mean AHI** 41.6. **ESS** 9.8.**BMI** 32.4. **Country:** Canada
Interventions	Participants were randomised to telemedicine intervention (TM, n = 39) or standard care (SC, n = 36). **TM:** 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 co-ordinator, 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 co-ordinator. Standard care identical to control group **SC:** 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 • 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)	Unclear risk	'intention to treat approach', high discontinuation rate (control group: 10/36, telemedicine group: 11/39)

Fox 2012 *(Continued)*
All outcomes

Selective reporting (reporting bias)	Unclear risk	Information not available
Other bias	Unclear risk	Information not available
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Only information provided as to the randomisation procedures used was within Methods: "Patients were randomised to either standard care or telemedicine (1:1 ratio) using sequential numbered envelopes prepared by one of the authors (JW)." No reference to random component. Allocation concealment method description inadequate for definitive determination. Key baseline characteristics (age, BMI, AHI) were reported for all randomised participants and differences were reported as non-significant (P values not presented). Statistical comparison of gender proportions (77.8% vs. 82.0% male in control vs. intervention arms) was not reported.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	Unblinded. No deviations documented; none suspected based upon review. Probable mITT. Authors report 'using an intention-to-treat approach,' but it is not clear how participants who 'Discontinued CPAP' (Figure 1) were handled (i.e. whether excluded from outcome calculations, as in mITT, or counted as non-adherent and counted as having 0 minutes/night.)
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Low risk	Although the authors do not state so explicitly, it seems likely that outcome data were available for all participants, As noted in Methods, "Identical to the standard pathway, all patients were oriented to CPAP, fitted with a mask, and given an auto titrating machine. A modem was attached to the PAP device EncoreAnywhere®, Philips Respironics Inc.)..." Thus, those participants who 'Discontinued CPAP' as per Flow Figure 1, probably did not have missing data but had 0 minutes/night.
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring; devices identical or sufficiently similar (i.e. similar distributions of CPAP device make) across groups. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Low risk	ClinicalTrials.gov entry (NCT00561860) indicates that the original primary outcome measures were the same as the current primary outcome measures, "CPAP compliance (3 months) and overall cost of patient care [Time Frame: 3 months]" (submitted 20nov2007). Final data collection date for primary outcome was Sep 2010. Publication year 2012. NCT outcome is the same as that presented in published report. Likely that analysis plan finalised before unblinded outcome data available for analysis. Methods section indicates one outcome time point (for primary adherence outcome) was planned. Results section reports one outcome time point. No evidence that multiple analyses (e.g. variable adherence 'thresholds') were conducted. No threshold-based adherence outcomes reported.
Overall risk of bias (ROB2, primary outcome) Machine usage	Unclear risk	-

Hoet 2017

Methods	Randomised, parallel-group study.
Participants	**N = 46** patients with a recent diagnosis of moderate to severe OSAS **Inclusion criteria:** at least 18 years old, recently diagnosed with OSAS (AHI ≥20/hours). **Exclusion criteria:** previous exposure to CPAP therapy, mixed/predominantly central sleep apnoea, language barriers, cognitive or psychiatric disorders making it difficult to comprehend information regarding CPAP therapy and provide informed consent, significant comorbidities such as severe COPD or hypoventilation syndromes. **Baseline characteristics:** 63% female. **Mean age** 56.6 (±13.5). **Mean AHI** 49.5. **Mean ESS** 11. **Mean BMI** 31.5. **Country:** Belgium
Interventions	Participants were randomised to usual care (UC, n = 23) or telemonitoring (TM, n = 23) group. **TM:** in addition to usual care, telemonitoring device was attached to CPAP machines. Via this device, sleep laboratory technical staff analysed participant data and contacted patients in the case of air leaks, residual AHI >10/hours, or CPAP use less than 3 hours in three consecutive days **UC:** group educational session 1 month after CPAP initiation, and a visit to the pneumologist scheduled and 1.5 and 3 months after CPAP initiation. **Study duration:** 3 months
Outcomes	• CPAP usage (hours/night) at 3 months. [authors' secondary outcome] • Time of delay to the first technical intervention after CPAP initiation [authors primary outcome] • Types of interventions required
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Authors report: "..patients were randomised in permuted blocks between usual care or TM for CPAP follow-up." Trialists provided no information regarding random component used in sequence generation or on how sequence concealment was achieved.
Allocation concealment (selection bias)	Unclear risk	Trialists provided no information regarding random component used in sequence generation or on how sequence concealment was achieved.
Blinding (performance bias and detection bias) All outcomes	Low risk	No evidence of blinding of participants, personnel or outcome assessors. Study only had objective outcomes, so lack of blinding is not likely affect outcomes.
Incomplete outcome data (attrition bias) All outcomes	High risk	Outcome data available for 37 of 46 (80.4%).
Selective reporting (reporting bias)	Low risk	NCT02773953 entry: Secondary outcome measure, daily use of CPAP at 3 months, submitted to clinicaltrials.gov on 13 May 2016. Probably specified prior to unblinded outcome data available for analysis.

Hoet 2017 *(Continued)*

Other bias	High risk	Intervention group composition was 83% female while control group was 43% female, P = 0.0076. Gender is a potentially key prognostic factor in compliance and the between-group difference is likely large enough to result in bias in the intervention effect estimate. No deviations from intended intervention reported or suspected.
Bias arising from the randomisation process (ROB2, primary outcome)	High risk	Authors report: "..patients were randomised in permuted blocks between usual care or TM for CPAP follow-up." Trialists provided no information regarding random component used in sequence generation or on how sequence concealment was achieved. Intervention group composition was 83% female while control group was 43% female, P = 0.0076. Gender is a potentially key prognostic factor in compliance and the between-group difference is likely large enough to result in bias in the intervention effect estimate.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	No deviations documented; none suspected based upon review. mITT used. Authors report, "During the 3-month study period, four patients were lost to follow-up in the TM group and three patients in the UC group. Two patients in the TM group had dysfunction of the TM system. Final analyses were performed on data for the remaining 37 patients (Fig. 1)."
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	High risk	Outcome data available for 37 of 46 (80.4%). Neither analyses to correct for bias nor sensitivity analyses were conducted. Loss to follow-up could be related to participant health status. There are differences in proportion missing between outcome groups (intervention group > control group). There are no reasons provided for the loss-to-follow-up in intervention (n = 3) or control (n = 4) groups. Equipment failure (n = 2) occurred only the intervention group.
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Unclear risk	No information
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Low risk	NCT02773953 entry: Secondary outcome measure, daily use of CPAP at 3 months, submitted to clinicaltrials.gov on 13 May 2016. Probably specified prior to unblinded outcome data available for analysis. Per NCT entry, a single time point planned/analysed. Per NCT entry, multiple analyses (e.g. variable adherence 'thresholds') not conducted.
Overall risk of bias (ROB2, primary outcome) Machine usage	High risk	-

Hoy 1999

Methods	Randomised, parallel study. Method of randomisation not reported. ITT
Participants	**N = 80** patients with SAHS. **Inclusion criteria:** AHI ≥ 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 **Baseline characteristics:** 2.5% **female. Mean age** 51 (±11). **Mean AHI** 58. **Mea**n ESS 13. **Mean BMI** 33. **Country:** UK (Scotland)

Hoy 1999 *(Continued)*

Interventions	Participants were randomised into usual care (UC, n = 40) or Telemonitoring (TM, n = 40). **TM:** 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 **UC:** 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 **Study duration:** 6 months
Outcomes	• Machine usage (hours/night) at 6, 12 months • 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
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	"Data were analysed on an intention-to-treat basis"
Selective reporting (reporting bias)	Unclear risk	Information not available
Other bias	Unclear risk	Information not available
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Authors report, "Randomization of each patient was done with predetermined balanced blocks generated by tossing a coin. Patients were blinded to the group to which they were allocated." No reference to allocation concealment method. Key baseline characteristics (age, BMI, AHI) were reported for all randomised participants and differences were insignificant (P values reported), consistent

Hoy 1999 *(Continued)*

		with chance. Randomised participants included only 2 females (78 males); authors did not report treatment allocation by gender.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	No deviations documented; none suspected based upon review. ITT
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Low risk	Authors report, "Seven of the 80 patients (four receiving standard and three intensive support) were unavailable for daytime function retesting at 6 mo; the four patients in the standard support group had stopped using CPAP, one patient in the intensive support group died of lung carcinoma diagnosed after randomisation, another stopped using CPAP, and one defaulted from daytime testing at 6 months. All 80 patients had their CPAP usage over the 6-mo trial period recorded and analysed."
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring; devices identical or sufficiently similar (i.e. similar distributions of CPAP device make) across groups. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Unclear risk	No protocol, abstract, clinical trials entry available for comparison. Results presented were in accordance with the plan specified in the Methods section of the publication. No information as to whether analysis plan was finalised before unblinded outcome data were available for analysis. Methods section indicates that multiple time points planned; each planned outcome displayed graphically but only final (6-month) outcome reported in table. No evidence that multiple analyses (e.g. variable adherence 'thresholds') were conducted. No threshold-based adherence outcomes reported.
Overall risk of bias (ROB2, primary outcome) Machine usage	Unclear risk	-

Hui 2000

Methods	Randomised, parallel-group study
Participants	**N = 108** patients with newly-diagnosed OSA. **Inclusion criteria:** diagnosis of OSA (AHI > 10 and subjective daytime sleepiness) **Exclusion criteria:** none reported. **Baseline characteristics:** 10% female. **Mean age** 45 (±11). **Mean AHI** 48. **Mean ESS** 12.8. **Mean BMI** 30. **Country:** China (Hong Kong)
Interventions	Participants were randomised to basic CPAP support (BS, n = 54) or augmented support (AS, n = 54) **AS:** 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

Hui 2000 *(Continued)*

	BS: 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/week) • 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
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
Selective reporting (reporting bias)	Unclear risk	Information not available
Other bias	Unclear risk	Information not available
Bias arising from the randomisation process (ROB2, primary outcome)	High risk	Only information provided as to the randomisation procedures used was within Methods: "The participants were randomised into two arms, with group 1 receiving basic CPAP education and support and group 2 receiving augmented education and support." No reference to random component or allocation concealment method. Some key baseline characteristics (BMI, AHI) were reported for all randomised participants and differences were insignificant (P values reported), consistent with chance. However, proportions of age and gender were not reported by intervention arm nor were statistical comparisons reported.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	No blinding. No deviations related to experimental context documented; none suspected based upon review. ITT. Authors report, "Data were analysed on an intention-to-treat basis." However, they also report, "All the patients returned for follow-up, but there was a technical problem with the Aria/Encore software, resulting in missing CPAP compliance data for 11 of the 108 patients (2 in the BS group and 9 in the AS group) at 3 months." They do not report how

Hui 2000 *(Continued)*

		missing outcome data were handled. Results table 2 indicates that outcomes are reported on all randomised Ns, so appears to be ITT.
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Low risk	Authors report, "All the patients returned for follow-up, but there was a technical problem with the Aria/Encore software, resulting in missing CPAP compliance data for 11 of the 108 patients (2 in the BS group and 9 in the AS group) at 3 months." Thus, outcome data were available for 11 of 108 (89.8%) of randomised participants. Neither analyses to correct for bias nor sensitivity analyses were conducted. Missing outcome data occurred for documented reasons ('technical problems with Aria/Encore software') that are unrelated to the outcome. These failures were differentially distributed across intervention arm. In Discussion (limitations), authors report, "There was also a technical failure with the Aria/Encore software, resulting in missing CPAP compliance data for two patients in the BS group and nine patients in the AS group at 12 weeks."
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring; devices identical or sufficiently similar (i.e. similar distributions of CPAP device make) across groups. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Unclear risk	No protocol, abstract, clinical trials entry available for comparison. Results presented were in accordance with the plan specified in the Methods section of the publication. No information as to whether analysis plan was finalised before unblinded outcome data were available for analysis. Methods section indicates that multiple time points planned; each planned outcome reported. Methods section indicates that multiple analyses of CPAP adherence outcomes were planned and all were reported in Results.
Overall risk of bias (ROB2, primary outcome) Machine usage	High risk	-

Hwang 2017

Methods	Cluster-randomised parallel-group study
Participants	**N = 1455** patients with suspected OSA were randomised to four study arms, by class-based (cluster) randomised design. This study used the existing home-based testing triage structure at the trialists institution. As they report, "Most patients are referred by primary care physicians, and a sleep medicine physician triages appropriate patients to home sleep apnoea testing after review of the referral information and electronic health record chart. HSAT classes (up to 13 people) are led by a sleep-trained respiratory therapist and sleep technologist and provide interactive OSA education and individualised HSAT setup. After a one-night test, each patient returns for an individual appointment with a respiratory therapist to review the results. Those with OSA are recommended to undergo a 1-week CPAP trial followed by an individual return appointment with a respiratory therapist to review CPAP data and patient experience. Patients willing to commit to CPAP therapy are immediately dispensed a device; otherwise CPAP troubleshooting or alternative treatments are discussed." This trial enrolled Consecutive patients referred to the Kaiser Permanente Fontana Sleep Disorders Center (Fontana, CA) for evaluation of suspected OSA and triaged to HSAT between November 2014 and August 2015.To conform to the sleep centre's usual care procedures, **groups of patients were randomised**, with all participants in each HSAT class following the same treatment arm. **Inclusion criteria:** at least 18 years of age, no previous sleep testing or trial of OSA therapy, eligible for HSAT.

Hwang 2017 *(Continued)*

	Exclusion criteria: at risk of other sleep disorders (e.g. severe insomnia), significant cardiopulmonary disease (e.g. heart failure, chronic respiratory failure), or English not preferred language. **Baseline characteristics:** 51% female. **Mean age** 49.1 (±12.5). **Mean AHI** 22.7. **Mean ESS** 9.1. **Mean BMI** 34. **Country:** USA
Interventions	Classes (and all participants in each class) were randomised (1:1:1:1) to one of four arms: 1) web-based OSA education (Tel-Ed, n=380), 2) telemonitoring and automated feedback (Tel-TM, n = 375), 3) Tel-Ed + Tel-TM (Tel-Both, n = 346), and 4) usual care (UC, n = 354) using a four-arm, randomised, factorial design. **Usual care:** all patients attended a 1-hour, small-group education class with HSAT set-up. After the trial, those willing to continue CPAP were prescribed therapy and scheduled for a 3-month follow-up appointment. **Tel-Ed:** education about the pathophysiology of OSA, health-related risks, impact on daytime vigilance, introduction to CPAP therapy. For patients eventually determined to have OSA, a link to a second education program was emailed. This focused on how to use CPAP, potential benefits, methods of acclimating, and equipment care instructions. Education sessions were interactive and self-paced. **Tel-TM:** Intervention based on automatic processing of device data. During the 3-month study period, if CPAP usage thresholds were met, a message was automatically sent to the patient providing encouragement to improve use or positively reinforcing successful adherence. **Tel-both:** patients received Tel-Ed and Tel-TM **Study duration:** 90 days
Outcomes	• CPAP usage (hours/night) at 90 days • Sleepiness (ESS) • Residual AHI • N of adherent participants (Medicare definition, usage ≥ 4 hours per night) • QoL (FOSQ) • Withdrawals
Notes	Trialists included three intervention arms. One arm was educational (Tel-Ed), one was Supportive (Tel-TM) and the third was Mixed (Tel-Both). These were compared to control in respective meta-analyses (i.e. Educational, Supportive, Mixed).

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Author's 'group randomisation' does not conform to individual or block randomisation schemes.
Allocation concealment (selection bias)	Unclear risk	No reference to allocation concealment method.
Blinding (performance bias and detection bias) All outcomes	High risk	No evidence of blinding of participants, personnel or outcome assessors. Study had subjective outcomes, so knowing group assignment could influence these outcomes.
Incomplete outcome data (attrition bias) All outcomes	High risk	Authors report, "Overall, 66% showed up for the HSAT class and were tested, and 81.1% of those tested were diagnosed with OSA (AHI>5). Five hundred and fifty-six patients (38.2% of all randomised patients; 71.7% of all patients with OSA) were eventually prescribed CPAP, all of whom had 90-day usage data to be included for analysis."

Hwang 2017 *(Continued)*

Selective reporting (reporting bias)	Low risk	NCT02279901: Original/current primary outcome measures (unchanged from original submission on 30 Oct 2014) was: 3-month average CPAP use/night (experimental pathway vs. traditional pathway). Secondary measures (30 Oct 2014, unchanged from original submission): Difference in 3-month average CPAP use/night (experimental vs. experimental), ESS, FOSQ-10, adherence to provider encounters (no-show), healthcare utilisation.
Other bias	Unclear risk	Baseline characteristics for all randomised participants presented in tabular form by authors but no statistical comparison reported. No deviations from intended intervention reported or suspected.
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Only information provided as to the randomisation procedures used was within Methods: "To conform to the sleep centre's usual care procedures, groups of patients were randomised, with all participants in each HSAT class following the same treatment arm. Classes were randomised (1:1:1:1)...both). Randomization was performed for each HSAT class (not in blocks), using a computerized random number generator." In their discussion, authors further note, "...group rather than individual randomisation was performed; nevertheless, treatment arm baseline characteristics were similar and within-group correlations were taken into account in analyses." Author's 'group randomisation' does not conform to individual or block randomisation schemes. No reference to allocation concealment method. Baseline characteristics for all randomised participants presented in tabular form by authors but no statistical comparison reported. Authors do report that "baseline characteristics for those prescribed CPAP were similar between the four arms."
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	Authors report, "Clinicians providing routine care and study analysts were blinded to study arm assignment." No deviations documented; none suspected based upon review. Probable mITT. There is one discrepancy in Tel-Ed group n = 164 in Study flowchart and baseline characteristics table 2 and the outcome data table n = 163.
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Unclear risk	Authors report, "use), 162 HSAT classes—accounting for 1,455 patients—were randomised (Figure 1). Overall, 66% showed up for the HSAT class and were tested, and 81.1% of those tested were diagnosed with OSA (AHI>5). Five hundred and fifty-six patients (38.2% of all randomised patients; 71.7% of all patients with OSA) were eventually prescribed CPAP, all of whom had 90-day usage data to be included for analysis." Neither analyses to correct for bias nor sensitivity analyses were conducted. Missing outcome data occurred for documented reasons (declined CPAP) that could be related to the outcome. Across intervention arms, the proportion of participants diagnosed with OSA (in evaluation period), who accepted CPAP therapy during the evaluation phase and, therefore, for whom 90 day CPAP usage data were available/analysed ranged from 68.3% (Tel-TM) to 76.3% (Tel-Ed) groups. UC and Tel-Both proportions were 71%. Thus, as noted by study authors, 'drop-out' rates were similar across groups. Additionally, there is no evidence that reasons for dropout differed across intervention arms and cited reasons for all dropouts in author's study flowchart is 'declined CPAP' and is noted in text to be 'elected for non-CPAP therapies'. Thus, due to similar proportions and cited reasons across intervention arms, missing outcome data are unlikely to lead to bias in the estimated effects of the intervention.
Bias in measurement of the outcome (ROB2, primary outcome)	Low risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring; devices identical or sufficiently similar (i.e. similar distributions of CPAP device make)

Hwang 2017 *(Continued)*

All outcomes		across groups. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Low risk	NCT02279901: Original/current primary outcome measures (unchanged from original submission on 30 Oct 2014) was: 3-month average CPAP use/night (experimental pathway vs. traditional pathway). Secondary measures (30 Oct 2014, unchanged from original submission): Difference in 3-month average CPAP use/night (experimental vs. experimental), ESS, FOSQ-10, adherence to provider encounters (no-show), healthcare utilisation. Primary outcome identical in protocol and in published report. Some secondary outcomes not noted in protocol but are in published report. One outcome time point (for primary adherence outcome) planned, one outcome time point reported. No evidence that multiple analyses (e.g. variable adherence 'thresholds') were conducted.
Overall risk of bias (ROB2, primary outcome) Machine usage	Unclear risk	-

Lai 2014

Methods	Randomised, parallel-group study
Participants	**N = 100** patients with newly diagnosed OSA. **Inclusion criteria:** at least 18 years old, newly diagnosed OSA, AHI ≥ 5, receiving in-laboratory auto-CPAP titration for the first time, no prior OSA or CPAP education classes. **Exclusion criteria:** CSA, periodic leg movement disorders, COPD, pregnancy, psychiatric illness on treatment, cognitive impairment, illiteracy, unstable health conditions, unable to attend the education session before discharge from Sleep Disorders Centre, scheduled for OSA follow-up in other hospitals, or participating in another clinical trial. **Baseline characteristics:** 17% female. **Mean age** 51.98 (±10). **Mean AHI**=29.42. **Mean ESS**=9.25. **Mean BMI**=28.96. **Country**: China (Hong Kong)
Interventions	Participants were randomised to usual care (UC, n = 51) or UC + brief motivational enhancement program (ME, n = 49). **UC:** 15-minute talk to teach basic operation of the CPAP device and titration procedure. Medical officer explanation of OSA, participant results, and prescribed treatment. Nurse advice on importance of CPAP therapy and care of accessories. **ME:** in addition to receiving UC, ME arm received an intervention designed to enhance the participant's perception of the risk of OSA, confidence in the ability to apply CPAP treatment (self-efficacy), and association of their behavior to the desired outcome (adherence) or outcome expectancy, including: a session on morning after CPAP titration, telephone call on day 2 of CPAP use, providing early follow-up, 25-minute video about CPAP education (including real-life experience of a current CPAP user), 20-minute patient centred face-to-face motivational interview, a 10-minute follow-up phone call on day 2 of CPAP. Checklists for interview and phone follow-up were used to ensure treatment fidelity. **Duration:** 3 months.
Outcomes	• CPAP usage (hours/night) at 1 and 3* months. • N of adherent participants (usage ≥ 4 hours per night for at least 70% of nights)

Lai 2014 *(Continued)*

- Intention to use (proportion of days CPAP turned on)
- Sleepiness (ESS)
- Self-efficacy (SEMSA)
- QoL (FOSQ, CSAQLI, SF-36)
- withdrawals

All outcomes assessed at 1 and 3 months.

Notes	* Indicates primary outcome analysed in this review.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Trialists give extensive explanation for randomisation procedures, including the use of a computer-generated sequence.
Allocation concealment (selection bias)	Low risk	"The allocation concealment was achieved with sequentially numbered opaque sealed envelopes."
Blinding (performance bias and detection bias) All outcomes	High risk	No evidence of blinding of participants to group allocation (but were not aware that adherence would be measured), personnel or outcome assessors. Although this is unlikely to affect adherence, study also investigated subjective outcomes, so knowing group assignment could influence these outcomes.
Incomplete outcome data (attrition bias) All outcomes	Low risk	One withdrawal from each group, results in less than 10% missing outcome data.
Selective reporting (reporting bias)	High risk	Publication (2014), earlier abstract (2013) and ClinicalTrials.gov entry available and reviewed. ClinicalTrials.gov entry (NCT01173406) indicates the originally-specified primary outcome measure was 4-week CPAP usage (submitted 30 Jul 2010). This was amended (18 Oct 2018) to 12-week CPAP usage (the original secondary outcome, submitted 30 Jul 2010). Updated (18 Oct 2013) secondary/other outcomes were 12-week daytime sleepiness, 12-week self-efficacy measure for sleep apnoea. This information suggests the possibility that reported numerical results were selected on the basis of results.
Other bias	Low risk	No baseline imbalances or reported deviations from intended intervention.
Bias arising from the randomisation process (ROB2, primary outcome)	Low risk	Authors report, "Randomization sequence was created using a computer-generated randomisation program (www.randomization.com). The randomisation was stratified into three severity groups: AHI ≥5 to < 15, AHI ≥ 15 to < 30, and AHI > 30, and with 1:1 allocation using a block size of 6." Authors provide additional information in the supplementary Appendix: "The application of stratified randomisation was used to prevent any significant difference in OSA severity of the recruited participants between two groups. The allocation concealment was achieved with sequentially numbered opaque sealed envelopes. Corresponding envelopes were opened only after the enrolled participants completed all baseline assessments. The randomisation and allocation concealment procedures were performed by a research staff who was not involved in the recruitment process, data collection or education intervention." The use of a fixed, relatively small (n = 6) block sizes would have made it possible for staff involved in allocation procedures to predict the last intervention assignment within each block. However, trialists report that randomisation and allocation concealment procedures were performed by a research staff member who was not involved in recruitment, data collection or intervention.

Lai 2014 *(Continued)*

		Key baseline characteristics (age, gender, BMI, AHI) were reported and differences were insignificant (P values reported), consistent with chance.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	Supplementary Appendix: "participants were asked to participate in an intervention that could improve their ability to use CPAP but they were not informed that this was an adherence study or the group to be assigned to. Data collectors were kept blinded to the allocation procedures and were not involved in the education intervention." No deviations documented; none suspected based upon review. ITT. In supplementary appendix, the authors report, "The intention–to-treat (ITT) principle was adopted to examine the efficacy of brief motivational enhancement education program. Specifically, patients were analysed as randomised and missing values were replaced by the last observed value. For the two dropouts, carry-forward data were computed to replace the missing values and the CPAP usages was counted as zero hours."
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Low risk	Information not available
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	High risk	Publication (2014), earlier abstract (2013) and ClinicalTrials.gov entry available and reviewed. ClinicalTrials.gov entry (NCT01173406) indicates the originally-specified primary outcome measure was 4-week CPAP usage (submitted 30 Jul 2010). This was amended (18 Oct 2018) to 12-week CPAP usage (the original secondary outcome, submitted 30 Jul 2010). Updated (18 Oc t2013) secondary/other outcomes were 12-week daytime sleepiness, 12-week self-efficacy measure for sleep apnoea. Final data collection date for primary outcome was April 2012. Published report indicates that outcomes would be assessed at 1 and 3 months. An earlier abstract, long-term efficacy of motivational interviewing on improving continuous positive airway pressure adherence in obstructive sleep apnoea: A randomised controlled trial [Abstract] presented at the European Respiratory Society Annual Congress, 2013 Sept 7-11, Barcelona, Spain (same sample N, same age/ESS means) stated alternate objectives: "This study aimed to examine the long-term efficacy of a theory-based behavioral education (BMI-E) programme on improving CPAP adherence... Primary outcome was to assess CPAP adherence 1 year after receiving BMI-E programme." Taken together, it is possible that some aspects of the analysis plan were not finalised before unblinded outcome data were available for analysis and there are discrepancies across different reports in the designation of primary and secondary outcome time points. The authors' final publication (Lai 2014) does report the original and amended outcome time points (1 and 3 months) report both time point outcomes listed in NCT entry. However, the authors do not report 1-year average CPAP usage/day outcome (listed as planned primary outcome measure in 2013 abstract) in the published 2014 report. Additionally, the abstract reports only a threshold-based adherence outcome, one not specified in the NCT entry. Finally, the published report describes multiple additional ways that the outcome was analysed (i.e. proportion of CPAP-adherent uses and CPAP usage index). This information suggests the possibility that reported numerical results were selected on the basis of results.

Lai 2014 *(Continued)*

Overall risk of bias (ROB2, primary outcome) Machine usage	High risk	-

Lewis 2006

Methods	Prospective, single-blinded interventional study
Participants	**N = 72** patients with newly-diagnosed SAHS immediately prior to CPAP titration. **Inclusion criteria:** diagnosis of OSA (based on home sleep study) and subjective daytime sleepiness **Exclusion criteria:** not reported **Baseline characteristics:** 13.8% female. **Mean age** 51.4 (±8.6). **Mean AHI** 42.5. **Mean ESS** 15.7. **Mean BMI** 36.5. **Country:** UK
Interventions	Participants were randomised to standard support (SS, n = 36) or intensive support (IS, n = 36) group. **IS:** 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 1, 6, and 12 months **SS:** participants provided telephone number for support within office hours. Sleep physician reviewed participants at 1, 6, 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'
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'

Lewis 2006 *(Continued)*

Incomplete outcome data (attrition bias) All outcomes	High risk	Non-completers not included in analysis of usage data
Selective reporting (reporting bias)	Unclear risk	Information not available
Other bias	Unclear risk	Information not available
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Only information provided as to the randomisation procedures used was within Methods: "Consecutive attenders at auto-titration were randomised, using block tables, to receive either intensive (intervention group) or standard support (control group)." Key baseline characteristics (age, gender, BMI, AHI) were reported for all randomised participants and differences were insignificant (P values reported), consistent with chance.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	Authors report, "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." No deviations documented; none suspected based upon review. Appears to be mITT. Authors report, "Data missing because of non-attendance were excluded from analysis." In Results text, authors reference '17 defaulters,' corresponding to the 17 participants missing from the Results graph, Figure 2 (n = 25 control, n = 30 intervention participants).
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	High risk	At 6-month endpoint, 32 of 36 and 26 of 36 of intervention and control groups, respectively, had CPAP usage data, corresponding to 80.6% of participants. At 12 months, 74.3% of outcome data were available. Neither analyses to correct for bias nor sensitivity analyses were conducted. Authors note, "Non-attenders were noted, but no further data could be reliably calculated. We did not utilise further statistical techniques for longitudinal data with missing information, as it is clear that data is not missing by random." Authors report, "Eight out of the 17 defaulters (or their relatives) returned their machines at various times in the year. All had negligible hours on the clock-timers, but we could not calculate average nightly use for these patients because we could not tell when they stopped using their machines." Authors did not report further information as to the reasons participants defaulted or returned their machines. Thus, missing outcome data occurred due to loss to follow-up, which means that missingness could depend on true value. Authors report, "Despite likely selection bias (poor users dropping out in the standard group but remaining in the intervention group), there were still fewer reporting problems, more reporting enthusiasm and lower mean side-effects scores in the intervention group at one year." There were differences between groups in proportion missing outcomes (control > intervention) at endpoints. No reasons were available for participants who defaulted, so comparison of reasons for missingness could not be conducted. Thus, as authors acknowledge, it is likely that missingness in the outcome depended on true value. Additional information provided by authors in their report: Methods (outcomes): "Numbers of patients who did not attend follow-up, phone for help or require additional interventions were noted at each time point. Those who did not attend follow-up were sent a written reminder and rebooked within two weeks of the original appointment. A second missed attendance triggered a phone call by a research assistant or sleep physician, ask-

Lewis 2006 *(Continued)*

		ing these patients to return their CPAP machine if unable to use it. Those who did return their machines with negligible use were referred for other treatment modalities." Statistical Analyses: "...Data missing because of non-attendance were excluded from analysis." Discussion: "By recording machine use at several points, we could see trends in usage in that eventual non-attenders tended to have less frequent use on their previous visits (or when they eventually returned their machines). This is particularly important because subsequent differences in non-attendance rates mean that previous studies recording machine usage only in those who turn up at clinic are prone to reporting bias. We asked all patients to re-attend clinic, and all patients knew about the merits of CPAP. Non-attenders were noted, but no further data could be reliably calculated. We did not utilise further statistical techniques for longitudinal data with missing information, as it is clear that data is not missing by random. We now believe that studies measuring group or individual trends in CPAP use should also record attendance rates to provide a more complete clinical picture."
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring; devices identical or sufficiently similar (i.e. similar distributions of CPAP device make) across groups. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Unclear risk	No protocol, abstract, clinical trials entry available for comparison. Results presented were in accordance with the plan specified in the Methods section of the publication. No information as to whether analysis plan was finalised before unblinded outcome data were available for analysis. Methods section indicates that multiple time points planned; each planned outcome reported. No evidence that multiple analyses (e.g. variable adherence 'thresholds') were conducted. No threshold-based adherence outcomes reported.
Overall risk of bias (ROB2, primary outcome) Machine usage	High risk	-

Mendelson 2014

Methods	Randomised, parallel-group study. Randomisation was stratified by recruitment centre in blocks of 6 participants.
Participants	**N = 107** patients with OSA and a high cardiovascular risk (cardiovascular score > 5% or secondary prevention). **Inclusion criteria:** age between 18 and 85 years, diagnosed with OSA on diagnostic sleep study (AHI > 15), BMI < 40 kg/m^2, cardiovascular risk score > 5%, or being in secondary prevention with a past history of cardiovascular disease. **Exclusion criteria:** CSA, cardiovascular score < 5%, cardiac failure, history of hypercapnic chronic respiratory failure, incapacitated patients, pregnancy or taking part in another clinical trial. **Baseline characteristics:** 16.8% female. **Mean age** 63 (±9). **Mean AHI**=39. **Mean ESS**=7.9. **Mean BMI**=29.9. **Country:** France

Mendelson 2014 *(Continued)*

Interventions	Participants were randomised to telemedicine (n = 54) or standard care (n = 53). **Standard care:** evaluated at baseline, fitted with a nasal mask and given an auto titrating machine. Patients were contacted after 2 days to ask about adherence and to troubleshoot. After 4 weeks of treatment, patients met with their sleep specialist and data downloaded from machines. After 4 months of treatment, patients consulted their sleep specialist and were re-evaluated. **Telemedicine:** in addition to standard care, TM participants were equipped with a smart phone for uploading BP measurements, CPAP adherence, sleepiness, and quality of life data. They received daily pictograms containing health-related messages. **Study duration:** 4 months.
Outcomes	• Home self-measured blood pressure (BP) [Author's primary outcome] • CPAP usage (hours/night) • Cardiovascular risk evolution (score) • Sleepiness (ESS) • QoL (SF-36) • Fatigue (Chalder Fatigue Scale) • Dyspnoea (Sadoul questionnaire) • Withdrawals All outcomes were measured at 4 months only.
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"Participants were enrolled and followed up by the research team who assigned them to telemedicine or standard care on the basis of a computer-generated allocation sequence. Randomization was stratified by the recruiting centre in blocks of 6 participants."
Allocation concealment (selection bias)	Low risk	"Treatment allocations were prepared by an individual otherwise unaffiliated with the study."
Blinding (performance bias and detection bias) All outcomes	High risk	No evidence of blinding of participants, personnel or outcome assessors. Study had subjective outcomes, so knowing group assignment could influence these outcomes.
Incomplete outcome data (attrition bias) All outcomes	High risk	Though not noted explicitly, outcome data were likely missing for those participants who were excluded, lost to follow-up or withdrew (enumerated in Figure 2), suggesting that outcome data were available for 79.2% (control) and 74.1% (intervention) at study endpoint.
Selective reporting (reporting bias)	Low risk	The study protocol is not available, but it is clear that the published reports include all expected outcomes in accordance with trial's NCT entry.
Other bias	Unclear risk	Key baseline characteristics (age, BMI, AHI) were reported for all randomised participants and differences appear non-significant (overlapping SEs). However, gender proportions (90.7% and 75.5% males in intervention and control arms, respectively) not statistically compared by authors.
Bias arising from the randomisation process (ROB2, primary outcome)	Low risk	Authors report, "Participants were enrolled and followed up by the research team who assigned them to telemedicine or standard care on the basis of a computer-generated allocation sequence. Randomization was stratified by the

Mendelson 2014 *(Continued)*

		recruiting centre in blocks of 6 participants. Treatment allocations were prepared by an individual otherwise unaffiliated with the study." Although allocations were made by an individual unaffiliated with the study, it is not clear if study investigators were aware of the fixed block size. However, given the number of recruiting centres, ability of study investigators at any single centre to predict allocation based on knowledge of block size is deemed to be low. Key baseline characteristics (age, BMI, AHI) were reported for all randomised participants and differences appear non-significant (overlapping SEs). Gender proportions (90.7% and 75.5% males in intervention and control arms, respectively) not statistically compared by authors.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	No deviations documented; none suspected based upon review. ITT. Authors report, "The data for all outcomes were analysed on an intention-to-treat basis....The missing values at baseline were replaced by the median of each group, and at follow-up, they were substituted by data at baseline (method of means bias)."
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	High risk	Though not noted explicitly, outcome data were likely missing for those participants who were excluded, lost to follow-up or withdrew (enumerated in Figure 2), suggesting that outcome data were available for 79.2% (control) and 74.1% (intervention) at study endpoint. Neither analyses to correct for bias (as described in Cochrane Handbook 6.1.6) nor sensitivity analyses were conducted. Missing outcome data occurred due to loss to follow-up or study withdrawal, both of which could be related to the outcome. Therefore, it is possible that missingness in the outcome was influenced by its true value. Though there is no substantial difference in the missingness proportions across groups, the reported reasons for missingness suggest that missingness depends on the true value and the reasons for missingness differ across groups. As authors note, "...it is possible that telemedicine was perceived as an additional burden associated with the self-management of BP and CPAP by patients randomised to this group. In fact, there were more dropouts in the telemedicine group than standard care (n = 8, 14.8% vs n = 1, 1.9%, respectively), which is consistent with another study using this type of intervention."
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring; devices identical or sufficiently similar (i.e. similar distributions of CPAP device make) across groups. Authors contacted to verify CPAP make, and provided the following reply: "Author response: "In the study "CPAP treatment supported by telemedicine does not improve blood pressure in high cardiovascular risk OSA patients: a randomised, controlled trial; Sleep 2014;37 MISC1 - SLP(11):1863-1870B", the CPAP device used was iSleep by BREAS (http://breas.com/products/isleep/). All patients included in this study used the same device." Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Low risk	ClinicalTrials.gov entry (NCT01226641) indicates that the original secondary outcome measure (that which is relevant to our review) was the same as the current primary outcome measure, "CPAP compliance [Time Frame: week 16] the CPAP compliance is assessed in the two groups at week 16 " (submitted 21 Oct 2010). Final data collection date for primary outcome was Jan 2012. NCT outcome is the same as that presented in published report (2014). Published report indicates that the study was conducted between July 2009 and January 2012. Thus, the dates provided indicate that outcomes were finalised before unblinded outcome data would have been available for analysis (i.e. outcome specified soon after start of recruitment period). NCT entry and published report Methods section indicates that one outcome time point (for adherence

Mendelson 2014 *(Continued)*

		outcome) was planned and one outcome endpoint reported. No evidence that multiple analyses (e.g. variable adherence 'thresholds') were conducted. No threshold-based adherence outcomes reported.
Overall risk of bias (ROB2, primary outcome) Machine usage	High risk	-

Meurice 2007

Methods	Randomised parallel-group trial.
Participants	**N = 112** participants with severe OSA and no prior treatment for OSA. **Inclusion criteria:** PSG-confirmed OSA (AHI > 30), no prior OSA treatment, treated with constant pressure. **Exclusion criteria:** none reported. **Baseline characteristics: Mean age** 58 (±11). **Mean AHI**=58(±25). Authors reported mean ESS and BMI by intervention arm and reported no significant differences. Gender distribution not reported. **Country:** France
Interventions	Participants were randomised to Intervention Group 1 (n = 27), Group 2 (n = 27), , Group 3 (n = 27) or Group 4 (n = 26), defined as follows. **Intervention group 1: RP + RH** **Intervention group 2: RP + SH** **Intervention group 3: SP + RH** **Intervention group 4: SP + SH (control)** **Reinforced education by Homecare Network (RH):** 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 (RP):** written material on CPAP use; explanation of OSA and CPAP with side effects; emphasis on importance of compliance with CPAP and detailed demonstration **Standard education by the homecare network (SH):** 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 (SP):** standard oral explanation of OSA and CPAP, brief demonstration of machine use plus manufacturer's literature. Participant was encouraged to ask questions and clarify misunderstandings. **Study duration:** 3 months, per protocol. Follow-up to 52 weeks (intervention administered at outset of study). Data extracted at three months. Authors report "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	• CPAP usage (hours/night) at 3 months (6 and 12 months data also presented but outside study protocol time period). • Sleepiness (ESS) • Quality of life (SF-36)

Meurice 2007 *(Continued)*

- Withdrawals
- Clinical symptoms.

Notes	Intervention groups 1, 2 and 3 combined for comparison to Control group (4) in meta-analysis, as recommended in Cochrane Handbook section 16.5.4.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Only information provided as to the randomisation procedures used was within Methods: "Patients were consecutively recruited from seven centres and were randomised into the four educational strategies." No reference to random component or allocation concealment method.
Allocation concealment (selection bias)	Unclear risk	No reference to allocation concealment method.
Blinding (performance bias and detection bias) All outcomes	High risk	No evidence of blinding of participants, personnel or outcome assessors. Study had subjective outcomes, so knowing group assignment could influence these outcomes.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Data were available for all randomised participants at the first endpoint (3 months).
Selective reporting (reporting bias)	Unclear risk	No protocol, abstract, clinical trials entry available for comparison.
Other bias	Unclear risk	Some key baseline characteristics (age, BMI, AHI) were reported and differences were insignificant (P values reported), consistent with chance. However, gender, another key characteristic, was neither reported nor compared across intervention arms. No deviations from intended interventions reported or suspected.
Bias arising from the randomisation process (ROB2, primary outcome)	High risk	Only information provided as to the randomisation procedures used was within Methods: "Patients were consecutively recruited from seven centres and were randomised into the four educational strategies." No reference to random component or allocation concealment method. Some key baseline characteristics (age, BMI, AHI) were reported and differences were insignificant (P values reported), consistent with chance. However, gender, another key characteristic, was neither reported nor compared across intervention arms.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	No deviations documented; none suspected based upon review. ITT
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Low risk	Authors provide CPAP usage outcome data at 3 endpoints. No endpoint was designated as primary by trialists. Data were available for all randomised participants at the first endpoint (3 months); for 96 of 112 (85.7%) at 6 months and for 91 of 112 (81.3%) at 12 months. For the purposes of our review, the 3-month endpoint was selected.

Meurice 2007 *(Continued)*

Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Unclear risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring. Unable to confirm with study authors that distribution of CPAP device makes did not differ between intervention arms. Authors report, "The choice of the machine used by the patients corresponded to the wishes of the prescribers." Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Unclear risk	No protocol, abstract, clinical trials entry available for comparison. Results presented were in accordance with the plan specified in the Methods section of the publication. No information as to whether analysis plan was finalised before unblinded outcome data were available for analysis. Methods section indicates that multiple time points planned; each planned outcome reported. No evidence that multiple analyses (e.g. variable adherence 'thresholds') were conducted.
Overall risk of bias (ROB2, primary outcome) Machine usage	High risk	-

Munafo 2016

Methods	Randomised, parallel-group study.
Participants	**N = 122** newly diagnosed patients with OSA. **Inclusion criteria:** age 18–80 years, CPAP-naïve, confirmed OSA (AHI 5–70) diagnosis based on polysomnography (PSG) or home sleep test, access to and be able to utilise communication technology (text messaging, e-mail). **Exclusion criteria:** prominent central apnoea (>20 %), claustrophobia, current use of mandibular repositioning device, other OSA therapy. **Baseline characteristics:** 31% female. **Mean age** 51.2 (±11.2). **Mean AHI**=30.4. **Mean ESS**=10.5. **Mean BMI**=33.2. **Country:** USA
Interventions	Participants were randomised to standard of care (SOC, n = 64) alone, or SOC + web-based automated telehealth messaging program (TH, n = 58). **SOC:** patients were dispensed a CPAP device on Day 0, then contacted via phone on Days 1, 7, 14, 30, and 90. CPAP usage and efficacy data were tracked via the wireless modem attached to CPAP machine. Modem data were accessed via online platform. Frequent phone calls and return clinic visits were provided, as necessary. **TH:** CPAP device dispensed on Day 0, along with a pamphlet about U-Sleep, a web-based application to monitor adherence and message patients and providers via automated series of text messages/emails were triggered by pre-set conditions. **Study duration:** 3 months
Outcomes	• CPAP usage (hours/night) at 90 days • N of adherent participants (Medicare: use for ≥ 4 hours/night on 70 % of nights during a 30 consecutive-day period anytime during first 90 days of initial usage) • Sleepiness (ESS) • Residual AHI • Withdrawals • Resource use

Munafo 2016 *(Continued)*

	All outcomes measured at 90 days.
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Only information provided as to the randomisation procedures used was within Methods: participants subsection, where authors report: "A simple randomisation scheme was used to allocate patients to CPAP treatment plus SOC or TH." Trialists provided no information regarding random component used in sequence generation or on how sequence concealment was achieved.
Allocation concealment (selection bias)	Unclear risk	No reference to allocation concealment method.
Blinding (performance bias and detection bias) All outcomes	High risk	No evidence of blinding of participants, personnel or outcome assessors. Study had subjective outcomes, so knowing group assignment could influence these outcomes.
Incomplete outcome data (attrition bias) All outcomes	High risk	There are differences in the proportion of missing outcome data between intervention groups. There are no reasons for missing outcome data other than 'loss-to-follow-up,' so uncertain as to whether these reasons differ by group.
Selective reporting (reporting bias)	Low risk	No protocol available. Published abstract (2014) listed the same primary outcomes, time points.
Other bias	Low risk	No baseline imbalances or reported/suspected deviations from intended intervention.
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Only information provided as to the randomisation procedures used was within Methods: participants subsection, where authors report: "A simple randomisation scheme was used to allocate patients to CPAP treatment plus SOC or TH." Trialists provided no information regarding random component used in sequence generation or on how sequence concealment was achieved. Key baseline characteristics (age, gender, BMI, AHI) were reported and differences were insignificant (P values reported), consistent with chance.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	No deviations documented; none suspected based upon review. Only observed deviations from planned intervention is non-compliance with behavioural intervention which is typical of routine care, so unrelated to the experimental context. ITT conducted only for 'Medicare Adherence' definition - "...use for ≥4 hours/night on 70 % of nights during a 30 consecutive-day period anytime during the first 90 days of initial usage." (p. 779) Authors report, "Primary endpoint analyses were generated for the intention-to-treat (ITT) and completed cases (CC) populations. The ITT population included all randomised patients except two who withdrew consent. Patients with no compliance data, and one patient who never enrolled in the U-Sleep program, were considered non-adherent to CPAP; for those lost-to-follow-up, adherence results for the last available assessment were used. The CC population included patients who completed the study according to the protocol. Additional analyses were conducted in the CC population without imputation for missing values."
Bias due to missing outcome data (ROB2, primary outcome)	High risk	Authors report: "Primary endpoint analyses were generated for the intention-to-treat (ITT) and completed cases (CC) populations. The ITT population included all randomised patients except two who withdrew consent. Patients

Munafo 2016 *(Continued)*

All outcomes		with no compliance data, and one patient who never enrolled in the U-Sleep program, were considered non-adherent to CPAP; for those lost-to-follow-up, adherence results for the last available assessment were used. The CC population included patients who completed the study according to the protocol. Additional analyses were conducted in the CC population without imputation for missing values." (p. 779) Reviewer note: Neither analyses to correct for bias nor sensitivity analyses were conducted. Authors note: "There are some limitations to this study. Firstly, the ability of the study to detect a significant difference in adherence and daily usage between the TH and SOC groups was reduced by the exclusion of 18 patients from the final analysis and the high adherence rate in the SOC group. Of the 18 patients with insufficient data, 12 were from the TH group and 6 were from the SOC group. Examination of the characteristics of these patients did not provide any explanation for the difference in dropout rates between the two groups, and there is no evidence that treatment allocation played any role." (p.783) Reviewer note: There is insufficient information regarding reasons for missing outcome data and, therefore, to conclude that the reasons are unrelated to outcome. There are differences in the proportion of missing outcome data between intervention groups. There are no reasons for missing outcome data other than 'loss-to-follow-up,' so uncertain as to whether these reasons differ by group.
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Unclear risk	No protocol available. Published abstract (2014) listed the same primary outcomes, time points. Methods section indicates that one, commonly-employed threshold adherence definition was planned; this outcome was reported in Results. No evidence that multiple analyses (e.g. variable adherence 'thresholds') were conducted.
Overall risk of bias (ROB2, primary outcome) Machine usage	High risk	-

Olsen 2012

Methods	Randomised parallel-group study
Participants	**N = 100** with OSA diagnosed by PSG. **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 **Baseline characteristics:** 31% **female (41.5% intervention, 28.3% control). Mean age** 56.6 (±11.0). **Mean RDI** 34.3. **Mean ESS** 21.9. **Mean BMI** 34.5 **Country:** Australia
Interventions	Participants were randomised to motivational interviewing intervention (MINT, n = 53) or control (n = 53) group.

Olsen 2012 *(Continued)*

MINT: 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"
Selective reporting (reporting bias)	Unclear risk	Information not available
Other bias	Unclear risk	Information not available
Bias arising from the randomisation process (ROB2, primary outcome)	Low risk	Authors report, "An equal number of allocations for the control (n=53) and MINT (n=53) groups were placed into opaque, unlabelled envelopes, and the envelopes were shuffled by a research assistant. No blocking or stratification of randomisation was used. The envelopes were then placed into an allocation box held in a secure clinic area. After recruitment into the study, participants were directed to the sleep centre's administrative officers to schedule future appointments. The officer withdrew an envelope containing the intervention allocation and booked the patient's future appointments on that basis. The administrative officers were not otherwise involved in recruitment or provision of the intervention." Key baseline characteristics (age, gender, BMI, AHI) were reported for all randomised participants and differences were insignificant (P values reported), consistent with chance.

Olsen 2012 *(Continued)*

Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	Authors report, "The nature of the intervention meant that we were unable to mask either the participants or the intervention nurses to treatment assignment." No deviations documented; none suspected based upon review. mITT Under Methods (Participants), authors report, "Participants were eligible for inclusion if they were at least 18 years of age, had a diagnosis of OSA confirmed by clinical polysomnography (PSG), had a clinical recommendation for CPAP treatment, and were naive to CPAP treatment. Participants were excluded from the study if they were found to require bi-level ventilation (e.g. due to evidence of central sleep apnoea syndrome), did not complete a CPAP titration study, or were unable to give informed consent." Under Methods (Randomisation and Masking), authors report, "Eligible participants were randomly assigned...," indicating N = 53 for each intervention arm. Participants were booked for CPAP titration after allocation. Even though the cited reasons for post-randomization exclusions would, in theory, have been determined following diagnostic PSG and, therefore, prior to randomisation, the reasons for post-randomisation exclusions appear to have been due to eligibility being confirmed after randomisation.
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Low risk	Outcome data available for 94 of 106 (88.7%) randomised participants. However, 94% of eligible randomised participants have outcome data.
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Unclear risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring. Unable to confirm with study author that distribution of CPAP device makes did not differ between intervention arms. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Unclear risk	No protocol available. Published abstract (2009) and published report (2012) listed the same primary outcomes, : "Objective CPAP adherence was assessed at 1, 2 and 3 months," except 12 month endpoint was included in final report. Results presented were in accordance with the plan specified in the Methods section of the publication. No information as to whether analysis plan was finalised before unblinded outcome data were available for analysis. Methods section indicates that multiple time points planned; each planned outcome reported. No evidence that multiple analyses (e.g. variable adherence 'thresholds') were conducted. No threshold-based adherence outcomes reported.
Overall risk of bias (ROB2, primary outcome) Machine usage	Unclear risk	-

Parthasarathy 2013

Methods	Randomised parallel-group open-label
Participants	**N = 39** veterans with OSA prescribed CPAP. **Inclusion criteria:** age 21-85, new diagnosis of OSA, AHI > 5, full night or split night polysomnography, 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 **Baseline characteristics:** 0% female. **Mean age** 52 (±14). **Mean AHI** 37. **Mean ESS** 10.8. **Mean BMI** 34.

Parthasarathy 2013 *(Continued)*

Country: USA

Interventions	Participants were randomised to usual care (UC, n = 17) or peer buddy system (PBS, n = 22) group. **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 **UC:** 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:** 90 days
Outcomes	• Participant ratings of acceptability of peer-buddy system • 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.

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
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
Selective reporting (reporting bias)	Unclear risk	Information not available
Other bias	Unclear risk	Information not available
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Only information provided as to the randomisation procedures used was within METHODS: "This prospective, randomised, parallel group, open label, pilot study randomly assigned patients with OSA who had not yet been initiated on CPAP therapy to the peer-buddy system to promote adherence to CPAP therapy (peer-driven intervention group) or be provided with educational brochures regarding OSA and CPAP therapy (usual care group)." Study flow chart shows that baseline measurements were obtained on 39 participants and arrows indicate the numbers allocated to each intervention arm. Authors state this is a randomised study so the flow chart implies randomisation occurred after 'CPAP initiation and education by respiratory therapist. Authors do explicitly

Parthasarathy 2013 *(Continued)*

		describe randomisation procedures or timing of randomisation, but it appears that key baseline characteristics (age, gender, BMI, AHI, ESS) were reported for randomised participants. The differences were insignificant (P values reported), consistent with chance.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	open-label No deviations documented; none suspected based upon review. mITT.
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Low risk	Authors report 2 participants (both in usual care group) were lost to follow-up. Outcome measures table (which does not include CPAP usage at 90 days) is based on total randomised participants in each group (i.e. n = 22, n = 17). However, the authors do not report on CPAP usage at 90-days (the pre-specified outcome endpoint) in the text or table. They present a graph of minutes CPAP usage in each group by week and report the MANOVA results for comparison of repeated measures between groups. Authors do not explicitly report the Ns upon which these graphical data are based, but it is likely that it is either all randomised participants (n = 39) or all participants who were not lost-to-follow-up (n = 37). Therefore, the primary CPAP usage/adherence data were available (to authors) for all or nearly all (95%) participants.
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Unclear risk	Outcome measured using objective CPAP usage data. Outcome measured using objective CPAP usage data. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	High risk	Publication (2013), earlier abstract (2012) and ClinicalTrials.gov entry (first submitted 15 Jun 2010, last updated 7 Apr 2015) available and reviewed. Primary and secondary outcomes (submitted 15 July 2010) and are the same as current primary and secondary outcomes (i.e. no updates/changes were submitted to ClinicalTrials.gov by authors). No information as to whether analysis plan was finalised before unblinded outcome data were available for analysis. In Methods section of published report, authors indicate the following planned outcome measurement: "CPAP adherence downloads: Mean number of hours per day of CPAP use was collected for the entire 90 days through downloads on days 30 and 90." In results, outcome data for each week (1-13) presented in graphical form. Only week 1 (not a pre-specified outcome endpoint) described in the text. No other numerical CPAP usage results presented in tables or text. 90-day endpoint result obtained from author. Thus, while authors seemed to have selected a different endpoint to be highlighted in the published report results section from the intended primary endpoint, the result we have assessed in our review (and obtained directly from authors) appears to have been pre-specified at the primary outcome. Report presents a threshold-based categorical adherence outcome not pre-specified in the NCT entry (protocol) nor in the published report methods section. Per NCT entry (first submitted 15 June 2010), authors planned secondary outcomes (submitted 15 jJuly 2010) included 'CPAP adherence [time frame: three months]'. The abstract and published report indicate that CPAP usage/adherence data were collected over the full 90 days and were analysed over that time period. The published report and earlier abstract (2012) report MANOVA results for comparison of CPAP usage in each group by week and the published report presents a graphical representation of CPAP usage by week. However, neither the abstract nor the full published report contains numeric (minutes/day) results for the 90-day pre-specified outcome endpoint. The report only presents actual CPAP usage values (minutes/day) at 1 week and reports a threshold-based categorical adherence outcome (proportion of par-

Parthasarathy 2013 *(Continued)*

		ticipants in each group using at least 4 hours/night) at an unspecified time point. Neither of these outcomes appeared to be pre-specified according to NCT entry, abstract and Methods section of published report. No other numerical CPAP usage results presented in tables or text. Nonethless, the numerical result being assessed for our review was for the pre-specified CPAP adherence endpoint.
Overall risk of bias (ROB2, primary outcome) Machine usage	High risk	-

Pengo 2018

Methods	Randomised, parallel-group study.
Participants	**N = 112** patients who had positive home-based pulse oximeter screen for OSA. **Inclusion criteria:** following at-home screening using nocturnal pulse oximetry, patients who had 4% ODI ≥ 5 and typical symptoms of sleep apnoea (ESS > 10 points), or a 4% ODI > 15 were invited for CPAP treatment. **Exclusion criteria:** mental or physical disability precluding compliance with study protocol, unable to participate in trial follow-up. **Baseline characteristics:** 25% female. **Mean age** 49.1 (±12.1). **Mean ODI** = 24.8. **Mean ESS**=11.3. **Mean BMI** = 36.5. **Country:** UK
Interventions	Participants were randomised to receive, in addition to CPAP therapy, either positively (n = 36) or negatively framed (n = 37) messages, or standard care (n = 39) alone. All patients received 2 weeks of APAP, followed by 4 weeks of fixed CPAP. **Standard care:** included explanation of importance of treating OSA, APAP introduction by expert sleep technicians, standard instructions on use of devices, review for troubleshooting, compliance assessment at 2-weeks post treatment initiation. **Positive:** positively-framed messages in addition to CPAP. Patients were phoned weekly and read the framed health messages (up to a total of 6 phone calls per patient). **Negative:** negatively-framed messages in addition to CPAP. Patients were phoned weekly and read the framed health messages (up to a total of 6 phone calls per patient). **Study duration:** 6 weeks
Outcomes	• CPAP usage (hours/night) at 6 weeks. • % Days CPAP used for > 4 hours • Sleepiness (ESS) • Withdrawals All outcomes reported at 2 and 6* weeks.
Notes	Intervention arms (positively- and negatively-valenced messages) combined for comparison to control arm in meta-analysis, as recommended in Cochrane Handbook section 16.5.4. * Indicates primary outcome analysed in this Review.

Risk of bias

Pengo 2018 *(Continued)*

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	No reference to how randomisation was achieved.
Allocation concealment (selection bias)	Unclear risk	No reference to allocation concealment method.
Blinding (performance bias and detection bias) All outcomes	Low risk	No evidence of blinding of participants, personnel or outcome assessors. Study only had objective outcomes, so lack of blinding is not likely affect outcomes.
Incomplete outcome data (attrition bias) All outcomes	High risk	Outcome data missing for 24 of the 112 (21%) randomised.
Selective reporting (reporting bias)	Unclear risk	No protocol available. Published abstract (2014) listed the same primary outcomes. Results presented were in accordance with the plan specified in the Methods section of the publication. No information as to whether analysis plan was finalized before unblinded outcome data were available for analysis.
Other bias	Low risk	No baseline imbalances or reported/suspected deviations from intended intervention.
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Authors report: "Patients were randomly assigned to one of the three groups: the first received positively framed messages in addition to CPAP, the second received negatively framed messages in addition to CPAP, and a control group entailed patients who received best standard care with CPAP, but no framed messages. The three groups were matched for age, sex and BMI." No reference to random component or allocation concealment method. Key baseline characteristics (age, gender, BMI, AHI) were reported for all randomised participants and differences were insignificant (P values reported), consistent with chance.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	No deviations documented; none suspected based upon review. Likely mITT.
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	High risk	Outcome data missing for 24 of the 112 (21%) randomised. Neither analyses to correct for bias nor sensitivity analyses were conducted. Loss to follow-up could be related to participant health status. There were differences in the proportions of missing outcome data among intervention groups: intervention group 1 (5/36) intervention group 2 (8/37) and control group (11/36). Authors note "p<0.05 for comparison between positively framed and control group," and that reasons for loss-to-follow-up were either the participant returned the CPAP machine or could not be contacted. They do not specify reasons by intervention group. Returning the machine and not responding to contact attempts are both potentially related to the true value of the outcome (i.e. those who returned their machines early or did not respond to calls may be less compliant than those who continue in the study). Favours comparator. If loss to follow-up associated with reduced adherence, control group would have lower adherence and advantage of experimental intervention would be underestimated.
Bias in measurement of the outcome (ROB2, primary outcome)	Low risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring; devices identical or sufficiently similar (i.e. similar distributions of CPAP device make)

Pengo 2018 *(Continued)*

All outcomes		across groups. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Unclear risk	No protocol available. Published abstract (2014) listed the same primary outcomes. Results presented were in accordance with the plan specified in the Methods section of the publication. No information as to whether analysis plan was finalised before unblinded outcome data were available for analysis. Methods section indicates that multiple time points planned; each planned outcome reported. No evidence that multiple analyses (e.g. variable adherence 'thresholds') were conducted.
Overall risk of bias (ROB2, primary outcome) Machine usage	High risk	-

Pepin 2019

Methods	Randomised, multi-centre parallel-group study.
Participants	**N = 306** patients with newly-diagnosed OSA . **Inclusion criteria:** 18 to 75 years, severe OSA (AHI > 30) on the basis of respiratory polygraphy or PSG, at least one cardiovascular disease or exhibit an elevated cardiovascular risk (Systematic Coronary Risk evaluation risk > 5% at 10 years or in secondary prevention). **Exclusion criteria:** CSA, heart failure with a left ventricular ejection fraction < 40%. **Baseline characteristics:** 26% female. **Median age** 61.3 (IQR: 54.1-66.1). **Median AHI** = 46. **Median ESS** = 9. **Median BM I** =32.0. **Country:** France
Interventions	Participants were randomised to usual care (UC, n = 149) or multimodal telemonitoring (TM, n = 157) for 6 months. **TM:** CPAP-related factors (adherence, leaks, and residual events), BP and physical activity recorded by connected devices. Symptoms and quality of life were recorded via electronic questionnaires completed by patients. Patients received demonstration home telemonitoring use and an explanation of why monitoring these physiological variables was relevant for their care. Automatic algorithms were constructed for the prompt adjustment of CPAP treatment. **UC:** Received standard care usually received from their assigned sleep centres. **Study duration:** 6 months
Outcomes	• Systolic blood pressure (primary outcome) • CPAP usage (hours/night) at 6 months. • Sleepiness (ESS) • QoL (SF-12) • Physical activity • Fatigue (Pichot questionnaire) • Withdrawals All outcomes were reported for 6 month endpoint only.
Notes	

Pepin 2019 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Participants were randomised to multimodal remote tele-monitoring or usual care (1:1 ratio) using computer-generated allocation. Randomisation was stratified by centre, home care provider, and CPAP brand
Allocation concealment (selection bias)	Unclear risk	No reference to allocation concealment method.
Blinding (performance bias and detection bias) All outcomes	High risk	No evidence of blinding of participants, personnel or outcome assessors. Study had subjective outcomes, so knowing group assignment could influence these outcomes.
Incomplete outcome data (attrition bias) All outcomes	High risk	At baseline, 306 patients were randomised: 157 to telemonitoring and 149 to usual care. 40 of 157 (18.1%) and 27 of 149 (25.5%) were reported as 'lost during follow-up' in the treatment and control arm, respectively.
Selective reporting (reporting bias)	Low risk	NCT information first submitted 15 Feb 2013, last updated 5 Sep 2014. Study start date reported as Feb 2013. Primary outcome (change from baseline CPAP compliance at 6 months) submitted 20 Feb 2013 and is the same as current primary outcome (i.e. no updates/changes were submitted to ClinicalTrials.gov by authors). Published report specifies the same primary outcome as that specified in NCT entry. Dates provided indicate that analysis plan was finalised before unblinded outcome data would have been available for analysis (i.e. outcome specified same month as recruitment period started).
Other bias	Low risk	No baseline imbalances or reported/suspected deviations from intended intervention.
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Authors report, "Participants were randomised to multimodal remote tele-monitoring or usual care (1:1 ratio) using computer-generated allocation. Randomization was stratified by centre, home care provider, and CPAP brand (four main brands used in France)." No reference to allocation concealment method. Key baseline characteristics (age, gender, BMI, AHI) were reported for all randomised participants and differences appeared non-significant, but no P values reported.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	Open-label. Authors report, "Neither participants nor investigators were masked to group assignment." No documented deviations suspected to have arisen because of experimental context.Authors report, "Data were initially analysed in intention-to-treat (ITT) including all randomised patients; then, a per-protocol analysis was done on all randomised participants excluding study dropouts. To replace missing data, multiple imputations were performed for the primary outcomes by using a logistic and linear regression model for binary or continuous variables, respectively. Fifty data sets were constituted." Documented deviations from protocol (not expected to have arisen because of experimental context: "The main limitation of this study was the failure to reach the estimated sample size. During the course of the study, reimbursement for telemonitoring was suspended in France because of opposition to it by several patients' associations. For the first time, the French health-care authorities had attempted, by decree, to make coverage of health costs conditional on patient's adherence to treatment. Patients successfully appealed against this decree through the highest court "Conseil d'Etat." Consequently, the trial data monitoring committee recommended trial termination for pragmatic reasons...."

Pepin 2019 *(Continued)*

Bias due to missing outcome data (ROB2, primary outcome) All outcomes	High risk	At baseline, 306 patients were randomised: 157 to telemonitoring and 149 to usual care. 40 of 157 (18.1%) and 27 of 149 (25.5%) were reported as 'lost during follow-up' in the treatment and control arm, respectively. Difference in proportion (N-1 chi-square test: chi-sq=2.455, DF=1, P = 0.1171; z-test: z=-1.5696, P = 0.1164) is not statistically significant. Neither analyses to correct for bias nor sensitivity analyses were conducted. Missing outcome data occurred due to loss to follow-up, which could be related to the outcome. Therefore, it is possible that missingness in the outcome was influenced by its true value. There are differences in the proportion of missing outcome data between intervention groups (see 3.1), but these are non-significant: N-1 chi-square test: difference=7.4% (95%CI: -1.86-16.6%), chi-sq=2.455, DF=1, P = 0.1171. There are no specific reasons for missing outcome data other than 'lost during follow-up,' so cannot determine if reasons differ between study arms. Per Cochrane handbook, 8.13.2.2, "Even if incomplete outcome data are balanced in numbers across groups, bias can be introduced if the reasons for missing outcomes differ." Without specific reasons for missing data, the potential for bias cannot be adequately assessed.
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring. Randomisation was stratified by centre, home care provider, and CPAP brand. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Unclear risk	Publication (2019), abstract (2017) and ClinicalTrials.gov entry, NCT01796769 available and reviewed. NCT information first submitted 15 Feb 2013, last updated 5 Sep 2014. Study start date reported as Feb 2013. Primary outcome (change from baseline CPAP compliance at 6 months) submitted 20 Feb 2013 and is the same as current primary outcome (i.e. no updates/changes were submitted to ClinicalTrials.gov by authors). Published report specifies the same primary outcome as that specified in NCT entry. Actual primary completion date was listed in NCT entry as: 'Sep 2014 (final data collection for primary outcome measure)'. Recruitment period specified in published report was Feb 2013 to Oct 2013. Dates provided indicate that analysis plan was finalised before unblinded outcome data would have been available for analysis (i.e. outcome specified same month as recruitment period started). Methods section indicates one outcome time point (for primary adherence outcome) was planned. Results section reports one outcome time point. No evidence that multiple analyses (e.g. variable adherence 'thresholds') were conducted. No threshold-based adherence outcomes reported.
Overall risk of bias (ROB2, primary outcome) Machine usage	High risk	-

Richards 2007

Methods	Randomised, parallel-group trial
Participants	**N = 100** participants with newly-diagnosed OSA referred for CPAP titration **Inclusion criteria:** newly diagnosed with OSA referred for CPAP titration **Exclusion criteria:** inability to understand fluent English, previous use of CPAP. **Baseline characteristics:** 4% female. **Mean age** 56. **Mean RDI** 26.5. **Mean ESS** 10.5. **Mean BMI** 30.3. **Country:** Australia

Richards 2007 *(Continued)*

Interventions	Participants were randomised to treatment as usual (TAU, n = 50) or Intervention (n = 50) group. **Intervention:** CBT. 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 **TAU:** 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:** 28 days
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"
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"
Selective reporting (reporting bias)	Unclear risk	Information not available
Other bias	Unclear risk	Information not available
Bias arising from the randomisation process (ROB2, primary outcome)	Low risk	Authors report: "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. Of the 109 individuals approached, 9 refused to participate. Consenting participants were randomly assigned to either a treatment as usual group (TAU) (n = 50) or to the CBT group (n = 50)." Random component not specified (how random sequence generated).

Richards 2007 *(Continued)*

		Allocation concealment method specified and appropriate, but block size not specified. Key baseline characteristics (age, gender, BMI, AHI) were reported and differences were insignificant (P values reported), consistent with chance.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	Report does not specify which staff members were blinded and which were involved in delivering the intervention. No deviations documented; none suspected based upon review. Authors report in stats section that analyses were ITT. However, flowchart indicates "Usage assessed at day 28 (n=48)." for each tx group. Additionally, under results section, authors write: "study. After attending the CPAP-pressure determination study, 2 participants were withdrawn from the study. One participant allocated to CBT was found to require bilevel noninvasive ventilation, and a participant allocated to treatment as usual went overseas for an indefinite period of time. The data from these participants were excluded from the outcome analysis at 7 and 28 days. The Smart-Card data from 2 participants at 28 days was lost in the mail, and these data were also excluded from this part of the analysis." This suggests analysis was mITT.
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Low risk	96 of 100 had outcome data at endpoint day 28.
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring; devices identical or sufficiently similar (i.e. similar distributions of CPAP device make) across groups. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Unclear risk	No protocol, abstract, clinical trials entry available for comparison. Results presented were in accordance with the plan specified in the METHODS section of the publication. Methods section indicates that multiple time points planned; each planned outcome reported. Methods section indicates that multiple threshold-based adherence analyses were planned and all were reported.
Overall risk of bias (ROB2, primary outcome) Machine usage	Unclear risk	Concerns primarily derive from lack of availability of a protocol or pre-specified analysis plan, which is common for older studies.

Roecklein 2010

Methods	Randomised parallel-group study
Participants	**N = 30** patients diagnosed with OSA by PSG, naive to CPAP and reporting intent to use CPAP. **Inclusion criteria:** age 18 to 65, CPAP naive, reported intent to use CPAP (other sleep, psychiatric or health problems were not exclusion criteria) **Exclusion criteria:** none reported. **Baseline characteristics:** 70% female. **Mean age** 46.3 (±11.2). **Mean AHI** 44.4. **Mean ESS** 11.6. **Mean BMI** 42.1. **Country:** USA

Roecklein 2010 *(Continued)*

Interventions	Participants were randomised to standard education (SE, n = 16) or personalised feedback (PF, n = 14) group. **PF:** 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 **SE (control):** written information from the American Academy of Sleep Medicine on OSA, Snoring and PAP therapy for OSA **Study duration:** 3 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
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
Selective reporting (reporting bias)	Unclear risk	Information not available
Other bias	Unclear risk	Information not available
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Only information provided as to the randomisation procedures used was within Methods: "Consecutive clinic patients were enrolled after receiving their OSA diagnosis and CPAP prescription. Participants were randomly assigned to feedback or standard information groups." Key baseline characteristics (age, gender, BMI, AHI, ESS) were reported and differences were insignificant (P values reported), consistent with chance.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	Authors report, "Physicians were blind to study participation, and participants were blind to their study condition." No information is provided as to who distributed the written intervention materials to the participants and how blinding was maintained from physicians or other study personnel. No deviations documented; none suspected

Roecklein 2010 *(Continued)*

		based upon review. In Methods (Measures) section, authors report, "Individuals who had not obtained machines (2 weeks: control, n =5 and feedback, n=2; 3 months: control, n =2 and feedback n =1) were recorded as having used CPAP for 0 hours per sessions. Individuals whose machines did not record use or who forgot to bring machines to the research session were treated as missing data (2 weeks: control, n = 1 and feedback, n= 0; 3 months: control, n =2 and feedback n = 2). Groups did not differ in the rates of missing versus present data at 2 weeks:X2(2,n=27)=3:86, ns; or 3 months: X2(2,n= 28) = 0:86, ns." In results, authors report, "Participants were 14 in the feedback group and 16 in the control group, and each group lost 1 to follow up." As the difference in Ns implies that the 'lost-to-follow-up' participants were neither those who did not obtain machines nor those for whom machines did not record use or who forgot to bring machines, it is not clear whether the lost-to-follow-up were assigned 0 hours/session or were treated as missing and excluded from analysis. Results tables do not indicate the Ns upon which the recorded results are based. Most likely, the results are based on mITT analysis.
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	High risk	Authors do not report the number of participants randomised and no Ns were reported in the results table. In Methods (Measures) section, authors report number in each group who did not obtain machines and in each group whose machines did not record use or who forgot to bring machines to research session. It is not clear if those who didn't get machines, whose machines did not record or who forgot to bring machines were amongst the participants referenced in the results section, "Participants were 14 in the feedback group and 16 in the control group, and each group lost 1 to follow-up." Thus, it is not clear whether the 15 total participants (N = 5 in intervention arm , N = 10 in control arm) who had no machine or no outcome data were amongst the 30 participants (N = 14 intervention, N = 16 control) referenced in the results or were in addition to them. Therefore, the total randomised number could have been as low as 15 (6,9) or as high as 45 (19, 26), depending upon whether the participant numbers in results section were numbers before or after accounting for those who did not obtain machines or had missing data. It is also not clear whether the one per group who were lost to follow-up were amongst or excluded from the reported N values. Neither analyses to correct for bias nor sensitivity analyses were conducted. Missing outcome data occurred for documented reasons, some of which ('forgot' CPAP device/data) could be related to the outcome. There were non-significant differences between groups in proportion of participants who met authors' definition of missing outcome data (n = 2 for each group at month 3). Reasons cited for missing data were either 'machines did not record use or who forgot to bring machines to the research session.' The latter reason (i.e. 'forgetting') can be related to outcome while machine failure would not be. The authors did not distinguish amongst those reasons in reporting the numbers of participants with missing outcome data for each intervention group. Thus, it is possible that there were differences between groups in the proportions missing because of 'forgetting'. Comparison of possible proportions is further complicated by the fact that we do not have the actual randomised denominators for each group. It is possible that both intervention participants with missing data had 'forgotten' to bring it for analysis while those missing data in control group were purely based on chance equipment failure. Depending on respective denominators, under the above-noted conditions, there would be a difference of 14% to 0% (intervention vs. control) or 10.5% to 0% (intervention vs. control) in proportion missing due to 'forgetting,' depending on actual randomised Ns.
Bias in measurement of the outcome (ROB2, primary outcome)	Low risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring. Unable to confirm with study author that distribution of CPAP device makes did not dif-

Roecklein 2010 *(Continued)*

All outcomes		fer between intervention arms. However, likely sufficiently similar (i.e. probably Respironics devices) based on authors note "95% of machines detected breathing; Respironics Inc., Murrysville, PA", suggesting most/all participants for whom data were available were using a Respironics device) across groups. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Unclear risk	No protocol, abstract, clinical trials entry available for comparison. Results presented were in accordance with the plan specified in the Methods section of the publication. No information as to whether analysis plan was finalised before unblinded outcome data were available for analysis. Methods section indicates that multiple time points planned; each planned outcome reported. No evidence that multiple analyses (e.g. variable adherence 'thresholds') were conducted. No threshold-based adherence outcomes reported.
Overall risk of bias (ROB2, primary outcome) Machine usage	High risk	-

Sarac 2017

Methods	Randomised, parallel-group study.
Participants	**N = 115** patients with OSA. **Inclusion criteria (not explicit):** ≥ 18 years old), newly diagnosed OSA (AHI ≥5), free from upper airway obstructions. **Exclusion criteria (not explicit):** not interested in PAP or in study participation, living outside Istanbul, unable to come to follow-up. **Baseline characteristics:** 24.5% female. **Mean age** 51 (±9.3). **Mean AHI** = 41.4. **Mean ESS** =10.0. **Mean BMI** = 32.5. **Country:** Turkey
Interventions	Participants were randomised to receive standard support (SS, n = 63) or educational support (ES, n = 52). **SS:** general explanation (˜10-15 minutes) of OSA and PAP. **ES:** SS + additional education (˜ 20 minutes) by a sleep medicine physician , including: viewing his/her own polysomnography chart on morning post PAP-titration, comparing the PSG from diagnostic and CPAP titration studies with explanations that emphasised obstructive events and oxygen desaturations, and the disappearance of those signs on PAP treatment. **Study duration:** approximately 6 months
Outcomes	• CPAP usage (hours/night) at 5 time points, participants invited to return at 15, 30, 60, 90 and 180 days post-randomisation (actual time of measurements varied by participant)* • N of adherent participants (usage ≥ 4 hours per night on at least 70% of nights) at short-term (first) and long-term (last) follow-up* • Sleepiness (ESS) • withdrawal
Notes	*58 out of 63 patients in the SS group, and 49 out of 52 patients in the ES group completed the five follow-up appointments during the study period. The median time from randomisation to first follow-up was 20 days for both groups with an IQR 17–27 days for the SS group, and 16–26 days for the ES group

Sarac 2017 *(Continued)*

(P = 0.89). The median time to last follow-up was 187 days (IQR 170-202 days) in the SS group, and 184 days (IQR 173–198 days) in the ES group (P = 0.16).

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Participants were randomly assigned in order of appearance (random number table: SS/ES) with exception for patients scheduled for weekend treatment, who were included in the SS group."
Allocation concealment (selection bias)	High risk	Sequence not concealed.
Blinding (performance bias and detection bias) All outcomes	Low risk	No evidence of blinding of participants, personnel or outcome assessors. Study only had objective outcomes, so lack of blinding is not likely affect outcomes.
Incomplete outcome data (attrition bias) All outcomes	Low risk	5/63 and 3/52 participants were lost to follow-up (never used device+did not come to final visit) in SC and INT groups respectively, less than 10%
Selective reporting (reporting bias)	Unclear risk	No information as to whether analysis plan was finalised before unblinded outcome data were available for analysis.
Other bias	Low risk	Baseline differences were insignificant for all variable s of interest. Although there was a deviation from the intervention (phone calls to reinforce use of machine), this was done for all participants regardless of group assignment.
Bias arising from the randomisation process (ROB2, primary outcome)	High risk	Authors report, "The remaining 115 patients were randomly 1: 1 assigned to standard support (SS) group (general information about OSA and PAP treatment at baseline), or to educational support (ES) group (additional polysomnography chart viewing from both diagnostic and titration nights). Participants were randomly assigned in order of appearance (random number table: SS/ES) with exception for patients scheduled for weekend treatment, who were included in the SS group." Key baseline characteristics (age, gender, BMI, AHI) were reported and differences were insignificant (P values reported), consistent with chance.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Unclear risk	No blinding. Authors report, "... the patients not coming to the scheduled follow-up visit were contacted by phone by the sleep physician, which might have reinforced the patients participation. This might be considered a bias. However, the phone calls were done for all participants regardless of the group allocation." It is not clear that phone call reminders were an intended aspect of the protocol or added later (i.e. a deviation). ITT. Authors report, "Two patients in the SS group, and two patients in the ES group never used their devices, and their CPAP usage hours/night was included in the final analysis as 0."
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Low risk	Authors report, "Two patients in the SS group, and two patients in the ES group never used their devices...." Thus, outcome data were available for 96.5% of randomised participants.
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring; devices identical or sufficiently similar (i.e. similar distributions of CPAP device make) across groups. This study permitted use of CPAP, APAP and BiPAP; however, distribution comparable across intervention arms as per authors, "Distrubu-

Sarac 2017 *(Continued)*

		tion of CPAP, APAP, and BPAP devices was 71.4%, 4.8%, and 23.8%, respectively, in the SS group, and 71.2%, 7.7%, and 21.2%, respectively, in the ES group (p=0.65)." Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Unclear risk	ClinicalTrials.gov entry (NCT02756299) indicates that the current primary outcome was unchanged from original primary outcome measure, "Positive Airway Pressure usage (hours/night) (Time Frame: 6 months) - Satisfactory device usage defined as minimum 4 hours of night during at least 70% of period based on the objective measures from the device." (submitted 26 Apr 2016). Final data collection date for primary outcome was April 2015. In published report, the primary outcome endpoint was defined only as 'at the last visit' and time of this 'long-term compliance' outcome varied across participants. No information as to whether analysis plan was finalised before unblinded outcome data were available for analysis. Given that primary endpoints not defined and outcomes assessed at 5 time points, insufficient information to determine if 'short-term' and 'long-term' endpoint definitions were prespecified. Short-term compliance outcome not mentioned in NCT entry. Methods section indicates that one, commonly-employed threshold adherence definition was planned; this outcome was reported in Results.
Overall risk of bias (ROB2, primary outcome) Machine usage	High risk	-

Sawyer 2017

Methods	Randomised, parallel-group study.
Participants	**N = 118** adults with newly diagnosed OSA Any adult patient referred for a diagnostic PSG was invited to participate in the study. **Inclusion criteria:** newly diagnosed with OSA (AHI > 10), PAP-naive, ≥18 years of age, able to read and speak English. **Exclusion criteria:** previous diagnosis or treatment of OSA; medical record documented new psychiatric diagnosis within previous six months of study enrolment; requirement of supplemental oxygen or bilevel PAP identified on PAP titration PSG suggesting diagnosis other than OSA; diagnosis of another sleep disorder in addition to OSA based on polysomnogram (i.e. periodic limb movement disorder [≥10 limb movements/hr of sleep with arousal], central sleep apnoea [≥ 5/hours central apneas], insomnia, sleep hypoventilation syndrome, or narcolepsy). **Baseline characteristics (per-protocol):** 30% female. **Mean age** 51.3 (±11.1). **Mean AHI** = 36. **Mean ESS**= 19.6. **Mean BMI**=38.0. **Country: USA**
Interventions	Participants were randomised to receive usual care (UC, n = 57) or a multi-phased and tailored intervention (TI, n = 61) targeting social cognitive perceptions of OSA–PAP treatment. **TI:** intervention addressed cognitive perceptions of the diagnosis and treatment, outcome expectancies with PAP treatment, and PAP treatment self-efficacy, all domains of SCT. Intervention delivered in four phases: prediagnosis, postdiagnosis (i.e. postdiagnostic polysomnogram), immediately post-PAP titration polysomnogram, and with week 1 of home PAP treatment. Intervention delivery guided by a

Sawyer 2017 *(Continued)*

	protocol and script templates for specific exposure phases to minimise a potential interventionist effect. **UC:** followed current practice standards for the diagnosis and treatment of OSA in adults (Epstein 2009; Kushida 2006). Included sleep centre–provided informational brochures about OSA, diagnostic testing, and PAP prescription. In addition, access by telephone to sleep centre staff for problems, questions, or concerns was provided during daytime and evening. **Study duration:** 3 months
Outcomes	• CPAP usage (hours/night) at 1 week, 1 month and 3* months. • N of adherent participants (usage ≥ 4 hours per night) at 1 week, 1 month and 3* months. • Withdrawals
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomisation employing random block sizes assigned participants to the exposure or comparison group and within each assignment level, 50% were randomly assigned to interview–no interview at study termination and debriefing. A randomisation list was generated by the study biostatistician (TSK) and securely maintained at the clinical research site.
Allocation concealment (selection bias)	Low risk	Random assignment was concealed and completed by consecutive sealed envelope, then opened sequentially by interventionist and study research assistant; sealed envelopes were secured, prepared, and monitored by unblinded study personnel
Blinding (performance bias and detection bias) All outcomes	Low risk	No evidence of blinding of participants, personnel or outcome assessors. Study only had objective outcomes, so lack of blinding is not likely affect outcomes.
Incomplete outcome data (attrition bias) All outcomes	High risk	Data not available for participants excluded (intentionally) post-randomisation. Reported reasons for missing outcome data may be related to health status.
Selective reporting (reporting bias)	Low risk	Published report Methods provides a comprehensive description of the intervention design, intervention protocol, study design, setting and sample, measures and analysis. Additionally, the pre-specified plan included per-protocol fidelity measures and a blinding assessment for participants upon study completion.
Other bias	Low risk	No baseline imbalances or reported/suspected deviations from intended intervention.
Bias arising from the randomisation process (ROB2, primary outcome)	Low risk	Authors report: "After pre enrolment screening and informed consent, participants completed a demographic questionnaire and were randomised. Randomization employing random block sizes assigned participants to the exposure or comparison group and within each assignment level, 50% were randomly assigned to interview–no interview at study termination and debriefing. A randomisation list was generated by the study biostatistician (TSK) and securely maintained at the clinical research site. Random assignment was concealed and completed by consecutive sealed envelope, then opened sequentially by interventionist and study research assistant; sealed envelopes were secured, prepared, and monitored by unblinded study personnel (DAS)."

Sawyer 2017 *(Continued)*

		Key baseline characteristics (age, gender, BMI, AHI) were reported and differences were insignificant (P values reported), consistent with chance.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	Authors report, "In order that a participant blind was supported from the outset of the trial, IRB-approved consent modification was employed that specifically did not differentiate between study groups in terms of study activities or time commitment and a limited description of the overall study objective; this necessitated debriefing at study termination." Regarding investigator blinding, authors report: "The intervention was delivered by one research assistant (study interventionist, unblinded, MV), a registered nurse without sleep specialty care experience, who was extensively trained to provide the tailored intervention." participants were randomised prior to PSG; therefore, some of the inclusion criteria could only be assessed after randomisation. Of the 118 randomised participants, 30 (18 in intervention arm and 12 in control arm) were excluded based on failure to meet AHI = 10 inclusion criteria. Additionally, authors report: "Exclusions or withdrawals occurred for the following reasons: refused PAP (n = 2), referred to other treatment (n = 1), and titrated on other positive airway device for other sleep-related breathing disorders (n = 10). Specific to the protocol, four participants did not complete titration PSG and eight participants requested to withdraw due to personal (i.e. transportation, familial issues, work-related issues) or other pressing health problems. The remaining participants (n = 60) completed the protocol; no attrition or loss of data for the PAP use outcome or feasibility and acceptability outcomes occurred. No study-related adverse or serious adverse events occurred." Non-OSA or BiPAP-requiring sleep disorders were planned exclusionary criteria; these exclusions should not be considered protocol deviations. Additionally, CPAP refusal and referral to other treatment (by provider) are also not deviations from intended interventions in this study. Thus, consistent with author's report, only 12 protocol deviations (6 in each arm) occurred. Administrative withdrawal: 2/31, 2/27; subject withdrawal: 4/31 and 4/27. mITT. Outcome data were not available for participants who withdrew (n = 12).
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Unclear risk	Data not available for participants excluded (intentionally) post-randomisation. Neither analyses to correct for bias nor sensitivity analyses were conducted. It is possible that withdrawals were related to health status, as per the reasons outlined in the report (transportation, familial issues, work-related issues, pressing health problems). The proportion of missing outcome data is similar across groups. Reported reasons make it possible that missingness is related to its true value. However, reported reasons do not differ between groups. While continuing symptoms may have made it more likely for participants to drop out, the roughly equivalent withdrawal rates across groups makes it unlikely that this would have resulted in substantial differences in the estimated effect of the intervention.
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Unclear risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring. Outcome "assessor" is CPAP device: no knowledge of allocation possible. Unable to confirm with study author that distribution of CPAP device makes did not differ between intervention arms.
Bias in selection of the reported result (ROB2, primary outcome)	Low risk	Published report Methods provides a comprehensive description of the intervention design, intervention protocol, study design, setting and sample, measures and analysis. Additionally, the pre-specified plan included per-protocol

Sawyer 2017 *(Continued)*

All outcomes		fidelity measures and a blinding assessment for participants upon study completion. Methods section indicates that multiple time points planned; each planned outcome reported. Methods section indicates that one, commonly-employed threshold adherence definition was planned; this outcome was reported in Results. No evidence that multiple analyses (e.g. variable adherence 'thresholds') were conducted.
Overall risk of bias (ROB2, primary outcome) Machine usage	Unclear risk	-

Scala 2012

Methods	Randomised, parallel-group study.
Participants	**N = 28** patients with newly-diagnosed OSAS. **Inclusion criteria:** newly-diagnosed, OSAS. **Exclusion criteria:** not reported. **Baseline characteristics:** 75.3% female.**Mean age** 57 (±11.2). **Mean AH**I NR. **Mean ESS** 12.6. **Mean BMI** NR. **Country:** Italy
Interventions	Participants were randomised to standard care (SC, n = 15) or an educational intervention (EDU, n = 13). **EDU:** 3 interactive sessions, video with discussion, focus group and role play, respectively 1, 2 and 3 months after receiving the CPAP device. **Study duration:** 6 months
Outcomes	• CPAP usage (hours/night) at 6 months (12 month results pending at time of report) • Sleepiness (ESS) • QoL (SF-36) • Sleep quality (PSQI) Outcomes measured at 6 months.
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	No information provided regarding randomisation or how randomisation was achieved.
Allocation concealment (selection bias)	Unclear risk	No information related to allocation concealment method.
Blinding (performance bias and detection bias) All outcomes	High risk	No evidence of blinding of participants, personnel or outcome assessors. Study had subjective outcomes, so knowing group assignment could influence these outcomes.

Scala 2012 *(Continued)*

Incomplete outcome data (attrition bias) All outcomes	Unclear risk	No information available regarding missing outcome data.
Selective reporting (reporting bias)	Unclear risk	No protocol, abstract, clinical trials entry available for comparison. Results presented were in accordance with the plan specified in the Methods section of the publication.
Other bias	Unclear risk	No information present to determine baseline imbalances or deviations from intended interventions.
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Based on information provided in translator form.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	Authors report analyses were conducted by intention to treat.
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Unclear risk	Based on information provided in translator form.
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring. We confirmed by personal correspondence with author that all participants received the same CPAP device make and pressure delivery system. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Unclear risk	No protocol, abstract, clinical trials entry available for comparison. Results presented were in accordance with the plan specified in the Methods section of the publication. No information as to whether analysis plan was finalised before unblinded outcome data were available for analysis. Methods section indicates that multiple time points planned. One endpoint (6-month) reported in the published study and one (12-month) noted to be 'in progress.' No evidence that multiple analyses (e.g. variable adherence 'thresholds') were conducted. No threshold-based adherence outcomes reported.
Overall risk of bias (ROB2, primary outcome) Machine usage	Unclear risk	-

Sedkaoui 2015

Methods	Randomised, parallel-group study.
Participants	**N = 379** with newly diagnosed SAHS **Inclusion criteria:** SAHS, prescribed CPAP, AHI ≥ 30 or AHI < 30 and > 10 arousals/hour, French fluency. **Exclusion criteria:** age <18 years, under guardianship, previous CPAP use, psychiatric illness, participating in another clinical trial **Baseline characteristics:** 72.0% female. **Mean age** 63. **Mean AHI** 42.2. **Mean ESS** 11.6. **Mean BMI** 40.

Sedkaoui 2015 *(Continued)*

	Country: France
Interventions	Participants were randomised to standard support (SS, n = 190) or coached support (CS, n = 189). **SS:** received information from their physician about modalities and usefulness of CPAP treatment. Technician performed CPAP set-up at participant's home, re-explained the device's function, and checked for mask fit and adaptation. Follow-up performed at 1 month and 4 months to assess CPAP parameters. **CS:** in addition to SS, participants in CS received standardised support completed through 5 sessions (day 3 , 10, 30, 60, and 90) via telephone-base counselling. Session 1 objective was to assess patient's knowledge about the disease, device and health consequences; to emphasise importance of good adherence; to encourage CPAP use throughout sleep every day. Objectives of the other educational sessions were to identify disadvantages or obstacles CPAP treatment and then focus on the benefits linked to use of CPAP. A particular effort was made to discuss misconceptions about sleep apnoea and barriers to use, concerns fears and beliefs, as well as the perceptions of their partners and family, in order to increase patients' positive expectations regarding CPAP benefits. **Study duration:** 4 months
Outcomes	• CPAP usage (hours/night) at 4 months • N of adherent participants (usage ≥ 3 hours per night) at 4 months • Withdrawals
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	"Randomization of patients was performed 1/1 ratio at each individual centre, by an automatic computer system." No reference to specific random component (e.g. random numbers generated/assigned by computer).
Allocation concealment (selection bias)	Unclear risk	No reference to allocation concealment method.
Blinding (performance bias and detection bias) All outcomes	Low risk	No evidence of blinding of participants, personnel or outcome assessors. Study only had objective outcomes, so lack of blinding is not likely affect outcomes.
Incomplete outcome data (attrition bias) All outcomes	Low risk	57 participants discontinued from the educational intervention, however, only data related to adherence was collected (and authors state that even though the intervention was discontinued, compliance was still measured for all participants).
Selective reporting (reporting bias)	High risk	Considerable evidence demonstrating that CPAP adherence time points were chosen after data was collected. The authors report, "In France, the condition for reimbursement by the national health system was a length of use of 3 or more hours per night over a 5 month period." The authors provide no justification for their choice to use a 4-month study endpoint, which is not only atypical among CPAP adherence studies but also not consistent with their cited national health system definition. Since these data are registered by the CPAP devices continuously, any endpoint within the 6-month collection period could have been used, including the one used by the national health system definition (5 months). Instead, only a 4-month endpoint was reported. With no means of determining if the 4-month primary outcome was specified prior to the availability of unblinded outcome data (NCT entry not made until after completion of primary data collection and very close to the time of final report

Sedkaoui 2015 *(Continued)*

		publication), the available information suggests the possibility that the endpoint being assessed/reported by trialists was selected on the basis of results.
Other bias	Low risk	No baseline imbalances or reported/suspected deviations from intended intervention.
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Only information provided as to the randomisation procedures used was within Methods: "Randomization of patients was performed 1/1 ratio at each individual centre, by an automatic computer system." No reference to specific random component (e.g. random numbers generated/assigned by computer) or allocation concealment method. Key baseline characteristics (age, gender, BMI, AHI) were reported for all randomised participants and differences were insignificant (P values reported), consistent with chance.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	NCT02435355: Listed as open-label on ClinicalTrials.gov entry. Published report mentions neither blinding or masking. Authors report, "Not all patients with coaching received the 5 phone calls as prescribed in the procedure due to business activity, holidays or patient requests to stop the phone calls. 85 % of patients in CG received at least 4 phone calls and 70 % received 5 phone calls. In Fig. 5, we observed a significant and gradual link between patient phone calls received and mean hours of CPAP use." The protocol included that patients in coached group (intervention arm) receive 5 sessions of telephone-based counselling. Thus, this was a protocol deviation. The reasons cited for the deviation, however, are likely not related to experimental context. Rather, they are consistent with routine care (i.e. scheduling issues, non-adherence). Authors report, "Analysis was by intention to treat. Outcome data from patients randomised in the coached group were analysed even if they dropped out of the study or refused phone calls." CONSORT flow diagram indicates that analyses were performed on randomised participants.
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Low risk	Authors report, "Outcome data from patients randomised in the coached group were analysed even if they dropped out of the study or refused phone calls." In addition to information provided in CONSORT flow diagram, this suggests outcome data were available for all participants.
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Unclear risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring. Unable to confirm with study author that distribution of CPAP device makes did not differ between intervention arms. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	High risk	Publication (2015), earlier abstract (2013) and ClinicalTrials.gov entry (first submitted 30 Apr 2015, last updated 06 May 2015) available and reviewed. Primary outcome submitted 05 May 2015 and is the same as current primary outcome (i.e. no updates/changes were submitted to ClinicalTrials.gov by authors). NCT entry and publication indicate participants were recruited from April 2010 to March 2012 and actual primary completion date was listed in NCT entry as: 'Aug 2012 (final data collection for primary outcome measure)'. There is insufficient information to determine whether analysis plan was finalised before unblinded outcome data were available for analysis particularly since information was posted to ClinicalTrials.gov in close proximity to publication of the final report (i.e. both in 2015). Although the protocol (NCT entry) and published study provide no direct evidence that multiple outcome

Sedkaoui 2015 *(Continued)*

		endpoints/definitions were planned or evaluated, other information provided raises some concerns about the possibility of selective reporting. According to protocol (NCT entry) and methods section of the published report, the authors planned one threshold-based adherence definition (> 3 hours per night for the first 4 months) and this was the only threshold-based outcome reported in Results. The authors report, "In France, the condition for reimbursement by the national health system was a length of use of 3 or more hours per night over a 5 month period." Thus, although the 3-hour threshold definition is not one that is commonly-employed by other trialists in the literature, the use of this nightly threshold is reasonable for a study in France. On the other hand, the authors provide no justification for their choice to use a 4-month study endpoint, which is not only atypical among CPAP adherence studies but also not consistent with their cited national health system definition. Furthermore, CPAP usage data was collected/downloaded at both a 3- and 6-month visit. Since these data are registered by the CPAP devices continuously, any endpoint within the 6-month collection period could have been used, including the one used by the national health system definition (5 months). Instead, only a 4-month endpoint was reported. With no means of determining if the 4-month primary outcome was specified prior to the availability of unblinded outcome data (NCT entry not made until after completion of primary data collection and very close to the time of final report publication), the available information suggests the possibility that the endpoint being assessed/reported by trialists was selected on the basis of results. Finally, the difference between intervention and control group is small (for both primary and secondary outcomes) and only barely reach statistical significance, selection bias could have influenced the reported effect estimates.
Overall risk of bias (ROB2, primary outcome) Machine usage	High risk	-

Shapiro 2017

Methods	Randomsied parallel-group trial
Participants	**N = 46** newly-diagnosed with OSA and prescribed CPAP for the first time. **Inclusion criteria:** ≥ 18 years; newly-diagnosed by PSG; commencing CPAP for first time; able to read/speak/understand/write English; CPAP with smart card technology **Exclusion criteria:** requires BiPAP, significant craniofacial abnormalities, Downs syndrome, cognitive delay, hypotonia, neuromuscular degenerative disorder, taking anti-anxiety medication, pregnant. **Baseline characteristics:** 45.5% female, **Mean age** 51.8 (13.1). **Mean AHI** 26.2. **Mean ESS** NR. **Mean BMI** 35.7. **Country:** USA
Interventions	Participants were randomised to standard care (SC, n = 33) or CPAP-SAVER Intervention (CI, n = 33). **SC:** basic OSA and CPAP teaching and follow-up provided by respiratory therapist/CPAP education employed by home medical supplier. **CI:** Standard care plus airway model, video education sheet, report card components, support calls.
Outcomes	• CPAP usage (hours/night) at 1 month • Anxiety symptoms (BAI) at 1 month • Withdrawals

Shapiro 2017 *(Continued)*

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomisation procedures adequately described and were sufficient.
Allocation concealment (selection bias)	Unclear risk	There is insufficient information regarding allocation concealment to make a determination as to whether it was possible for enrolling investigators/staff to have knowledge of forthcoming allocation.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Authors report participants were "masked as to group assignment," but do not describe the methods by which this masking was carried out for a behavioural intervention. Study had subjective outcomes, so knowing group assignment could influence these outcomes.
Incomplete outcome data (attrition bias) All outcomes	Low risk	1 of 33 (intervention) and 0 of 33 (control) were lost to attrition.
Selective reporting (reporting bias)	Low risk	This is a dissertation and the author presents a comprehensive protocol with design and analytic plan. Thus, it is likely that analytic plan was finalized before unblinded outcome data were available for analysis.
Other bias	Low risk	No baseline imbalances reported for variables of interest. Although there was a deviation from protocol (reduction of number of study sites) this seems to not have resulted in a deviation from the intended intervention.
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	After consent, participants were randomly assigned to either the intervention or control group, and were masked as to group assignment. Randomisation procedures: the investigator prepared 33 manila clasp envelopes; the contents included a sheet with the word Intervention printed on it...The envelopes were numbered sequentially from one through 33; this number served as the participant's identification number.... The investigator prepared another 33 manila envelopes; the content included a sheet with the words Standard care printed on it...The envelopes were numbered sequentially from 34 through 66; this number served as the participant's identification number. The investigator mixed all the envelopes into one batch and shuffled them 10 times. The investigator divided the shuffled envelopes into four piles, one pile for each home medical supply facility site (Sites A, B, C, and D). According to this description, the investigator who prepared the envelopes would be aware of the allocation contained within each envelope based on viewing the outside of the envelope. It is not clear whether any other investigator/staff (e.g. those responsible for selecting the next envelope from the stack) was also aware of the sequence correlation (i.e. that lower numbers were assigned to intervention and higher numbers to control). Additionally, author reports that, due to withdrawal of sites from the study, "unused envelopes from Sites B, C, and D were taken to Site A." It is unclear who delivered those unused envelopes. There is insufficient information regarding allocation concealment to make a determination as to whether it was possible for enrolling investigators/staff to have knowledge of forthcoming allocation. Mean and SD for all key baseline characteristics (age, gender, BMI, AHI) were reported for all randomised participants. Authors reported that differences were non-significant: "After comparing the frequencies (chi-square tests) and descriptives (independent samples t-tests) analyses by group, the groups were determined to be homogeneous. There were no statistically significant differ-

Shapiro 2017 *(Continued)*

		ences between the intervention and standard care groups as to general and sleep demographics."
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	Authors report participants were "masked as to group assignment," but do not describe the methods by which this masking was carried out for a behavioral intervention. Authors report, "The initial number of sites was four (Sites A, B, C, and D). Two sites were lost to attrition (Sites C and D) due to the unavailability of a respiratory therapist to provide CPAP teaching. As these two sites withdrew from the study, recruitment slowed at Site B, and recruitment progressed at Site A, unused envelopes from Sites B, C, and D were taken to Site A. Additional envelopes were provided to sites as needed; all 66 envelopes were used." Though this is a deviation from planned randomisation protocol, it did not appear to result in a deviation from the intended intervention. Moreover, "[I]ntervention fidelity was maintained with the use of a protocol training manual and initial and booster training sessions to prepare the research assistants; monthly fidelity checks were conducted with no problems noted." (p. 102) From Methods, "If participants were noted to have values that appeared missing at random, their data was included in the analyses. Other missing data were evaluated on a case-by-case basis and excluded from analyses" From Results, "One intervention group participant was lost to attrition midway through the study. Missing data were determined to be missing at random and were included in the statistical analyses; where applicable, cases were excluded pairwise." These descriptions do not describe how missing data were 'included,' e.g. last observation carried forward, imputation, set to 0, excluded. However, there is no evidence that trialists used either 'as-treated' or naive per-protocol analysis. Rather, report suggests that all participants were analysed in the group to which they were randomised.
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Low risk	1 of 33 (intervention) and 0 of 33 (control) were lost to attrition.
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring; devices identical or sufficiently similar (i.e. similar distributions of CPAP device make) across groups. The distribution of Philips and ResMed devices were equal in each arm. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Low risk	Authors report, "Before data was collected, IRB approval and informed consent were obtained." Additionally, this is a dissertation and the author presents a comprehensive protocol with design and analytic plan. Thus, it is likely that analytic plan was finalised before unblinded outcome data were available for analysis. Methods section indicates that two time points were planned; each planned outcome reported. Methods section indicates that one, commonly-employed threshold adherence definition was planned; this outcome was reported in Results.
Overall risk of bias (ROB2, primary outcome) Machine usage	Unclear risk	-

Smith 2006

Methods	Randomised parallel-group trial
Participants	**N = 19** with newly-diagnosed OSA, non-adherent with CPAP for 3 months **Inclusion criteria:** new OSA diagnosis, first CPAP prescription, received initial education on CPAP use and supplemental audiotaped/videotaped reinforcement at two and four weeks, non-adherent with CPAP for 3 months **Exclusion criteria (unclear if a priori):** positive screen for drug or alcohol abuse, depression requiring hospitalisation **Baseline characteristics:** % female NR. **Mean age** 63 (± 8). **Mean AHI** NR. **Mean ESS** NR. **Mean BMI** NR. **Country:** USA
Interventions	Participants were randomised to control (n = 9) or intervention (n = 10) group. **Intervention:***t*wo-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
Outcomes	• N of adherent participants (usage ≥ 4 hours/night on ≥ 9 of 14 nights) at 12 weeks • 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 September 2008. Carol Smith responded 15 September 2008. For updated review, further email communication was required to verify that updated inclusion criteria were met, confirmation received from Carol Smith, 27 March 2019.

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)	Low risk	All participants finished follow-up and contributed to data on adherence. Two satisfaction surveys were not submitted (one from each group)

Smith 2006 *(Continued)*
All outcomes

Selective reporting (reporting bias)	Unclear risk	Information not available
Other bias	Unclear risk	Information not available
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Only information provided as to the randomisation procedures used was within Methods: "After the University of Kansas Medical Center's Institutional Review Board approval, the random assignment process began." No reference to random component or allocation concealment method. Regarding baseline characteristics, the authors provided no table. They reported, "Group 1 and group 2 were compared using two group t test statistics to assure there were no between-group differences. Mean ages of the two groups did not differ. Patient ages ranged from 50 to 83, with a mean of 63 +/- 7.95. All patients' respiratory distress index (RDI) scores were all in the severe range with scores not differing significantly between groups 1 and 2 (t test = 0.737, P = 0.471). These results indicate there was no significant difference between group 1 and group 2 on age or severity of sleep apnoea. Thus, age or severity of sleep apnoea did not influence outcomes of adherence." Thus, authors report that differences in age and baseline OSA severity are consistent with chance. However, they do not report (and may not have evaluated) baseline differences in gender or BMI. There was no information on some potentially influential baseline characteristics. Given the date of the publication and the author affiliation with a VA hospital, as well as the small N, Review authors suspect this study was conducted on all male participants.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	No deviations documented; none suspected based upon review. Outcome based on all randomised participants based on denominators used for calculation of proportions adherent, "A higher percentage of group 1 than group 2 participants were adhering to CPAP after the telehealth interventions (X2=4.55, P = 0.033). Specifically, 90% (n = 9 of 10) of group 1 compared to 44% (n = 4 of 9) of group 2 participants were adherent after the telehealth sessions."
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Low risk	Authors report, "...there were only 3 episodes of transmission problems, each easily corrected." This suggests that there were no missing outcome data.
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	The adherence outcome measurement comes from participants' CPAP ventilator timer-recorder. This is consistent with CPAP technology available at the time of the study. Each intervention group outcome data ascertained via automated CPAP device monitoring; devices identical or sufficiently similar (i.e. similar distributions of CPAP device make) across groups (verified via author correspondence). Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Unclear risk	No protocol, abstract, clinical trials entry available for comparison. Results presented were in accordance with the plan specified in the Methods section of the publication. Methods section indicates one outcome time point (for primary adherence outcome) was planned. Results section reports one outcome time point. Methods section indicates that one, commonly-employed threshold adherence definition was planned; this outcome was reported in Results. No evidence that multiple analyses (e.g. variable adherence 'thresholds') were conducted.
Overall risk of bias (ROB2, primary outcome)	Unclear risk	-

Smith 2006 *(Continued)*

Machine usage

Smith 2009

Methods	Randomised parallel-group trial
Participants	**N = 97** patients with newly-diagnosed OSA. Mean age: 63.4, male sex: 55%, Mean AHI: Intervention group: 52.3, Control group: 47.3 **Inclusion criteria:** new diagnosis of OSA, age ≥ 18, AHI ≥ 20 **Exclusion criteria (unclear if a priori):** positive screen for drug or alcohol abuse, depression requiring hospitalisation **Baseline characteristics:** 45% female. **Mean age** 63. **Mean AHI** 50.1. **Mean ESS** NR. **Mean BMI** NR. **Country:** USA
Interventions	Participants were randomised to control (n = 42) or CPAP Habit Intervention (Intervention, n = 55) group.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:** 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:** 6 months
Outcomes	• N adhering to CPAP (≥ 4 hours/day and ≥ 9 of 14 nights) at 1, 3* and 6 months • Self-reported audiotape/diary use • Participant satisfaction • Withdrawals
Notes	* Indicates primary outcome analysed in this review.

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

Smith 2009 *(Continued)*

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
Selective reporting (reporting bias)	Unclear risk	Information not available
Other bias	Unclear risk	Information not available
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Only information provided as to the randomisation procedures used was within Methods "Patients were randomly assigned to the intervention (n=55) or the placebo control group (n=42) using computerized random assignment program." No reference to random component or allocation concealment method. Key baseline characteristics (age, gender, BMI, AHI) were reported and differences were insignificant (P values reported), consistent with chance. Though not explicitly stated (and no Ns provided in baseline tables), these appeared to reflect all randomised participants.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	Authors report, "Trained personnel used a software program to obtain nightly CPAP use of > or < 4 hours at 1, 2 and 6 months from these data cards. These personnel were blind to allocation of treatment." Additionally, "Patients were given pre-paid, addressed envelopes for returning the completed diary pages to the research centre. Research nurses contacted patients by telephone monthly reminding them to use their respective intervention, write in their diary and return their diary pages by mail to the research centre. These nurses were blinded to the data and evaluations participants mailed in." Therefore research nurses responsible for delivering intervention were aware of intervention assignment. No deviations documented; none suspected based upon review. ITT. Authors report (in Table 9 caption), "No participants had dropped out of the study at one month post intervention. participants who dropped out from the study (numbers listed below) had either stopped using CPAP, had less than 4 hours of CPAP use, or were lost to contact. Per the intent-to-treat analysis all dropouts remained in each analysis. Dropouts lost to contact were counted as non-adherent."
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Low risk	Authors report three primary endpoints: 1, 3, 6 months. Outcome data were available for 97 of 97 at 1 month, 94 of 97 (96.9%) at 3 months and 73 of 97 (75.3%) at 6 months.
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome measured using objective CPAP usage data. Intervention group outcome data ascertained via automated CPAP device monitoring; devices identical or sufficiently similar (i.e. similar distributions of CPAP device make) across groups. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Unclear risk	No protocol, abstract, clinical trials entry available for comparison. Results presented were in accordance with the plan specified in the Methods section of the publication. No information as to whether analysis plan was finalised before unblinded outcome data were available for analysis. Methods section indicates that multiple time points planned; each planned outcome reported. Authors chose an uncommon threshold definition of CPAP adherence, "4 or more hours per night and at least 9 of each 14 nights of ventilator use." The published report also does not explicitly state how this standard was applied

Smith 2009 *(Continued)*

		to the 'CPAP nightly use data' collected at 1-, 3- and 6-month endpoints. Review authors are not clear as to how proportion adherent was calculated at each endpoint. For example, was 1-month adherence threshold set at 64.3% of nights for 30-day or calendar month, or was it calculated based on a 28 day month to preserve multiples of 14 days? Each option would yield different adherence proportions.
Overall risk of bias (ROB2, primary outcome) Machine usage	Unclear risk	-

Soares-Pires 2013

Methods	Randomised, parallel-group study.
Participants	**N = 202** patients with OSAHS. **Inclusion criteria:** AHI ≥15 or ≥5 events per hour plus symptoms that included unintentional sleep episodes while awake, daytime sleepiness, unrefreshing sleep, fatigue, insomnia, gasping or choking, or loud snoring and/or apnoea described by the patient's bed partner. **Exclusion criteria:** lung disease, obesity hypoventilation syndrome, restrictive ventilatory syndromes, long-term oxygen therapy, Cheyne–Stokes breathing pattern, central apnoea, cognitive disability. **Baseline characteristics:** 29.5% female. **Median age** 58.5. **Median AHI** 38. **Median ESS** 12. **Median BMI** 32. **Country:** Portugal
Interventions	**Education group:** participants were assigned to a single group education session one month after beginning APAP therapy. Sessions were conducted by a pulmonologist, a psychologist, and a respiratory physiotherapist. Sessions included information regarding OSAHS, its symptoms and risks, APAP treatment, the importance of good adherence, and different machine interfaces. Patients were invited to share their experience on the use of APAP, and each patient's adherence reports were analysed and discussed. Patients' concerns, fears, and beliefs were also addressed. **Standard Care:** the sleep physician provided a brief explanation of the disease to patients of both groups, as well as informed patients of the need for APAP treatment, its benefits and function mode. None of the patients had previously received any form of PAP therapy. Approximately 3–5 days after the prescription, technicians from the PAP systems delivery companies performed a home visit to drop the APAP device. In this visit, an explanation on how to turn on and off the machine and on the placement of the interface was provided to all patients. **Study duration:** 6 months
Outcomes	• CPAP usage (hours/night) at 6 months. • N of adherent participants (usage > 4 hours/night for ≥ 70% days • withdrawals
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	No reference to random component or allocation concealment method.

Soares-Pires 2013 *(Continued)*

Allocation concealment (selection bias)	Unclear risk	No reference to random component or allocation concealment method.
Blinding (performance bias and detection bias) All outcomes	Low risk	No evidence of blinding of participants, personnel or outcome assessors. Study only had objective outcomes, so lack of blinding is not likely affect outcomes.
Incomplete outcome data (attrition bias) All outcomes	High risk	Data were available/analysed for 146 of 202 (72.3%) randomised participants.
Selective reporting (reporting bias)	High risk	No protocol, abstract, clinical trials entry available for comparison. However likely that definition was chosen for its result.
Other bias	Unclear risk	Incomplete information available regarding baseline differences for variables of interest. No deviations from intended interventions reported or suspected.
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Only information provided as to the randomisation procedures used was within METHODS: "Patients were randomised into a study group and a control group. All patients in the study group were assigned to a single group education session, approximately 1 month after beginning APAP therapy (Fig. 1). Patients in the control group did not participate in the education session." No reference to random component or allocation concealment method. In the Methods (Study Design) section, and in the study design flow diagram (Figure 1), authors report that 202 participants were randomised to study arm, GI (n = 100) and control arm, G2 (n = 102). In the results section, authors report, "We evaluated 146 patients, 103 (70.5 %) males and 43 (29.5 %) females, with a median age of 58.5 years. Most patients were obese, hypertensive, and had severe OSAHS (Table 1). Baseline demographic and clinical characteristics did not differ in the study and control groups (Table 1)." This implies that Table 1 provides baseline characteristics and comparisons for only those who were analysed (n = 146) rather than for all randomised participants (n = 202). Therefore, cannot determine if baseline differences between intervention groups suggests a problem with randomisation.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	No deviations documented; none suspected based upon review. Probably mITT.
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	High risk	Data were available/analysed for 146 of 202 (72.3%) randomised participants. Neither analyses to correct for bias nor sensitivity analyses were conducted. Missing outcome data occurred for undocumented reasons and, therefore, missingness could be related to the outcome. There are no significant differences between intervention arms in the proportions of missing outcome data. However, there are no reasons for missing outcome data other than 'dropped out,' so review authors cannot evaluate whether specific reasons provide evidence that missingness depends on true value or whether these reasons differ across intervention arms. Without this information, it is likely that those who are non-adherent would be more likely to drop out and that, therefore, missingness depends on the true value of the outcome (adherence). Per Cochrane Handbook, 8.13.2.2, "Even if incomplete outcome data are balanced in numbers across groups, bias can be introduced if the reasons for missing outcomes differ." Since authors provide no information as to the reasons for dropouts, the potential for bias cannot be adequately assessed.

Soares-Pires 2013 *(Continued)*

Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Unclear risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring. Authors reported using one of two device makes in the study (ResMed, Breas), but did not provide information as to the distributions of device make in each intervention arm. Outcome "assessor" is CPAP device: no knowledge of allocation possible. Unable to confirm with study author that distribution of CPAP device makes did not differ between intervention arms.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	High risk	No protocol, abstract, clinical trials entry available for comparison. Results presented were in accordance with the plan specified in the Methods section of the publication. No information as to whether analysis plan was finalised before unblinded outcome data were available for analysis. Methods section indicates one outcome time point (for primary adherence outcome) was planned. Results section reports one outcome time point. Authors report, "After 6 months of APAP therapy, usage data were downloaded by sleep technicians during a home visit. Adherence data, air leakage, air pressure delivered, and residual AHI were recorded. Adherence was analysed as a continuous and as a dichotomous variable. When analysed as a continuous variable, we recorded the percentage of days the APAP was used and the mean effective use per [*]effective day, defined as the cumulative time of effective use divided by the number of days APAP was actually used. When analysed as a dichotomous variable, we compared adherent versus non-adherent. Patients were defined as being adherent if they used APAP at least 4 hours per night for at least 70 % of days." These outcomes were reported in results section. However, standard reporting for daily use is mean use per day over *all days in the study period. Mean use per effective day will result in upward bias in usage estimates. Since mean use per day was likely also calculated, the decision to report mean use per effective day suggests that the numerical result being assessed was selected on the basis of the results from multiple outcome measurements. Methods section indicates that one, commonly-employed threshold adherence definition was planned; this outcome was reported in Results.
Overall risk of bias (ROB2, primary outcome) Machine usage	High risk	-

Sparrow 2010

Methods	Randomised parallel-group trial
Participants	**N = 250** patients undergoing initial set-up of fixed-pressure CPAP or BiPAP. **Inclusion criteria:** age 18 to 80 years, AHI > 10 **Exclusion criteria:** Not reported **Baseline characteristics:** 18% female. **Median age** 55. **Median AHI** 38.3. **Median ESS** 10.5. **Median BMI** 35.1. **Country:** USA
Interventions	Participants were randomised to control (n = 126) or interactive voice response system, TLC-CPAP (TLC-CPAP , n = 124) group. **TLC-CPAP:** 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, feed-

Sparrow 2010 *(Continued)*

	back 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:** 12 months
Outcomes	• Machine usage (data downloaded from memory cards or by direct interrogation of CPAP devices) at 6* and 12 months. • N of adherent participants (usage > 4 hours per night) • Self-efficacy index • Decisional balance index • Withdrawals
Notes	* Indicates primary outcome analysed in this Review.

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
Selective reporting (reporting bias)	Unclear risk	Information not available
Other bias	Unclear risk	Information not available
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Only information provided as to the randomisation procedures used was within Methods: " Participants were then randomised to one of two groups: one group used an educational control TLC system ('attention placebo control group') and the other group used the TLC-CPAP system. Randomisation was stratified by sex, age and AHI using a randomised block design to ensure balance of these factors in the treatment arms." 250 participants were randomised: 124 to intervention, 126 to control. Key baseline characteristics (age, gender, BMI, AHI) were reported for all randomised participants and differences were insignificant (P values reported), consistent with chance.

Sparrow 2010 *(Continued)*

Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	Analyses were performed by intention-to-treat. No deviations documented; none suspected based upon review. Authors report, "Analyses were performed by intention to treat." Results report, "CPAP adherence data were available from either the 6- or 12-month follow-up visit in 93.6% of participants (figure 1), who were therefore included in the primary analysis." This suggests primary CPAP usage results were based on mITT analyses.
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Unclear risk	Authors report, "CPAP adherence data were available from either the 6- or 12-month follow-up visit in 93.6% of participants (figure 1)." Participant flow shows that 110 of 124 (88%) randomised to intervention arm had CPAP adherence data at 6-month endpoint; 112 of 126 (88%) in control arm. Despite the availability of outcome data for at least one endpoint (6- or 12-month) in 93.6% of participants, each group had < 90% of outcome data at each endpoint. Moreover, authors did not provide information as to the reasons for missing data and there was a slight imbalance in missing data across arms at 12 months (83.8% in intervention arm, 88.1% in control arm). Per Cochrane Handbook, 8.13.2.2, "Even if incomplete outcome data are balanced in numbers across groups, bias can be introduced if the reasons for missing outcomes differ." Since authors provide no information as to the reasons for missing data, the potential for bias cannot be adequately assessed.
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring. Unable to confirm with study author that distribution of CPAP device makes did not differ between intervention arms. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Low risk	Publication (2010) and ClinicalTrials.gov entry, NCT00232544 (first submitted 30 Sep 2005, last updated 10 Oct 2018) available and reviewed. Actual primary completion date is listed as 'March 2008 (final data collection date for primary outcome measure.' Original primary outcome (submitted 30 Sep 2005) was "Objective CPAP use and disease specific quality of life at 6 and 12 months" and current primary outcome (submitted 31 Dec 2013) is "Objective CPAP Use (Time Frame: 12 months) Mean nightly hours of CPAP use over 12 months." Published report (2010) includes both 6- and 12-month endpoints. Though the trialists do not explicitly state that analysis plan was finalised before unblinded outcome data were available for analysis, the original primary outcomes were submitted well before primary completion date and are identical to outcomes reported in published report. Methods section indicates that multiple time points planned; each planned outcome reported. No evidence that multiple analyses (e.g. variable adherence 'thresholds') were conducted. No threshold-based adherence outcomes reported.
Overall risk of bias (ROB2, primary outcome) Machine usage	Unclear risk	-

Stepnowsky 2007

Methods	Randomised parallel-group trial
Participants	**N = 45** patients newly-diagnosed with OSA. **Inclusion criteria:** AHI ≥ 15, no prior CPAP treatment, stable sleep environment

Stepnowsky 2007 *(Continued)*

	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 co-morbid medical conditions that could interfere with daily use of CPAP **Baseline characteristics:** 2% female. **Mean age** 59 (±14.3). **Mean AHI** 39. **Mean ESS** 12.6. **Mean BMI** 32.8. **Country:** USA
Interventions	Participants were randomised to usual care (UC, n = 24) or telemonitoring (TM, n = 21) group. **TM:** 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 apneas and hypopnoeas per hour of sleep) **UC:** 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:** 2 months
Outcomes	• CPAP usage (hours/night) • % nights with CPAP use > 4 hours • Sleepiness (ESS) • QoL (FOSQ) • Depressive symptoms • AHI • CPAP self-efficacy • Communication with healthcare team • Withdrawals All outcomes reported at 2 months.
Notes	For original (Wozniak 2014) review: 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"
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"

Stepnowsky 2007 *(Continued)*

Selective reporting (reporting bias)	Unclear risk	Information not available
Other bias	Unclear risk	Information not available
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Only information provided as to the randomisation procedures used was within Methods: "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." No reference to random component or allocation concealment method. Baseline characteristics were presented (Table 9) for those participants who completed the study (n = 40), not for all randomised participants (n = 45). Key baseline characteristics (age, BMI, AHI) were reported for all participants who completed the study and differences were non-significant (P values reported), consistent with chance.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	Unblinded trial. No deviations documented; none suspected based upon review. mITT.
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	High risk	40 of 45 (88.9%) randomised participants had outcome data at primary endpoint. Authors report all of these participants 'rejected' CPAP "within the first day or two," presumably after randomisation. Neither analyses to correct for bias nor sensitivity analyses were conducted. Missing outcome data occurred for documented reasons (rejected CPAP) that could be related to the outcome. 1 of 21 (4.8%) and 4 of 24 (16.7%) of control and intervention arms, respectively, rejected CPAP after randomisation. There were differences between intervention arms in the proportions of missing outcome data. Reason for missing outcome data (CPAP rejection within 1-2 days after randomisation) is related to the outcome but did not differ between groups. It is likely that missingness in the outcome depended on its true value, which may have biased estimated effect. Favours experimental. CPAP rejectors would have zero hours of use, which would disproportionately reduce average CPAP usage/adherence in the experimental arm relative to the reduction in the control arm.
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring; devices identical or sufficiently similar (i.e. similar distributions of CPAP device make) across groups. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Unclear risk	No protocol available. Results presented were in accordance with the plan specified in the Methods section of the publication. No information as to whether analysis plan was finalised before unblinded outcome data were available for analysis. Methods section indicates one outcome time point (for primary adherence outcome) was planned. Results section reports one outcome time point. Methods section lists no threshold-based adherence definition. Results table includes two threshold-based adherence outcomes, one of which was also discussed in Results (text) section. These were likely selected after analysis of results, but were not presented as primary outcome of interest.
Overall risk of bias (ROB2, primary outcome) Machine usage	High risk	-

Stepnowsky 2013

Methods	Randomised parallel-group trial
Participants	**N = 241** patients with a recent OSA diagnosis and prescription for CPAP therapy. **Inclusion criteria:** diagnosis of OSA (AHI ≥ 15), CPAP therapy prescription, and age ≥ 18 years. **Exclusion criteria:** residence in a geographical area outside of San Diego County, fatal comorbidity (life expectancy less than 6 months as indicated by physician); or significant documented substance/chemical abuse. **Baseline characteristics:** % female NR (may be all male veterans). **Mean age** 52.1 (± 13.3). **Mean AHI** 36.5. **Mean ESS** 10.6. **Mean BMI** 32.5. **Country:** USA
Interventions	Participants were randomised to telemonitoring (TM, n = 126) usual care (UC, n = 115) group. **TM:** main goals of MyCPAP intervention were to (a) allow both the patient and provider access to telemonitored adherence and efficacy data on a daily basis, (b) act on that data collaboratively to guide CPAP management and troubleshoot problems early and effectively, and (c) emphasise ways for the patient to express their preferences and needs **UC:** diagnostic sleep study, CPAP instruction and setup by trained healthcare provider, and follow-up at predetermined times (1 week, 1 month) by CPAP clinic staff. Beyond these pre-determined clinic contacts, patients were encouraged to call whenever they had a problem or concern. **Study duration:** 4 months
Outcomes	• CPAP usage (hours/night) Sleepiness (ESS) • QoL (SAQLI) • Depressive symptoms • Patient satisfaction with MyCPAP • Withdrawals Outcomes were reported at 2 and 4* months.
Notes	* Indicates primary outcome analysed in this review.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	No reference to random component provided.
Allocation concealment (selection bias)	Unclear risk	No reference to allocation concealment method.
Blinding (performance bias and detection bias) All outcomes	High risk	No evidence of blinding of participants, personnel or outcome assessors. Study had subjective outcomes, so knowing group assignment could influence these outcomes.
Incomplete outcome data (attrition bias) All outcomes	Low risk	It appears that outcome data are available for nearly all (> 95%) of participants.

Stepnowsky 2013 *(Continued)*

Selective reporting (reporting bias)	Unclear risk	No protocol, abstract, clinical trials entry available for comparison. Results presented were in accordance with the plan specified in the Methods section of the publication.
Other bias	Low risk	No baseline imbalances or reported/suspected deviations from intended intervention. Although gender was not reported, it was likely that this population was 100% male as it was conducted in a VA (Veterans Affairs) hospital in the USA.
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Only information provided as to the randomisation procedures used was within Methods: "The design was a randomised parallel group trial with blinded evaluation that compared an Internet intervention based on the wireless telemonitoring of CPAP data (i.e. Internet-based positive airway pressure care, or MyCPAP) versus a usual care CPAP treatment protocol (i.e. Usual Care, or UC)." No reference to random component or allocation concealment method. Key baseline characteristics (age, BMI, AHI) were reported for all randomised participants and differences were insignificant (P values reported), consistent with chance. Gender was reported as an intended demographic characteristic to be collected, but gender distribution among participants was not reported. Since study conducted at Veteran's Hospital in US, suspect that all participants were male, but cannot confirm.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	No deviations documented; none suspected based upon review. Authors do not report if any outcome data were missing and, if so, how missingness was handled. Thus, analysis was either ITT or mITT.
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Low risk	Authors report, "Two hundred forty-one participants were enrolled over the project period (115 to Usual Care and 126 to the MyCPAP group).The total number of withdrawals during the course of the project was seven. These were due to CPAP intolerance or subsequent self-withdrawal from the study." Baseline characteristics and 2- and 4-month outcome results are reported for 126 (intervention) and 114 (control), respectively. Depending on whether the 7 participants who withdrew were included among the reported 241 enrolled, outcome data may be missing for 2.8% to 2.9% of participants. It is also possible that only one participant had missing data since results table lists group Ns as 126 (intervention) and 114 (control). Authors do not report on missingness. It is also unclear what, if any, data were missing at 2- and 4-month endpoints and how the missingness was handled in reporting results. Regardless, it appears that outcome data are available for nearly all (> 95%) of participants.
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring; devices identical or sufficiently similar (i.e. similar distributions of CPAP device make) across groups. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Unclear risk	No protocol, clinical trials entry available for comparison. Results presented were in accordance with the plan specified in the Methods section of the publication. No information as to whether analysis plan was finalised before unblinded outcome data were available for analysis. Methods section indicates that multiple time points planned; each planned outcome reported. No evidence that multiple analyses (e.g. variable adherence 'thresholds') were conducted. No threshold-based adherence outcomes reported.
Overall risk of bias (ROB2, primary outcome) Machine usage	Unclear risk	-

Turino 2017

Methods	Prospective randomised controlled trial.
Participants	**N = 100** newly diagnosed OSA patients **Inclusion criteria:** >18 years, newly diagnosed OSA requiring treatment with CPAP (AHI >15). **Exclusion criteria:** impaired lung function (overlap syndrome, obesity hypoventilation and restrictive disorders), severe heart failure, psychiatric disorders, periodic leg movements, pregnancy, other dyssomnias or parasomnias, history of previous CPAP treatment. **Baseline characteristics:** 23% female. **Mean age** 55 (NR). **Mean AHI** 52. **Mean ESS** NR. **Mean BMI** 35. **Country:** Spain
Interventions	Participants were randomised to standard management (SM, n = 48) or a telemonitoring programme (TM, n = 52) **TM:** each CPAP device equipped with mobile 2G technology capable of sending daily information on CPAP adherence, CPAP pressures, mask leak and residual respiratory events to the web database. Automatic alarms for the provider were generated in case of mask leak >30 L/minute for > 30% of the night or usage of < 4 hours/night on two consecutive nights. In case of alarm, the pulmonary specialist medical officer of the CPAP provider contacted the patient, providing case-by-case problem solving. **SM:** patients were fitted with a mask and given a CPAP device and a leaflet explaining how to use it. A short instruction session on CPAP device use was provided to patients and partners in the sleep unit by a trained nurse. This included a practical demonstration of how to put on the mask, and the correct management and cleaning of the tubes, masks and humidifier. Information on how to turn the CPAP device on and off was provided by the homecare provider at the time of machine delivery. All patients were visited after 1 month of treatment by the nurse at the sleep unit.
Outcomes	• Machine usage (hours/night) at 1 month, 3* months • QoL (EQ-5D) • Blood pressure • BMI • Symptoms • Withdrawals • Cost-effectiveness
Notes	* Indicates primary outcome analysed in this Review.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	"Patients were randomised to have CPAP therapy managed using standard care or a telemonitoring-based strategy and followed up over 3 months." No reference to how randomisation was achieved.
Allocation concealment (selection bias)	Unclear risk	No reference to allocation concealment method.
Blinding (performance bias and detection bias) All outcomes	High risk	No evidence of blinding of participants, personnel or outcome assessors. Study had subjective outcomes, so knowing group assignment could influence these outcomes.
Incomplete outcome data (attrition bias)	Unclear risk	Authors do not report any similar outcome (dropouts, withdrawals, missing) in the published report. Authors report that all analyses would be performed

Turino 2017 *(Continued)*

All outcomes		on intent-to-treat and per-protocol basis. However, they do not report per-protocol results. Additionally, all results tables Ns correspond to randomised Ns. Thus, it is unclear if there were any missing outcome data and, if so, how that was handled in the derivation of primary mean CPAP usage/adherence.
Selective reporting (reporting bias)	Unclear risk	Dates provided in trial's NCT entry do not allow us to determine if analysis plan was finalised before unblinded outcome data were available for analysis.
Other bias	Low risk	No baseline imbalances or reported/suspected deviations from intended intervention.
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Only information provided as to the randomisation procedures used was within Methods: "Patients were randomised to have CPAP therapy managed using standard care or a telemonitoring-based strategy and followed up over 3 months." No reference to random component or allocation concealment method. Key baseline characteristics (age, gender, BMI, AHI) were reported for all randomised participants and differences were insignificant (P values reported), consistent with chance.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	Open-label. No deviations documented; none suspected based upon review. ITT. Authors report, "All analyses were performed on both an intention-to-treat and a per-protocol basis...," and "All results presented are for the intention-to-treat analysis...."
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	Low risk	Protocol (NCT02517346) includes 'abandons at 3 months: Number of patients lost at follow up at 3 months of CPAP therapy' as a secondary outcome. Authors do not report this or any similar outcome (dropouts, withdrawals, missing) in the published report. Authors report that all analyses would be performed on intent-to-treat and per-protocol basis. However, they do not report per-protocol results. Additionally, all results tables Ns correspond to randomised Ns. Thus, it is unclear if there were any missing outcome data and, if so, how that was handled in the derivation of primary mean CPAP usage/adherence. In Methods, authors report, "Given the high motivation of both professionals and patients to be involved, no dropouts were anticipated and thus a total of 100 patients were planned to be recruited." Thus, it is possible that there were no dropouts.
Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring; devices identical or sufficiently similar (i.e. similar distributions of CPAP device make) across groups. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Unclear risk	Publication (2017), abstract (2017) and ClinicalTrials.gov entry, NCT02517346 available and reviewed. NCT information first submitted 30 July 2015, last updated 15 Apr 2016. Study start date reported as January 2015. Primary outcome (CPAP adherence, hours/night, at 3 months) submitted 04 Aug2015 and is the same as current primary outcome (i.e. no updates/changes were submitted to ClinicalTrials.gov by authors). Published report includes primary outcome specified in NCT entry and also includes 1 month compliance. Actual primary completion date was listed in NCT entry as: 'Sep 2015 (final data collection for primary outcome measure)'. Dates of recruitment not specified in NCT entry. Journal submission received by journal 7 June 2016, accepted after revision 20 Nov 2016. Dates provided do not allow us to determine if analysis plan was finalized before unblinded outcome data were available for analysis. Protocol and Methods section of published report indicate one outcome time point (for primary adherence outcome) was planned. Results section reports two outcome time points, including planned primary. No evidence that multi-

Turino 2017 *(Continued)*

		ple analyses (e.g. variable adherence 'thresholds') were conducted. No threshold-based adherence outcomes reported.
Overall risk of bias (ROB2, primary outcome) Machine usage	Unclear risk	-

Wang 2012

Methods	Randomised parallel-group study.
Participants	**N = 152** participants with a new OSA diagnosis. **Incusion criteria:** new OSA diagnosis, 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' **Baseline characteristics:** 6.8% female. **Mean age** NR. **Mean AHI** 43.1. **Mean ESS**=14.1. **Mean BMI** NR. Authors did not report mean age for full sample or by intervention arm (reported only distribution Ns per (4) age groups for each arm). Also did not report average BMI for full sample or by intervention arm (reported only distrubution Ns per (4) BMI groups for each arm). **Country:** China
Interventions	Participants were randomised to one of four arms: PMR+EDU (n = 38), EDU (n = 38), PMR (n = 38), Control (n = 38). **Education (EDU only):** three nights of CPAP titration in the first week, 4-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 **Progressive Muscle Relaxation Training (PMR only):** 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. **EDU + PMR:** three nights of CPAP titration in the hospital. Combination of interventions as in Education and PMR group (see above) **Control:** one night of CPAP titration in the hospital in the first week **Study duration:** 12 weeks
Outcomes	• CPAP usage (hours/night) at 4, 8 and 12* weeks • N of adherent participants (≥ 4 hours/night and at least 9 of 14 nights ventilator use) at 4, 8 and 12 weeks of intervention • Sleepiness (ESS) • QoL • Anxiety Symptoms (State-Trait Anxiety Inventory) • Depressive Symptoms (HADS-D) • Withdrawals
Notes	Trialists included three intervention arms. One arm was Educational (EDU), one was Behavioral (PMR) and the third was Mixed (EDU+PRM). These were compared to control in respective meta-analyses (i.e. Educational, Behavioral, Mixed).

Wang 2012 *(Continued)*

*Indicates primary outcome endpoint analysed in this review.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	"The patients were randomly assigned to a control group (C), an education group (E), a PMR group (P), and an education+PMR group (E+P) by block randomisation, resulting in 38 patients each group." No reference to how randomisation was achieved.
Allocation concealment (selection bias)	Unclear risk	No reference to allocation concealment method.
Blinding (performance bias and detection bias) All outcomes	High risk	No evidence of blinding of participants, personnel or outcome assessors. Study had subjective outcomes, so knowing group assignment could influence these outcomes.
Incomplete outcome data (attrition bias) All outcomes	High risk	47.4% (Control) to 78.9% (E+P) of participants, corresponding to an overall availability of 63.8% across groups.
Selective reporting (reporting bias)	Unclear risk	No protocol, abstract, clinical trials entry available for comparison.
Other bias	Low risk	No baseline imbalances or reported/suspected deviations from intended intervention.
Bias arising from the randomisation process (ROB2, primary outcome)	Unclear risk	Only information provided as to the randomisation procedures used was within Methods: "The patients were randomly assigned to a control group (C), an education group (E), a PMR group (P), and an education+PMR group (E+P) by block randomisation, resulting in 38 patients each group." No reference to random component or allocation concealment method. Key baseline characteristics (age, gender, AHI) were reported for all randomised participants and differences were insignificant (P values reported), consistent with chance. BMI was not presented and compared across intervention arms as a continuous variable; rather, distribution across derived BMI categories were compared across arms. In this comparison, there was no statistical difference in distribution.
Bias due to deviations from intended interventions (ROB2, primary outcome)	Low risk	No deviations documented; none suspected based upon review. Authors report, "The patients' CPAP adherence rates and dropout rates were analysed on an intention-to-treat basis. The nonadherent patients were those who either dropped out of the study or those who stayed in the study but only used CPAP for a fraction of the required time. All dropouts remained in the analysis."
Bias due to missing outcome data (ROB2, primary outcome) All outcomes	High risk	At 12 weeks (final endpoint assessed), outcome data were available for 47.4% (Control) to 78.9% (E+P) of participants, corresponding to an overall availability of 63.8% across groups. Neither analyses to correct for bias nor sensitivity analyses were conducted. Missing outcome data occurred due to study dropout, which could be related to the outcome. Therefore, it is possible that missingness in the outcome was influenced by its true value. Missing data (due to dropout) proportions differed by intervention arm at each endpoint. Though missing outcome data did not differ across groups, the only reason cited for missing outcome data was study dropout, which is likely to be related to the true value of the outcome. Thus, missingness in the outcome is likely dependent on its true value.

Wang 2012 *(Continued)*

Bias in measurement of the outcome (ROB2, primary outcome) All outcomes	Low risk	Outcome measured using objective CPAP usage data. Each intervention group outcome data ascertained via automated CPAP device monitoring; devices identical or sufficiently similar (i.e. similar distributions of CPAP device make) across groups. Outcome "assessor" is CPAP device: no knowledge of allocation possible.
Bias in selection of the reported result (ROB2, primary outcome) All outcomes	Unclear risk	No protocol, abstract, clinical trials entry available for comparison. Results presented were in accordance with the plan specified in the Methods section of the publication. No information as to whether analysis plan was finalised before unblinded outcome data were available for analysis. Methods section indicates that multiple time points planned; each planned outcome reported. Through a threshold definition of "4 or more hours per night and at least 9 of each 14 nights of ventilator use" is uncommon relative to the more common definition (> 4 hours/night on at least 70% of nights), there is no evidence that multiple analyses (e.g. variable adherence 'thresholds') were conducted and only this one was reported.
Overall risk of bias (ROB2, primary outcome) Machine usage	High risk	-

AHI: Apnoea Hypopnoea Index; **APAP:** Automatic positive airway pressure; **BAI:** Beck Anxiety Inventory**; BiPAP:** Bi-level positive airway pressure; **BMI:** Body Mass Index; **BP:** Blood pressure**; CHF:** Congestive Heart Failure; **COPD:** Chronic Obstructive Pulmonary Disease; **CBI:** cognitive behavioural therapy; **CPAP:** Continuous positive airway pressure; **CSA:** Central Sleep Apnoea; **CVD:** cardiovascular disease;**DASS:** Depression Anxiety Stress Scales; **ESS:** Epworth Sleepiness Scale; **ESRD:** End-Stage Renal Disease; **FOSQ:** Functional Outcomes of Sleep Questionnaire; **HADS:** Hospital Anxiety and Depression Scale; **HSAT:** Home sleep Apnoea testing; **ICSD:** International Classification of Sleep Disorders; **IQR:** Interquartile range; **LCOF:** last observation carried forward; **LTOT:** long-term oxygen therapy; **mITT:** Modified intention-to-treat; **MSLT:** Multiple sleep latency test; **ODI:** Oxygen saturation index; **OSA:** Obstructive sleep apnoea; **OSAHS:** Obstructive sleep apnoea-hypopnoea syndrome; **PAP:** Positive airway pressure; **PBS:** Peer buddy system; **PSG:** Polysomnography; **PSQI:** Pittsburgh Sleep Quality Index; **QoL:** Quality of life**; RCT:** randomised controlled trial; **RDI:** Respiratory Disturbance Index; **SAQLI:** Sleep apnoea Quality of Life Index; **SEMSA:** Self-efficacy in sleep apnoea; **SF-36:** Short-Form health survey, 36 items; **SOC:** Standard of care; **TIA:** Transient Ischaemic attack; **TLC-CPAP:** Telephone-linked communications-continuous positive airway pressure; **VA:** Veterans Affairs.

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

Study	Reason for exclusion
Aloia 2005	Inconsistent CPAP make or pressure delivery mode.
Andreu 2012	Suspected OSA (not all participants received dx evaluation).
Andrews 2010	Wrong intervention.
Antic 2009	Wrong intervention.
Arrua 2016	Suspected OSA (not all participants received dx evaluation).
Bague 2015	Inclusion/exclusion criteria not verified/no author response.
Bague-Cruz 2014	Inclusion/exclusion criteria not verified/no author response.
Baltzan 2014	Wrong intervention.
Barbe 2013	Wrong intervention.
Barbe 2014	Wrong intervention.

Study	Reason for exclusion
Berry 2008	Wrong intervention.
Billings 2010	Wrong intervention.
Bittencourt 2015	Wrong intervention.
Cartwright 2017	Inclusion/exclusion criteria not verified/no response from author.
Chai-Coetzer 2011	Wrong intervention.
Chai-Coetzer 2012	Wrong intervention.
Chai-Coetzer 2013	Wrong intervention.
Cotton 2012	Inclusion/exclusion criteria not verified/no response from author.
Damjanovic 2005	No randomisation or randomisation not verifiable.
Damjanovic 2009	No randomisation or randomisation not verifiable.
Dawson 2015	Inclusion/exclusion criteria not verified/no response from author.
Deng 2013	Inconsistent CPAP make or pressure delivery mode.
Di Elia 2008	Wrong study design.
Engleman 1993	Intervention could not be classified.
Epstein 2000	Inclusion/exclusion criteria not verified/no response from author
Escourrou 2012	Inclusion/exclusion criteria not verified/no response from author.
Fields 2016	OSA diagnosis not verified.
Fletcher 1991	Wrong study design.
Fresnelli 2016	No randomisation or randomisation not verifiable.
Gupta 2011	Wrong intervention.
Ha 2015	Controls received intervention not provided to intervention arm.
Harris 2014	Inclusion/exclusion criteria not verified/no response from author.
Hayes 2009	Wrong intervention.
Hood 2013	OSA diagnosis not verified.
Hostler 2014	No randomisation or randomisation not verifiable.
Hostler 2017	No randomisation or randomisation not verifiable.
Hwang 2014	No randomisation or randomisation not verifiable.
Igelstrom 2018	Wrong outcomes.

Study	Reason for exclusion
Ip-Buting 2017	OSA diagnosis not verified.
Isetta 2014a	Inclusion/exclusion criteria not verified/no response from author.
Isetta 2014b	Wrong outcomes.
Isetta 2015	Inclusion/exclusion criteria not verified/no response from author.
Jones 2016	Inclusion/exclusion criteria not verified/no response from author.
Jurado-Gamez 2015	No randomisation, randomisation not verifiable.
Kataria 2017	Inclusion/exclusion criteria not verified/no response from author
Klein 2010	No randomisation, randomisation not verifiable.
Kreutzer 2003	Wrong study design.
Kuna 2011	OSA diagnosis not verified.
Kuna 2015	Inconsistent CPAP make or pressure delivery mode.
Kushida 2011	Wrong intervention.
Lang 2018	Wrong outcomes.
Lettieri 2009	Wrong intervention.
Lopez-Martin 2005	Wrong comparator.
Luyster 2018	Inclusion/exclusion criteria not verified/no response from author.
Marques 2017	Inclusion/exclusion criteria not verified/no response from author.
Marshall 2003	No randomisation, randomisation not verifiable.
Moore 2012	Inclusion/exclusion criteria not verified/no response from author.
Nadeem 2013	Inconsistent CPAP make or pressure delivery mode.
NCT00310310	Wrong outcomes.
NCT00873977	Wrong intervention.
NCT00939601	Wrong study design.
NCT01013207	Wrong intervention.
NCT01102920	Wrong outcomes.
NCT01535586	Wrong study design.
NCT01538069	Wrong outcomes.
NCT01569022	Wrong study design.

Study	Reason for exclusion
NCT01924507	Wrong outcomes.
NCT01960465	No randomisation, randomisation not verifiable
NCT02085720	Wrong study design.
NCT02278094	Wrong intervention.
NCT02331992	Wrong study design.
NCT02339597	Wrong intervention.
NCT02375321	Inclusion/exclusion criteria not verified/no response from author.
NCT02459548	Wrong intervention.
NCT02509247	No randomisation or randomisation not verifiable.
NCT02553694	Inclusion/exclusion criteria not verified/no response from author.
NCT02553902	Wrong outcomes.
NCT02755831	Wrong outcomes.
NCT02779894	Wrong outcomes.
NCT02953028	Wrong intervention.
NCT03007745	Wrong intervention.
NCT03202602	Wrong study design.
NCT03472612	Wrong study design.
Palmer 2004	OSA diagnosis not verified.
Pepin 1996	Wrong intervention.
Pepin 1999	Intervention could not be classified.
Pepin 2018	Wrong study design.
Rodgers 2015	Inclusion/exclusion criteria not verified/no response from author.
Ruhle 1999	Wrong study design.
Sanchez-de-la-Torre 2015	Intervention could not be classified.
Sanchez-Quiroga 2018	Wrong intervention.
Schiefelbein 2005	Inclusion/exclusion criteria not verified/no response from author.
Signes-Costa 2005	Wrong intervention.
Singhal 2016	Inclusion/exclusion criteria not verified/no response from author.

Study	Reason for exclusion
Tarasiuk 2012	Wrong outcomes.
Tarraubella 2017	Suspected OSA (not all participants received dx evaluation).
Tatousek 2015	Inclusion/exclusion criteria not verified/no response from author.
Taylor 2006	Inclusion/exclusion criteria not verified/no response from author.
Wenzel 2008	Wrong intervention.
Wiese 2005	OSA diagnosis not verified.
Williams 2014	Wrong outcomes.

CPAP: continuous positive airway pressure; **OSA:** obstructive sleep apnoea.

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

Alessi 2018

Methods	Randomised parallel-group trial
Participants	n = 125 Veterans aged ≥ 50 years (mean age 63, 96% male, 42% non-Hispanic white) with OSA and chronic insomnia
Interventions	Behavioural Insomnia Therapy + PAP adherence program vs. general sleep education program
Outcomes	Sleep (sleep onset latency (SOL-d, minutes to fall asleep), Wake after sleep onset (WASO-d, and Sleep Efficiency (SE-d, Time asleep/time in bed) by sleep diary; Pittsburgh Sleep Quality Index (PSQI) Sleep Efficiency by actigraphy (SE-a)) and objective PAP adherence (mean hours use/night (PAPhrs) and number of nights used ≥ 4hrs (PAPnts))
Notes	Reason for "Awaiting Classification" Status: unable to confirm inclusion criteria at this time

Aloia 2013a

Methods	Randomised parallel-group trial
Participants	n = 11 Newly diagnosed adults with moderate to severe OSA
Interventions	Education + a personalised video of apneic events vs. education + a standard video
Outcomes	Self-reported risk perception, objective PAP adherence
Notes	Reason for "Awaiting Classification" Status: no published report/data

Becker 2012

Methods	Randomised parallel-group trial
Participants	n = 160 Patients undergoing ambulatory PSG who were diagnosed with OSA
Interventions	Supportive respiratory therapist based follow up vs. standard follow-up
Outcomes	Cumulative PAP compliance at 1, 2 and 3 months, cost-analysis
Notes	Reason for "Awaiting Classification" Status: no published report/data

ChiCTR-ONC-17013132

Methods	
Participants	
Interventions	
Outcomes	
Notes	No available abstract or trial details in archive search. Reason for "Awaiting Classification" Status: no published report/data

Chin 2018

Methods	Randomised parallel-group trial
Participants	n = 491 Inclusion criteria for participation were: 1) diagnosis of OSA by an overnight sleep study, 2) started CPAP more than three months previously; and 3) visited the sleep centre or clinic every one or two months. Results: men n = 424, mean age = 60+/-13 years old
Interventions	1) Telemonitoring + clinic visit every 3 months vs. 2) Clinic visits every 3 months vs. 3) Clinic visits ever 1 month
Outcomes	Data on adherence to CPAP were analysed for 6 months.
Notes	Reason for "Awaiting Classification" Status: unable to confirm review inclusion criteria at this time, Results data for this study not currently available

Daaz-Cambrilles 2002

Methods	
Participants	

Daaz-Cambrilles 2002 *(Continued)*

Interventions	
Outcomes	
Notes	No available abstract or trial details in archive search. Reason for "Awaiting Classification" Status: no published report/data

Deng 2017

Methods	Randomised parallel-group trial
Participants	n = 48, severe adult OSAHS patients
Interventions	Sleep apnoea monitoring management platform vs. traditional CPAP card reader mode
Outcomes	Compliance, mean blood oxygen saturation, titration pressure, Epworth sleepiness scale after 1, 3, 6 and 12 months of treatment
Notes	Reason for "Awaiting Classification" Status: unable to confirm review inclusion criteria at this time

Duncan 2018

Methods	Randomised parallel-group trial
Participants	n = ?. Patients attending a Sleep Clinic with a diagnosis of OSA
Interventions	Patient-Centered Sleep Study Report (Myhill 201SR) vs. usual care
Outcomes	Perceived Efficacy in Patient-Physician Interactions scale (PEPPI-5), Apnoea Knowledge Test (AKT) and Self Care Management tool (SCM). Objective compliance to CPAP therapy will be collected at three months following the sleep study.
Notes	Reason for "Awaiting Classification" Status: unable to confirm review inclusion criteria at this time, Results data for this study not currently available

Georgoulis 2018

Methods	Randomised parallel-group trial
Participants	n = 108 Adult overweight patients (79% men, mean age: 47+/-10 years, mean body mass index (BMI): 35.9 ± 6.2 kg/m^2] with polysomnography-diagnosed moderate-to-severe OSA (mean apnoea-hypopnoea index (AHI): 59.6+/-31.6 events/hour)
Interventions	Weight-loss Mediterranean lifestyle intervention (MLI) combined with CPAP vs. CPAP alone
Outcomes	Patients were evaluated pre- and post-intervention with regard to polysomnographic data, OSA symptomatology, anthropometric indices and lifestyle habits.

Georgoulis 2018 *(Continued)*

Notes	Reason for "Awaiting Classification" Status: unable to confirm review inclusion criteria at this time, unable to confirm if nightly machine usage was a study outcome

Kataria 2018

Methods	Randomised parallel-group trial
Participants	n = 19 Veterans with chronic stage TBI and newly diagnosed OSA
Interventions	Intensive education at the initial visit and nightly text message reminders to use PAP vs. standard-of-care
Outcomes	Mean percentage overall PAP compliance was averaged over the first seven days and at one month. The Epworth Sleepiness Scale (ESS) and cognitive tests were administered at baseline and 1 month.
Notes	Reason for "Awaiting Classification" Status: unable to confirm review inclusion criteria at this time

Liaw 2018

Methods	Randomised parallel-group trial
Participants	n = 20 Patients diagnosed with OSA and prescribed CPAP therapy.
Interventions	Long-term follow-up with GP and CPAP therapist vs. standard follow-up with sleep physician
Outcomes	CPAP compliance, trial feasibility
Notes	Reason for "Awaiting Classification" Status: unable to confirm review inclusion criteria at this time

Marques 2018

Methods	Randomised parallel-group trial
Participants	n = 73 PAP-naive adult patients with moderate to severe OSA; mean age was 57.2 years, mean AHI was 38,4 events/hour, and 59% of patients were male.
Interventions	Standard care consisting of first week, first, third and sixth month consultations vs daily telemonitoring information (i.e. adherence, air leak, residual AHI) plus standard care
Outcomes	Machine usage (hours/night), % participants deemed adherent (at least 5 hours per night for at least 90% of the days monitored), correlation between adherence and cardio-metabolic clinical parameters.
Notes	Reason for "Awaiting Classification" Status: unable to confirm review inclusion criteria at this time

Murase 2018

Methods	Randomised parallel-group trial
Participants	n > 500; OSA patients
Interventions	Telemedicine vs. standard care
Outcomes	Objective CPAP adherence
Notes	Reason for "Awaiting Classification" Status: unable to confirm review inclusion criteria at this time, Results data for this study not currently available

Naik 2015

Methods	Randomised parallel-group trial
Participants	n = 30 Veterans naive to CPAP with confirmed OSA
Interventions	Wireless care with frequent modem monitoring vs. usual care
Outcomes	PAP adherence (more than 4 hours per night 70% of the time)
Notes	Reason for "Awaiting Classification" Status: no published report/data

NCT01259440

Methods	Randomised parallel-group trial
Participants	n = 23 Adults with a confirmed diagnosis of moderate-severe OSA, newly prescribed CPAP therapy with chronic symptoms noted on screening check list
Interventions	Supportive video teleconferencing vs. usual care
Outcomes	Nightly CPAP adherence over two months
Notes	Reason for ""Awaiting Classification" Status: no published report/data

NCT01642160

Methods	Randomised parallel-group trial
Participants	n = 50 Adults newly diagnosed with OSA who have been recommended to CPAP therapy
Interventions	Internet based education with weekly electronic follow up vs. usual care

NCT01642160 *(Continued)*

Outcomes	Change in number of nursing interventions at 1 month
Notes	Reason for "Awaiting Classification" Status: no published report/data

NCT01715194

Methods	Randomised parallel-group trial
Participants	n = 240 Symptomaticadults with OSA and an AHI and ODI of > 5/hour
Interventions	Telemonitoring with nursing contact as needed vs. usual care
Outcomes	Proportion of nights with CPAP use (>1hour/night), average nightly CPAP use
Notes	Reason for "Awaiting Classification" Status: no published report/data

NCT01785303

Methods	Randomised parallel-group trial
Participants	n = 121 Adults newly diagnosed with OSA with co-morbid insomnia
Interventions	Multidisciplinary approach to OSA (CBT for Insomnia + sleep diaries) vs. usual care
Outcomes	CPAP adherence at 3 months, Pittsburgh Sleep Quality Index , improvement in PSG sleep efficiency, Insomnia Severity Index, Functional Outcomes of Sleep Questionnaire, actigraphy
Notes	Reason for "Awaiting Classification" Status: no published report/data

NCT01796769

Methods	Randomised parallel-group trial
Participants	n = 936 Sleep apnoea patients with low cardiovascular risk, newly treated with CPAP
Interventions	Telemonitoring web platform vs. usual care
Outcomes	Change in CPAP compliance at 6 months, Eppworth Sleepiness Scale, Pichot Scale, quality of life (SF-12 questionnaire), cost-analysis
Notes	Reason for "Awaiting Classification" Status: no published report/data

NCT01848509

Methods	Randomised parallel-group trial
Participants	n = 200 Patients with OSA
Interventions	Telemonitoring system with alerts vs. usual care
Outcomes	CPAP use (hours/night), cost estimation, quality of life (SF 36, Functional Outcomes of Sleep Questionnaire)
Notes	Reason for "Awaiting Classification" Status: no published report/data

NCT01916655

Methods	Randomised parallel-group trial
Participants	n = 360 Patients newly diagnosed with OSA
Interventions	Self-management support protocol vs. mobile self-management support protocol vs. usual care
Outcomes	Objective PAP adherence, self reported OSA symptoms, basic cost analysis
Notes	Reason for "Awaiting Classification" Status: no published report/data

NCT02056002

Methods	Randomised parallel-group trial
Participants	n = 362
Interventions	Peer buddy visits, both scheduled and as needed contacts vs. usual care
Outcomes	Patient satisfaction, CPAP adherence (hours/night, proportion of nights over 4 hours), self-efficacy (SEMSA), Functional Outcomes of Sleep Questionnaire, Epworth Sleepiness Scale
Notes	Reason for "Awaiting Classification" Status: no published report/data

NCT02159885

Methods	Randomised parallel-group trial
Participants	n = 53 Veteran adults with AHI > 5 as determined by home sleep study initiating APAP therapy
Interventions	Telemonitoring of APAP machine with phone follow up as needed vs. usual care

NCT02159885 *(Continued)*

Outcomes	Daily APAP use (hours/night), change in Functional Outcomes of Sleep Questionnaire, cost analysis, Epworth Sleepiness Scale, depression (CES-D), overall health (SF-12), number of days CPAP adherent (> 4 hours)
Notes	Reason for "Awaiting Classification" Status: no published report/data

NCT02641496

Methods	Randomised parallel-group trial
Participants	n = 144 Adults diagnosed with OSA by a sleep medicine physician with co-morbid post traumatic stress disorder (PTSD)
Interventions	Cognitive behavioural therapy for OSA vs. sleep education
Outcomes	Time in hours of "mask-on" CPAP use per night, Functional Outcomes of Sleep Questionnaire, PTSD Checklist
Notes	Reason for "Awaiting Classification" Status: no published report/data

NCT02657304

Methods	Randomised parallel-group trial
Participants	n = 120 Adults with AHI > 30/hour or between 15-30/hour with a Sleep Fragmentation Index of more than 10/hour
Interventions	Early education and monthly telephone calls vs. usual care
Outcomes	Percentage of participant with mean duration of CPAP >5 hours/night
Notes	Reason for "Awaiting Classification" Status: no published report/data

NCT03116958

Methods	Randomised parallel-group trial
Participants	n = 60 Adults diagnosed with OSA and prescribed CPAP treatment
Interventions	Telemedicine via personalised smart phone application vs. usual care
Outcomes	Objective CPAP compliance (hours/night), number of nights adherence (> 4 hours/night), patient satisfaction, quality of life (EuroQOL), Epworth Sleepiness Scale, cost effectiveness
Notes	Reason for "Awaiting Classification" Status: no published report/data

NCT03243487

Methods	Randomised parallel-group trial
Participants	n = 250 Adults with diagnostic AHI ≥15 as determined by PSG or home sleep test
Interventions	Structured patient adherence management system (phone calls based on recorded adherence) vs. usual care
Outcomes	Proportion of nights adherent (> 4 hours/night), nightly CPAP use (hours/night), participant satisfaction, cost analysis
Notes	Reason for "Awaiting Classification" Status: no published report/data

NCT03345524

Methods	Randomised parallel-group trial
Participants	n = 145 Adults with suspected OSA who were referred for sleep testing
Interventions	Peer buddy system vs. usual care
Outcomes	Proportion of patients who followed through with sleep testing, nightly CPAP use
Notes	Reason for "Awaiting Classification" Status: no published report/data

NCT03446560

Methods	Randomised parallel-group trial
Participants	n = 560 Adults with a verified OSA diagnosis indicated for CPAP treatment
Interventions	Telemedicine follow up customised according to objective CPAP use vs. usual care
Outcomes	Nightly CPAP use (hours/night), Epworth Sleepiness Scale, change in AHI, proportion of patients refusing CPAP, health care utilisation, patient satisfaction, Hospital Anxiety and Depression Scale, Insomnia Severity Index
Notes	Reason for "Awaiting Classification" Status: no published report/data

NCT03536572

Methods	Randomised parallel-group trial
Participants	n = 250

NCT03536572 *(Continued)*

	Adults with confirmed diagnosis of OSA with chronic symptoms, newly prescribed for CPAP therapy
Interventions	Individualised pressure adjustment vs. usual care
Outcomes	CPAP adherence (hours/night)
Notes	Reason for "Awaiting Classification" Status: no published report/data

NCT03792880

Methods	Randomised parallel-group trial
Participants	n = 60 Inclusion criteria: 1) Patients with a recent diagnostic of OSAHS with AHI ≥ 30 and indication of CPAP, 2) age,≥ 18 years, 3) Few symptoms,without hyper somnolence (Epworth sleepiness scale ≤ 10) 4) Absence of clinic suspect or confirmation of other sleep pathology. 5)With interest in the use of new technologies
Interventions	telemedicine vs. standard care
Outcomes	% patients with a CPAP compliance ≥4 hours per day, CPAP compliance, dropouts, side effects, ESS, change in snoring, frequency of refreshing sleep, air leaks and residual AHI, EuroQoL, circadian rhythm parameters, cost-effectiveness
Notes	Reason for "Awaiting Classification" Status: unable to confirm review inclusion criteria at this time, Results data for this study not currently available

NCT03835702

Methods	Randomised parallel-group trial
Participants	n = 166. Inclusion criteria: 1) >18 years old, 2) moderate to severe OSA (apnoea hypopnoea index (AHI) ≥15 events/hour) on polysomnogram (PSG), 3) Followed by non-sleep providers for OSA (mainly primary care providers), 4) New PAP set up < 1 month. 5) Sub-optimal PAP adherence by objective PAP adherence data (<70 % usage and <4 hours of average PAP usage)
Interventions	Sleep Apnea Management (SAM) Clinic vs. Usual Care with the non-sleep provider
Outcomes	Hours of PAP usage (>4 hours), % days of PAP use in, ESS, PHQ-9, PROMIS Global Health, PROMIS Fatigue, PROMIS Sleep Related Impairment, PAP Barrier questionnaire
Notes	Reason for "Awaiting Classification" Status: unable to confirm review inclusion criteria at this time, Results data for this study not currently available

Nilius 2012

Methods	Randomised parallel-group trial
Participants	n = 84

Nilius 2012 *(Continued)*

	Adults with newly diagnosed OSA
Interventions	Intensive inpatient education + weekly phone calls and follow up vs. Intensive inpatient education + standard follow-up
Outcomes	Average daily CPAP use (hours/night), Epworth Sleepiness Scale, CPAP rejection
Notes	Reason for "Awaiting Classification" Status: no published report/data

Ordonez-Dios 2013

Methods	Randomised parallel-group trial
Participants	n = 166 Adults newly diagnosed with OSA who were eligible for CPAP treatment
Interventions	CPAP installation at CPAP-school vs. CPAP installation in home
Outcomes	Objective CPAP adherence (hours/night), Epworth Sleepiness Scale, AHI
Notes	Reason for "Awaiting Classification" Status: no published report/data

Pak 2016

Methods	
Participants	
Interventions	
Outcomes	
Notes	No available abstract or trial details in archive search. Reason for "Awaiting Classification" Status: no published report/data

Park 2014

Methods	Randomised parallel-group trial
Participants	n=50 CPAP naive adults with OSA
Interventions	Web based education portal vs. usual care
Outcomes	CPAP adherence (hours/night), proportion of days with > 4 hours CPAP, participant satisfaction
Notes	Reason for "Awaiting Classification" Status: no published report/data

Peach 2003

Methods	
Participants	
Interventions	
Outcomes	
Notes	No available abstract or trial details in archive search. Reason for "Awaiting Classification" Status: no published report/data

Royant-Parola 2013

Methods	Randomised parallel-group trial
Participants	n = 200
Interventions	Insufficient information provided in initial abstract
Outcomes	Insufficient information provided in initial abstract
Notes	Reason for "Awaiting Classification" Status: no published report/data

Schoch 2017

Methods	Randomised parallel-group trial
Participants	n = 240 Symptomatic adults with OSA consenting to long term CPAP therapy
Interventions	Telemedicine monitoring with as needed nursing follow up vs. usual care
Outcomes	Proportion of nights with CPAP use (> 1 hour/night), average nightly CPAP use (hours/night), Quebec Sleep Quality index, Epworth Sleepiness Scale
Notes	Reason for "Awaiting Classification" Status: no published report/data

Shaikh 2009

Methods	
Participants	
Interventions	
Outcomes	

Shaikh 2009 *(Continued)*

Notes	No available abstract or trial details in archive search. Reason for "Awaiting Classification" Status: no published report/data

Stepnowsky 2009

Methods	
Participants	
Interventions	
Outcomes	
Notes	No available abstract or trial details in archive search. Reason for "Awaiting Classification" Status: no published report/data

Stepnowsky 2014a

Methods	Randomised parallel-group trial
Participants	n = 280 Patients diagnosed with OSA and prescribed CPAP therapy
Interventions	Individualised self-management (ISM) vs. telemonitoring care (TC) vs. combined (ISM +TC) vs. usual care
Outcomes	Average CPAP use (hours/night)
Notes	Reason for "Awaiting Classification" Status: no published report/data

Stepnowsky 2014b

Methods	Randomised parallel-group trial
Participants	Insufficient information in abstract
Interventions	Video teleconferencing follow up vs. usual care
Outcomes	Objective CPAP adherence (hours/night), Epworth Sleepiness Scale, self reported OSA symptoms
Notes	Reason for "Awaiting Classification" Status: no published report/data

Suarez 2017

Methods	Randomised parallel-group trial
Participants	Insufficient information in abstract

Suarez 2017 *(Continued)*

Interventions	Telemonitoring vs. usual care
Outcomes	CPAP compliance (unspecified), Epworth Sleepiness Scale, ambulatory blood pressure, actigraphy
Notes	Reason for "Awaiting Classification" Status: no published report/data

Tolson 2016

Methods	Randomised parallel-group trial
Participants	n = 23 Adults recruited from a clinical sleep laboratory who were commencing CPAP therapy
Interventions	Group CBT targeting self efficacy vs. usual care
Outcomes	CPAP usage (unspecified), Self-efficacy Measure for Sleep Apnea
Notes	Reason for "Awaiting Classification" Status: no published report/data

Van Der Kleij 2018

Methods	Randomised parallel-group trial
Participants	n = 115; patients with newly diagnosed OSA; Mean age (intervention vs control resp. 54;54 years), apnoea-hypopnoea-index (AHI, 47;48/hour), BMI (33;31 kg/m2), sex (man 75;74%), ESS (12;14) and FSS (37;37)
Interventions	Remote monitoring and adjustment using AirViewTM versus placebo
Outcomes	Compliance after 10 weeks and 1 year (CPAP use in mean hours/night), withdrawals
Notes	Reason for "Awaiting Classification" Status: unable to confirm review inclusion criteria at this time

Zaldivar 2009

Methods	Randomised parallel-group trial
Participants	n = 128 Adults with suspected OSA who were referred for sleep study
Interventions	Weekly phone calls vs. usual care
Outcomes	CPAP compliance (unspecified)
Notes	Reason for "Awaiting Classification" Status: unable to confirm review inclusion criteria at this time

AHI: apnoea hypopnoea index; **BMI:** body mass index; **BP:** blood pressure; **CBT:** cognitive behavioural therapy; **CPAP:** continuous positive airway pressure; **ODI:** oxygen desaturation index**; OSA:** obstructive sleep apnoea; **PAP:** positive airway pressure; PSG: polysomnography ;TBI: traumatic brain injury.

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

Abreu 2013

Trial name or title	Evaluation of wireless telemonitoring of CPAP therapy in obstructive sleep apnoea - TELEPAP study
Methods	Randomised, controlled clinical trial
Participants	51 patients (42 males; mean age: 54 years old; mean apnoea/hypopnoea index (AIH): 36.8/h) newly diagnosed with OSA
Interventions	Standard clinical care (SC) vs active weekly phone call care (Myhill 201) (n = 18) vs. telemonitored clinical care (TC) (n = 12) with the use of Restraxx™
Outcomes	Objective CPAP usage (hour per night), residual AHI
Starting date	2013
Contact information	
Notes	Author correspondence (21 Feb 2019): manuscript currently under review for publication.

Bakker 2017

Trial name or title	A randomised trial demonstrating the feasibility of a group-based peer-support intervention for maximizing CPAP adherence
Methods	Randomised, controlled trial
Participants	N = 40; aged >21 years, newly diagnosed with OSA; 70% male, median age = 52 years [IQR=39-62]
Interventions	Group-based behavioral intervention delivered by trained 'patient advocates' (successful CPAP users) x two 90-minute sessions vs standard care
Outcomes	% of participants using machine < 4 hours per night over 6 weeks, % agreement that attendance of peer support group was helpful
Starting date	2015
Contact information	
Notes	Author correspondence (25 Jan 2019): data currently available through NCT entry NCT02538419, results have yet to be published as a full manuscript.

Castronovo 2017

Trial name or title	Adherence and acceptance of a telemedicine monitoring system for OSA patients treated with CPAP
Methods	Randomised, controlled trial

Castronovo 2017 *(Continued)*

Participants	30 patients (mean age 53.3 ± 9.5 years) with moderate to severe OSA (mean apnoea hypopnoea index (AHI) 45.3 ± 21) that had PAP prescribed
Interventions	Standard care (SC) vs telemedicine (TM)
Outcomes	% days of use for more than 4 hours at 1, 3 months, reduction in number of visits, patient satisfaction
Starting date	2017
Contact information	
Notes	Author correspondence (2 7Feb 2019): results data provided by authors, results have yet to be published as a full manuscript

Crawford 2016

Trial name or title	Evaluating the treatment of obstructive sleep apnoea comorbid with insomnia disorder using an incomplete factorial design
Methods	Randomised controlled trial (three-arm)
Participants	N = 140 (expected); males and females age 18 and over will be considered eligible for this study if they meet criteria for ID and OSA. The presence of OSA will be demonstrated by an Apnea-Hypopnea Index (AHI) = 5 on a full-night in-lab baseline polysomnography (PSG) and at least one of the following clinical symptoms: daytime sleepiness or fatigue, unrefreshing sleep, gasping, choking, or holding breath at night, witnessed apneas or loud snoring. Insomnia is characterised by either a complaint of difficulty initiating sleep, maintaining sleep, or waking too early, despite adequate opportunity and circumstances for sleep, coupled with at least one area of significant daytime impairment or distress. In addition, the sleep disturbance will have to be present for at least 3 months. Participants will also have to meet quantitative criteria as evaluated by a sleep diary showing sleep onset latency or wake after sleep onset > 30 minutes, at least 3 nights per week.
Interventions	Treatment Arm A: receive sequential treatment beginning with CBT-I followed by PAP, Treatment Arm B: CBT-I and PAP are administered concurrently, Treatment Arm C: where individuals receive PAP alone.
Outcomes	PSQI, PAP adherence, ISI (Insomnia Severity Index), daytime sleepiness and fatigue, treatment satisfaction
Starting date	2016
Contact information	
Notes	Author correspondence (30 Jan 2019): results have yet to be published as a full manuscript

Kotzian 2018

Trial name or title	Home polygraphic recording with telemedicine monitoring for diagnosis and treatment of sleep apnoea in stroke (HOPES Study): study protocol for a single-blind, randomised controlled trial

Kotzian 2018 *(Continued)*

Methods	Randomised, controlled, single-blind
Participants	55 patients who had a subacute stroke, aged 19-70 years, with moderate to severe OSA, who have undergone successful PAP training and titration at the neurorehabilitation unit.
Interventions	PAP training strategy during in hospital rehabilitation combined with a telemedicine monitoring system vs standard care
Outcomes	CPAP adherence (minutes per night), systolic BP, Barthel Index
Starting date	2016
Contact information	
Notes	Results have yet to be published as a full manuscript.

Seixas 2018

Trial name or title	
Methods	Randomised parallel-group trial
Participants	N = 398 Patients of African descent with low-to-high OSA risk
Interventions	Culturally-tailored peer education/support groups vs. standard care with same level of contact
Outcomes	Rate of adherence to recommended home OSA evaluation and treatment, rate of OSA among black men and women at the community level
Starting date	
Contact information	
Notes	Reason for "Awaiting Classification" Status: unable to confirm review inclusion criteria at this time. Results data for this study not currently available

AHI: apnoea hypopnoea index; **BP:** blood pressure; **CBT:** cognitive behavioural therapy; **CPAP:** continuous positive airway pressure; **IQR:** interquartile range; **OSA:** obstructive sleep apnoea; **PAP:** positive airway pressure; **PSQI:** Pittsburgh Sleep Quality Index.

DATA AND ANALYSES

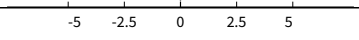
Comparison 1. Educational intervention versus control

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 CPAP Device Usage (hours/night)	10	1128	Mean Difference (IV, Random, 95% CI)	0.85 [0.32, 1.39]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
2 Machine usage, sensitivity analysis: adherence in control group < four hours/night	6	698	Mean Difference (IV, Random, 95% CI)	0.85 [0.06, 1.64]
3 N deemed adherent (≥ four hours/night)	7	1019	Odds Ratio (M-H, Random, 95% CI)	2.58 [1.50, 4.44]
4 Withdrawal	9		Odds Ratio (M-H, Random, 95% CI)	Totals not selected
5 Epworth Sleepiness Scale - Comparison of Values at Endpoint	3		Mean Difference (IV, Random, 95% CI)	Totals not selected

Analysis 1.1. Comparison 1 Educational intervention versus control, Outcome 1 CPAP Device Usage (hours/night).

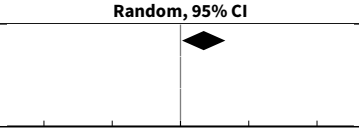
Study or subgroup	Educational Interventions N	Mean(SD)	Control N	Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
Aloia 2013	66	4.5 (2.5)	55	3.7 (2.4)		12.53%	0.83[-0.04,1.7]
Basoglu 2011	66	5.5 (1.2)	67	5.1 (1.6)		16.22%	0.4[-0.08,0.88]
Chervin 1997	14	7.1 (1.8)	7	4.4 (3.4)		3.28%	2.7[0.01,5.39]
Falcone 2014	90	5.3 (0)	71	4.1 (0)			Not estimable
Hwang 2017	163	4 (2.4)	129	3.8 (2.5)		15.43%	0.2[-0.37,0.77]
Pengo 2018	60	3.1 (2.5)	25	3.1 (2.7)		9.4%	-0.04[-1.27,1.2]
Richards 2007	48	5.4 (2.6)	48	2.5 (2.7)		10.87%	2.87[1.82,3.92]
Roecklein 2010	13	2.4 (2.2)	15	2 (2.2)		6.69%	0.38[-1.28,2.04]
Sarac 2017	52	5.2 (2.1)	63	4.2 (2.5)		12.79%	1[0.16,1.84]
Wang 2012	38	3.4 (2.1)	38	2.6 (1.6)		12.8%	0.8[-0.04,1.64]
Total * **	**610**		**518**			**100%**	**0.85[0.32,1.39]**
Heterogeneity: Tau²=0.4; Chi²=25.07, df=8(P=0); I²=68.09%							
Test for overall effect: Z=3.12(P=0)							



Analysis 1.2. Comparison 1 Educational intervention versus control, Outcome 2 Machine usage, sensitivity analysis: adherence in control group < four hours/night.

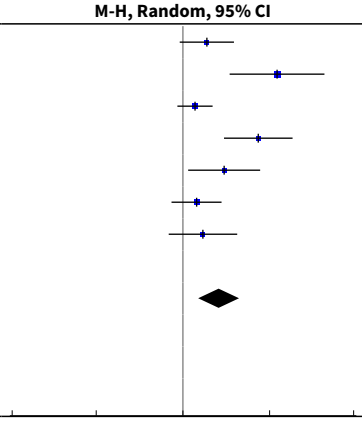
Study or subgroup	Educational Interventions N	Mean(SD)	Control N	Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
Aloia 2013	66	4.5 (2.5)	55	3.7 (2.4)		18.12%	0.83[-0.04,1.7]
Hwang 2017	163	4 (2.4)	129	3.8 (2.5)		20.69%	0.2[-0.37,0.77]
Pengo 2018	60	3.1 (2.5)	25	3.1 (2.7)		14.85%	-0.04[-1.27,1.2]
Richards 2007	48	5.4 (2.6)	48	2.5 (2.7)		16.46%	2.87[1.82,3.92]
Roecklein 2010	13	2.4 (2.2)	15	2 (2.2)		11.5%	0.38[-1.28,2.04]
Wang 2012	38	3.4 (2.1)	38	2.6 (1.6)		18.38%	0.8[-0.04,1.64]

Study or subgroup	Educational Interventions N	Mean(SD)	Control N	Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
Total ***	**388**		**310**			**100%**	**0.85[0.06,1.64]**
Heterogeneity: Tau²=0.71; Chi²=21.01, df=5(P=0); I²=76.21%							
Test for overall effect: Z=2.1(P=0.04)							



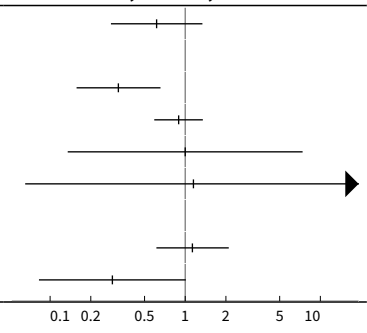
Analysis 1.3. Comparison 1 Educational intervention versus control, Outcome 3 N deemed adherent (≥ four hours/night).

Study or subgroup	Educational Interventions n/N	Control n/N	Odds Ratio M-H, Random, 95% CI	Weight	Odds Ratio M-H, Random, 95% CI
Basoglu 2011	47/66	38/67		15.59%	1.89[0.92,3.88]
Falcone 2014	87/90	50/71		9.98%	12.18[3.46,42.89]
Hwang 2017	100/163	69/129		18.5%	1.38[0.86,2.2]
Richards 2007	37/48	15/48		13.41%	7.4[2.98,18.36]
Sarac 2017	45/52	43/63		12.88%	2.99[1.15,7.78]
Soares-Pires 2013	45/71	41/75		16.25%	1.44[0.74,2.79]
Wang 2012	23/38	18/38		13.39%	1.7[0.69,4.23]
Total (95% CI)	**528**	**491**		**100%**	**2.58[1.5,4.44]**
Total events: 384 (Educational Interventions), 274 (Control)					
Heterogeneity: Tau²=0.36; Chi²=20.16, df=6(P=0); I²=70.23%					
Test for overall effect: Z=3.42(P=0)					



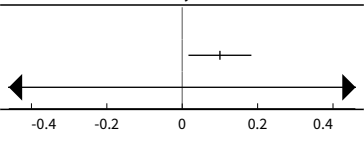
Analysis 1.4. Comparison 1 Educational intervention versus control, Outcome 4 Withdrawal.

Study or subgroup	Educational Interventions n/N	Control n/N	Odds Ratio M-H, Random, 95% CI	Odds Ratio M-H, Random, 95% CI
Aloia 2013	14/80	19/74		0.61[0.28,1.34]
Basoglu 2011	0/66	0/67		Not estimable
Falcone 2014	13/103	32/103		0.32[0.16,0.66]
Hwang 2017	51/375	53/354		0.89[0.59,1.35]
Richards 2007	2/50	2/50		1[0.14,7.39]
Roecklein 2010	1/14	1/16		1.15[0.07,20.34]
Sarac 2017	0/52	0/63		Not estimable
Soares-Pires 2013	29/100	27/102		1.13[0.61,2.1]
Wang 2012	4/38	11/38		0.29[0.08,1.01]



Analysis 1.5. Comparison 1 Educational intervention versus control, Outcome 5 Epworth Sleepiness Scale - Comparison of Values at Endpoint.

Study or subgroup	Educational Interventions		Control		Mean Difference	Mean Difference
	N	Mean(SD)	N	Mean(SD)	Random, 95% CI	Random, 95% CI
Basoglu 2011	66	3.8 (0)	67	4.4 (0)		Not estimable
Falcone 2014	90	4.1 (0.3)	71	4 (0.2)		0.1[0.02,0.18]
Wang 2012	34	9.7 (3.5)	27	10.8 (4.2)		-1.1[-3.07,0.87]



Favours Educational Interventions — Favours Control

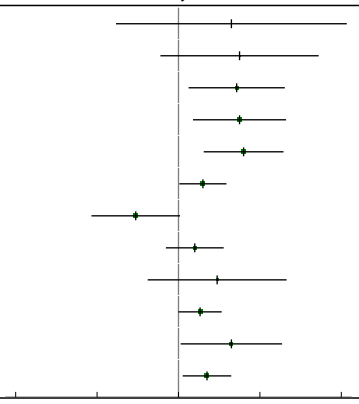
Comparison 2. Supportive intervention versus control

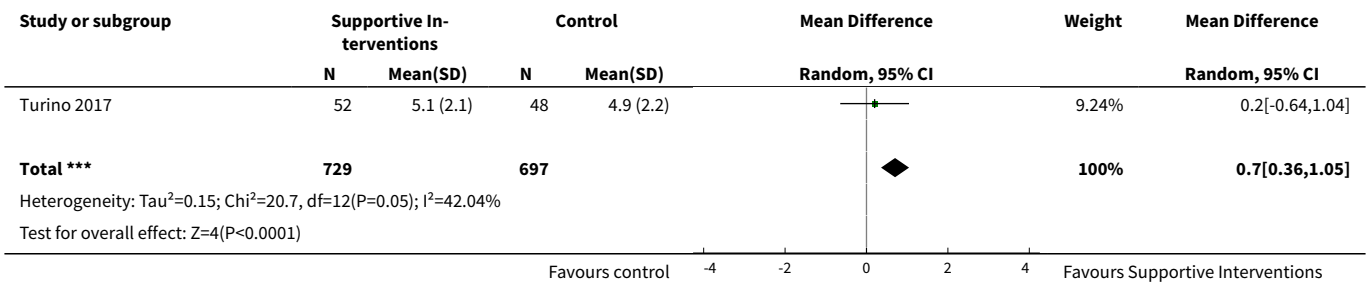
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 CPAP Device Usage (hours/night)	13	1426	Mean Difference (IV, Random, 95% CI)	0.70 [0.36, 1.05]
2 Machine usage, sensitivity analysis: adherence in control group < four hours/night	7	735	Mean Difference (IV, Fixed, 95% CI)	0.91 [0.57, 1.25]
3 N deemed adherent (≥ four hours/night)	2	376	Odds Ratio (M-H, Fixed, 95% CI)	1.68 [1.08, 2.60]
4 Withdrawals	11	1702	Odds Ratio (M-H, Fixed, 95% CI)	1.27 [0.97, 1.66]
5 Epworth Sleepiness Scale - Comparison Endpoint or Change from Baseline Values	9		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
5.1 ESS: Endpoint Scores	6	700	Mean Difference (IV, Fixed, 95% CI)	0.03 [-0.59, 0.64]
5.2 ESS: Change from Baseline	5	470	Mean Difference (IV, Fixed, 95% CI)	-0.32 [-1.19, 0.56]
6 Quality of Life: Comparison of Values at Endpoint	7	683	Std. Mean Difference (IV, Fixed, 95% CI)	0.16 [0.01, 0.31]
6.1 QoL: FOSQ - Endpoint	3	109	Std. Mean Difference (IV, Fixed, 95% CI)	0.15 [-0.23, 0.53]
6.2 QoL: SAQLI - Endpoint	1	240	Std. Mean Difference (IV, Fixed, 95% CI)	0.22 [-0.04, 0.47]
6.3 QoL: SF-36 (PH) - Endpoint	3	334	Std. Mean Difference (IV, Fixed, 95% CI)	0.13 [-0.09, 0.34]
7 Quality of LIfe: Comparison of Change from Baseline Values	3	294	Std. Mean Difference (IV, Fixed, 95% CI)	0.22 [-0.01, 0.45]
7.1 QoL: FOSQ - Change from Baseline	1	39	Std. Mean Difference (IV, Fixed, 95% CI)	0.24 [-0.40, 0.87]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
7.2 QoL: SF-36 (PH) - Change from Baseline	1	82	Std. Mean Difference (IV, Fixed, 95% CI)	0.04 [-0.40, 0.47]
7.3 QoL: FOSQ-10 - Change from Baseline	1	173	Std. Mean Difference (IV, Fixed, 95% CI)	0.30 [0.00, 0.60]
8 Anxiety Symptom Rating (HADS-A) - Comparison of Values at Endpoint	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
9 Machine usage, sensitivity analysis: excluding study with opposite direction of effect (authors suggest negative effect of intervention)	12	1319	Mean Difference (IV, Random, 95% CI)	0.74 [0.49, 0.98]
10 AHI on treatment - Comparison of Values at Endpoint	2		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
11 Depression Symptom Rating (HADS-D, CES-D) - Comparison of Values at Endpoint	3		Std. Mean Difference (IV, Fixed, 95% CI)	Totals not selected
11.1 HADS-Depression	1		Std. Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
11.2 CES-D	2		Std. Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
12 Cost-Effectiveness	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
13 Machine usage, sensitivity analysis: excluding participants aware of machine usage	2		Mean Difference (IV, Fixed, 95% CI)	Totals not selected

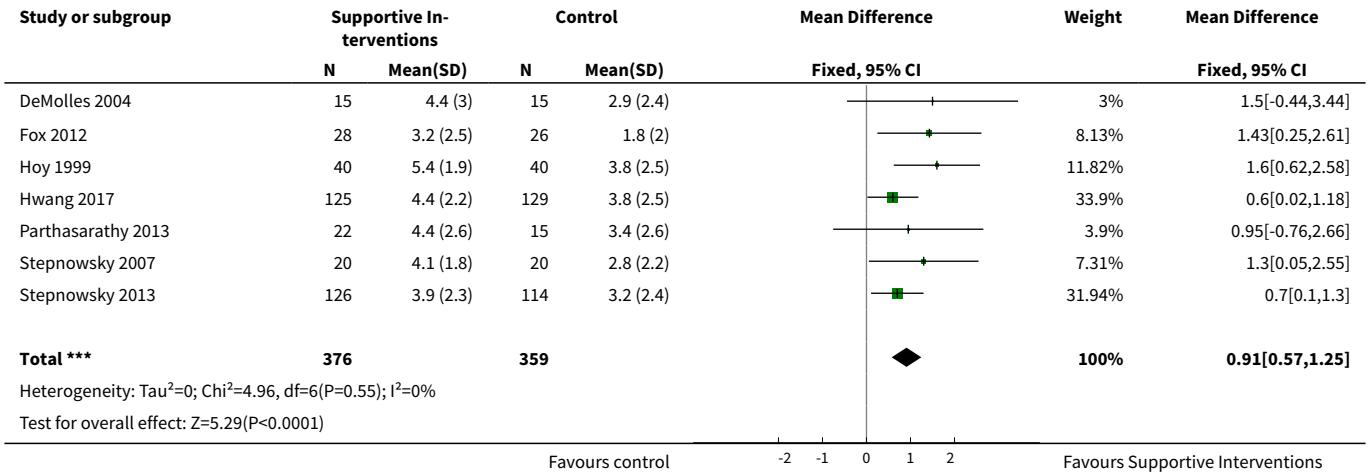
Analysis 2.1. Comparison 2 Supportive intervention versus control, Outcome 1 CPAP Device Usage (hours/night).

Study or subgroup	Supportive Interventions		Control		Mean Difference	Weight	Mean Difference
	N	Mean(SD)	N	Mean(SD)	Random, 95% CI		Random, 95% CI
Chervin 1997	12	5.7 (2.3)	7	4.4 (3.4)		1.38%	1.3[-1.54,4.14]
DeMolles 2004	15	4.4 (3)	15	2.9 (2.4)		2.73%	1.5[-0.44,3.44]
Fox 2012	28	3.2 (2.5)	26	1.8 (2)		6.03%	1.43[0.25,2.61]
Hoet 2017	20	5.7 (1.6)	17	4.2 (1.9)		6.31%	1.5[0.36,2.64]
Hoy 1999	40	5.4 (1.9)	40	3.8 (2.5)		7.74%	1.6[0.62,2.58]
Hwang 2017	125	4.4 (2.2)	129	3.8 (2.5)		13.09%	0.6[0.02,1.18]
Mendelson 2014	54	3.1 (3)	53	4.2 (2.8)		6.76%	-1.05[-2.14,0.04]
Munafo 2016	58	5.1 (1.9)	64	4.7 (2.1)		11.04%	0.4[-0.31,1.11]
Parthasarathy 2013	22	4.4 (2.6)	15	3.4 (2.6)		3.41%	0.95[-0.76,2.66]
Pepin 2019	157	5.3 (2.2)	149	4.8 (2.5)		13.89%	0.53[-0,1.06]
Stepnowsky 2007	20	4.1 (1.8)	20	2.8 (2.2)		5.59%	1.3[0.05,2.55]
Stepnowsky 2013	126	3.9 (2.3)	114	3.2 (2.4)		12.8%	0.7[0.1,1.3]

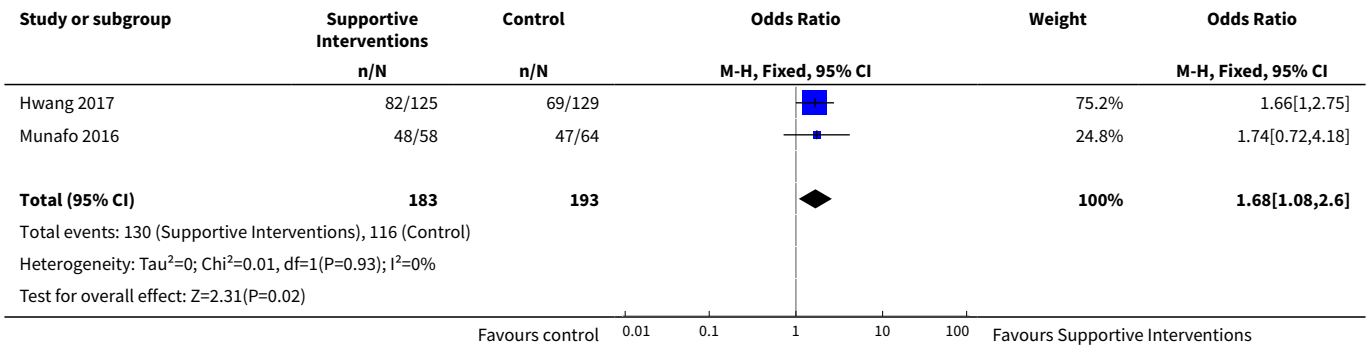




Analysis 2.2. Comparison 2 Supportive intervention versus control, Outcome 2 Machine usage, sensitivity analysis: adherence in control group < four hours/night.



Analysis 2.3. Comparison 2 Supportive intervention versus control, Outcome 3 N deemed adherent (≥ four hours/night).

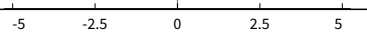


Analysis 2.4. Comparison 2 Supportive intervention versus control, Outcome 4 Withdrawals.

Study or subgroup	Supportive Interventions n/N	Control n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
DeMolles 2004	0/15	0/15			Not estimable
Fox 2012	11/39	10/36		7.98%	1.02[0.37,2.8]
Hoet 2017	6/23	3/23		2.37%	2.35[0.51,10.86]
Hoy 1999	0/40	0/40			Not estimable
Hwang 2017	58/380	53/354		49.72%	1.02[0.68,1.53]
Mendelson 2014	14/54	11/53		8.79%	1.34[0.54,3.29]
Munafo 2016	12/70	6/70		5.32%	2.21[0.78,6.26]
Parthasarathy 2013	0/22	2/17		2.93%	0.14[0.01,3.07]
Pepin 2019	40/157	27/149		22.08%	1.54[0.89,2.68]
Stepnowsky 2007	4/21	1/24		0.81%	5.41[0.55,52.87]
Turino 2017	0/52	0/48			Not estimable
Total (95% CI)	**873**	**829**		**100%**	**1.27[0.97,1.66]**
Total events: 145 (Supportive Interventions), 113 (Control)					
Heterogeneity: Tau^2=0; Chi^2=7, df=7(P=0.43); I^2=0.03%					
Test for overall effect: Z=1.73(P=0.08)					

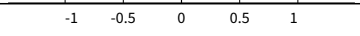
Analysis 2.5. Comparison 2 Supportive intervention versus control, Outcome 5 Epworth Sleepiness Scale - Comparison Endpoint or Change from Baseline Values.

Study or subgroup	Supportive Interventions N	Supportive Interventions Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
2.5.1 ESS: Endpoint Scores							
Hoy 1999	40	5.5 (3.8)	40	6.3 (5.1)		9.79%	-0.8[-2.76,1.16]
Mendelson 2014	40	6.4 (4.4)	42	5.1 (3.3)		13.17%	1.3[-0.39,2.99]
Parthasarathy 2013	22	7.1 (4.7)	17	8.1 (4.3)		4.68%	-1[-3.83,1.83]
Pepin 2019	108	4.6 (3.9)	111	6.1 (4.1)		33.92%	-1.47[-2.52,-0.42]
Stepnowsky 2007	20	9.2 (6.6)	20	9.9 (5.2)		2.77%	-0.7[-4.38,2.98]
Stepnowsky 2013	126	7.1 (4.5)	114	5.7 (3.6)		35.67%	1.4[0.37,2.43]
Subtotal ***	**356**		**344**			**100%**	**0.03[-0.59,0.64]**
Heterogeneity: Tau^2=0; Chi^2=18.15, df=5(P=0); I^2=72.46%							
Test for overall effect: Z=0.09(P=0.93)							
2.5.2 ESS: Change from Baseline							
Fox 2012	28	-1.6 (5.1)	26	-0.7 (5.2)		10.16%	-0.9[-3.65,1.85]
Hwang 2017	90	-3.7 (5.2)	83	-3.7 (4.7)		35.3%	0[-1.48,1.48]
Mendelson 2014	40	-2.3 (4)	42	-2.1 (4.1)		24.99%	-0.2[-1.95,1.55]
Munafo 2016	58	-5.8 (5.5)	64	-5.1 (5.9)		18.77%	-0.7[-2.72,1.32]
Parthasarathy 2013	22	-3.4 (5)	17	-3 (3.5)		10.77%	-0.4[-3.07,2.27]
Subtotal ***	**238**		**232**			**100%**	**-0.32[-1.19,0.56]**
Heterogeneity: Tau^2=0; Chi^2=0.51, df=4(P=0.97); I^2=0%							
Test for overall effect: Z=0.71(P=0.48)							



Analysis 2.6. Comparison 2 Supportive intervention versus control, Outcome 6 Quality of Life: Comparison of Values at Endpoint.

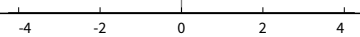
Study or subgroup	Supportive Interventions N	Supportive Interventions Mean(SD)	Control N	Control Mean(SD)	Std. Mean Difference Fixed, 95% CI	Weight	Std. Mean Difference Fixed, 95% CI
2.6.1 QoL: FOSQ - Endpoint							
DeMolles 2004	15	18.1 (2.8)	15	17 (3.7)		4.37%	0.33[-0.39,1.05]
Parthasarathy 2013	22	17.1 (3.5)	17	17.1 (3)		5.67%	0[-0.63,0.63]
Stepnowsky 2007	20	15.2 (5)	20	14.4 (4.2)		5.89%	0.17[-0.45,0.79]
Subtotal ***	**57**		**52**			**15.92%**	**0.15[-0.23,0.53]**
Heterogeneity: Tau^2=0; Chi^2=0.45, df=2(P=0.8); I^2=0%							
Test for overall effect: Z=0.79(P=0.43)							
2.6.2 QoL: SAQLI - Endpoint							
Stepnowsky 2013	126	5.1 (2)	114	4.6 (2.6)		35.16%	0.22[-0.04,0.47]
Subtotal ***	**126**		**114**			**35.16%**	**0.22[-0.04,0.47]**
Heterogeneity: Not applicable							
Test for overall effect: Z=1.67(P=0.1)							
2.6.3 QoL: SF-36 (PH) - Endpoint							
Hoy 1999	40	49 (12.6)	40	48 (12.6)		11.81%	0.08[-0.36,0.52]
Mendelson 2014	40	44.6 (9.4)	42	45.9 (8.5)		12.07%	-0.14[-0.58,0.29]
Pepin 2019	80	45.6 (5.3)	92	44.1 (5.4)		25.04%	0.28[-0.02,0.58]
Subtotal ***	**160**		**174**			**48.92%**	**0.13[-0.09,0.34]**
Heterogeneity: Tau^2=0; Chi^2=2.52, df=2(P=0.28); I^2=20.79%							
Test for overall effect: Z=1.15(P=0.25)							
Total ***	**343**		**340**			**100%**	**0.16[0.01,0.31]**
Heterogeneity: Tau^2=0; Chi^2=3.26, df=6(P=0.78); I^2=0%							
Test for overall effect: Z=2.11(P=0.04)							
Test for subgroup differences: Chi^2=0.28, df=1 (P=0.87), I^2=0%							



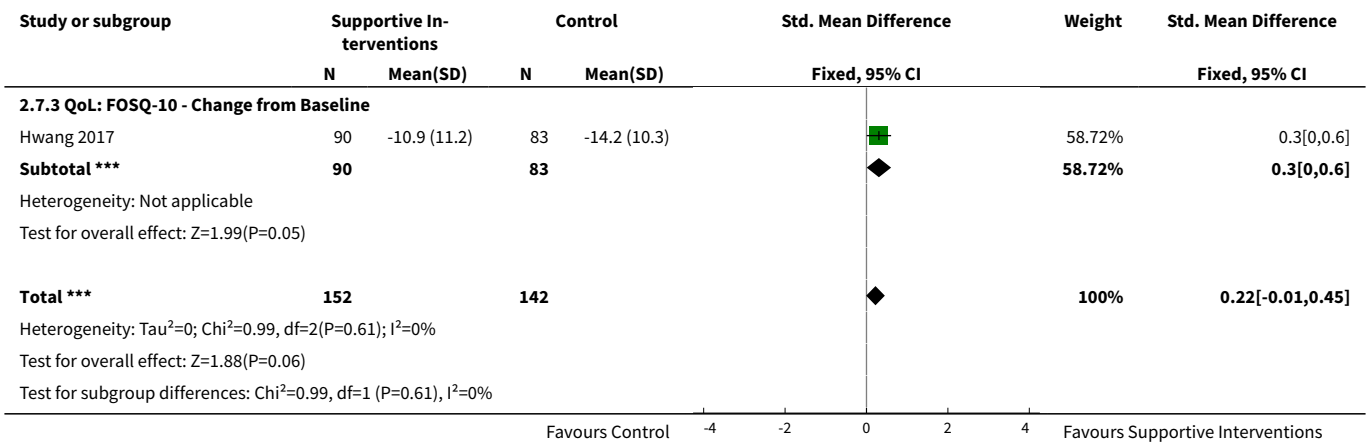
Favours Control — Favours Supportive Interventions

Analysis 2.7. Comparison 2 Supportive intervention versus control, Outcome 7 Quality of LIfe: Comparison of Change from Baseline Values.

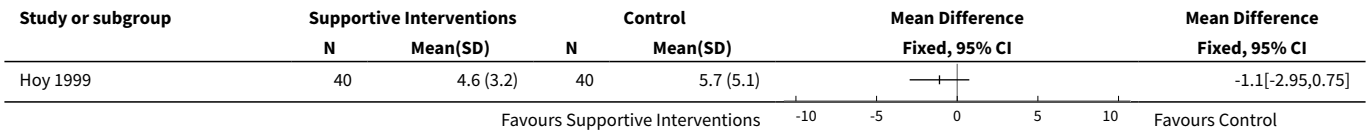
Study or subgroup	Supportive Interventions N	Supportive Interventions Mean(SD)	Control N	Control Mean(SD)	Std. Mean Difference Fixed, 95% CI	Weight	Std. Mean Difference Fixed, 95% CI
2.7.1 QoL: FOSQ - Change from Baseline							
Parthasarathy 2013	22	1.9 (3.4)	17	1.1 (3.1)		13.09%	0.24[-0.4,0.87]
Subtotal ***	**22**		**17**			**13.09%**	**0.24[-0.4,0.87]**
Heterogeneity: Tau^2=0; Chi^2=0, df=0(P<0.0001); I^2=100%							
Test for overall effect: Z=0.74(P=0.46)							
2.7.2 QoL: SF-36 (PH) - Change from Baseline							
Mendelson 2014	40	3.2 (8.6)	42	2.9 (7)		28.19%	0.04[-0.4,0.47]
Subtotal ***	**40**		**42**			**28.19%**	**0.04[-0.4,0.47]**
Heterogeneity: Not applicable							
Test for overall effect: Z=0.17(P=0.86)							



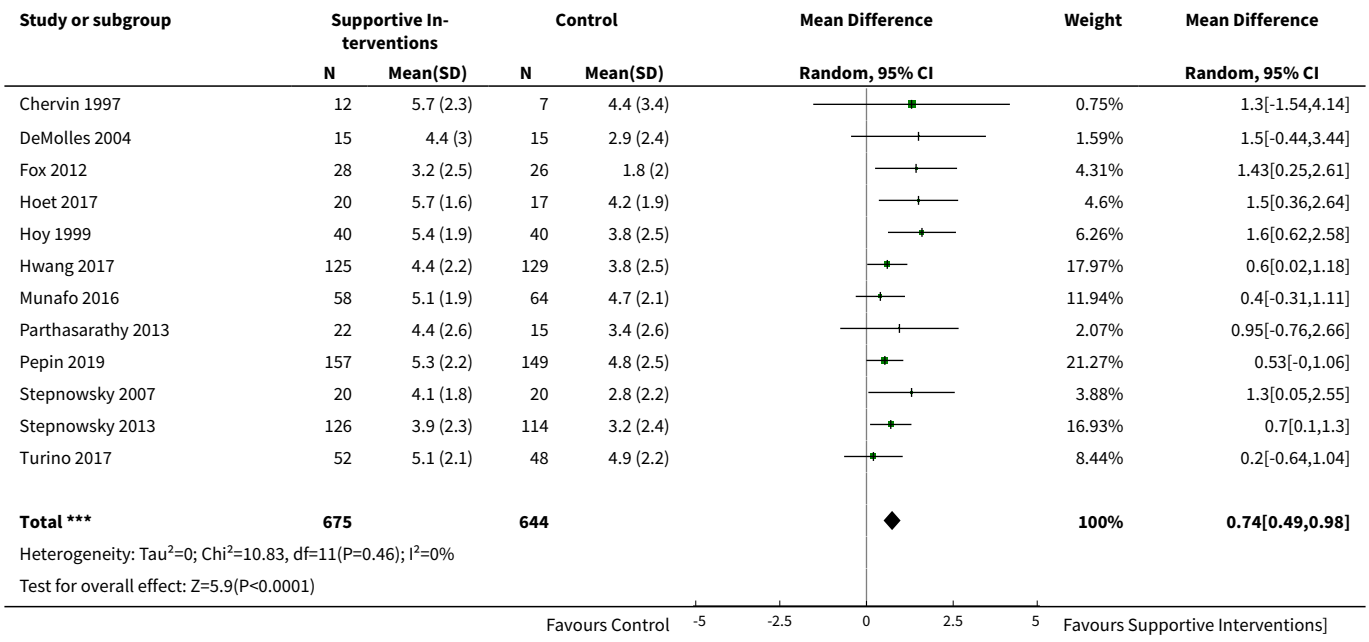
Favours Control — Favours Supportive Interventions



Analysis 2.8. Comparison 2 Supportive intervention versus control, Outcome 8 Anxiety Symptom Rating (HADS-A) - Comparison of Values at Endpoint.

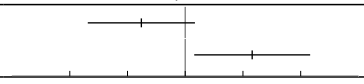


Analysis 2.9. Comparison 2 Supportive intervention versus control, Outcome 9 Machine usage, sensitivity analysis: excluding study with opposite direction of effect (authors suggest negative effect of intervention).



Analysis 2.10. Comparison 2 Supportive intervention versus control, Outcome 10 AHI on treatment - Comparison of Values at Endpoint.

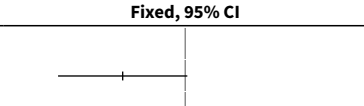
Study or subgroup	Supportive Interventions N	Supportive Interventions Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Mean Difference Fixed, 95% CI
Fox 2012	28	4.7 (3.8)	26	6.6 (4.8)		-1.9[-4.22,0.42]
Stepnowsky 2007	20	7.9 (4.1)	20	5 (4)		2.9[0.39,5.41]



Favours Supportive Interventions — Favours control

Analysis 2.11. Comparison 2 Supportive intervention versus control, Outcome 11 Depression Symptom Rating (HADS-D, CES-D) - Comparison of Values at Endpoint.

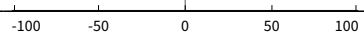
Study or subgroup	Supportive Interventions N	Supportive Interventions Mean(SD)	Control N	Control Mean(SD)	Std. Mean Difference Fixed, 95% CI	Std. Mean Difference Fixed, 95% CI
2.11.1 HADS-Depression						
Hoy 1999	40	2.6 (1.9)	40	3.9 (3.8)		-0.43[-0.87,0.01]
2.11.2 CES-D						
Stepnowsky 2007	20	8.6 (7)	20	8.3 (5.8)		0.05[-0.57,0.67]
Stepnowsky 2013	126	8.6 (5.5)	114	7.1 (4.9)		0.29[0.03,0.54]



Favours Supportive Interventions — Favours control

Analysis 2.12. Comparison 2 Supportive intervention versus control, Outcome 12 Cost-Effectiveness.

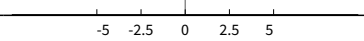
Study or subgroup	Supportive Interventions N	Supportive Interventions Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Mean Difference Fixed, 95% CI
Turino 2017	52	123.7 (0)	48	171 (0)		Not estimable



Favours Supportive Interventions — Favours Control

Analysis 2.13. Comparison 2 Supportive intervention versus control, Outcome 13 Machine usage, sensitivity analysis: excluding participants aware of machine usage.

Study or subgroup	Supportive Interventions N	Supportive Interventions Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Mean Difference Fixed, 95% CI
Hoy 1999	40	5.4 (1.9)	40	3.8 (2.5)		1.6[0.63,2.57]
Lewis 2006	30	3.8 (2.9)	25	3.4 (3.2)		0.4[-1.23,2.03]



Favours control — Favours Supportive Interventions

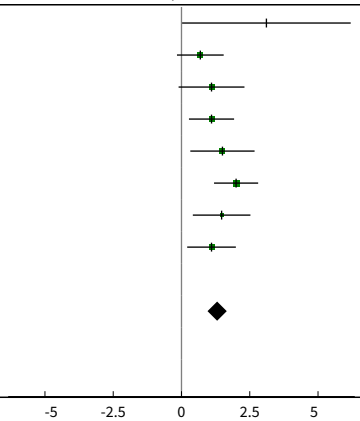
Comparison 3. Behavioural intervention versus control

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 CPAP Device Usage (hours/night)	8	578	Mean Difference (IV, Fixed, 95% CI)	1.31 [0.95, 1.66]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
2 CPAP Device Usage (hours/night), sensitivity analysis: adherence in control group < four hours/night	6	525	Mean Difference (IV, Fixed, 95% CI)	1.32 [0.93, 1.72]
3 N deemed adherent (≥ four hours/night)	6	549	Odds Ratio (M-H, Fixed, 95% CI)	1.70 [1.20, 2.41]
4 Withdrawal	10	939	Odds Ratio (M-H, Fixed, 95% CI)	0.66 [0.44, 0.98]
5 Epworth Sleepiness Scale (End-point scores)	5	271	Mean Difference (IV, Random, 95% CI)	-2.42 [-4.27, -0.57]
6 AHI on treatment - Endpoint	2	89	Mean Difference (IV, Fixed, 95% CI)	-0.95 [-2.25, 0.35]
7 Quality of Life - Comparison of Values at Endpoint	3	228	Std. Mean Difference (IV, Fixed, 95% CI)	0.00 [-0.26, 0.26]
7.1 QoL: FOSQ - Endpoint	2	200	Std. Mean Difference (IV, Fixed, 95% CI)	0.01 [-0.26, 0.29]
7.2 QoL: SF-36 (PH) - Endpoint	1	28	Std. Mean Difference (IV, Fixed, 95% CI)	-0.07 [-0.82, 0.67]

Analysis 3.1. Comparison 3 Behavioural intervention versus control, Outcome 1 CPAP Device Usage (hours/night).

Study or subgroup	Behavioural Interventions		Control		Mean Difference	Weight	Mean Difference
	N	Mean(SD)	N	Mean(SD)	Fixed, 95% CI		Fixed, 95% CI
Aloia 2001	6	7.8 (1.9)	6	4.7 (3.4)		1.31%	3.11[0.02,6.2]
Aloia 2013	62	4.3 (2.4)	55	3.7 (2.4)		17.01%	0.69[-0.17,1.55]
Bakker 2016	41	4.4 (2.9)	42	3.3 (2.7)		8.55%	1.1[-0.11,2.31]
Dantas 2015	20	6.2 (1.3)	21	5.1 (1.4)		18.21%	1.1[0.27,1.93]
Diaferia 2017	22	5.1 (2.3)	27	3.6 (1.8)		8.98%	1.5[0.32,2.68]
Lai 2014	49	4.4 (1.8)	51	2.4 (2.3)		19.07%	2[1.19,2.81]
Olsen 2012	50	4.6 (2.7)	50	3.2 (2.7)		11.19%	1.47[0.42,2.52]
Wang 2012	38	3.7 (2.3)	38	2.6 (1.6)		15.68%	1.1[0.21,1.99]
Total ***	**288**		**290**			**100%**	**1.31[0.95,1.66]**
Heterogeneity: Tau^2=0; Chi^2=6.89, df=7(P=0.44); I^2=0%							
Test for overall effect: Z=7.25(P<0.0001)							



Analysis 3.2. Comparison 3 Behavioural intervention versus control, Outcome 2 CPAP Device Usage (hours/night), sensitivity analysis: adherence in control group < four hours/night.

Study or subgroup	Behavioural Interventions N	Mean(SD)	Control N	Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Aloia 2013	62	4.3 (2.4)	55	3.7 (2.4)		21.14%	0.69[-0.17,1.55]
Bakker 2016	41	4.4 (2.9)	42	3.3 (2.7)		10.63%	1.1[-0.11,2.31]
Diaferia 2017	22	5.1 (2.3)	27	3.6 (1.8)		11.16%	1.5[0.32,2.68]
Lai 2014	49	4.4 (1.8)	51	2.4 (2.3)		23.69%	2[1.19,2.81]
Olsen 2012	50	4.6 (2.7)	50	3.2 (2.7)		13.9%	1.47[0.42,2.52]
Wang 2012	38	3.7 (2.3)	38	2.6 (1.6)		19.48%	1.1[0.21,1.99]
Total * **	**262**		**263**			**100%**	**1.32[0.93,1.72]**

Heterogeneity: Tau^2=0; Chi^2=5.34, df=5(P=0.38); I^2=6.32%

Test for overall effect: Z=6.59(P<0.0001)

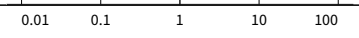
Analysis 3.3. Comparison 3 Behavioural intervention versus control, Outcome 3 N deemed adherent (≥ four hours/night).

Study or subgroup	Behavioural Interventions n/N	Control n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Aloia 2001	5/6	4/6		1.37%	2.5[0.16,38.6]
Diaferia 2017	11/22	8/27		7.39%	2.38[0.73,7.69]
Lai 2014	20/49	10/51		11.93%	2.83[1.15,6.93]
Smith 2009	30/55	24/42		25.45%	0.9[0.4,2.02]
Sparrow 2010	46/104	38/111		42.17%	1.52[0.88,2.64]
Wang 2012	26/38	18/38		11.69%	2.41[0.95,6.13]
Total (95% CI)	**274**	**275**		**100%**	**1.7[1.2,2.41]**

Total events: 138 (Behavioural Interventions), 102 (Control)

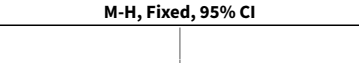
Heterogeneity: Tau^2=0; Chi^2=4.68, df=5(P=0.46); I^2=0%

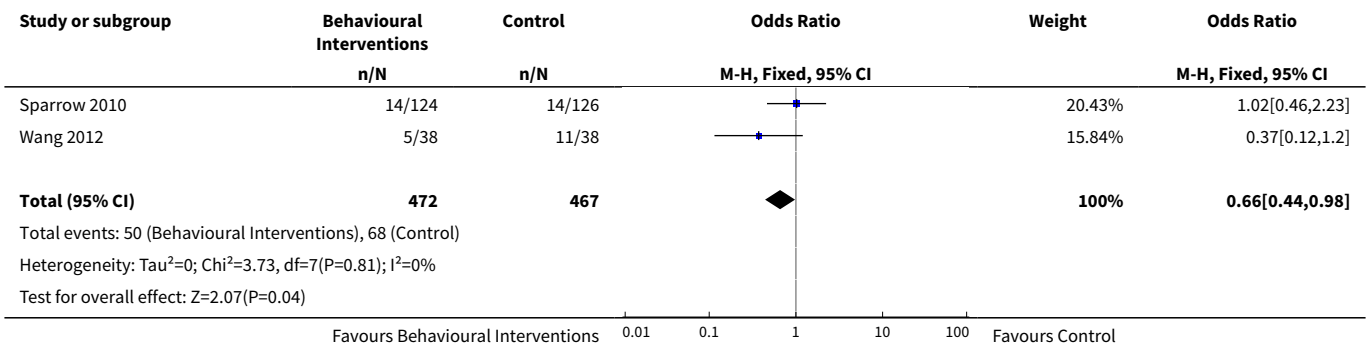
Test for overall effect: Z=2.99(P=0)



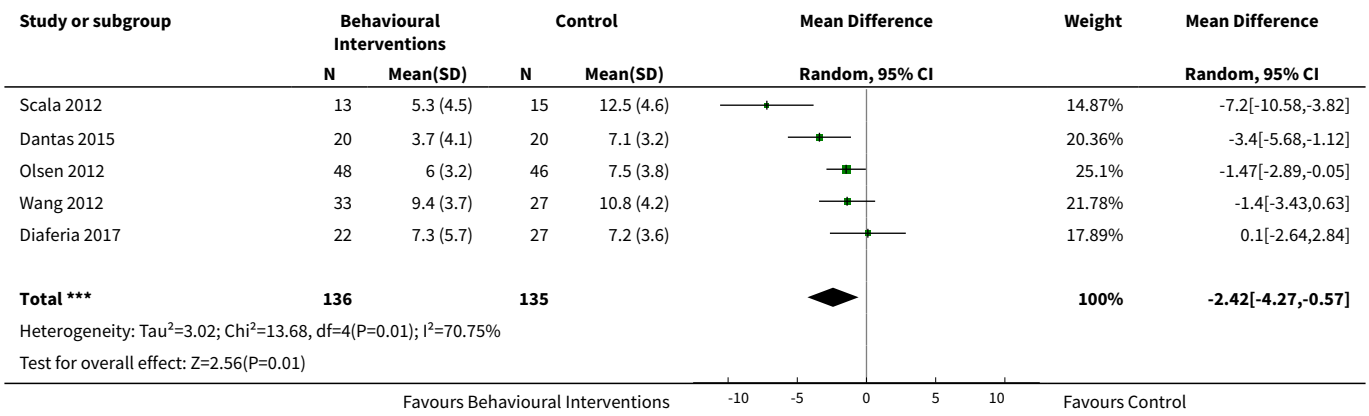
Analysis 3.4. Comparison 3 Behavioural intervention versus control, Outcome 4 Withdrawal.

Study or subgroup	Behavioural Interventions n/N	Control n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Aloia 2001	0/6	0/6			Not estimable
Aloia 2013	11/73	19/74		26.58%	0.51[0.22,1.17]
Bakker 2016	3/41	2/42		3.04%	1.58[0.25,9.98]
Dantas 2015	0/20	1/20		2.43%	0.32[0.01,8.26]
Lai 2014	1/49	1/51		1.59%	1.04[0.06,17.13]
Olsen 2012	5/53	7/53		10.52%	0.68[0.2,2.31]
Scala 2012	0/13	0/15			Not estimable
Smith 2009	11/55	13/42		19.56%	0.56[0.22,1.41]

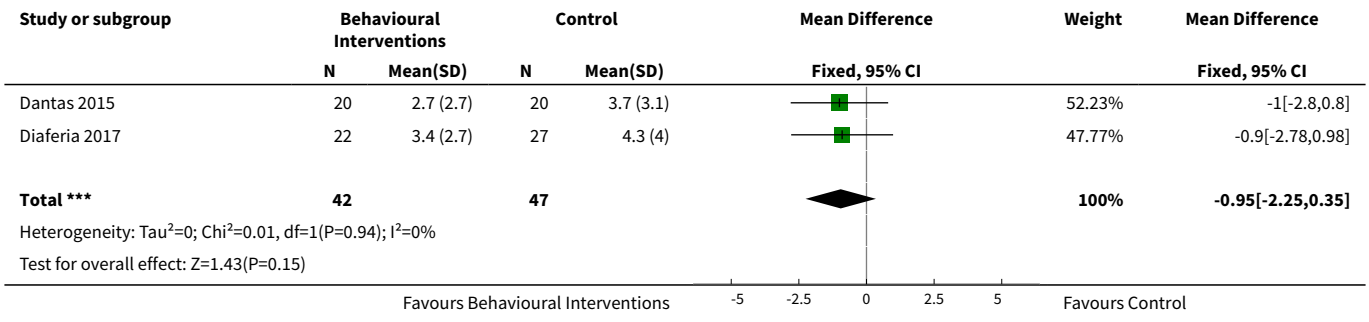




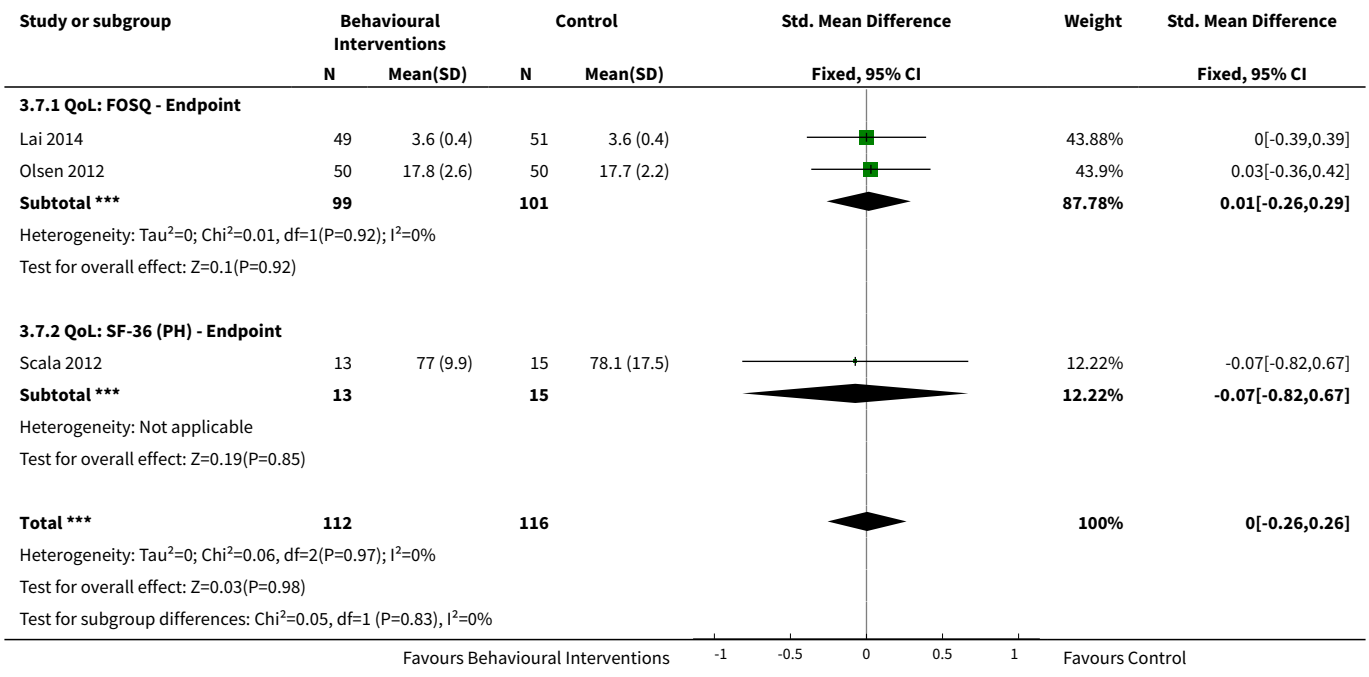
Analysis 3.5. Comparison 3 Behavioural intervention versus control, Outcome 5 Epworth Sleepiness Scale (Endpoint scores).



Analysis 3.6. Comparison 3 Behavioural intervention versus control, Outcome 6 AHI on treatment - Endpoint.



Analysis 3.7. Comparison 3 Behavioural intervention versus control, Outcome 7 Quality of Life - Comparison of Values at Endpoint.



Comparison 4. Mixed (SUP/EDU/BEH) intervention versus control

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 CPAP Device Usage (hours/night)	11	4509	Mean Difference (IV, Random, 95% CI)	0.82 [0.20, 1.43]
2 CPAP Device Usage, sensitivity analysis: adherence in control group < four hours/night	2	343	Mean Difference (IV, Random, 95% CI)	1.77 [0.21, 3.34]
3 N deemed adherent (≥ four hours/night)	9	4015	Odds Ratio (M-H, Random, 95% CI)	1.71 [1.08, 2.72]
4 Withdrawal	11	4956	Odds Ratio (M-H, Random, 95% CI)	0.61 [0.28, 1.30]
5 Quality of LIfe: Comparison of Change from Baseline Values	2	3012	Std. Mean Difference (IV, Random, 95% CI)	0.45 [0.12, 0.78]
5.1 QoL: FOSQ-10 - Change from Baseline	1	176	Std. Mean Difference (IV, Random, 95% CI)	0.25 [-0.05, 0.54]
5.2 QoL: SF-36 (PH) - Change from Baseline	1	2836	Std. Mean Difference (IV, Random, 95% CI)	0.59 [0.52, 0.67]
6 Quality of Life: Comparison of Values at Endpoint	4	3191	Std. Mean Difference (IV, Random, 95% CI)	0.45 [0.06, 0.83]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
6.1 QoL: FOSQ - Endpoint	1	177	Std. Mean Difference (IV, Random, 95% CI)	0.10 [-0.19, 0.40]
6.2 QoL: SF-36 (PH) - Endpoint	3	3014	Std. Mean Difference (IV, Random, 95% CI)	0.59 [-0.01, 1.19]
7 Anxiety Symptom Rating - Comparison of Values at Endpoint	3	333	Std. Mean Difference (IV, Random, 95% CI)	-0.19 [-0.47, 0.09]
7.1 DASS - Anxiety	1	177	Std. Mean Difference (IV, Random, 95% CI)	-0.03 [-0.32, 0.27]
7.2 BAI	1	65	Std. Mean Difference (IV, Random, 95% CI)	-0.15 [-0.63, 0.34]
7.3 STAI - State	1	91	Std. Mean Difference (IV, Random, 95% CI)	-0.49 [-0.92, -0.06]
8 Depression Symptom Rating - Comparison of Values at Endpoint	4		Std. Mean Difference (IV, Fixed, 95% CI)	Totals not selected
8.1 BDI	1		Std. Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
8.2 HADS - Depression	2		Std. Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
8.3 DASS - Depression	1		Std. Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
9 Epworth Sleepiness Scale Score	7		Mean Difference (IV, Random, 95% CI)	Totals not selected
9.1 ESS: Endpoint Scores	5		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
9.2 ESS: Change from Baseline	3		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

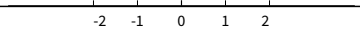
Analysis 4.1. Comparison 4 Mixed (SUP/EDU/BEH) intervention versus control, Outcome 1 CPAP Device Usage (hours/night).

Study or subgroup	Mixed Interventions N	Mixed Interventions Mean(SD)	Control N	Control Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
Bartlett 2013	109	3.5 (2.6)	97	4.1 (2.7)		10.05%	-0.6[-1.33,0.13]
Bouloukaki 2014	1550	6.9 (1.8)	1550	5.2 (2.2)		11.63%	1.7[1.56,1.84]
Chen 2015	40	6.4 (1.3)	40	4.2 (1.2)		10.71%	2.21[1.66,2.76]
Hui 2000	54	5.3 (1.5)	54	5.3 (2.2)		10.14%	0[-0.71,0.71]
Hwang 2017	138	4.8 (2.3)	129	3.8 (2.5)		10.61%	1[0.42,1.58]
				Favours Control	-2 -1 0 1 2		Favours Mixed Interventions

Study or subgroup	Mixed Interventions N	Mixed Interventions Mean(SD)	Control N	Control Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
Lewis 2006	32	4.9 (0)	26	4.5 (0)			Not estimable
Meurice 2007	85	5.1 (2.4)	27	4.7 (2.4)		8.78%	0.42[-0.62,1.45]
Sawyer 2017	30	4.8 (2.3)	30	4.7 (1.9)		8.73%	0.1[-0.95,1.15]
Sedkaoui 2015	188	4.6 (2.3)	189	4.1 (2.4)		10.94%	0.44[-0.03,0.91]
Shapiro 2017	32	5.4 (1.8)	33	5.5 (2.5)		8.7%	-0.1[-1.16,0.96]
Wang 2012	38	5.2 (2)	38	2.6 (1.6)		9.71%	2.6[1.79,3.41]
Total * **	**2296**		**2213**			**100%**	**0.82[0.2,1.43]**

Heterogeneity: Tau²=0.84; Chi²=111.83, df=9(P<0.0001); I²=91.95%

Test for overall effect: Z=2.61(P=0.01)



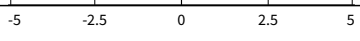
Favours Control — Favours Mixed Interventions

Analysis 4.2. Comparison 4 Mixed (SUP/EDU/BEH) intervention versus control, Outcome 2 CPAP Device Usage, sensitivity analysis: adherence in control group < four hours/night.

Study or subgroup	Mixed Interventions N	Mixed Interventions Mean(SD)	Control N	Control Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
Wang 2012	38	5.2 (2)	38	2.6 (1.6)		48.32%	2.6[1.79,3.41]
Hwang 2017	138	4.8 (2.3)	129	3.8 (2.5)		51.68%	1[0.42,1.58]
Total * **	**176**		**167**			**100%**	**1.77[0.21,3.34]**

Heterogeneity: Tau²=1.15; Chi²=9.87, df=1(P=0); I²=89.87%

Test for overall effect: Z=2.22(P=0.03)



Favours Control — Favours Mixed Interventions

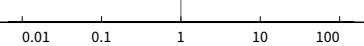
Analysis 4.3. Comparison 4 Mixed (SUP/EDU/BEH) intervention versus control, Outcome 3 N deemed adherent (≥ four hours/night).

Study or subgroup	Mixed Interventions n/N	Control n/N	Odds Ratio M-H, Random, 95% CI	Weight	Odds Ratio M-H, Random, 95% CI
Bartlett 2013	55/109	54/97		13.76%	0.81[0.47,1.4]
Bouloukaki 2014	1389/1497	1069/1339		16.33%	3.25[2.56,4.12]
Hui 2000	40/54	38/54		10.89%	1.2[0.52,2.8]
Hwang 2017	101/138	69/129		14.12%	2.37[1.42,3.96]
Sawyer 2017	19/30	20/30		8.99%	0.86[0.3,2.5]
Sedkaoui 2015	141/188	124/189		14.73%	1.57[1.01,2.46]
Shapiro 2017	23/33	25/33		8.78%	0.74[0.25,2.19]
Smith 2006	9/10	4/9		2.96%	11.25[0.97,130.22]
Wang 2012	30/38	18/38		9.44%	4.17[1.52,11.4]
Total (95% CI)	**2097**	**1918**		**100%**	**1.71[1.08,2.72]**

Total events: 1807 (Mixed Interventions), 1421 (Control)

Heterogeneity: Tau²=0.33; Chi²=37.4, df=8(P<0.0001); I²=78.61%

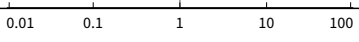
Test for overall effect: Z=2.28(P=0.02)



Favours Control — Favours Mixed Interventions

Analysis 4.4. Comparison 4 Mixed (SUP/EDU/BEH) intervention versus control, Outcome 4 Withdrawal.

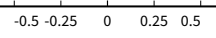
Study or subgroup	Mixed Interventions n/N	Control n/N	Odds Ratio M-H, Random, 95% CI	Weight	Odds Ratio M-H, Random, 95% CI
Bartlett 2013	10/109	19/97		14.18%	0.41[0.18,0.94]
Bouloukaki 2014	53/1550	211/1550		16.51%	0.22[0.16,0.31]
Hui 2000	9/54	2/54		9.79%	5.2[1.07,25.33]
Hwang 2017	57/346	53/354		16.19%	1.12[0.75,1.68]
Lewis 2006	4/36	10/36		11.54%	0.33[0.09,1.16]
Meurice 2007	0/85	0/27			Not estimable
Sawyer 2017	7/61	8/57		12.62%	0.79[0.27,2.35]
Sedkaoui 2015	1/189	1/190		5.21%	1.01[0.06,16.19]
Shapiro 2017	1/33	0/33		4.18%	3.09[0.12,78.7]
Smith 2006	0/10	0/9			Not estimable
Wang 2012	2/38	11/38		9.77%	0.14[0.03,0.67]
Total (95% CI)	**2511**	**2445**		**100%**	**0.61[0.28,1.3]**
Total events: 144 (Mixed Interventions), 315 (Control)					
Heterogeneity: Tau^2=0.89; Chi^2=52.89, df=8(P<0.0001); I^2=84.87%					
Test for overall effect: Z=1.28(P=0.2)					



Favours Mixed Interventions — Favours Control

Analysis 4.5. Comparison 4 Mixed (SUP/EDU/BEH) intervention versus control, Outcome 5 Quality of LIfe: Comparison of Change from Baseline Values.

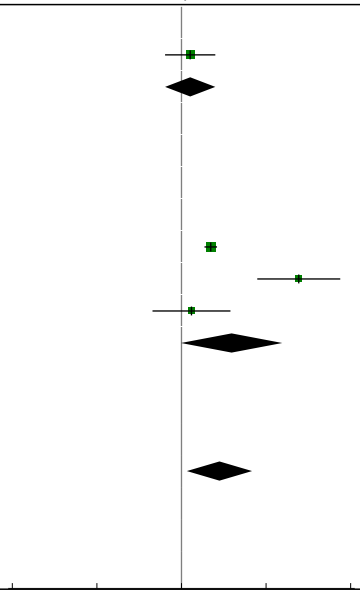
Study or subgroup	Mixed Interventions N	Mixed Interventions Mean(SD)	Control N	Control Mean(SD)	Std. Mean Difference Random, 95% CI	Weight	Std. Mean Difference Random, 95% CI
4.5.1 QoL: FOSQ-10 - Change from Baseline							
Hwang 2017	93	-11.3 (12.8)	83	-14.2 (10.3)		40.97%	0.25[-0.05,0.54]
Subtotal ***	**93**		**83**			**40.97%**	**0.25[-0.05,0.54]**
Heterogeneity: Not applicable							
Test for overall effect: Z=1.63(P=0.1)							
4.5.2 QoL: SF-36 (PH) - Change from Baseline							
Bouloukaki 2014	1497	11.6 (7.7)	1339	5.9 (11.4)		59.03%	0.59[0.52,0.67]
Subtotal ***	**1497**		**1339**			**59.03%**	**0.59[0.52,0.67]**
Heterogeneity: Not applicable							
Test for overall effect: Z=15.41(P<0.0001)							
Total ***	**1590**		**1422**			**100%**	**0.45[0.12,0.78]**
Heterogeneity: Tau^2=0.05; Chi^2=4.87, df=1(P=0.03); I^2=79.45%							
Test for overall effect: Z=2.66(P=0.01)							
Test for subgroup differences: Chi^2=4.87, df=1 (P=0.03), I^2=79.45%							



Favours Control — Favours Mixed Interventions

Analysis 4.6. Comparison 4 Mixed (SUP/EDU/BEH) intervention versus control, Outcome 6 Quality of Life: Comparison of Values at Endpoint.

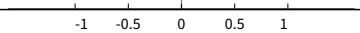
Study or subgroup	Mixed Interventions N	Mixed Interventions Mean(SD)	Control N	Control Mean(SD)	Std. Mean Difference Random, 95% CI	Weight	Std. Mean Difference Random, 95% CI
4.6.1 QoL: FOSQ - Endpoint							
Bartlett 2013	99	17 (2.9)	78	16.7 (2.9)		26.47%	0.1[-0.19,0.4]
Subtotal ***	**99**		**78**			**26.47%**	**0.1[-0.19,0.4]**
Heterogeneity: Not applicable							
Test for overall effect: Z=0.68(P=0.5)							
4.6.2 QoL: SF-36 (PH) - Endpoint							
Bouloukaki 2014	1497	86.3 (6.2)	1339	81.7 (18.2)		31.03%	0.35[0.27,0.42]
Chen 2015	40	50 (5)	40	43 (5)		20.82%	1.39[0.9,1.88]
Meurice 2007	74	47 (7.9)	24	46 (10.8)		21.68%	0.12[-0.34,0.58]
Subtotal ***	**1611**		**1403**			**73.53%**	**0.59[-0.01,1.19]**
Heterogeneity: Tau^2=0.24; Chi^2=18.01, df=2(P=0); I^2=88.9%							
Test for overall effect: Z=1.94(P=0.05)							
Total ***	**1710**		**1481**			**100%**	**0.45[0.06,0.83]**
Heterogeneity: Tau^2=0.12; Chi^2=20.79, df=3(P=0); I^2=85.57%							
Test for overall effect: Z=2.28(P=0.02)							
Test for subgroup differences: Chi^2=2.06, df=1 (P=0.15), I^2=51.38%							



Favours Control — Favours Mixed Interventions

Analysis 4.7. Comparison 4 Mixed (SUP/EDU/BEH) intervention versus control, Outcome 7 Anxiety Symptom Rating - Comparison of Values at Endpoint.

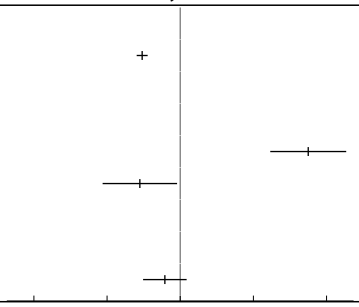
Study or subgroup	Mixed Interventions N	Mixed Interventions Mean(SD)	Control N	Control Mean(SD)	Std. Mean Difference Random, 95% CI	Weight	Std. Mean Difference Random, 95% CI
4.7.1 DASS - Anxiety							
Bartlett 2013	99	6.8 (7.6)	78	7 (7.8)		45.8%	-0.03[-0.32,0.27]
Subtotal ***	**99**		**78**			**45.8%**	**-0.03[-0.32,0.27]**
Heterogeneity: Not applicable							
Test for overall effect: Z=0.17(P=0.86)							
4.7.2 BAI							
Shapiro 2017	32	5 (7.3)	33	6.1 (7.5)		24.55%	-0.15[-0.63,0.34]
Subtotal ***	**32**		**33**			**24.55%**	**-0.15[-0.63,0.34]**
Heterogeneity: Not applicable							
Test for overall effect: Z=0.59(P=0.55)							
4.7.3 STAI - State							
Wang 2012	36	32.7 (5.2)	55	43.2 (27)		29.65%	-0.49[-0.92,-0.06]
Subtotal ***	**36**		**55**			**29.65%**	**-0.49[-0.92,-0.06]**
Heterogeneity: Not applicable							
Test for overall effect: Z=2.25(P=0.02)							
Total ***	**167**		**166**			**100%**	**-0.19[-0.47,0.09]**
Heterogeneity: Tau^2=0.02; Chi^2=3.07, df=2(P=0.22); I^2=34.79%							
Test for overall effect: Z=1.35(P=0.18)							
Test for subgroup differences: Chi^2=3.07, df=1 (P=0.22), I^2=34.79%							



Favours Mixed Interventions — Favours Control

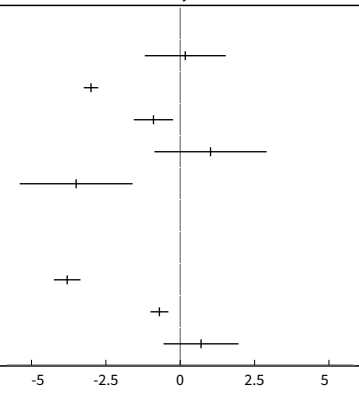
Analysis 4.8. Comparison 4 Mixed (SUP/EDU/BEH) intervention versus control, Outcome 8 Depression Symptom Rating - Comparison of Values at Endpoint.

Study or subgroup	Mixed Interventions N	Mixed Interventions Mean(SD)	Control N	Control Mean(SD)	Std. Mean Difference Fixed, 95% CI	Std. Mean Difference Fixed, 95% CI
4.8.1 BDI						
Bouloukaki 2014	1497	7.8 (5.9)	1339	11.1 (6.8)		-0.52[-0.6,-0.45]
4.8.2 HADS - Depression						
Chen 2015	40	6.4 (1.3)	40	4.2 (1.2)		1.75[1.23,2.27]
Wang 2012	36	4.9 (2.1)	27	6.2 (2.6)		-0.55[-1.06,-0.04]
4.8.3 DASS - Depression						
Bartlett 2013	99	6.6 (8.3)	78	8.6 (10.8)		-0.21[-0.51,0.09]



Analysis 4.9. Comparison 4 Mixed (SUP/EDU/BEH) intervention versus control, Outcome 9 Epworth Sleepiness Scale Score.

Study or subgroup	Mixed Interventions N	Mixed Interventions Mean(SD)	Control N	Control Mean(SD)	Mean Difference Random, 95% CI	Mean Difference Random, 95% CI
4.9.1 ESS: Endpoint Scores						
Bartlett 2013	99	7.8 (4.7)	78	7.6 (4.5)		0.17[-1.19,1.53]
Bouloukaki 2014	1497	4.2 (1.6)	1339	7.2 (4.3)		-3[-3.24,-2.76]
Chen 2015	40	10.3 (1.4)	40	11.2 (1.7)		-0.9[-1.56,-0.24]
Meurice 2007	85	6.2 (5.1)	27	5.2 (4.1)		1.02[-0.87,2.91]
Wang 2012	36	7.3 (3.2)	27	10.8 (4.2)		-3.5[-5.4,-1.6]
4.9.2 ESS: Change from Baseline						
Bouloukaki 2014	1497	-8.1 (6)	1339	-4.3 (6.1)		-3.8[-4.25,-3.35]
Hui 2000	54	-8.1 (0.8)	54	-7.4 (0.8)		-0.7[-1,-0.4]
Hwang 2017	93	-3 (3.7)	83	-3.7 (4.7)		0.7[-0.56,1.96]



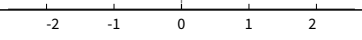
Comparison 5. Post-hoc sensitivity analyses

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 EDU: CPAP Device Usage (hours/night), original EDU study classification	8	1095	Mean Difference (IV, Fixed, 95% CI)	0.48 [0.21, 0.76]
2 SUP: CPAP Device Usage (hours/night), original SUP study classification	14	1534	Mean Difference (IV, Fixed, 95% CI)	0.58 [0.36, 0.81]
3 BEH: CPAP Device Usage (hours/night), original BEH study classification	9	625	Mean Difference (IV, Fixed, 95% CI)	1.47 [1.12, 1.83]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
4 EDU: CPAP Device Usage (hours/night), exclude HIGH 'Risk of bias' studies	4	642	Mean Difference (IV, Random, 95% CI)	0.98 [0.07, 1.89]
5 SUP: CPAP Device Usage (hours/night), exclude HIGH 'Risk of bias' studies	5	728	Mean Difference (IV, Fixed, 95% CI)	0.75 [0.42, 1.09]
6 BEH: CPAP Device Usage (hours/night), exclude HIGH 'Risk of bias' studies	4	340	Mean Difference (IV, Fixed, 95% CI)	1.05 [0.57, 1.53]
7 MIX: CPAP Device Usage (hours/night), exclude HIGH 'Risk of bias' studies	5		Mean Difference (IV, Random, 95% CI)	Totals not selected

Analysis 5.1. Comparison 5 Post-hoc sensitivity analyses, Outcome 1 EDU: CPAP Device Usage (hours/night), original EDU study classification.

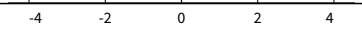
Study or subgroup	Educational Interventions		Control		Mean Difference	Weight	Mean Difference
	N	Mean(SD)	N	Mean(SD)	Fixed, 95% CI		Fixed, 95% CI
Aloia 2013	66	4.5 (2.5)	55	3.7 (2.4)		10.07%	0.83[-0.04,1.7]
Basoglu 2011	66	5.5 (1.2)	67	5.1 (1.6)		32.86%	0.4[-0.08,0.88]
Falcone 2014	90	5.3 (0)	71	4.1 (0)			Not estimable
Hwang 2017	163	4 (2.4)	129	3.8 (2.5)		23.54%	0.2[-0.37,0.77]
Meurice 2007	85	5.1 (2.4)	27	4.7 (2.4)		7.06%	0.42[-0.62,1.45]
Pengo 2018	60	3.1 (2.5)	25	3.1 (2.7)		4.99%	-0.04[-1.27,1.2]
Sarac 2017	52	5.2 (2.1)	63	4.2 (2.5)		10.72%	1[0.16,1.84]
Wang 2012	38	3.4 (2.1)	38	2.6 (1.6)		10.75%	0.8[-0.04,1.64]
Total * **	**620**		**475**			**100%**	**0.48[0.21,0.76]**
Heterogeneity: Tau²=0; Chi²=4.38, df=6(P=0.63); I²=0%							
Test for overall effect: Z=3.44(P=0)							



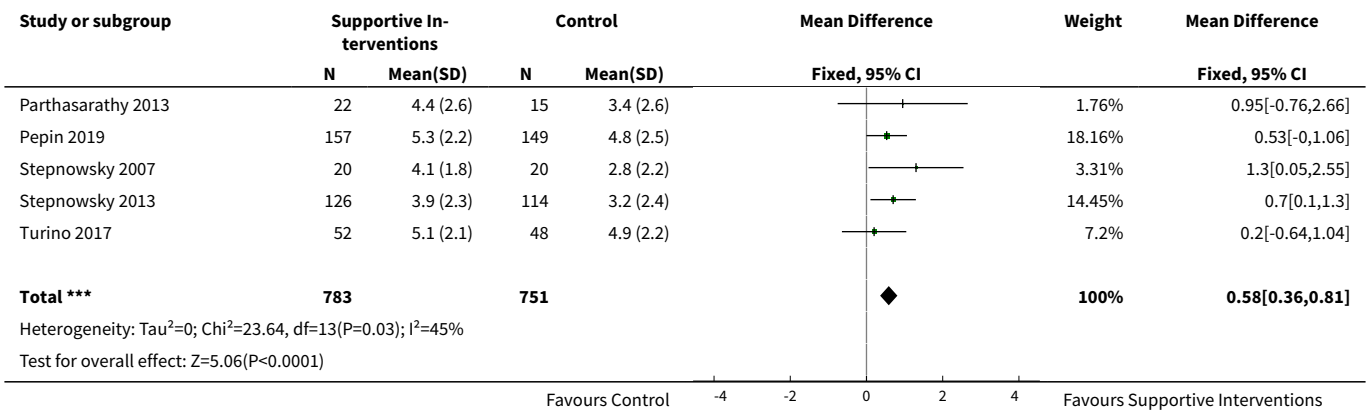
Favours Control — Favours Educational Interventions

Analysis 5.2. Comparison 5 Post-hoc sensitivity analyses, Outcome 2 SUP: CPAP Device Usage (hours/night), original SUP study classification.

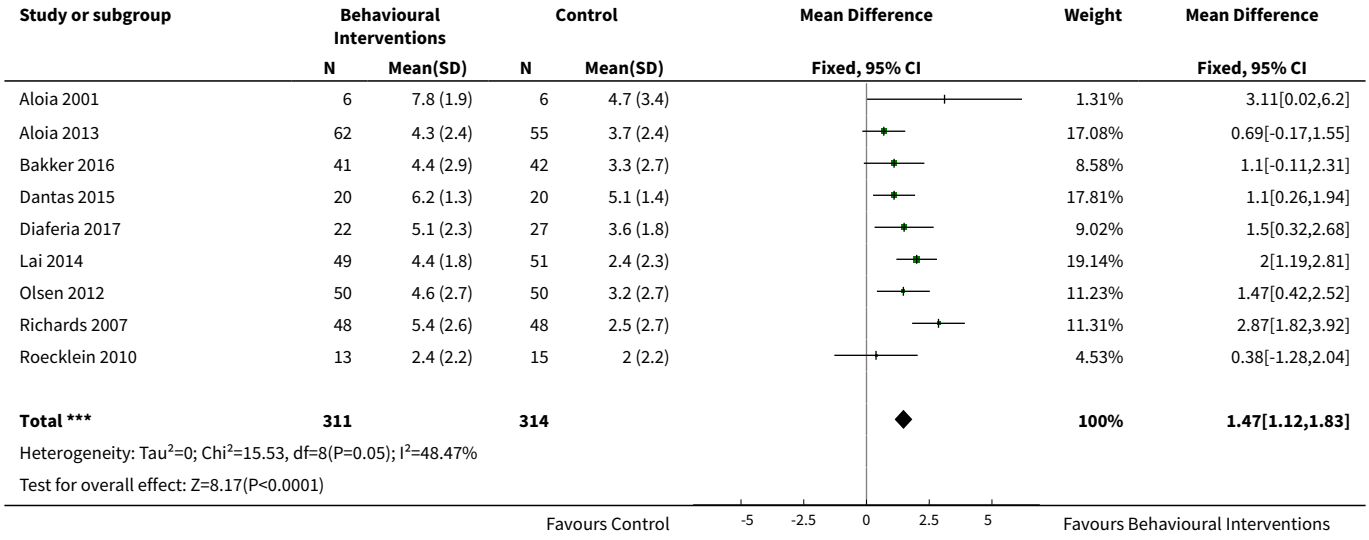
Study or subgroup	Supportive Interventions		Control		Mean Difference	Weight	Mean Difference
	N	Mean(SD)	N	Mean(SD)	Fixed, 95% CI		Fixed, 95% CI
Chervin 1997	12	5.7 (2.3)	7	4.4 (3.4)		0.64%	1.3[-1.54,4.14]
DeMolles 2004	15	4.4 (3)	15	2.9 (2.4)		1.36%	1.5[-0.44,3.44]
Fox 2012	28	3.2 (2.5)	26	1.8 (2)		3.68%	1.43[0.25,2.61]
Hoet 2017	20	5.7 (1.6)	17	4.2 (1.9)		3.93%	1.5[0.36,2.64]
Hoy 1999	40	5.4 (1.9)	40	3.8 (2.5)		5.35%	1.6[0.62,2.58]
Hui 2000	54	5.3 (1.5)	54	5.3 (2.2)		10.29%	0[-0.71,0.71]
Hwang 2017	125	4.4 (2.2)	129	3.8 (2.5)		15.34%	0.6[0.02,1.18]
Mendelson 2014	54	3.1 (3)	53	4.2 (2.8)		4.34%	-1.05[-2.14,0.04]
Munafo 2016	58	5.1 (1.9)	64	4.7 (2.1)		10.2%	0.4[-0.31,1.11]



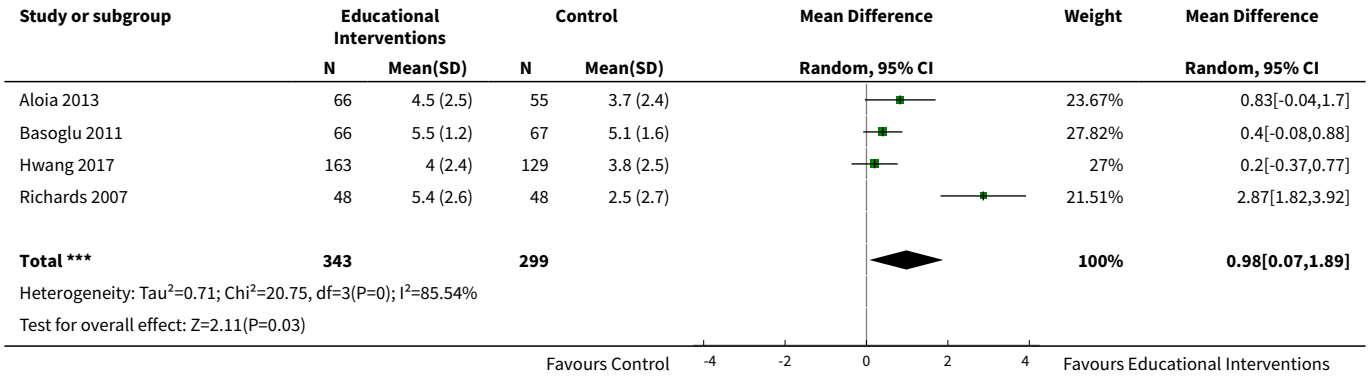
Favours Control — Favours Supportive Interventions



Analysis 5.3. Comparison 5 Post-hoc sensitivity analyses, Outcome 3 BEH: CPAP Device Usage (hours/night), original BEH study classification.



Analysis 5.4. Comparison 5 Post-hoc sensitivity analyses, Outcome 4 EDU: CPAP Device Usage (hours/night), exclude HIGH 'Risk of bias' studies.

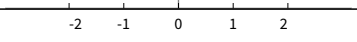


Analysis 5.5. Comparison 5 Post-hoc sensitivity analyses, Outcome 5 SUP: CPAP Device Usage (hours/night), exclude HIGH 'Risk of bias' studies.

Study or subgroup	Supportive Interventions N	Supportive Interventions Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Fox 2012	28	3.2 (2.5)	26	1.8 (2)		7.99%	1.43[0.25,2.61]
Hoy 1999	40	5.4 (1.9)	40	3.8 (2.5)		11.62%	1.6[0.62,2.58]
Hwang 2017	125	4.4 (2.2)	129	3.8 (2.5)		33.33%	0.6[0.02,1.18]
Stepnowsky 2013	126	3.9 (2.3)	114	3.2 (2.4)		31.41%	0.7[0.1,1.3]
Turino 2017	52	5.1 (2.1)	48	4.9 (2.2)		15.65%	0.2[-0.64,1.04]
Total ***	**371**		**357**			**100%**	**0.75[0.42,1.09]**

Heterogeneity: $Tau^2=0$; $Chi^2=6.08$, df=4(P=0.19); $I^2=34.17\%$

Test for overall effect: Z=4.41(P<0.0001)



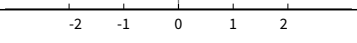
Favours Control — Favours Supportive Interventions

Analysis 5.6. Comparison 5 Post-hoc sensitivity analyses, Outcome 6 BEH: CPAP Device Usage (hours/night), exclude HIGH 'Risk of bias' studies.

Study or subgroup	Behavioural Interventions N	Behavioural Interventions Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Aloia 2013	62	4.3 (2.4)	55	3.7 (2.4)		31.22%	0.69[-0.17,1.55]
Bakker 2016	41	4.4 (2.9)	42	3.3 (2.7)		15.69%	1.1[-0.11,2.31]
Dantas 2015	20	6.2 (1.3)	20	5.1 (1.4)		32.56%	1.1[0.26,1.94]
Olsen 2012	50	4.6 (2.7)	50	3.2 (2.7)		20.53%	1.47[0.42,2.52]
Total ***	**173**		**167**			**100%**	**1.05[0.57,1.53]**

Heterogeneity: $Tau^2=0$; $Chi^2=1.31$, df=3(P=0.73); $I^2=0\%$

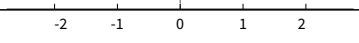
Test for overall effect: Z=4.3(P<0.0001)



Favours Control — Favours Behavioural Interventions

Analysis 5.7. Comparison 5 Post-hoc sensitivity analyses, Outcome 7 MIX: CPAP Device Usage (hours/night), exclude HIGH 'Risk of bias' studies.

Study or subgroup	Mixed Interventions N	Mixed Interventions Mean(SD)	Control N	Control Mean(SD)	Mean Difference Random, 95% CI	Mean Difference Random, 95% CI
Bartlett 2013	109	3.5 (2.6)	97	4.1 (2.7)		-0.6[-1.33,0.13]
Bouloukaki 2014	1550	6.9 (1.8)	1550	5.2 (2.2)		1.7[1.56,1.84]
Hwang 2017	138	4.8 (2.3)	129	3.8 (2.5)		1[0.42,1.58]
Sawyer 2017	30	4.8 (2.3)	30	4.7 (1.9)		0.1[-0.95,1.15]
Shapiro 2017	32	5.4 (1.8)	33	5.5 (2.5)		-0.1[-1.16,0.96]



Favours Control — Favours Mixed Interventions

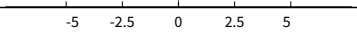
Comparison 6. Post-hoc subgroup analyses (exploratory)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 EDU: CPAP Device Usage (hours/night)	10	1128	Mean Difference (IV, Random, 95% CI)	0.85 [0.32, 1.39]
1.1 Intervention Duration > 4 weeks	3	453	Mean Difference (IV, Random, 95% CI)	0.33 [-0.10, 0.77]
1.2 Intervention Duration ≤ 4 weeks	7	675	Mean Difference (IV, Random, 95% CI)	1.20 [0.39, 2.01]
2 EDU: CPAP Device Usage (hours/night)	9	836	Mean Difference (IV, Random, 95% CI)	0.98 [0.36, 1.59]
2.1 Contact Episodes: > 1	6	514	Mean Difference (IV, Random, 95% CI)	1.20 [0.41, 2.00]
2.2 Contact Episodes: 1 (single)	3	322	Mean Difference (IV, Random, 95% CI)	0.40 [-0.06, 0.86]
3 EDU: CPAP Device Usage (hours/night)	8	808	Mean Difference (IV, Random, 95% CI)	1.04 [0.37, 1.71]
3.1 Contact Time > 60 min	3	293	Mean Difference (IV, Random, 95% CI)	1.46 [0.22, 2.71]
3.2 Contact Time ≤ 60 min	5	515	Mean Difference (IV, Random, 95% CI)	0.61 [0.00, 1.22]
4 SUP: Subgroup Analysis - CPAP Device Usage (hours/night)	13	1426	Mean Difference (IV, Random, 95% CI)	0.70 [0.36, 1.05]
4.1 Intervention Duration > 12 weeks	4	530	Mean Difference (IV, Random, 95% CI)	0.49 [-0.53, 1.51]
4.2 Intervention duration ≤12 weeks	9	896	Mean Difference (IV, Random, 95% CI)	0.72 [0.43, 1.01]
5 SUP: Subgroup Analysis - CPAP Device Usage (hours/night)	13	1426	Mean Difference (IV, Random, 95% CI)	0.70 [0.36, 1.05]
5.1 Intervention entailed Automated Contact Only	4	513	Mean Difference (IV, Random, 95% CI)	0.26 [-0.51, 1.04]
5.2 Intervention included Human Contact	9	913	Mean Difference (IV, Random, 95% CI)	0.84 [0.52, 1.17]
6 SUP: Subgroup Analysis - CPAP Device Usage (hours/night)	13	1426	Mean Difference (IV, Fixed, 95% CI)	0.65 [0.41, 0.89]
6.1 Scheduled, Human Interaction	3	136	Mean Difference (IV, Fixed, 95% CI)	1.43 [0.61, 2.24]
6.2 Automated and/or Ad-hoc Human Contact only	10	1290	Mean Difference (IV, Fixed, 95% CI)	0.58 [0.33, 0.83]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
7 BEH: Subgroup Analysis - CPAP Device Usage (hours/night)	8	577	Mean Difference (IV, Random, 95% CI)	1.31 [0.95, 1.66]
7.1 BEH: Intervention Duration > 4 weeks	3	208	Mean Difference (IV, Random, 95% CI)	1.21 [0.60, 1.82]
7.2 BEH: Intervention Duration ≤ 4 weeks	5	369	Mean Difference (IV, Random, 95% CI)	1.38 [0.80, 1.95]
8 BEH: Subgroup Analysis - CPAP Device Usage (hours/night)	8	577	Mean Difference (IV, Random, 95% CI)	1.31 [0.95, 1.66]
8.1 BEH: Contact Episodes: > 1	7	537	Mean Difference (IV, Random, 95% CI)	1.35 [0.94, 1.77]
8.2 BEH: Contact Episodes: 1 (single)	1	40	Mean Difference (IV, Random, 95% CI)	1.10 [0.26, 1.94]
9 BEH: Subgroup Analysis - CPAP Device Usage (hours/night)	8	577	Mean Difference (IV, Random, 95% CI)	1.31 [0.95, 1.66]
9.1 BEH: Contact Time > 60	6	437	Mean Difference (IV, Random, 95% CI)	1.15 [0.71, 1.60]
9.2 BEH: Contact Time ≤ 60	2	140	Mean Difference (IV, Random, 95% CI)	1.56 [0.68, 2.44]
10 MIX: Subgroup Analysis - CPAP Device Usage (hours/night)	11	4509	Mean Difference (IV, Random, 95% CI)	0.82 [0.20, 1.43]
10.1 Intervention Duration > 4 weeks	8	4178	Mean Difference (IV, Random, 95% CI)	1.22 [0.60, 1.83]
10.2 Intervention Duration ≤ 4 weeks	3	331	Mean Difference (IV, Random, 95% CI)	-0.31 [-0.83, 0.21]
11 MIX: Subgroup Analysis - CPAP Device Usage (hours/night)	10	4242	Mean Difference (IV, Random, 95% CI)	0.79 [0.10, 1.48]
11.1 Contact Episodes: > 1	9	4036	Mean Difference (IV, Random, 95% CI)	0.98 [0.32, 1.63]
11.2 Contact Episodes: 1 (single)	1	206	Mean Difference (IV, Random, 95% CI)	-0.60 [-1.33, 0.13]
12 MIX: Subgroup Analysis - CPAP Device Usage (hours/night)	10	4242	Mean Difference (IV, Random, 95% CI)	0.79 [0.10, 1.48]
12.1 Contact Time > 60 min	6	3751	Mean Difference (IV, Random, 95% CI)	1.45 [0.73, 2.16]
12.2 Contact Time ≤ 60 min	4	491	Mean Difference (IV, Random, 95% CI)	-0.15 [-0.56, 0.27]

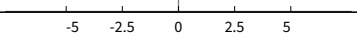
Analysis 6.1. Comparison 6 Post-hoc subgroup analyses (exploratory), Outcome 1 EDU: CPAP Device Usage (hours/night).

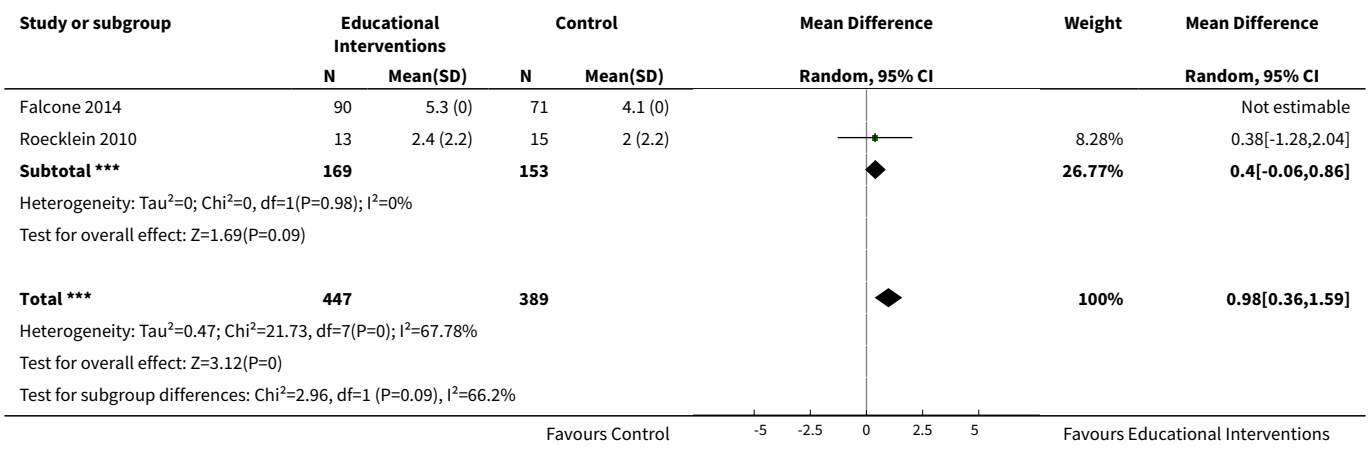
Study or subgroup	Educational Interventions N	Mean(SD)	Control N	Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
6.1.1 Intervention Duration > 4 weeks							
Hwang 2017	163	4 (2.4)	129	3.8 (2.5)		15.43%	0.2[-0.37,0.77]
Pengo 2018	60	3.1 (2.5)	25	3.1 (2.7)		9.4%	-0.04[-1.27,1.2]
Wang 2012	38	3.4 (2.1)	38	2.6 (1.6)		12.8%	0.8[-0.04,1.64]
Subtotal ***	**261**		**192**			**37.62%**	**0.33[-0.1,0.77]**
Heterogeneity: Tau²=0; Chi²=1.74, df=2(P=0.42); I²=0%							
Test for overall effect: Z=1.49(P=0.14)							
6.1.2 Intervention Duration ≤ 4 weeks							
Aloia 2013	66	4.5 (2.5)	55	3.7 (2.4)		12.53%	0.83[-0.04,1.7]
Basoglu 2011	66	5.5 (1.2)	67	5.1 (1.6)		16.22%	0.4[-0.08,0.88]
Chervin 1997	14	7.1 (1.8)	7	4.4 (3.4)		3.28%	2.7[0.01,5.39]
Falcone 2014	90	5.3 (0)	71	4.1 (0)			Not estimable
Richards 2007	48	5.4 (2.6)	48	2.5 (2.7)		10.87%	2.87[1.82,3.92]
Roecklein 2010	13	2.4 (2.2)	15	2 (2.2)		6.69%	0.38[-1.28,2.04]
Sarac 2017	52	5.2 (2.1)	63	4.2 (2.5)		12.79%	1[0.16,1.84]
Subtotal ***	**349**		**326**			**62.38%**	**1.2[0.39,2.01]**
Heterogeneity: Tau²=0.68; Chi²=19.81, df=5(P=0); I²=74.77%							
Test for overall effect: Z=2.89(P=0)							
Total ***	**610**		**518**			**100%**	**0.85[0.32,1.39]**
Heterogeneity: Tau²=0.4; Chi²=25.07, df=8(P=0); I²=68.09%							
Test for overall effect: Z=3.12(P=0)							
Test for subgroup differences: Chi²=3.36, df=1 (P=0.07), I²=70.22%							



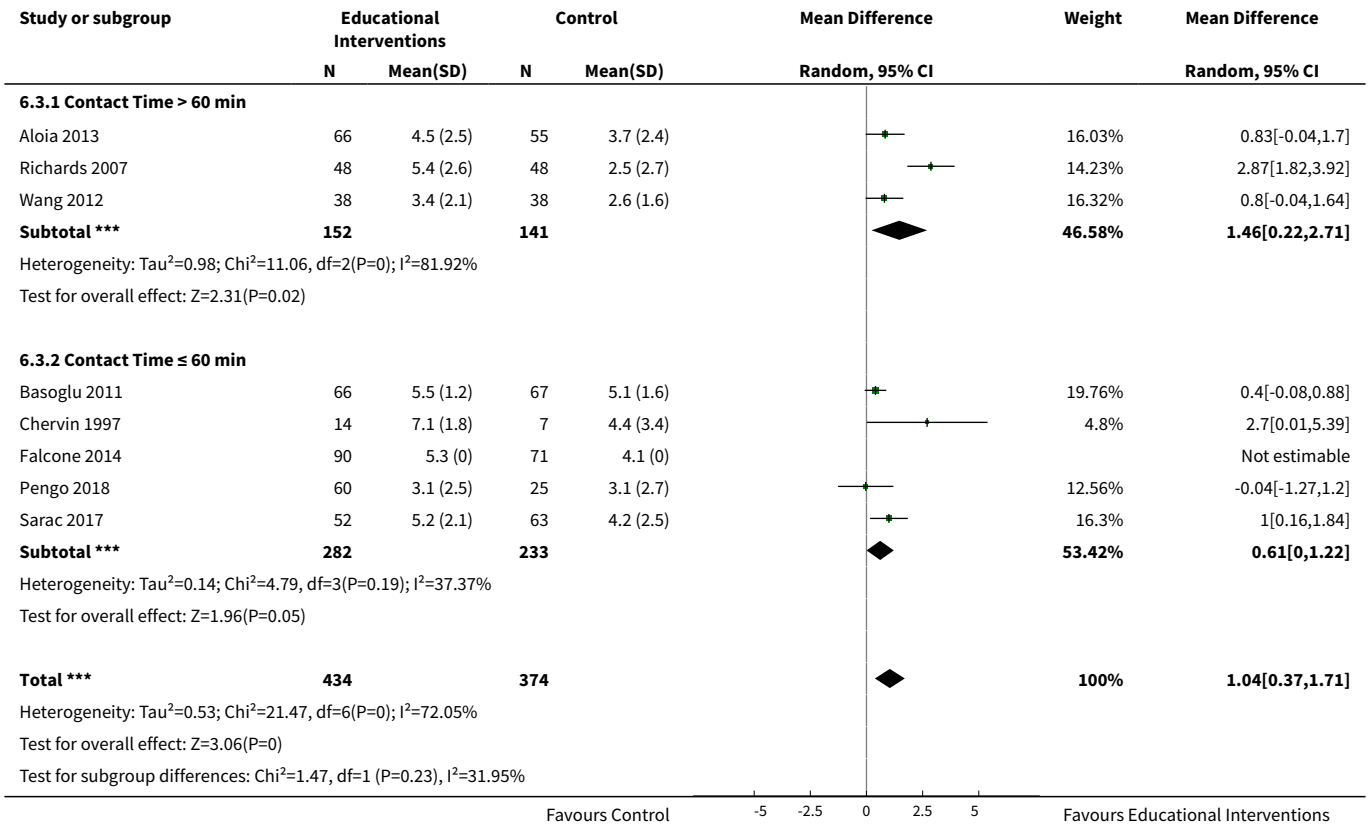
Analysis 6.2. Comparison 6 Post-hoc subgroup analyses (exploratory), Outcome 2 EDU: CPAP Device Usage (hours/night).

Study or subgroup	Educational Interventions N	Mean(SD)	Control N	Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
6.2.1 Contact Episodes: > 1							
Aloia 2013	66	4.5 (2.5)	55	3.7 (2.4)		14.73%	0.83[-0.04,1.7]
Chervin 1997	14	7.1 (1.8)	7	4.4 (3.4)		4.18%	2.7[0.01,5.39]
Pengo 2018	60	3.1 (2.5)	25	3.1 (2.7)		11.35%	-0.04[-1.27,1.2]
Richards 2007	48	5.4 (2.6)	48	2.5 (2.7)		12.96%	2.87[1.82,3.92]
Sarac 2017	52	5.2 (2.1)	63	4.2 (2.5)		15%	1[0.16,1.84]
Wang 2012	38	3.4 (2.1)	38	2.6 (1.6)		15.01%	0.8[-0.04,1.64]
Subtotal ***	**278**		**236**			**73.23%**	**1.2[0.41,2]**
Heterogeneity: Tau²=0.64; Chi²=16.43, df=5(P=0.01); I²=69.56%							
Test for overall effect: Z=2.97(P=0)							
6.2.2 Contact Episodes: 1 (single)							
Basoglu 2011	66	5.5 (1.2)	67	5.1 (1.6)		18.49%	0.4[-0.08,0.88]



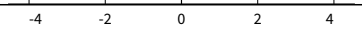


Analysis 6.3. Comparison 6 Post-hoc subgroup analyses (exploratory), Outcome 3 EDU: CPAP Device Usage (hours/night).



Analysis 6.4. Comparison 6 Post-hoc subgroup analyses (exploratory), Outcome 4 SUP: Subgroup Analysis - CPAP Device Usage (hours/night).

Study or subgroup	Supportive Interventions N	Supportive Interventions Mean(SD)	Control N	Control Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
6.4.1 Intervention Duration > 12 weeks							
Hoy 1999	40	5.4 (1.9)	40	3.8 (2.5)		7.74%	1.6[0.62,2.58]
Mendelson 2014	54	3.1 (3)	53	4.2 (2.8)		6.76%	-1.05[-2.14,0.04]
Parthasarathy 2013	22	4.4 (2.6)	15	3.4 (2.6)		3.41%	0.95[-0.76,2.66]
Pepin 2019	157	5.3 (2.2)	149	4.8 (2.5)		13.89%	0.53[-0,1.06]
Subtotal ***	**273**		**257**			**31.8%**	**0.49[-0.53,1.51]**
Heterogeneity: Tau^2=0.79; Chi^2=12.91, df=3(P=0); I^2=76.76%							
Test for overall effect: Z=0.94(P=0.35)							
6.4.2 Intervention duration ≤12 weeks							
Chervin 1997	12	5.7 (2.3)	7	4.4 (3.4)		1.38%	1.3[-1.54,4.14]
DeMolles 2004	15	4.4 (3)	15	2.9 (2.4)		2.73%	1.5[-0.44,3.44]
Fox 2012	28	3.2 (2.5)	26	1.8 (2)		6.03%	1.43[0.25,2.61]
Hoet 2017	20	5.7 (1.6)	17	4.2 (1.9)		6.31%	1.5[0.36,2.64]
Hwang 2017	125	4.4 (2.2)	129	3.8 (2.5)		13.09%	0.6[0.02,1.18]
Munafo 2016	58	5.1 (1.9)	64	4.7 (2.1)		11.04%	0.4[-0.31,1.11]
Stepnowsky 2007	20	4.1 (1.8)	20	2.8 (2.2)		5.59%	1.3[0.05,2.55]
Stepnowsky 2013	126	3.9 (2.3)	114	3.2 (2.4)		12.8%	0.7[0.1,1.3]
Turino 2017	52	5.1 (2.1)	48	4.9 (2.2)		9.24%	0.2[-0.64,1.04]
Subtotal ***	**456**		**440**			**68.2%**	**0.72[0.43,1.01]**
Heterogeneity: Tau^2=0; Chi^2=7.19, df=8(P=0.52); I^2=0%							
Test for overall effect: Z=4.81(P<0.0001)							
Total ***	**729**		**697**			**100%**	**0.7[0.36,1.05]**
Heterogeneity: Tau^2=0.15; Chi^2=20.7, df=12(P=0.05); I^2=42.04%							
Test for overall effect: Z=4(P<0.0001)							
Test for subgroup differences: Chi^2=0.17, df=1 (P=0.68), I^2=0%							



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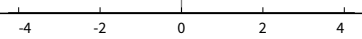
Analysis 6.5. Comparison 6 Post-hoc subgroup analyses (exploratory), Outcome 5 SUP: Subgroup Analysis - CPAP Device Usage (hours/night).

Study or subgroup	Supportive Interventions N	Supportive Interventions Mean(SD)	Control N	Control Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
6.5.1 Intervention entailed Automated Contact Only							
DeMolles 2004	15	4.4 (3)	15	2.9 (2.4)		2.73%	1.5[-0.44,3.44]
Hwang 2017	125	4.4 (2.2)	129	3.8 (2.5)		13.09%	0.6[0.02,1.18]
Mendelson 2014	54	3.1 (3)	53	4.2 (2.8)		6.76%	-1.05[-2.14,0.04]
Munafo 2016	58	5.1 (1.9)	64	4.7 (2.1)		11.04%	0.4[-0.31,1.11]
Subtotal ***	**252**		**261**			**33.61%**	**0.26[-0.51,1.04]**
Heterogeneity: Tau^2=0.37; Chi^2=8.44, df=3(P=0.04); I^2=64.46%							
Test for overall effect: Z=0.66(P=0.51)							
6.5.2 Intervention included Human Contact							
Chervin 1997	12	5.7 (2.3)	7	4.4 (3.4)		1.38%	1.3[-1.54,4.14]



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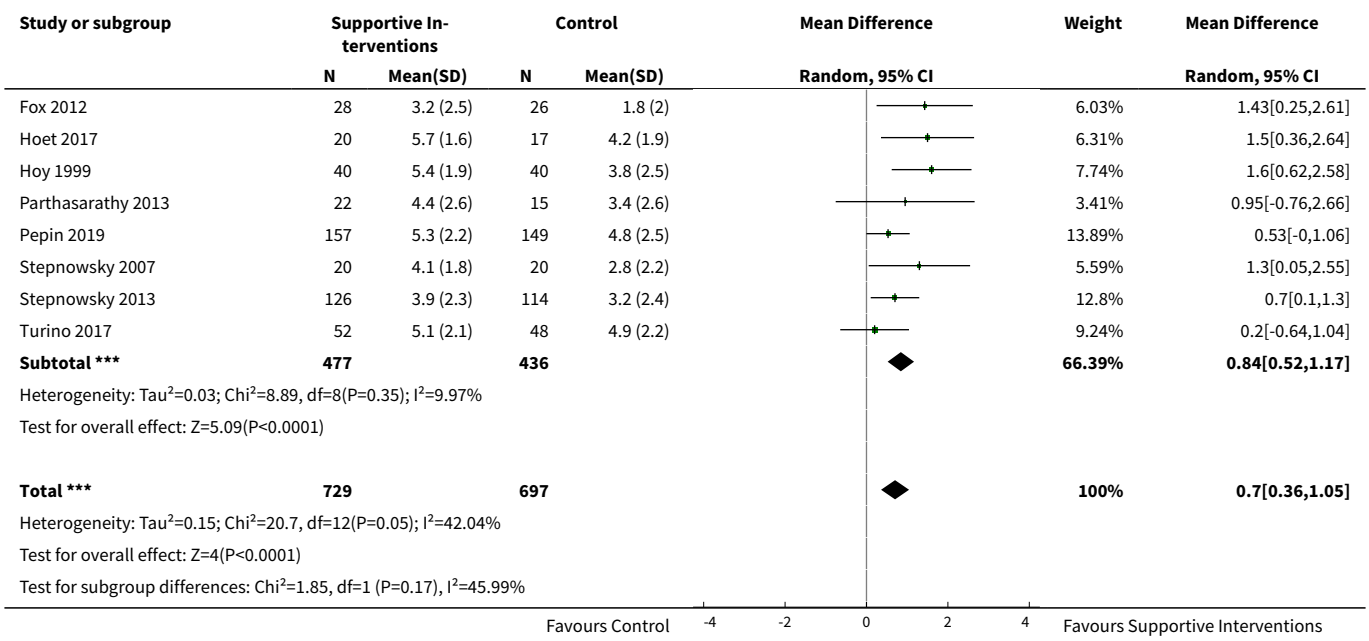
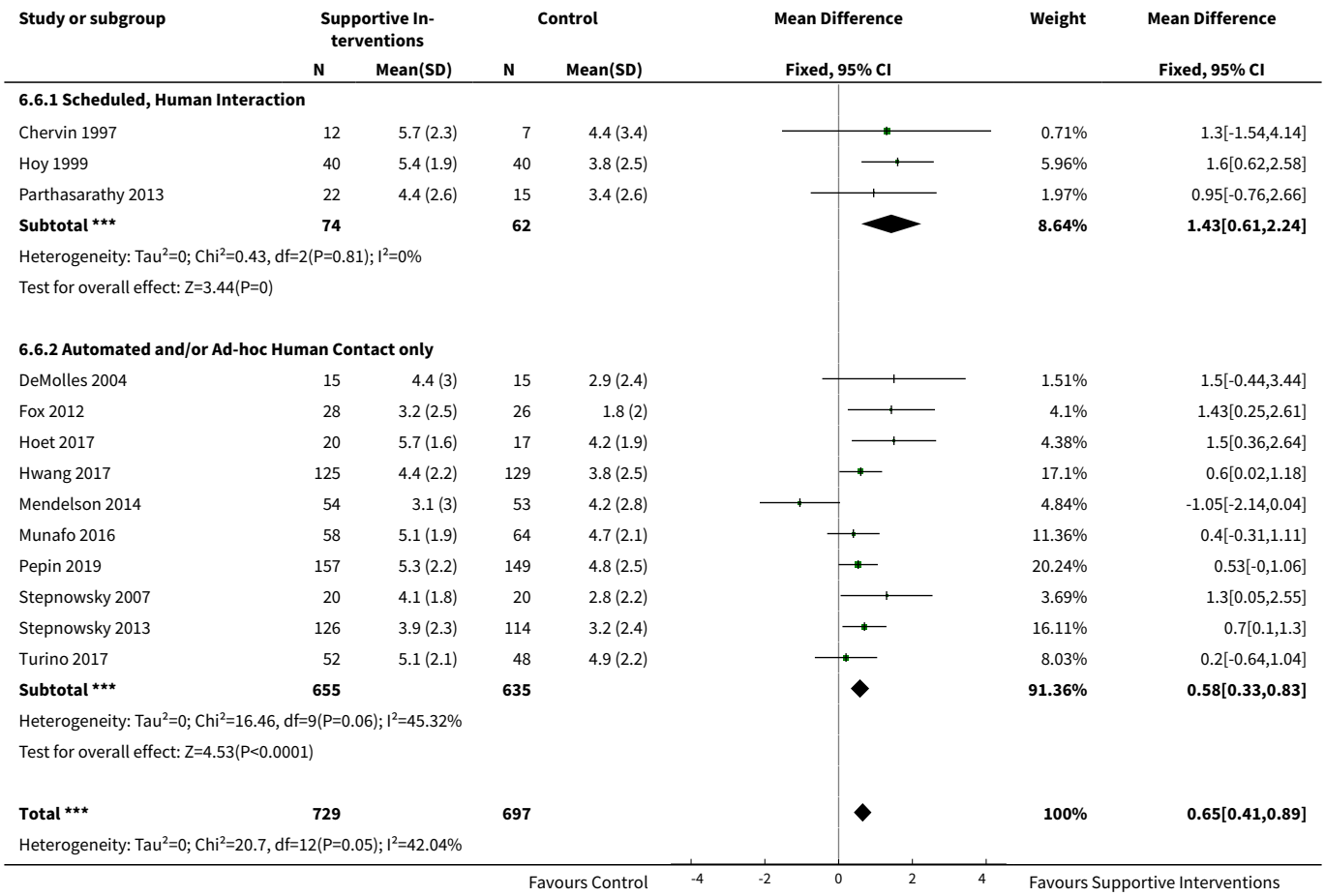
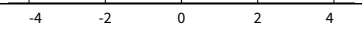


Analysis 6.6. Comparison 6 Post-hoc subgroup analyses (exploratory), Outcome 6 SUP: Subgroup Analysis - CPAP Device Usage (hours/night).



Study or subgroup	Supportive Interventions N	Supportive Interventions Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Test for overall effect: Z=5.34(P<0.0001)							
Test for subgroup differences: Chi^2=3.82, df=1 (P=0.05), I^2=73.81%							



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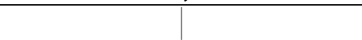
Analysis 6.7. Comparison 6 Post-hoc subgroup analyses (exploratory), Outcome 7 BEH: Subgroup Analysis - CPAP Device Usage (hours/night).

Study or subgroup	Behavioural Interventions N	Behavioural Interventions Mean(SD)	Control N	Control Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
6.7.1 BEH: Intervention Duration > 4 weeks							
Bakker 2016	41	4.4 (2.9)	42	3.3 (2.7)		8.59%	1.1[-0.11,2.31]
Diaferia 2017	22	5.1 (2.3)	27	3.6 (1.8)		9.03%	1.5[0.32,2.68]
Wang 2012	38	3.7 (2.3)	38	2.6 (1.6)		15.75%	1.1[0.21,1.99]
Subtotal ***	**101**		**107**			**33.37%**	**1.21[0.6,1.82]**
Heterogeneity: Tau^2=0; Chi^2=0.32, df=2(P=0.85); I^2=0%							
Test for overall effect: Z=3.87(P=0)							
6.7.2 BEH: Intervention Duration ≤ 4 weeks							
Aloia 2001	6	7.8 (1.9)	6	4.7 (3.4)		1.31%	3.11[0.02,6.2]
Aloia 2013	62	4.3 (2.4)	55	3.7 (2.4)		17.09%	0.69[-0.17,1.55]
Dantas 2015	20	6.2 (1.3)	20	5.1 (1.4)		17.83%	1.1[0.26,1.94]
Lai 2014	49	4.4 (1.8)	51	2.4 (2.3)		19.16%	2[1.19,2.81]
Olsen 2012	50	4.6 (2.7)	50	3.2 (2.7)		11.24%	1.47[0.42,2.52]
Subtotal ***	**187**		**182**			**66.63%**	**1.38[0.8,1.95]**
Heterogeneity: Tau^2=0.16; Chi^2=6.42, df=4(P=0.17); I^2=37.66%							
Test for overall effect: Z=4.66(P<0.0001)							
Total ***	**288**		**289**			**100%**	**1.31[0.95,1.66]**
Heterogeneity: Tau^2=0; Chi^2=6.89, df=7(P=0.44); I^2=0%							
Test for overall effect: Z=7.24(P<0.0001)							
Test for subgroup differences: Chi^2=0.15, df=1 (P=0.7), I^2=0%							



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Analysis 6.8. Comparison 6 Post-hoc subgroup analyses (exploratory), Outcome 8 BEH: Subgroup Analysis - CPAP Device Usage (hours/night).

Study or subgroup	Behavioural Interventions N	Behavioural Interventions Mean(SD)	Control N	Control Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
6.8.1 BEH: Contact Episodes: > 1							
Aloia 2001	6	7.8 (1.9)	6	4.7 (3.4)		1.31%	3.11[0.02,6.2]
Aloia 2013	62	4.3 (2.4)	55	3.7 (2.4)		17.09%	0.69[-0.17,1.55]
Bakker 2016	41	4.4 (2.9)	42	3.3 (2.7)		8.59%	1.1[-0.11,2.31]
Diaferia 2017	22	5.1 (2.3)	27	3.6 (1.8)		9.03%	1.5[0.32,2.68]
Lai 2014	49	4.4 (1.8)	51	2.4 (2.3)		19.16%	2[1.19,2.81]

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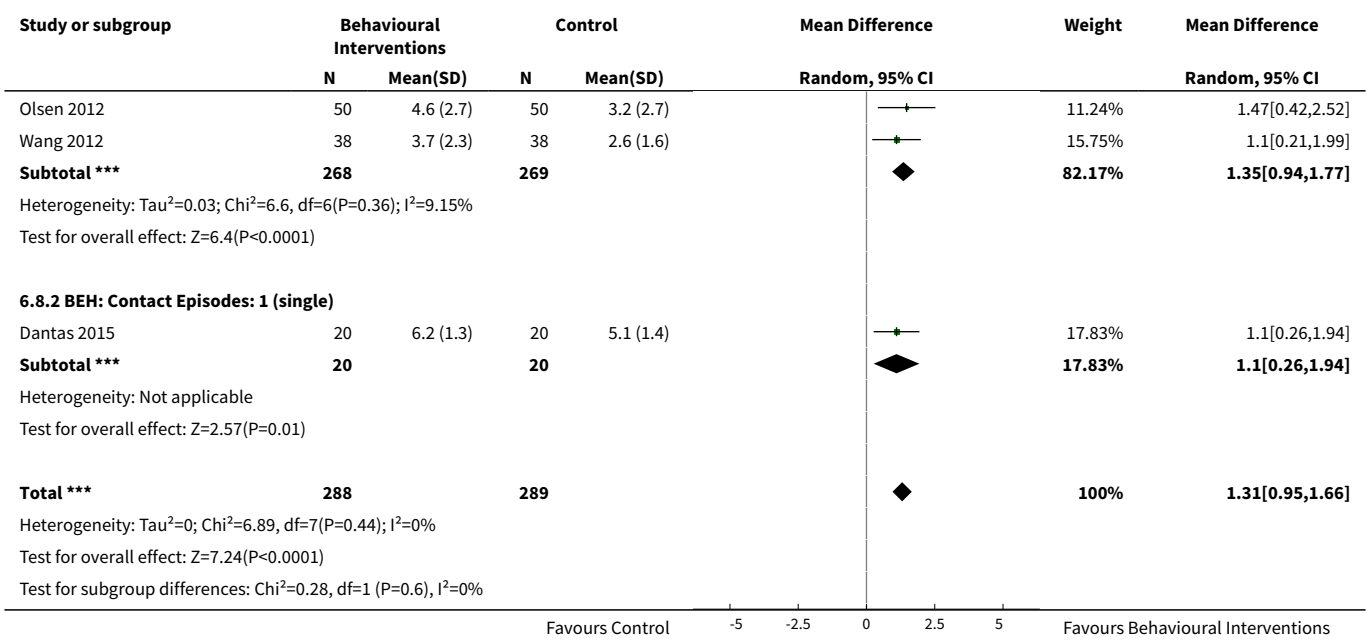
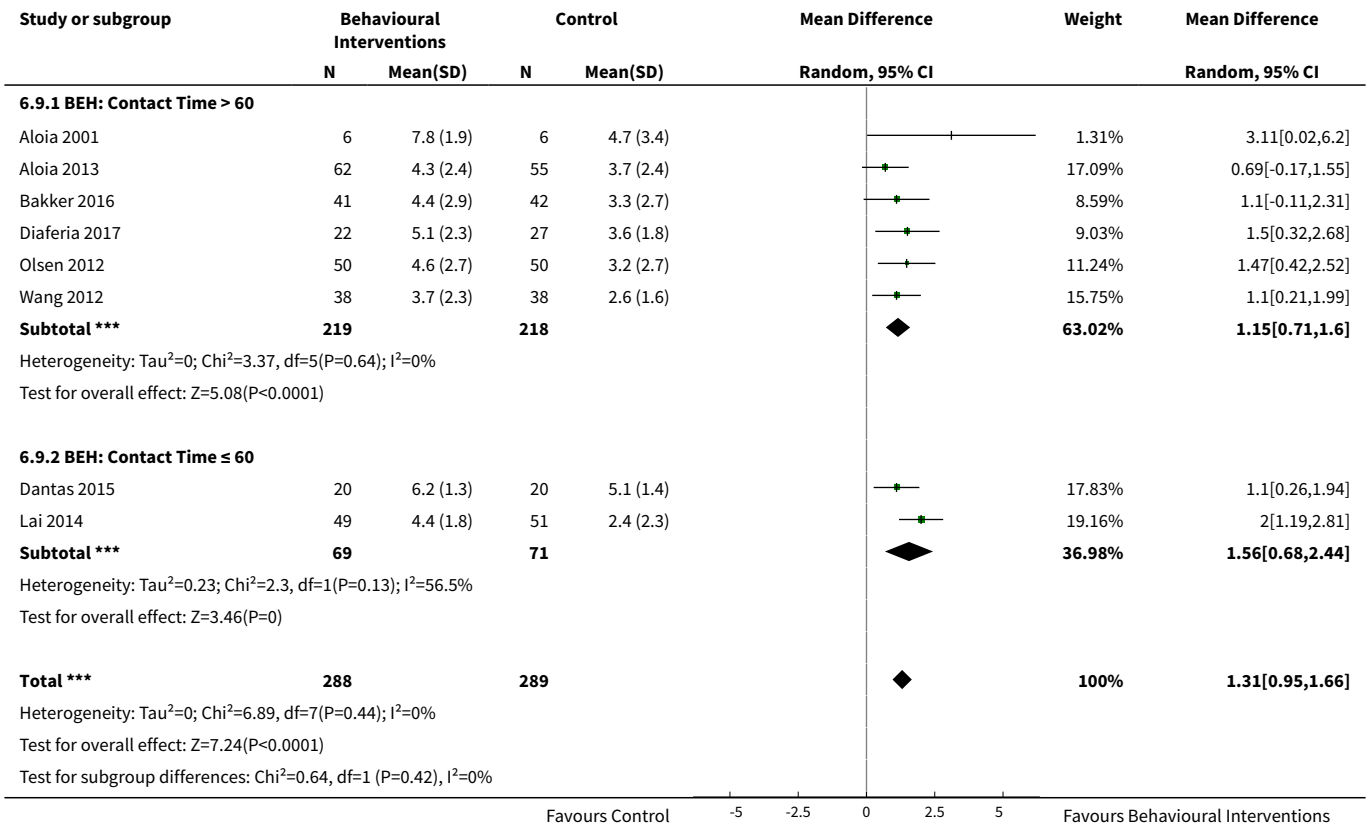
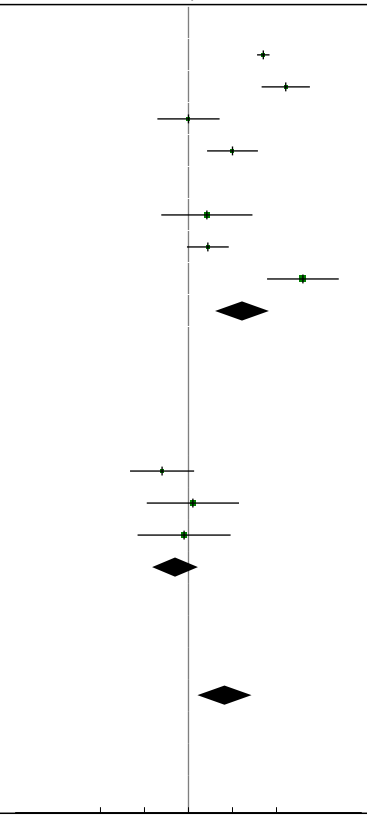


Analysis 6.9. Comparison 6 Post-hoc subgroup analyses (exploratory), Outcome 9 BEH: Subgroup Analysis - CPAP Device Usage (hours/night).



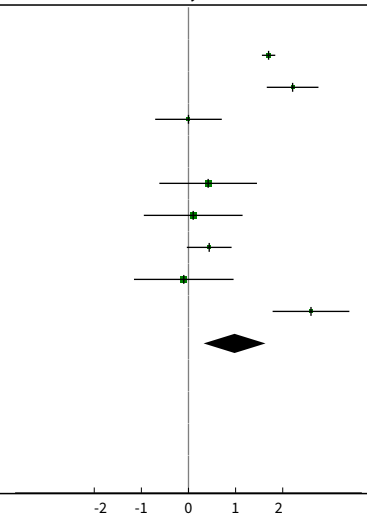
Analysis 6.10. Comparison 6 Post-hoc subgroup analyses (exploratory), Outcome 10 MIX: Subgroup Analysis - CPAP Device Usage (hours/night).

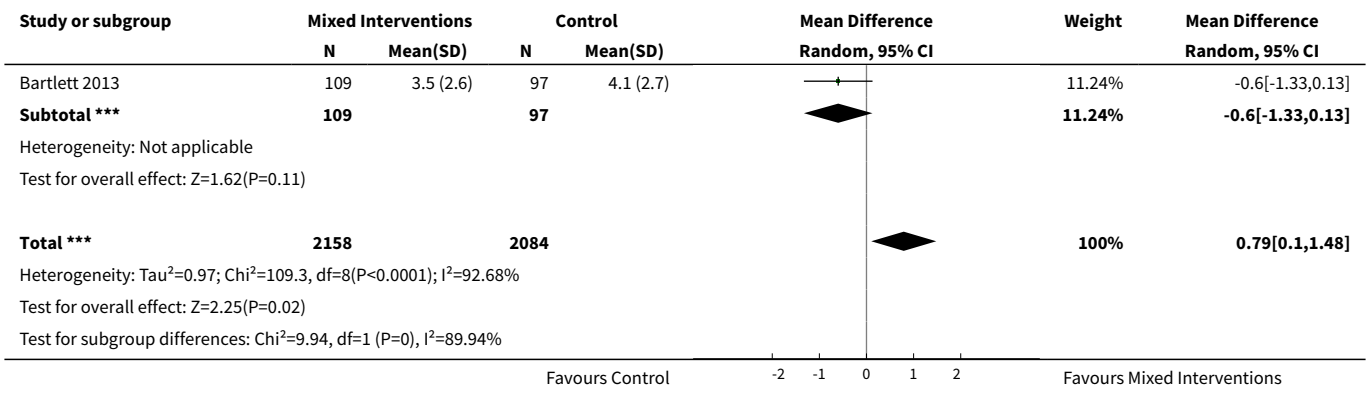
Study or subgroup	Mixed Interventions N	Mixed Interventions Mean(SD)	Control N	Control Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
6.10.1 Intervention Duration > 4 weeks							
Bouloukaki 2014	1550	6.9 (1.8)	1550	5.2 (2.2)		11.63%	1.7[1.56,1.84]
Chen 2015	40	6.4 (1.3)	40	4.2 (1.2)		10.71%	2.21[1.66,2.76]
Hui 2000	54	5.3 (1.5)	54	5.3 (2.2)		10.14%	0[-0.71,0.71]
Hwang 2017	138	4.8 (2.3)	129	3.8 (2.5)		10.61%	1[0.42,1.58]
Lewis 2006	32	4.9 (0)	26	4.5 (0)			Not estimable
Meurice 2007	85	5.1 (2.4)	27	4.7 (2.4)		8.78%	0.42[-0.62,1.45]
Sedkaoui 2015	188	4.6 (2.3)	189	4.1 (2.4)		10.94%	0.44[-0.03,0.91]
Wang 2012	38	5.2 (2)	38	2.6 (1.6)		9.71%	2.6[1.79,3.41]
Subtotal ***	**2125**		**2053**			**72.52%**	**1.22[0.6,1.83]**
Heterogeneity: Tau^2=0.58; Chi^2=63.82, df=6(P<0.0001); I^2=90.6%							
Test for overall effect: Z=3.89(P<0.0001)							
6.10.2 Intervention Duration ≤ 4 weeks							
Bartlett 2013	109	3.5 (2.6)	97	4.1 (2.7)		10.05%	-0.6[-1.33,0.13]
Sawyer 2017	30	4.8 (2.3)	30	4.7 (1.9)		8.73%	0.1[-0.95,1.15]
Shapiro 2017	32	5.4 (1.8)	33	5.5 (2.5)		8.7%	-0.1[-1.16,0.96]
Subtotal ***	**171**		**160**			**27.48%**	**-0.31[-0.83,0.21]**
Heterogeneity: Tau^2=0; Chi^2=1.35, df=2(P=0.51); I^2=0%							
Test for overall effect: Z=1.15(P=0.25)							
Total ***	**2296**		**2213**			**100%**	**0.82[0.2,1.43]**
Heterogeneity: Tau^2=0.84; Chi^2=111.83, df=9(P<0.0001); I^2=91.95%							
Test for overall effect: Z=2.61(P=0.01)							
Test for subgroup differences: Chi^2=13.79, df=1 (P=0), I^2=92.75%							



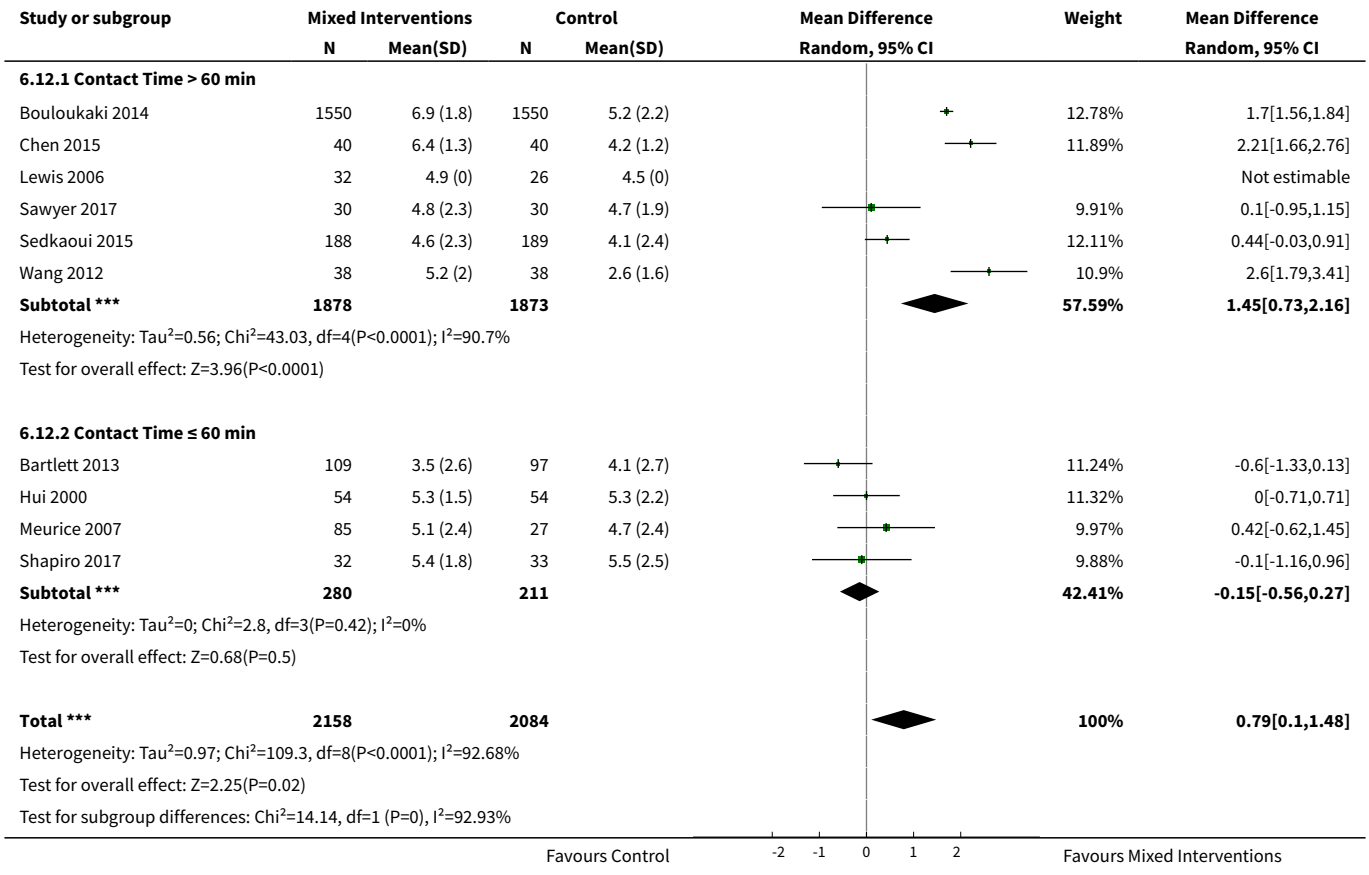
Analysis 6.11. Comparison 6 Post-hoc subgroup analyses (exploratory), Outcome 11 MIX: Subgroup Analysis - CPAP Device Usage (hours/night).

Study or subgroup	Mixed Interventions N	Mixed Interventions Mean(SD)	Control N	Control Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
6.11.1 Contact Episodes: > 1							
Bouloukaki 2014	1550	6.9 (1.8)	1550	5.2 (2.2)		12.78%	1.7[1.56,1.84]
Chen 2015	40	6.4 (1.3)	40	4.2 (1.2)		11.89%	2.21[1.66,2.76]
Hui 2000	54	5.3 (1.5)	54	5.3 (2.2)		11.32%	0[-0.71,0.71]
Lewis 2006	32	4.9 (0)	26	4.5 (0)			Not estimable
Meurice 2007	85	5.1 (2.4)	27	4.7 (2.4)		9.97%	0.42[-0.62,1.45]
Sawyer 2017	30	4.8 (2.3)	30	4.7 (1.9)		9.91%	0.1[-0.95,1.15]
Sedkaoui 2015	188	4.6 (2.3)	189	4.1 (2.4)		12.11%	0.44[-0.03,0.91]
Shapiro 2017	32	5.4 (1.8)	33	5.5 (2.5)		9.88%	-0.1[-1.16,0.96]
Wang 2012	38	5.2 (2)	38	2.6 (1.6)		10.9%	2.6[1.79,3.41]
Subtotal ***	**2049**		**1987**			**88.76%**	**0.98[0.32,1.63]**
Heterogeneity: Tau^2=0.75; Chi^2=77.06, df=7(P<0.0001); I^2=90.92%							
Test for overall effect: Z=2.92(P=0)							
6.11.2 Contact Episodes: 1 (single)							





Analysis 6.12. Comparison 6 Post-hoc subgroup analyses (exploratory), Outcome 12 MIX: Subgroup Analysis - CPAP Device Usage (hours/night).



ADDITIONAL TABLES

Table 1. Number screened, entered and completed

Study	N Screened	Entered	Completed	% Screened	% Entered

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

Aloia 2001	NA	12	12	NA	100
Aloia 2013	339	227	183	54	81
Bakker 2016	479 (only 2 of 4 treatment arms included in this review)	83	78	16	94
Bartlett 2013	294	206	177	60	86
Basoglu 2011	246	133	133	54	100
Bouloukaki 2014	5100	3100	2836	56	91
Chen 2015	85	80	80	94	100
Chervin 1997	NA (75% of those approached agreed to participate)	33	33	NA	100
Dantas 2015	61	41	40	66	98
DeMolles 2004	NA	30	30	NA	100
Diaferia 2017	NA	49	49	NA	100
Falcone 2014	533	206	161	30	78
Fox 2012	NA	75	54	NA	72
Hoet 2017	127	46	37	29	80
Hoy 1999	NA	80	80	NA	100
Hui 2000	NA	108	97	NA	90
Hwang 2017	1873	1455	1236	66	85
Lai 2014	212	100	98	46	98
Lewis 2006	74	72	58	78	81
Mendelson 2014	107	107	82	77	76
Meurice 2007	133	112	112	84	100
Munafo 2016	140	140	122	87	87
Olsen 2012	132	106	94	71	89
Parthasarathy 2013	49	39	37	76	95
Pengo 2018	NA	112	85	NA	76

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

Pepin 2019	NA	306	239	NA	78
Richards 2007	109	100	96	88	96
Roecklein 2010	NA	30	28	NA	93
Sarac 2017	490	115	115	23	100
Sawyer 2017	431	118	103	24	87
Scala 2012	NA	28	28	NA	100
Sedkaoui 2015	391	379	377	96	99
Shapiro 2017	NA	66	65	NA	98
Smith 2006	NA	19	19	NA	100
Smith 2009	NA	97	73	NA	75
Soares-Pires 2013	NA	202	146	NA	72
Sparrow 2010	423	250	222	52	89
Stepnowsky 2007	91	45	40	44	89
Stepnowsky 2013	NA	241	240	NA	99
Turino 2017	NA	100	100	NA	100
Wang 2012	NA	152	130	NA	86

Table 2. Descriptive summaries: particpant characteristics, by intervention class

Variable	Behavioural (BEH)	Educational (EDU)	Supportive (SUP)	Mixed (MIX)
N (total randomised)	989	1878	1962	5041
Age in years (Mean, SD)	56.44 (5.76)	52.73 (4.68)	53.94 (4.88)	52.55 (5.46)
BMI (Mean, SD)	32.31 (2.90)	34.19 (3.51)	33.19 (2.02)	33.73 (2.80)
Sex (% female)*	34.38	29.98	24.68	32.44
AHI (Mean, SD)	38.08 (9.04)	39.72 (12.25)	41.11 (10.52)	38.82 (10.62)
ESS (Mean, SD)	12.80 (4.02)	11.27 (1.29)	10.47 (1.50)	12.53 (1.92)

* Percentage female calculated based on studies reporting statistics on gender (those not reporting excluded from calculation).

Table 3. Descriptive summaries: intervention characteristics, by intervention class

Intervention Details	Behavioural (BEH), (median, IQR)	Educational (EDU), (median, IQR)	Supportive (SUP), (median, IQR)	Mixed (MIX), (median, IQR)
Study duration (weeks)	12 (12-52)	12 (6-26)	12 (12-16)	14 (12-52)
Intervention duration (weeks)	4 (2-12)	0 (0-4.5)*	12 (9-13)	12 (10-25)
# of Intervention episodes	3 (3-14)	2 (1-6)	NR (MOST)	7 (5-10)
Contact time (minutes)	90 (80-240)	21 (11-105)	NR	75 (33-143)

* Educational interventions that took place in a single participant interaction (e.g., dispensing written material, single presentation) were assigned a duration of '0' weeks.
Abbreviations: IQR: interquartile range; **NR:** not reported; **NR (MOST):** most studies did not report.

Table 4. EDU Study characteristics

Study	Studies employing Educational Intervention		Control	Study duration (weeks)
	Increased support and reinforcement components (if applicable)	Increased educational components		
Aloia 2013		2 x 45-minute education sessions regarding pathophysiology of apnoea, medical and behavioral consequences, and the benefits of treatment; presented in standardised formats, with no tailoring to participant readiness, 1 booster call from sleep nurse	Usual care	52
Basoglu 2011		One 10-minute educational video session on OSA and CPAP	Usual care	24
Chervin 1997		Written information on OSA and CPAP	Usual care	8
Falcone 2014		Two consecutive PSG videos on the computer screen: the first recorded during a standard diagnostic overnight polysomnography, and the second during a full-night polysomnography with nasal CPAP	Usual care	52
Hwang 2017		Education about OSA pathophysiology , health-related risks, impact on daytime vigilance, introduction to CPAP therapy	Usual care	12
Pengo 2018		Positively or negatively framed messages in addition to CPAP. Patients were phoned weekly and read framed messages (≤ 6 phone calls per patient).	Usual care	6
Richards 2007		Slide presentation and written information on OSA and CPAP and 2 x 1-hour CBT sessions	Usual care	4

Table 4. EDU Study characteristics *(Continued)*

Roecklein 2010		Personalised feedback report, including detailed information OSA and its associated risk and barriers to CPAP use and attitudes to change	Usual care	12
Sarac 2017		1 x 20-minute educational session by a sleep medicine physician, including: viewing his/her own PSG chart on morning post PAP-titration, comparing PSG from diagnostic and CPAP titration studies with explanations that emphasized obstructive events and oxygen desaturations, and the disappearance of those signs on PAP treatment.	Usual care	24
Soares-Pires 2013		1 x 1-hour educational session with information regarding OSA, its symptoms and risks, APAP treatment, the importance of good adherence, and different machine interfaces.	Usual care	24
Wang 2012	Two additional nights of CPAP titration	4-hour group education session, written information, video CD	Usual care	12

Abbreviations:
CBT: Cognitive behavioural therapy; **CD:** compact disc; **CPAP:** continuous positive air pressure; **OSA:** obstructive sleep apnoea; **PAP:** positive air pressure; **PSG:** polysomnography

Table 5. SUP Study characteristics

Study	Studies employing Supportive Intervention		Control	Study duration (weeks)
	Increased support and reinforcement components	Increased educational components (if applicable)		
Chervin 1997	Weekly telephone calls to monitor progress and troubleshoot		Usual care	8
DeMolles 2004	Computer-based telecommunication system allowing for monitoring and reinforcing compliance	Education via computer-based telecommunication system	Usual care	8
Fox 2012	Telecomunication system for daily monitoring of CPAP usage, timely detection and troubleshooting of problems		Usual care	12
Hoet 2017	Telemonitoring device forair leaks, residual AHI > 10/h, or CPAP use less than 3 hours for 3 days		Usual care	12
Hoy 1999	2 additional titration nights in hospital, 4 additional home visits by sleep nurses	Initial education at home with partner	Usual care	24
Hwang 2017	Automatic processing of device data. Where CPAP usage thresholds met, automated message encouraged participant to improve use/positive reinforcement		Usual care	12

Table 5. SUP Study characteristics *(Continued)*

Mendelson 2014	Participants equipped with smartphone for uploading BP, CPAP adherence, sleepiness, and QoL data. They received daily pictograms containing health-related messages	Usualo care	16
Munafo 2016	Web-based app used to monitor adherence and automatically message patients and providers when pre-set conditions met	Usual care	12
Parthasarathy 2013	2 individual sessions and 8 telephone conversations with trained peer CPAP users providing support and sharing their positive experience with CPAP	Usual care	12
Pepin 2019	BP and physical activity recorded by multimodal telemonitoring device and electronic questionnaires completed by patients. Automatic algorithms constructed for prompt adjustment of CPAP treatment.	Usual care	24
Stepnowsky 2007	Daily wireless telemonitoring of compliance and treatment efficacy and acting on the data via prespecified clinical pathways	Usual care	8
Stepnowsky 2013	Telemonitoring device collecting daily CPAP adherence viewable by both patient and provider. Troubleshooting and feedback provided when necessary	Usual care	16
Turino 2017	Daily CPAP adherence, CPAP pressures, mask leak and residual respiratory events transmitted into a web database. Case by case guidance provided by provider when signalled by automatic alarm in the web database	Usual care	12

Abbreviations:
AHI: apnoea hypopnoea index; **BP:** Blood pressure; **CPAP:** continuous positive air pressure; **QoL:** quality of life.

Table 6. BEH Study characteristics

Study	Studies employing Behavioural Intervention			Control	Study duration (weeks)
	Increased support and reinforcement components (if applicable)	Increased educational components (if applicable)	Behavioural therapy		
Aloia 2001		Elements of education on consequences of OSA and efficacy of CPAP	2 x 45-minute sessions of CBT interventions	2 x 45-minute sessions on sleep architecture and sleep clinic	12
Aloia 2013			2 x 45-minute sessions of MET, one booster phone call	Usual care	52

Table 6. BEH Study characteristics *(Continued)*

Bakker 2016			Eight - hour in person MET session	Usual care	52
Dantas 2015			1 x 10-minute MET session	Usual care	8
Diaferia 2017			Thirty-six myofunctional therapy sessions	Usual care	36
Lai 2014			One brief MET session (video and patient interview), followed by a follow-up phone call	Usual Care	12
Olsen 2012		45-Minute individual education session	Three 30-minute sessions of MET	45-Minute educational session + usual care	52
Scala 2012			3 interactive sessions, video with discussion, focus group and role play, respectively 1, 2 and 3 months after receiving the CPAP device.	Usual Care	52
Smith 2009			Audiotaped music and softly spoken directions on relaxation techniques and habit-promoting instructions for using CPAP nightly. Information packet,including CPAP use reminder placard, handouts on benefits of CPAP adherence and health consequences of poor compliance, 4-week diary for recording experience with CPAP	Audiotaped music with softly spoken information on vitamins, informational packet on vitamins and health.	12
Sparrow 2010			Automated telephone-linked communication system designed around the concept of Motivational Interviewing, which allowed one to assess and enhance CPAP compliance	Education on unrelated health topics via automated telephone-linked communication system	52
Wang 2012	One night of CPAP titration in the hospital		12 x 40-minute group 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.	Usual care	12

Abbreviations:
CBT: Cognitive behavioural therapy; **CPAP:** continuous positive air pressure; **MET:** Motivational Enhancement Therapy;**OSA:** obstructive sleep apnoea; **PMR:** progressive muscle relaxation;

Table 7. MIX Study characteristics

Study	Studies employing Mixed Intervention			Control	Study duration (weeks)
	Increased support and reinforcement components	Increased educational components	Behavioural therapy		
Bartlett 2013		1 x 30 minute group education session	1 x 35-minute intervention based on SCT ,	Usual care + a 30-minute group educa-	24

Table 7. MIX Study characteristics *(Continued)*

			including perceived self-efficacy, outcome expectations, and social support	tion session and social period matching the duration of the intervention	
Bouloukaki 2014	Two phone calls from study nurse to discuss CPAP use, 1 month of sleep diary review by sleep specialist, and 6 in-person follow-ups involving patient's family or spouse	1 x 15 minute video education session covering OSA topics, followed by 10-minute lecture to reinforce key topics		Usual care	104
Chen 2015	Personalised guidance from a study nurse, home visits from a nurse discussing lifestyle management, mental well-being, and 1 x 30-minute consultation with a sleep physician	1 x pre-treatment OSA educational video		Usual care	52
Hui 2000	2 additional early reviews by sleep physician and frequent telephone calls by sleep nurses	Videotape and additional education session		Usual care	12
Hwang 2017	Intervention based on automatic processing of device data. If CPAP usage thresholds were met, a message was automatically sent to the patient providing encouragement to improve use or positively reinforcing successful adherence.	Education about pathophysiology of OSA, health-related risks, impact on daytime vigilance, introduction to CPAP therapy		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 2007	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
Sawyer 2017		Educational DVD on sleep apnoea and PSG review	4 x 30-60 minute sessions addressing cognitive perceptions of the OSA and CPAP, outcome expectancies with PAP treatment, and PAP treatment self-ef-	Usual care and an informational pamphlet about OSA, diagnosis and PAP prescription provided by sleep centre	12

Table 7. MIX Study characteristics *(Continued)*

			ficacy, all domains of SCT		
Sedkaoui 2015	5 x standardised support sessions through telephone-based counselling	Education addressing knowledge about OSA, disadvantage or obstacles to CPAP		Usual care	16
Shapiro 2017	2 x support calls with study investigator to promote the use of CPAP	1 x educational session using an airway model along with a video and worksheet on OSA, and a report card to document OSA severity, CPAP setting and use and participant self-evaluation		Usual care	4
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
Wang 2012	Three nights of CPAP titration in the hospital	4-hout group education session, written information, video CD	12 x 40 minute group PMR practice sessions over 12 weeks	Usual care	12

Abbreviations:
CPAP: continuous positive air pressure;**DVD:** Digital versatile disc; **OSA:** obstructive sleep apnoea; **PAP:** positive air pressure; **PSG:** polysomnography; **SCT:** social cognitive therapy

Table 8. Post-hoc sensitivity analysis: effect of high 'Risk of bias' studies

Class	Full class effect estimate, MD (95% CI)	Sensitivity: excluding high RoB studies (MD, 95%CI)
Behavioural	1.31 (0.95 to 1.66) I^2 = 0% Analysis 3.1	1.05 (0.57 to 1.53)[1] I^2 = 0% Analysis 5.6
Educational	0.85 (0.32 to 1.39) I^2 = 68% Analysis 1.1	0.98 (0.07 to 1.89)[2] I^2 = 86% Analysis 5.4
Supportive	0.70 (0.36 to 1.05) I^2 = 42% (Analysis 2.1)	0.75 (0.42 to 1.09)[3] I^2 = 34%

Table 8. Post-hoc sensitivity analysis: effect of high 'Risk of bias' studies *(Continued)*

		Analysis 5.5
Mixed	0.82 (0.20 to 1.43) I^2 = 92% Analysis 4.1	NA

1. Included in sensitivity analysis: Aloia 2013; Bakker 2016; Dantas 2015; Olsen 2012
2. Included in sensitivity analysis: Aloia 2013; Basoglu 2011; Hwang 2017; Richards 2007
3. Included in sensitivity analysis: Fox 2012; Hoy 1999; Hwang 2017; Stepnowsky 2013; Turino 2017

Table 9. Post-hoc subgroup analysis: effects of intervention duration, contact episodes, contact time

Class	Full class effect estimate, MD (95%CI)	Intervention duration, MD (95%CI)	Contact episodes: 1 vs. > 1, MD (95%CI)	Total contact time: > vs. ≤ 60 minutes, MD (95%CI)
Behavioral	1.31 (0.95 to1.66) I^2 = 0% Analysis 3.1	> 4 weeks[1]: 1.21 (0.60 to 1.82) I^2 = 0% ≤ 4 weeks[2]: 1.38 (0.80 to 1.95) I^2 = 38% Test for subgroup differences: Chi^2 = 0.15, df = 1 (P = 0.70), I^2 = 0% Analysis 6.7	> 1 episode[3]: 1.35 (0.94 to 1.77) I^2 = 9% 1 episode[4]: 1.10 (0.26 to1.94) I^2 = 0% Test for subgroup differences: Chi^2 = 0.28, df = 1 (P = 0.60), I^2 = 0% Analysis 6.8	> 60 minutes[5]: 1.15 (0.71 to 1.60); I^2 = 0% ≤ 60 minutes[6]: 1.56 (0.68 to 2.44); I^2 = 57% Test for subgroup differences: Chi^2 = 0.64, df = 1 (P = 0.42), I^2 = 0% Analysis 6.9
Educational	0.85 (0.32 to 1.39) I^2 = 68% Analysis 1.1	> 4 weeks[7]: 0.33 (-0.10 to 0.77); I^2 = 0% ≤ 4 weeks[8]: 1.20 (0.39 to2.01); 12=75% Test for subgroup differences: Chi^2 = 3.36, df = 1 (P = 0.07), I^2 = 70.2% Analysis 6.1	> 1 episode[9]: 1.20 (0.41 to2.00); I^2 = 70% 1 episode[10]: 0.40 (-0.06 to 0.86); I^2 = 0% Test for subgroup differences: Chi^2 = 2.96, df = 1 (P = 0.09), I^2 = 66.2% Analysis 6.2	> 60 minutes[11]: 1.46 (0.22 to 2.71); I^2 = 82% ≤ 60 minutes[12]: 0.61 (0.00 to 1.22); I^2 = 37% Test for subgroup differences: Chi^2 = 1.47, df = 1 (P = 0.23), I^2 = 31.9% Analysis 6.3
Supportive	0.70 (0.36 to 1.05) I^2 = 42% (Analysis 2.1)	> 12 weeks[13]: 0.49 (-0.53 to 1.51); I^2 = 77% ≤ 12 weeks[14]: 0.72 (0.43 to 1.01); I^2 = 0% Test for subgroup differences: Chi^2 = 0.17, df = 1 (P = 0.68), I^2 = 0% Analysis 6.4	NA	NA
Mixed	0.82 (0.20 to 1.43) I^2 = 92% Analysis 4.1	> 4 weeks[15]: 1.22 (0.60 to 1.83); I^2 = 91% ≤ 4 weeks[16]: -0.31 (-0.83 to 0.21); I^2 = 0%	> 1 episode[17]: 0.98 (0.32 to 1.62); I^2 = 92% 1 episode[18]: -0.60 (-1.33 to 0.13); I^2 = 93%	> 60 minutes[19]: 1.45 (0.73 to 2.16); I^2 = 91% ≤ 60 minutes[20]: -0.15 (-0.56 to 0.27); I^2 = 0%

Table 9. Post-hoc subgroup analysis: effects of intervention duration, contact episodes, contact time *(Continued)*

	Test for subgroup differences: Chi^2 = 13.79, df = 1 (P = 0.0002), I^2 = 92.7% Analysis 6.10	Test for subgroup differences: Chi^2 = 9.94, df = 1 (P = 0.002), I^2 = 89.9% Analysis 6.11	Test for subgroup differences: Chi^2 = 14.14, df = 1 (P = 0.0002), I^2 = 92.9% Analysis 6.12

1. Bakker 2016; Diaferia 2017; Wang 2012
2. Aloia 2001; Aloia 2013; Dantas 2015; Lai 2014; Olsen 2012
3. Aloia 2001; Aloia 2013; Bakker 2016; Diaferia 2017; Lai 2014; Olsen 2012; Wang 2012
4. Dantas 2015
5. Aloia 2001; Aloia 2013; Bakker 2016; Diaferia 2017; Olsen 2012; Wang 2012
6. Dantas 2015; Lai 2014
7. Hwang 2017; Pengo 2018; Wang 2012
8. Aloia 2013; Basoglu 2011; Chervin 1997; Falcone 2014; Richards 2007; Roecklein 2010; Sarac 2017
9. Aloia 2013; Chervin 1997; Richards 2007; Sarac 2017; Pengo 2018; Wang 2012
10. Basoglu 2011; Falcone 2014; Roecklein 2010
11. Aloia 2013; Richards 2007; Wang 2012
12. Basoglu 2011; Chervin 1997; Falcone 2014; Sarac 2017
13. Hoy 1999; Mendelson 2014; Parthasarathy 2013; Pepin 2019
14. Chervin 1997; DeMolles 2004; Fox 2012; Hoet 2017; Hwang 2017; Munafo 2016; Stepnowsky 2007; Stepnowsky 2013; Turino 2017
15. Bouloukaki 2014; Chen 2015; Hui 2000; Hwang 2017; Meurice 2007; Sedkaoui 2015; Wang 2012
16. Bartlett 2013; Sawyer 2017; Shapiro 2017
17. Bouloukaki 2014; Chen 2015; Hui 2000; Meurice 2007; Sawyer 2017; Sedkaoui 2015; Shapiro 2017; Wang 2012
18. Bartlett 2013
19. Bouloukaki 2014; Chen 2015; Sawyer 2017; Sedkaoui 2015; Wang 2012
20. Bartlett 2013; Hui 2000; Meurice 2007; Shapiro 2017

Table 10. Post-hoc subgroup analysis: effect of human support components in supportive interventions

Class	All supportive interventions, MD (95%CI)	Intervention involved human support, MD (95%CI)	Intervention involved scheduled human support, MD (95%CI)
Supportive	0.70 (0.35 to 1.05) I^2 = 42% (Analysis 2.1)	Any human support[1]: 0.84 (0.52 to 1.17) I^2 = 10% Automated support only[2]: 0.26 (-0.51 to 1.04) I^2 = 64% Test for subgroup differences: Chi^2 = 1.85, df = 1 (P = 0.17), I^2 = 46.0% Analysis 6.5	Pre-scheduled human support[3]: 1.43 (0.61 to 2.24) I^2 = 0% No Scheduled human support[4]: 0.58 (0.33 to 0.83) I^2 = 45% Test for subgroup differences: Chi^2 = 3.82, df = 1 (P = 0.05), I^2 = 73.8% Analysis 6.6

1. Chervin 1997; Fox 2012; Hoet 2017; Hoy 1999; Parthasarathy 2013; Pepin 2019; Stepnowsky 2007; Stepnowsky 2013; Turino 2017
2. DeMolles 2004; Hwang 2017; Mendelson 2014; Munafo 2016
3. Chervin 1997; Hoy 1999; Parthasarathy 2013
4. DeMolles 2004; Fox 2012; Hoet 2017; Hwang 2017; Mendelson 2014; Munafo 2016; Pepin 2019; Stepnowsky 2007; Stepnowsky 2013; Turino 2017

Table 11. Post-hoc sensitivity analysis: effect of intervention classification decisions

Class	Updated Review (Askland 2019) Classification Decision, MD (95%CI)	Sensitivity: Original (Wozniak 2014) Classification Decision, MD (95%CI)
Behavioral	1.31 (0.95 to1.66) I^2 = 0%	1.47 (1.12 to 1.83) I^2 = 48%

Table 11. Post-hoc sensitivity analysis: effect of intervention classification decisions *(Continued)*

	Analysis 3.1	Analysis 5.3
Educational	0.85 (0.32 to 1.39) I^2 = 68% Analysis 1.1	0.48 (0.21 to 0.76) I^2 = 0% Analysis 5.1
Supportive	0.70 (0.36 to 1.05) I^2 = 42% (Analysis 2.1)	0.58 (0.36 to 0.81) I^2 = 45% Analysis 5.2

Table 12. Post-hoc sensitivity analysis: effect of selection of (closest to) 3-month endpoint

Class	Full Class Effect Estimates	Exclude endpoints NOT 3 months
Behavioral	1.31 (0.95 to 1.66) I^2 = 0% Analysis 3.1	1.38 (0.97 to 1.79)
Educational	0.85 (0.32 to 1.39) I^2 = 68% Analysis 1.1	0.63 (0.26 to 1.00)
Supportive	0.70 (0.36 to 1.05) I^2 = 42% (Analysis 2.1)	0.67 (0.29 to 1.04)
Mixed	0.82 (0.20 to 1.43) I^2 = 92% Analysis 4.1	1.09 (0.21 to 1.97)

Full class effect estimates are those derived in our primary analyses, which includes the data from each included study closest to our primary 3-month endpoint. That is, if no 3-month endpoint data were available for a study, the endpoint closest to (and later than) 3 months was used. For example if a study reported data at 2 months and 4 months post-intervention, the 4-month endpoint data were used. If only a single endpoint was reported by authors (e.g. Bouloukaki 2014 reported only 2-year endpoint), data for that endpoint was used.

APPENDICES

Appendix 1. Impact of CPAP adherence on assessment of health outcomes

Despite persuasive evidence for several health benefits of CPAP treatment from longitudinal studies, the largest RCT of CPAP and secondary prevention was negative with no apparent benefit of CPAP therapy in reducing the incidence of cardiovascular events (McEvoy 2016). While the authors argued that low adherence was insufficient to explain the lack of benefit, we would suggest that further consideration may be warranted given the many downstream implications of these conclusions. Specifically, if there is widespread agreement in the field that there are limited cardiovascular, cerebrovascular and mortality benefits to using CPAP, then this has implications for future expenditure, not only on RCTs targeting these outcomes with CPAP, but also on development and assessment of CPAP adherence interventions, the

topic addressed in the present review. We believe that the data do not sufficiently support the negative conclusions in recent reports; rather, we would suggest that further study is definitely warranted to achieve the robust results required for directing future research and clinical initiatives in this field.

In McEvoy 2016 RCT, the average nightly CPAP use was 3.3 hours. Interestingly, while 58% of participants used CPAP for < 4 hours/night, the authors' propensity-matched analyses comparing 'good' (> 4 hours/night) to 'bad' (< 4 hours/night) users, showed marginal benefit of CPAP usage for stroke risk and significant benefit for risk of composite cerebrovascular events. We would suggest that this is somewhat remarkable given the rather low 'adherence' definition employed. That is, considering that a cut-off of 4 hours/night has no sound evidentiary basis and would not result in subclinical OSA with treatment (i.e. would not reduce the average participant's AHI to less than 15 events/hour, below 'moderate OSA' diagnostic threshold), finding any effect is noteworthy. Additionally, despite low overall adherence among participants, the study demonstrated significant differences in many secondary measures (sleepiness, depression, QoL measures, work absenteeism) which supports previous evidence that different benefits may accrue at different adherence levels (Campos-Rodriguez 2005; Sawyer 2011; Stradling 2000; Wang 2017; Weaver 2007; Zimmerman 2006).

Interestingly, in their sample size calculations, the SAVE trial authors found that CV risk increased by 25% to 32% for every increase of 10 events/hour (AHI). Given that CPAP corrects AHI (in the majority of users) during use (but not during non-use), we can calculate the expected improvement in AHI for the participants in the study. That is, 3.3 hours/night average use would reduce AHI among participants in the CPAP arm from the baseline average AHI of 29 events/hour, to a weighted mean endpoint AHI of 15.6 events/hour (assuming 8 total hours sleep, AHI = 0 for 3.3 hours sleep with CPAP use and AHI = 29 during remaining 4.7 hours without CPAP use). By investigators CV risk calculations, this would correspond to the average 'treated' CPAP arm participant having a roughly 37% to 47% elevated CV risk due to 'residual' OSA (i.e. risk attributable to proportion of sleep without CPAP), relative to OSA-free population. This suggests that the apparent lack of effect of CPAP use on CV risk may be due to insufficient reduction of overall AHI (i.e. *inadequate OSA treatment*) among participants in the 'treatment' arm due to sub therapeutic CPAP adherence. In other words, rather than providing evidence for a lack of benefit of CPAP on CV outcomes, the findings may be interpreted as follows:

- a) adherence of 3.3 hours/night is insufficient to produce meaningful benefit in CV risk or MVA risk;
- b) modest (3.3 hours/night) adherence yields statistically-significant benefits for other outcomes including daytime sleepiness, depression/anxiety, QoL measures, and work absenteeism;
- c) the widespread and arbitrary threshold of ≥4 hours/night warrants closer scrutiny and may be contributing to underestimation of the impact of CPAP on CV risk and
- d) as with any pharmacologic treatment, studies should report CPAP dosage and present aggregate findings based on different dosage thresholds to facilitate appropriate interpretation.

Additionally, in the largest and most recent systematic review and meta-analysis of the effect of CPAP on cardiovascular outcomes (Yu 2017), authors included data from 10 trials (9 CPAP; 1 ASV) of 7266 patients with sleep apnoea and found no significant association with major CV events, CV death or all-cause death. Meta-regressions identified no associations of PAP with outcomes for different levels of OSA severity, follow-up duration, or adherence to PAP (all P > .13). Failure to observe an impact on CV outcomes in these RCTs may again relate to poor PAP adherence observed across all included RCTs, rates likely consistent with clinical populations more generally. The vast majority of (and all large) RCTs analysed in the review have mean/median CPAP usage < 4 hours/night. A single medium-sized study (Barbé 2012) and three small studies had mean nightly use > 4 hours/night. By our calculations, the weighted average nightly CPAP usage across all studies was 3.67 hours/night and 83.6% of studies had mean/median < 4 hours/night. We would recommend caution when interpreting results of studies and meta-analyses when the average dosage received in the 'treatment' arms are well-below clinical recommendations and when that dosage is probably sub therapeutic (i.e. does not reduce the AHI below diagnostic threshold).

As noted by Baker 2016, the question of whether and the extent to which OSA-related brain structural and functional changes are reversible may be best addressed by longitudinal studies of adherent patients using within-participants design. Unsurprisingly, improvements in cognitive ability following CPAP treatment have been found to be related to level of CPAP use. For example, Zimmerman 2006 found that memory impaired OSA patients with mean CPAP > 6 hours per night were 7.8 times more likely to experience a normalisation of memory abilities than memory-impaired OSA patients with mean CPAP use < 2 hours per night. Moreover, although the neurocognitive domain assessed varied across studies, multiple studies have reported treatment-related normalisation of neuropsychological functioning and neuroimaging metrics in *highly-adherent* OSA patients (Canessa 2011; Castronovo 2014; Dalmases 2014; Kim 2016).

Appendix 2. Sources and search methods for the Cochrane Airways Trials Register

Electronic searches: core databases

Database	Dates searched	Frequency of search
CENTRAL (via the Cochrane Register of Studies (CRS))	From inception	Monthly

(Continued)

MEDLINE (Ovid SP) ALL	1946 onwards	Weekly
Embase (Ovid SP)	1974 onwards	Weekly
PsycINFO (Ovid SP)	1967 onwards	Monthly
CINAHL (EBSCO)	1937 onwards	Monthly
AMED (EBSCO)	From inception	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 (IMyhill 201RG)	2002 onwards
Thoracic Society of Australia and New Zealand (TSANZ)	1999 onwards

MEDLINE search strategy used to identify trials for the Cochrane Airways Trials Register

Sleep apnoea search

1. exp Sleep Apnea Syndromes/

2. (sleep$ adj3 (apnoea$ 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.

Appendix 3. Search strategies and results

A. Search Strategies: Cochrane Airways Trials Register (via the Cochrane Register of Studies)

Strategy	Details
#1	SLP:MISC1
#2	MeSH DESCRIPTOR Sleep Apnea, Obstructive
#3	sleep near3 (apnoea* or apnoea*)
#4	(hypopnoea* or hypopnoea*)
#5	(OSA OR SHS OR OSAHS:TI,AB)
#6	#1 OR #2 OR #3 OR #4 OR #5
#7	MESH DESCRIPTOR Continuous Positive Airway Pressure
#8	CPAP or Auto-CPAP or APAP or NCPAP
#9	(continuous* OR nasal* OR inspiratory*) NEAR "positive airway"
#10	(positive* or expiratory*) NEAR (pressure*)
#11	(PEEP or IPB or IPPB):ti,ab
#12	#7 OR #8 OR #9 OR #10 OR #11
#13	#12 AND #5
#14	MESH DESCRIPTOR Education
#15	MESH DESCRIPTOR Patient Education as Topic
#16	MESH DESCRIPTOR Health Promotion EXPLODE ALL
#17	MESH DESCRIPTOR Self-Management

(Continued)

#18	MESH DESCRIPTOR Self care
#19	educat* or train* or instruct*
#20	self-manage* or self manage*
#21	Self-care* or self care*
#22	support*:ti,ab
#23	MESH DESCRIPTOR Behavior Therapy EXPLODE ALL
#24	(behavior* or behaviour*):ti,ab,kw
#25	psychotherap*:ti,ab,kw
#26	MESH DESCRIPTOR Motivational Interviewing
#27	MESH DESCRIPTOR Motivation EXPLODE ALL
#28	motivat*:ti,ab,kw
#29	cognitive*:ti,ab,kw
#30	self-efficacy:ti,ab,kw
#31	MeSH DESCRIPTOR Patient Compliance Explode All
#32	MeSH DESCRIPTOR Patient Acceptance of Health Care Explode All
#33	adhere* or nonadhere* or non-adhere*
#34	accept* or comply or compliance or reinforce*
#35	#14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34
#36	#35 AND #13
#37	INREGISTER
#38	#36 AND #37

B. Search Strategies: ClinicalTrials.gov

Field	Search Term
Condition	Sleep Apnoea
Intervention	CPAP OR continuous positive airway pressure
Other search terms	adherence OR compliance OR comply

(Continued)

Study type	Interventional Studies

adherence OR compliance OR comply | Interventional Studies | Sleep Apnea | CPAP OR continuous positive airway pressure

C. Search Strategies: WHO International Clinical Trials Registry Platform

Condition sleep apnoea

Intervention CPAP

D. Search Strategies: Epistemonikos (International Systematic Review Database)

(title:(sleep apnoea OR sleep apnoea) OR abstract:(sleep apnoea OR sleep apnoea)) AND (title:(CPAP OR continuous positive airway pressure) OR abstract:(CPAP OR continuous positive airway pressure)) AND (title:(education OR behaviour OR behavior OR motivat* OR cognitiv* OR adhere* OR self-manage* OR psychotherap*) OR abstract:(education OR behaviour OR behavior OR motivat* OR cognitiv* OR adhere* OR self-manage* OR psychotherap*))

Limits=Systematic reviews

E. Results of main search

Database	Years searched	Date of search	References before de-duplication	References after de-duplication	Comments
Airways Register (via the CRS)	all	2018/07/11	861	861	
Clinicaltrial.gov	all	2018/07/11	162	147	
WHO trials portal	all	2018/07/11	122	94	
Epistemonikos	all	2018/08/29	32	-	Search for related systematic reviews
Total			1177	1102	1074; 28 included refs; 4 awaiting classification

F. Results of updated search

Database	Years searched	Date of search	References before de-duplication	References after de-duplication
Airways Register (via the CRS)	July 2018-April 2019	2019/04/29	167	167
Clinicaltrial.gov	July 2018-April 2019	2019/04/29	9	9
WHO trials portal	July 2018-April 2019	2019/04/29	7	6
Total			183	182

WHAT'S NEW

Date	Event	Description
29 April 2019	New citation required and conclusions have changed	Review updated with 11 new studies. The background was re-drafted and updated. 'Risk of bias 2' assessment of the primary outcome for all studies. Outcomes and subgroup analyses up-dated.
29 April 2019	New search has been performed	New literature search run

HISTORY

Protocol first published: Issue 1, 2002
Review first published: Issue 2, 2009

Date	Event	Description
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
17 January 2013	New search has been performed	Literature searches rerun
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

KDA: review conception/development, study screening/assessment, data extraction, data entry and analysis, and preparation of report (2019)

LW: review conception/development, study screening/assessment, data extraction, data entry and analysis, and preparation of report (2019)

TE: data extraction, data entry and analysis, and preparation of report (2019)

JC: review conception/development, data extraction (2019).

DRW: review conception/development, study screening/assessment (2013); data extraction (2013), data entry and analysis (2013); and preparation of report (2013 and 2019).

IS: review conception/development, study screening/assessment (2013), data extraction (2013) and analysis (2013), and preparation of report (2009, 2013 and 2019).

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

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

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

Contributions of editorial team

Rebecca Fortescue (Co-ordinating Editor): edited the review; advised on methodology, interpretation and content.

Chris Cates (Co-ordinating Editor) checked the data entry prior to the full write up of the review; advised on methodology, interpretation and content, approved the final review prior to publication.

Emma Dennett (Managing Editor): co-ordinated the editorial process; advised on interpretation and content; edited the review.

Emma Jackson (Assistant Managing Editor): conducted peer review; obtained translations; edited the Plain language summary and reference sections of the protocol and the review.

Elizabeth Stovold (Information Specialist): designed the search strategy; ran the searches; edited the search methods section.

DECLARATIONS OF INTEREST

K. Askland: none known.

L. Wright: is employed by AstraZeneca Canada. AstraZeneca Canada has no financial interest in the findings of this non-pharmaceutical review, nor do they have business involvement with CPAP devices or any competing interventions for sleep apnoea.

D. Wozniak: none known.

T. Emmanuel: none known.

J. Caston: none known.

I. Smith: 2018 speakers fee at conference sponsored by Fisher and Paykel (topic aviation medicine). 2018 support for conference attendance Itamar Medical, manufacturer of sleep diagnostic equipment.

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DIFFERENCES BETWEEN PROTOCOL AND REVIEW

The inclusion criteria of the current review varied slightly from the last publication (Wozniak 2014). Studies explicitly recruiting participants with a diagnosis of central sleep apnoea were excluded, and we elected to allow studies that utilised different makes of CPAP devices provided that proper randomisation was apparent and disproportionate representation of any one CPAP device in a treatment arm was unlikely. Subjective participant reports of the CPAP machine usage were not analysed as studies that included this outcome were not of sufficient quality to be considered meaningfully.

Due to considerable variation in endpoints, we elected to use an endpoint of three months (or the measured endpoint closest to three months) as it was both the modal endpoint across studies and, in our judgement, the most clinically-relevant among those commonly reported.

'Risk of bias' assessments were conducted using both the previous 'Risk of bias1 ' tool (Higgins 2011) and the newly revised 'Risk of bias 2' tool (Sterne 2019). The 'Risk of bias 2' tool was employed to give an *outcome-level* assessment of bias for the review's main outcome of interest (CPAP machine usage). The 'Risk of bias 1' tool was used to give a *study-level* assessment of overall bias for all outcomes of interest. These tools were used for all 41 included studies in this review. Information derived from the application of both 'Risk of bias' tools were used in conducting the GRADE assessments; details are provided within the Methods section under 'Summary of findings' tables.

Relative to outcomes, we elected to add proportion of people adherent to CPAP (four hours/night), oxygen desaturation index (ODI), and cost-effectiveness as secondary outcomes. Due to finding very few, or no studies in the previous review (Wozniak 2014), we excluded the following outcomes from the present review: maintenance of wakefulness, cardiovascular outcomes and adverse events.

For subgroup analyses, we planned to adjust the categorisation of apnoea hypopnoea index (AHI) severity (now mild (AHI ≥ 5 to < 15), moderate (AHI ≥ 15 to < 30), severe (AHI ≥ 30)), and to complete an additional stratification by baseline Epworth Sleepiness Scale score.

Multiple post-hoc analyses were conducted for the main outcome of CPAP usage that were not previously specified in the protocol. These analyses were conducted to explore the effects of:

- intervention classification decisions (updated review versus previous review) (Analysis 5.1, Analysis 5.2, Analysis 5.3);
- excluding "high" risk of bias studies, within each class (Analysis 5.4, Analysis 5.5, Analysis 5.6);
- grouping studies (within each class) based on intervention duration, number of contact episodes, and total contact time (Analysis 6.1; Analysis 6.2; Analysis 6.3; Analysis 6.4, Analysis 6.7; Analysis 6.8; Analysis 6.9; Analysis 6.10; Analysis 6.11; Analysis 6.12);
- grouping studies (within the supportive class) based on whether there was human versus automated-only (Analysis 6.5), and scheduled versus non-scheduled human support (Analysis 6.6);
- our selection of the modal three-month endpoint (Additional Table 12, summary of analyses).

Careful considerations were given regarding the effects of interventions on cardiovascular outcomes related to obstructive sleep apnoea (OSA); these considerations can be found in Appendix 1.

INDEX TERMS

Medical Subject Headings (MeSH)

Bias; Cognitive Behavioral Therapy [*methods]; Continuous Positive Airway Pressure [instrumentation] [*statistics & numerical data]; Disorders of Excessive Somnolence [epidemiology]; Motivation; Patient Compliance [*statistics & numerical data]; Patient Education as Topic [*methods]; Randomized Controlled Trials as Topic; Reinforcement, Psychology; Sleep Apnea, Obstructive [psychology] [*therapy]; Time Factors

MeSH check words

Adult; Humans