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Intervention Programmes among Obstructive Sleep Apnea Patients: A systematic review

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Abstract

Aims: To assess the effectiveness of intervention programs to improve functional outcomes, continuous positive airway pressure (CPAP) adherence, daytime sleepiness, and knowledge among obstructive sleep apnea (OSA) patients. **Background:** Oxygen desaturations, awakenings, and snoring are symptoms of OSA. **Design:** Through five databases such as Google Scholar, Science Direct, Web of Science, Medline, and Research Gate. **Conclusions:** Patients improved their knowledge; CPAP compliance was higher in the intervention group compared to the control group. Regular CPAP utilization can improve functional outcomes and reduce daytime sleepiness. **Implication for practice:** researchers need to develop educational initiatives appropriate for OSA patients in Malaysia.

Keywords: Obstructive sleep apnea; Intervention programs; Continuous positive airway pressure.

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1.0 Introduction

1.1 Obstructive Sleep Apnea (OSA)

Obstructive sleep apnea (OSA) is a result from repeated obstruction of the upper airway due to the relaxation of the pharyngeal and tongue muscles during sleep (Theerakittikul et al., 2022). Consequent oxygen desaturation, increased inspiratory effort, sleep fragmentation, and arousal from sleep lead to excessive daytime sleepiness, cardiovascular and metabolic diseases, cognitive and memory impairments, and mood disorders (Rapelli et al., 2021). Screening for OSA is performed using questionnaires that ask about OSA symptoms and sometimes include clinical factors such as body mass index, neck circumference, and blood pressure (Rapelli et al., 2021). Patients have some options for the management of OSA. Continuous positive airway pressure (CPAP), oral appliances, surgical procedures, and lifestyle changes are among the management options for OSA. Nonetheless, the preferred course of treatment

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for OSA syndrome is CPAP therapy (Theerakittikul et al., 2022). An individual needs to seek advice from a physician and get treatment if suspecting of suffering from OSA because their life really could depend on it.

1.2 Continuous Positive Airway Pressure (CPAP)

Continuous positive airway pressure is also known as CPAP. In order to splint open and maintain patency of the upper airways during the inspiratory and expiratory phases of breathing, involves the use of an airflow generator, which consistently produces pressurized air (Campbell & Sapro, 2023). Patients need to use a CPAP machine when sleeping. The main treatment for OSA is a positive airway pressure device, which maintains the airway with compressed air. It is also advised that patients with obesity and overweight lose weight (Mangione et al., 2022). Even though CPAP devices are the gold standard treatment for OSA patients but in this study, the main problem with CPAP treatment is poor compliance among patients.

1.3 Problem statement

The prevalence of obstructive sleep apnea (OSA) appears to be rising, which could be attributed to rising obesity or OSA detection rates. It is estimated that OSA affects about 1 billion of the 7.3 billion people in the world between the ages of 30 and 69 (Mangione et al., 2022). African Americans have been reported as having a higher risk for OSA when compared to Asian, Indian, Hispanic, and European ancestry (Dudley, 2015). In Asia countries, the prevalence of OSA ranged from 7.8% (Hong Kong) to as high as 77.2% (Malaysia) for mild OSA (Lyons et al., 2020). OSA prevalence is rising and affects all countries, including Malaysia. The increase in prevalence is driven by the global increase in obesity, the major risk factor for OSA (Lyons et al., 2020).

Health consequences of OSA range from daytime sleepiness, decreased productivity, and increased risk of traffic accidents. While in the long term, OSA increases the risk of metabolic disorders, cardiovascular diseases, impaired cognition, and premature mortality (Theerakittikul, 2022). In addition, patients also get a sleep pattern disorder where they cannot sleep at night or do not get enough sleep. They also have problems managing their daily lives due to the absence of a partner, income, and unemployment (Batool-Anwar et al., 2016). Recurrent airway obstruction may have vascular consequences that raise the risk of erectile dysfunction (ED) and cause a loss of intimacy in a marriage or long-term relationship, which can have an impact on both partners' mental health (Pascual et al., 2018).

1.4 Objective

This review was performed to assess the effectiveness of intervention programs to improve functional outcomes, continuous positive airway pressure (CPAP) adherence, daytime sleepiness, and knowledge among obstructive sleep apnea patients.

2.0 Literature Review

Data sources and literature search strategy

A literature review was conducted with the following search engines and databases such as Google Scholar, Science Direct, Web of Science, Medline, and Research Gate to find publications that were published between 2018 and 2023. Only the English language is available for search terms. The inclusion criteria and keywords intervention programs, "obstructive sleep apnea," and "Continuous positive airway pressure" were used in the search. In the last phase, seven studies were evaluated and reviewed. There were relatively limited articles on obstructive sleep apnea in nursing journals; therefore, the search process was extended to healthcare, medical, and health education journals.

3.0 Methods

3.1 Inclusion criteria

The following criteria were used for inclusion:

3.1.1 Types of study

- Intervention studies (e.g., randomized control trials)
- True experimental study
- Intervention programs in relation to obstructive sleep apnea
- Programs involved with or without a control group
- Articles published in nursing, healthcare, medical, or health education journals

3.1.2 Types of participants

Patients with obstructive sleep apnea

3.1.3 Types of intervention

- Intervention programs that included teaching, education, and training
- Discussion, demonstration, and assessment
- The programs conducted by medical personnel

Table 1 Literature summary of the intervention programs

Title	Author, Country	Design	Sample size/ groups no	Program/ intervention types	Duration and follow-up	Outcome measures, tool	Results
Culturally tailored, peer-based sleep health education and social support to increase obstructive sleep apnea assessment and adherence among a community sample of blacks	Seixas et al. (2018) New York	Randomized controlled trial	398	Participants at risk of OSA will receive linguistically tailored peer education based on Motivational Enhancement principles, participants are encouraged to participate in a sleep home study to determine the risk of OSA and, if found to be at risk, they are invited to undergo a diagnostic sleep assessment at a clinic. Participants who are diagnosed with OSA and who are prescribed continuous positive airway pressure treatment will be encouraged, through peer-based education, to adhere to the recommended treatment.	12 months	Epworth sleepiness scale Apnea Knowledge Test (AKT) and Apnea Beliefs Scale (ABS)	The use of a culturally tailored sleep health education program, peer health educators trained in sleep health, and home-based sleep assessment are novel approaches to improving OSA assessment and treatment adherence in blacks who are significantly at risk for OSA
A mixed method evaluation of a group-based educational program for CPAP use in patients with obstructive sleep apnea	Brosstrom et al. (2013) Sweden	Sequential explanatory mixed method	25 patients.	The problem-based learning program incorporated theories and models concerning motivation and habits. Tutorial consisting of four to eight sessions for six months.	Quantitative data regarding OSA variables, CPAP use, and knowledge were collected at baseline, after two weeks and six months. Qualitative data regarding patients' perceptions of participation were collected after six months by semi-structured interviews using a phenomenographic approach.	Apnea Knowledge Test 72% of the patients were adherent to CPAP treatment after two weeks and six months. All patients improved their baseline knowledge about OSA and CPAP after two weeks and sustained it after six months.	

Title	Author, Country	Design	Sample size/ groups no	Program/ intervention types	Duration and follow-up	Outcome measures, tool	Results
Long-term adherence to CPAP treatment with obstructive sleep apnea: Importance of educational program	La Piana et al (2011) Italy	Randomized controlled trial (RCT)	202 patients	The educational program consisted of intensive training, whereby each patient performed individual and collective sessions of three hours receiving information about obstructive sleep apnea syndrome, and familiarizing themselves with CPAP tools on six consecutive days.	Three months and one year.	Epworth Sleepiness Scale (ESS)	The mean (standard deviation) apnea/hypopnea index was 45 ± 22 , the Epworth Sleepiness Scale score was 14 ± 5 , and the average titration pressure was 10 ± 2 cm H ₂ O. At three months, 166 patients (82%) used CPAP for an average of 7.3 hours per night. At one year, 162 (80%) used CPAP for about seven hours per night. At two years, 92 patients (43%) used CPAP for about five hours per night. The level of satisfaction remained higher in patients in ventilation. At three months, CPAP adherence was 82%. Adherence to CPAP was 80% at one year; two years after, adherence to ventilation was 43%. Strong adherence to CPAP at three months and one year, with a decrease at two years. Daytime sleepiness was 6 ± 4 at three months and 5 ± 4 at one and two years.
Educational Program Applied to Obstructive Sleep Apnea	Correa et al (2016) Brazil	Randomized controlled trial (RCT)	5	The knowledge multiplication strategies were comprised of the creation of educational material and implementation of the training program (face-to-face classes, practical activity, access to the Cyber tutor, and social action). Next, an assessment was performed by applying the investigation questionnaire of the level of knowledge and the Motivational Research Form.	-	Level of knowledge and the questionnaires	The comparison between results pre and post-shows an increase of the score was observed for all questions showing increasing knowledge. The significance level used was $p < 0.05$.

Title	Author, Country	Design	Sample size/ groups no	Program/ intervention types	Duration and follow-up	Outcome measures, tool	Results
Improving CPAP Compliance by a Basic Educational Program for Obstructive Sleep Apnea Syndrome Patients	Rita et al. (2008) Brazil	True experimental	95 patients	OSA training, supported by video sessions and outpatient visits with the nurse. The control group did not receive any educational information or training.	At 7 days, 30 days, 60 days, and 90 days after CPAP initiation.	15Epworth Sleepiness Scale (ESS)	CPAP compliance was significantly higher in the educational program group compared with the control group (71 vs. 56%, p=0.02; and 6.3±1.9 vs. 5.1±1.7 hrs/night, respectively, p=0.01) on the 90th day. In the educational program group, regular CPAP users had lower ESS scores after 90 days of CPAP therapy compared with irregular users (7.1±4.9 vs. 10.2±5.3, respectively, p=0.007).
Sleep quality, sleepiness and functioning among obstructive sleep apnea patients receiving continuous positive airway therapy	Theerakitkul Thai (2022)	Randomized controlled trial (RCT)	50 patients	CPAP health education, multilevel effects modeling approaches	Baseline, 1 month, and 3 months.	1-Functional Sleep Questionnaire (FOSQ) and 3-Sleep Epworth Sleepiness Scale (ESS)	Thirty-nine participants completed the study. Approximately 53% (n=25) and 71.1% (n=27) of the patients adhered to CPAP treatment by the end of the 1- and 3-months, respectively. After controlling for patients' adherence, at 1-month follow-up, the intervention improved the quality of sleep (β 5 _2.65, 95% CI 5 _1.60, _4.13), daytime functioning (β 5 3.24, 95% CI 5 1.87, 4.61) and decreased daytime sleepiness (β 5 _3.29, 95% CI 5 _1.85, _4.73). At three months, the intervention still improved the quality of sleep (β 5 3.53, 95% CI 5 2.05, 5.01) and daytime functioning (β 5 4.34, 95% CI 5 2.76, 5.92) and decreased daytime sleepiness (β 5 _4.82, 95% CI 5 _3.16, _6.49). CPAP adherence at the 1-month follow-up was quite low compared to at three months. The results showed that at 1-month follow-up, there were no statistically significant differences in all outcomes between the two groups. However, at 3-month follow-up, participants in the adherence group had better sleep quality scores (p < 0.01).

Title	Author, Country	Design	Sample size/ groups no	Program/ intervention types	Duration and follow-up	Outcome measures, tool	Results
Educational, supportive, and behavioral interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea	Askland et al (2020) USA	Randomized controlled trial (RCT)	9005 participants	Educational interventions using a variety of techniques, including educational/situational videos, education sessions, extended personalized explanations, polysomnography (PSG) reports, positive/negative risk message framing, Supportive interventions including telemonitoring under various formats and platforms, in-home tutorials and extended follow-up visits, peer support, phone support, and personalized web-based support platforms. Behavioral studies: Motivational Enhancement Therapy (MET) aimed at resolving ambivalence towards treatment, a combination of various motivational strategies, habit-promoting audiotapes, and myofunctional therapy. mixed class used a combination of educational materials (videos, brochures, tutorials) and support systems (telemedicine or extended follow-up) in their active intervention.	six weeks, three months, four months, six months, and 24 months	Functional Outcomes of Sleep Questionnaire (FOSQ), standardized Sleepiness Scale mean difference (SMD) 0.00, 95% CI -0.26 to 0.26, N = 228	Regular CPAP utilization has been reported to improve sleep quality, daily functioning, and overall quality of life. The mean score of FOSQ at baseline was 13.1 and significantly increased to 16.9 at one month and 18.6 at the end of the study (trend $p < 0.001$). At the baseline, 52% (n=526) of the participants reported excessive daytime sleepiness; this proportion significantly dropped to 20.4% (n 510) after one month of CPAP utilization and 15.4% (n 5 6) after three months (trend $p < 0.001$).

3.2 Exclusion criteria

The studies were excluded from the review in the case of the following:

- Studies related to diagnostic instruments, clinical, and other designs (e.g., qualitative, non-experimental, systematic review, meta-analysis, and case reports)
- Participants among healthcare providers
- Articles published in another field (apart from nursing, healthcare, medical, and education journals)

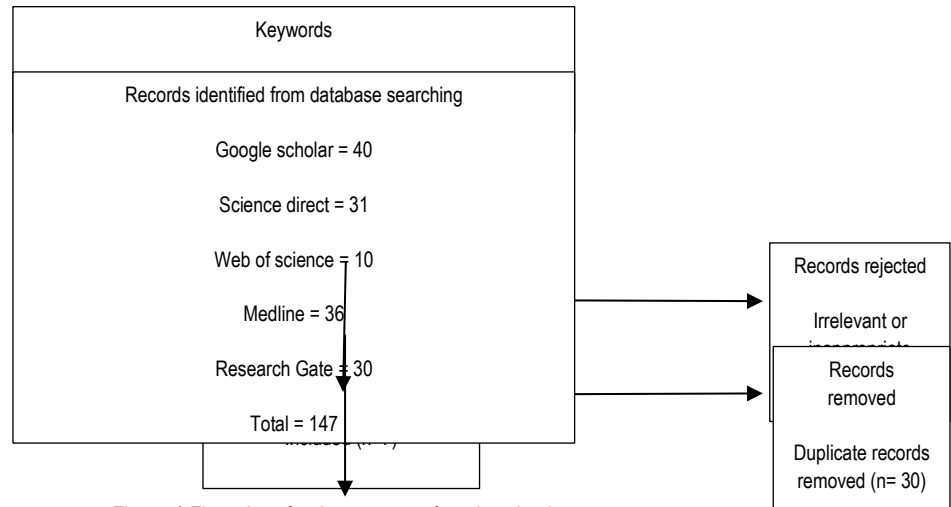


Figure 1 Flow chart for the process of study selection

4.0 Result

4.1 Types of programs

Referring to Table 1, there are seven studies regarding OSA and intervention programs. Of these studies, five studies are randomized controlled trials (RCT) (Seixas et al., 2018; La Piana et al., 2011; Correa et al., 2016; Askland et al., 2020; Theerakittikul, 2022), one study is a true experimental (Rita et al., 2008) and one study is a sequential explanatory mixed method (Brostrom et al., 2013). Most of the studies use the apnea knowledge test (AKT) to measure the level of knowledge, the functional outcomes of sleep questionnaire (FOSQ) to measure functional outcomes, and Epworth sleepiness scale (ESS) to measure daytime sleepiness. The result shows all studies have a positive effect on CPAP adherence and knowledge. Four studies show the intervention program can reduce daytime sleepiness among OSA patients (La Piana et al., 2011; Rita et al., 2008; Askland et al., 2020; Theerakittikul, 2022).

4.2 Setting and Sample

The studies were conducted in five countries: two studies were conducted in the United States (Seixas et al., 2018; Askland et al., 2020), two studies in Brazil (Rita et al., 2008; Correa et al., 2016) and one each in Thailand (Theerakittikul, 2022), Itali (La piana et al., 2011), and Sweden (Brostrom et al., 2013). Six studies were conducted in the healthcare setting (e.g., clinic and hospital) (La Piana et al., 2011; Correa et al., 2016; Askland et al., 2020; Brostrom et al., 2013; Rita et al., 2008; Theerakittikul, 2022). One study was conducted both in the participants' homes and in the healthcare setting. That is, after the participants participate in a home sleep study, they are invited to undergo a diagnostic sleep assessment at the clinic, and education was given (Seixas et al., 2018). Three studies were conducted in groups (Seixas et al., 2018; Brostrom et al., 2013; Askland et al., 2020;). Four studies were conducted by one-to-one approach (La Piana et al., 2011; Correa et al., 2016; Rita et al., 2008; Theerakittikul, 2022). One study reported that the program provided information and training, supported by video sessions and outpatient visits for the intervention group, while the control group did not receive any information or training, then both groups were evaluated at each visit (Rita et al., 2008). Six studies did not mention control groups (Seixas et al., 2018; La Piana et al., 2011; Correa et al., 2016; Askland et al., 2020; Brostrom et al., 2013; Theerakittikul, 2022).

4.3 Duration, follow-up and evaluation

All studies did not report the duration of teaching (Seixas et al., 2018; La Piana et al., 2011; Correa et al., 2016; Askland et al., 2020; Brostrom et al., 2013; Rita et al., 2008; Theerakittikul, 2022). The time of follow-up and evaluation varied across the studies. One study was assessed at the baseline and 12 months (Seixas et al., 2018), one study at six weeks, two months, three months, four months, six months, 12 months, and 24 months (Askland et al., 2020), one study at baseline, after two weeks and six months (Brostrom et al., 2013), one study at baseline, 1-month, and 3-months (Theerakittikul, 2022), one study at 7, 15, 30, 60 and 90 days after CPAP initiation (Rita

et al., 2008), one study at three months and one year (La Piana et al., 2011). while one study did not mention regarding the duration and timeline (Correa et al., 2016). A significant variation in the time interval from the baseline to the study end was observed among the studies. The shortest time of evaluation was one week (Rita et al., 2008), and the longest evaluation period was two years (Askland et al., 2020).

4.4 Outcome measures

Outcomes measured in these articles included knowledge, functional outcomes, CPAP adherence, and daytime sleepiness. The instruments used to measure the outcome varied across the studies. Functional outcomes of sleep questionnaire (FOSQ) were used to assess functional outcomes (Theerakittikul, 2022; Askland et al., 2020). Epworth sleepiness scale (ESS) was used to assess daytime sleepiness (Seixas et al., 2018; La Piana et al., 2011; Rita et al., 2008; Theerakittikul, 2022; Askland et al., 2020). Apnea knowledge test to assess knowledge among OSA patients (Seixas et al., 2018; Brostom et al., 2013; Correa et al., 2016).

5.0 Discussion

5.1 Types of programme

This review assessed seven studies from various types of intervention designs: RCTs and true experimental studies. Nevertheless, the studies also provided relevant information on the effectiveness of the intervention programs. Studies either focused specifically on education program, motivation, or training. All intervention programs were delivered by personnel trained in the research field. The advantage of this strategy is the prevention of observer bias and the provision of quality information. However, the person delivering the program may be from a different background, although most of the providers were medical and health science certified. The types of intervention program in the studies reviewed varied. The researchers conducted the program based on their own research objective and design. Some studies were conducted in the hospital and clinic. The intervention programs were delivered in a group session or one-to-one through education, training, video sessions, and discussions (Seixas et al., 2018; La Piana et al., 2011; Correa et al., 2016; Askland et al., 2020; Brostom et al., 2013; Rita et al., 2008; Theerakittikul, 2022).

5.2 Setting and Sample

Some studies reviewed in this article involved more than one group in their program. Some of the control groups received different interventions than the intervention group. Furthermore, some studies had different time intervals between the follow-up and the evaluation depending on the study objectives and strategies. This may have influenced the impact of the programs. Another issue was bias, as the methods and approaches used in the different interventions affected the outcomes, especially when the programs involved multiple strategies (FitzGerald et al., 2019).

5.3 Duration of follow-up and evaluation

In the reviewed studies, differences were observed in the duration between the follow-up and the evaluation depending on the study objectives and outcome measures of the researchers. Askland et al. (2020) conducted a 2-year study to assess the functional outcome and daytime sleepiness. In the study by Rita et al. (2008), daytime sleepiness was assessed as early as seven days of intervention. It is likely that this to prove that educational program does not shows big difference to outcomes, since OSA severity, age, and objective CPAP use at the beginning of 7th day were similar between both groups (experimental and control) (Rita et al., 2008).

5.4 Outcome measures

The instruments used to measure outcomes varied across the studies reviewed in this article. Most researchers used a questionnaire as their research tool. Self-reported questionnaires are prone to validity issues and misclassification and are less precise. Different instruments used to measure the same outcome may influence the outcome. The studies were recruited from several countries. The outcomes of the programs may have been slightly influenced by the differences in geographical and cultural backgrounds (Roosa et al., 2008).

6.0 Conclusion

Intervention programs differed in terms of design, setting, approach, outcome measurement, and results. Patients improved their knowledge about OSA and CPAP after the intervention programs. CPAP compliance was significantly higher in the intervention program group compared with the control group, and regular CPAP utilization has been reported to improve sleep quality, functional outcomes, overall quality of life, and reduce daytime sleepiness. However, owing to different methodological approaches, populations, settings, outcomes measured, follow-up and evaluation, the findings need to be taken into consideration. The results of this study provide credence to the idea that an intervention program improves knowledge, CPAP adherence, sleep quality, functional outcomes, overall quality of life, and reduces daytime sleepiness. Nonetheless, a few methodological issues were raised in the evaluated papers, suggesting that more analysis is required. In the future, educators and researchers need to develop educational initiatives that are appropriate for Malaysian patients suffering from obstructive sleep apnea. The previous finding shows the increasing cases of OSA in Malaysia but there is no published educational/ intervention program is conducted in Malaysia among OSA patients. To the best of researcher knowledge, there is no study conducted in Malaysia that can prove educational/intervention program improves functional

outcomes, CPAP adherence, daytime sleepiness, and knowledge between the intervention and control group among obstructive sleep apnea patients before and after intervention program. In future, researcher want to have some new findings related to the intervention program and OSA in Malaysia.

Contributions

Study design: NR, SKAS, SNII, SK; data collection and analysis: NR, SKAS, SNII, SK; and manuscript preparation: NR, SKAS, SNII, SK.

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List of Abbreviations

CPAP	Continuous Positive Airway Pressure
AHI	Apnea-hypopnea Index
OSA	Obstructive sleep apnea
ESS	Epworth sleepiness scale

AKT	Apnea Knowledge Test
FOSQ	Functional outcomes of sleep questionnaire