

RESEARCH ARTICLE

Effects of a Self-determination Theory-Based Intervention on CPAP Treatment of Patients with Obstructive Sleep Apnea

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Abstract

Purpose. With continuous positive airway pressure (CPAP) being the treatment of choice for Obstructive Sleep Apnea (OSA), adherence rates to CPAP are still low without a clear consensus of causes. The Self-Determination Theory (SDT) is a general theory of human motivation that emphasizes the extent to which behaviors are relatively autonomous based on the psychological needs that are critical to supporting the process of internalization and the development of optimal motivation. This study sought to determine whether the implementation of an SDT-based intervention is effective in improving: (1) perceived competence, (2) treatment self-regulation, (3) CPAP treatment adherence, and (4) Apnea-hypopnea index (AHI) of OSA patients.

Methods. Using a true experimental pretest-posttest design, 30 purposively selected participants were randomly allocated to experimental and control groups. The SDT-based intervention included group sessions, individual sessions, and follow up phone calls in three weeks. Written permission to conduct the study was obtained from the Institutional Review Board of the University of the East - Ramon Magsaysay Memorial Medical Center, Inc. (UERMMMC) and the Lung Center of the Philippines. Participation was voluntary and all participants had the right to refuse or discontinue their participation at any time during the study. Data were analyzed using two-way repeated-measures ANOVA, student's T-test, and chi-square.

Results and Conclusion. The participants in the experimental group have increased adherence rates from Time 1 (60%) to Time 2 (92.9%) and Time 3 (85.7%). Although, when compared to the control group, no significant difference was noted across the different periods of measurement ($p=0.70810$, $p=0.0870$, $p=0.2403$). There were higher proportions of patients who eventually became adherent in the experimental group compared to the control group immediately after and 5 weeks after the intervention ($p=0.0001$). The experimental group had significantly better improvement in AHI compared to the control group immediately after ($p=0.0152$) and 5 weeks after the intervention ($p=0.0022$). Considering the importance of CPAP adherence in effectively treating OSA, measures to improve adherence such as SDT-based intervention could be usefully incorporated into OSA patients' treatment plans.

Keywords: *Obstructive Sleep Apnea, Continuous Positive Airway Pressure, Adherence, Self-determination Theory*

Introduction

Being one of the most common types of sleep-disordered breathing, obstructive sleep apnea (OSA) is a sleep disorder that involves cessation or a significant decrease in airflow in the presence of breathing effort. It is characterized by recurrent episodes of upper airway collapse during sleep (Downey & Gold, 2018). The resulting sleep fragmentation can cause daytime symptoms, including sleepiness, headaches, and cognitive dysfunction. Apart from this, OSA can also be a risk factor for hypertension, cardiac failure, stroke, and occupational accidents due to sleepiness (Shamsuzzaman, Gersh, & Somers, 2003). From the 2016 Healthy Living Index, Filipinos have one of the

highest rates of sleep deprivation in Asia, whereas 46% of Filipinos do not get enough sleep, and one of the most common causes of poor sleep quality is the Obstructive Sleep Apnea (Judani, 2017).

Continuous positive airway pressure (CPAP) is considered the treatment of choice for OSA. If used consistently, it is deemed an efficacious treatment as it reduces the symptoms and improves the quality of life (Gilles et al., 2006; Vlachantoni et al., 2012). However, studies have found low adherence rates to CPAP, no clear consensus of causes, and affected by multifaceted factors,

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which include patient, treatment, social, and other healthcare-related factors (Brostrom et al., 2010).

In general, patients' non-adherence with medical regimens is a complex and multidimensional health care problem, which may be related to the patient, treatment, and/or health care provider. If this problem continuously rises, a considerable number of patients will not benefit optimally from the treatment, thus, resulting in increased morbidity, mortality, and societal costs. Many studies from 2009 to 2017 have been conducted to identify salient factors of CPAP adherence and effective strategies to promote adherence (Brostrom et al., 2010; Weaver & Sawyer, 2010; Stuck et al., 2011; Ninan & Balachandran, 2017). However, despite the years of implementing strategies and interventions, these have only reported modest effects on treatment adherence. In the study of Haniffa, Lasserson, & Smith (2004), it was pointed out that although machine improvements were done to increase comfort, with the presumption that this could increase patient adherence, they are still far from the key determinants in overall adherence. Haniffa et al. also mentioned that many of the adverse effects of CPAP, such as mask discomfort, leaks, and aerophagia (i.e. excessive and repetitive air swallowing), probably depend on the level of CPAP treatment pressure. Thus, the auto-CPAP machine has been developed to optimize the delivered pressure through the night (i.e. reduced mean pressure overnight). Moreover, the participants in Haniffa and colleague's study preferred using auto-CPAP compared to either fixed CPAP or neither of the treatment. Nonetheless, there was no significant increase in their quality of life or a decrease in symptoms of OSA when compared to those who used fixed CPAP (Haniffa, Lasserson, & Smith, 2004).

Amidst the robust evidence regarding the effectiveness of CPAP treatment for OSA, when patients are non-adherent, the maintenance of CPAP use becomes a challenge in the long term and the effect of the treatment becomes irrelevant (Shapiro & Shapiro, 2010). Some of the considerations are that CPAP treatment is intrusive and requires a dramatic lifestyle change – such change may be difficult for many to tolerate. Likewise, this substantial commitment is far different from many other chronic conditions that require a simpler treatment only. Hence, a better understanding of the drive to engage in CPAP treatment is paramount and might be improved by considering motivational factors related to self-determined behavior. While a patient-centered approach focuses on the individual's personal needs, desires, and goals as central to the care and nursing process (Draper & Tetley, 2013), nurses can use the principles of Self Determination Theory to help patients establish self-regulation and to sustain life-long behavior changes (Johnson, 2007). Meanwhile, very few studies in the past utilized the principles of behavior change in the CPAP treatment context (Woidtke, 2013 & Wild, et al., 2004) and none of these tried to explore the role of self-determined motivation. This study aimed to determine the

effect of SDT-based intervention in the (1) perceived competence, (2) treatment self-regulation, (3) CPAP treatment adherence, and (4) Apnea–hypopnea index of OSA patients.

Methods

Utilizing true experimental pretest-posttest design, the study participants were sent randomly either to the experimental group or to the control group. The design and the protocol of the study were approved by the UERM and the Lung Center of the Philippines Institutional Review Board.

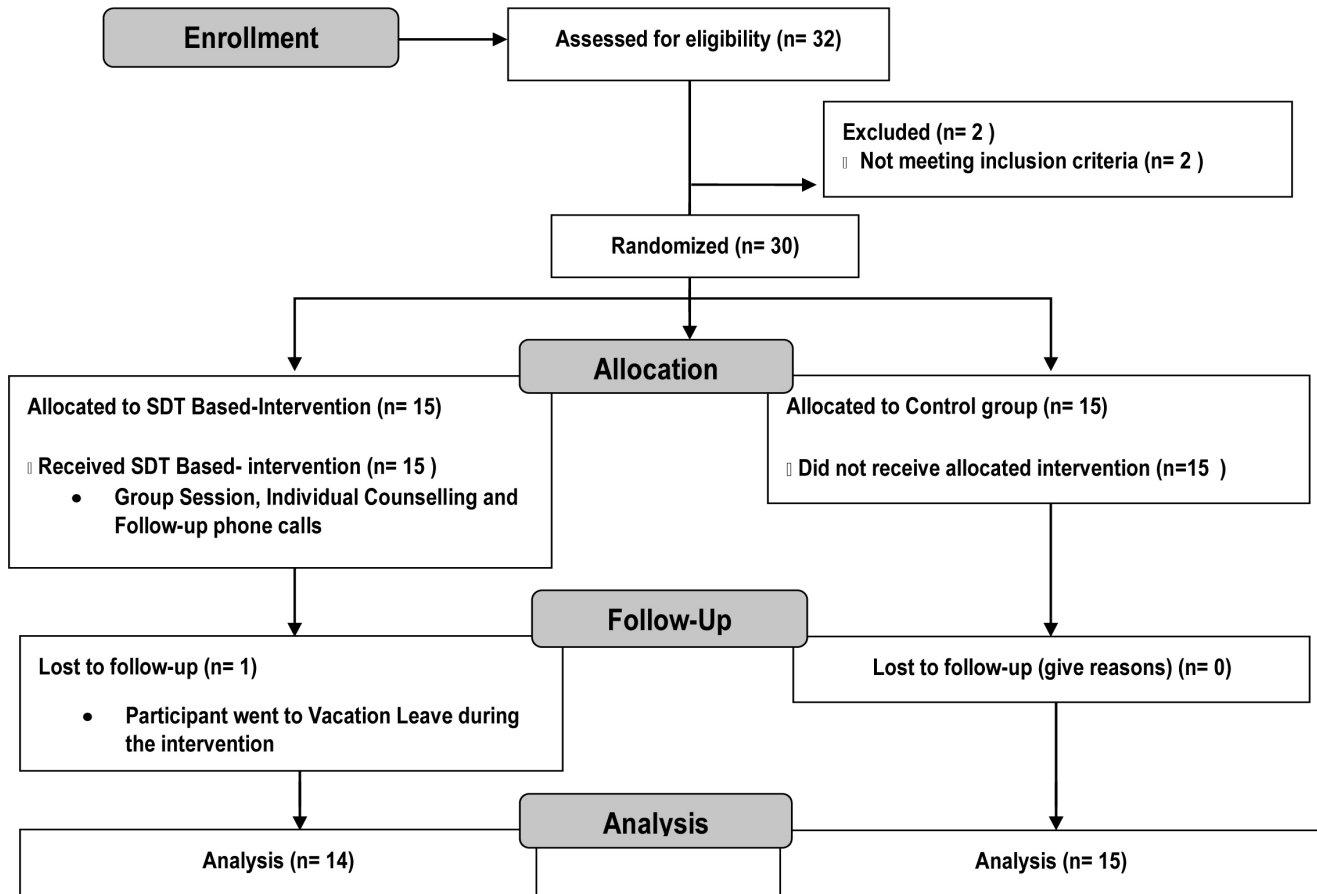
Recruitment

The study was done in a tertiary hospital in the National Capital Region that has sleep laboratories and sleep specialists to manage and treat OSA. Being one of the few tertiary hospitals that can provide the expertise and the resources for the sleep study in the country, the setting provided a convenient place for testing the SDT-based intervention for the participants. Using purposive sampling, the participants were selected using the following inclusion criteria: (a) having been diagnosed with OSA, (b) aged between 18 to 60 years old, (c) patients who currently used nasal CPAP masks with a secured digital card available, (d) moderate to severe OSA, (e) increased body mass index (over 25), (f) at least high school graduate, (g) with fix schedule at work (e.g., morning shift only), and (h) more than six months CPAP user. Exclusion criteria included (a) patients who used other treatments for OSA alongside with CPAP like BIPAP, (b) patients with comorbidities aside from Diabetes and Hypertension, (c) patients with allergic rhinitis, and (d) patients who are smokers.

At 95% confidence level, 80% power of test, and an effect size of 1.1 (Hedge's G), the minimum sample size required per group was at least 14 patients. This was based on the study of Halvari and Halvari (2006) with a difference of means on both groups of 0.24, the standard deviation in the intervention group of 0.26, and standard deviation in the control group of 0.14. Ethical clearance was sought from UERM Research Ethics Committee and the Institutional Review Board of the Lung Center of the Philippines. Consent for study participation was sought by the researcher from the eligible participants after their check-up during clinic visits.

After securing consent, the participant-assigned numbers were used instead of names, and the participants' documents were enclosed in sealed envelopes. Allocation concealment was done to minimize the effect of selection bias. Random Sequence generator from *random.org* was utilized as a mechanism to assign participants in the intervention and control group. The participants who were assigned in the intervention group received a phone call from the research assistant to participate in the group session, individual counseling, and follow up phone calls. The participants in the control group were advised to follow up to their pulmonologists/sleep doctors.

Figure 1. CONSORT recruitment and retention of participants



Measures

Seven-point Likert scaled questionnaires were used, with responses ranging from 1 ('not at all true') to 7 ('very true'). First, the perceived competence for OSA self-management was assessed through the Perceived Competence Scale (PCS) (Williams et al., 1999). The PCS measures feelings about behaving in healthy ways. In a study of diabetic patients (Williams, Freedman, & Deci, 1998), the alpha reliability for the perceived competence items was about 0.90. Some words were modified in the context of OSA management. Permission on the use of the tool was sought from the SDT Center before its use in this study. Second, the autonomous self-regulation for CPAP treatment was assessed through the Treatment Regulation Questionnaire (TSRQ) by Williams et al. (1999). The 15-item TSRQ is a set of questions concerning why people do or would do some healthy behavior, enter treatment for some disease, try to change unhealthy behavior, follow a treatment regimen, or engage in some other health-relevant behavior. The three dimensions of TSRQ assess: autonomous motivation (items 1, 3, 6, 8, 11, & 13), controlled motivation (items 2, 4, 7, 9, 12, & 14), and amotivation, (absence of intention or motivation (items 5, 10, & 15). The internal consistency of each subscale for TSRQ (Levesque et al., 2007) was acceptable (most values >0.73).

Some words were modified in the context of CPAP treatment. Third, the measurement of CPAP adherence was based on Kribbs et al.'s (1993) definition of "more than four hours per night for at least 70% of the days that were monitored" and was monitored through the CPAP tracking system by usage hours for five consecutive nights. For example, a participant who used CPAP for more than four hours per night and consistently used it for more than three days (out of five days) was considered as 'adherent'; otherwise was considered as 'non-adherent'. Lastly, AHI was generally expressed as the number of events per hour (None/Minimal if AHI < 5 per hour; Mild if AHI ≥ 5, but < 15 per hour; Moderate if AHI ≥ 15, but < 30 per hour; Severe if AHI ≥ 30 per hour).

Procedures

The study was conducted from September 2018 to November 2018. As a baseline, the participants were asked also to provide their recent five-day CPAP treatment adherence measures from their CPAP tracking device system and AHI values were collected in the polysomnogram result. The TSRQ and PCS were given directly to participants and a web-based survey was also provided to those who prefer to answer the questions online.

The Experimental Group

The SDT-based intervention included group sessions, individual sessions, and follow up phone calls. The health care providers included one pulmonologist and three duly trained registered nurses. The group session was facilitated by a pulmonologist, while individual counseling and follow up phone calls were done by the nurses. The duration of the actual procedure was done over three weeks (September 10-30, 2018).

The Intervention group had 15 participants originally but one had dropped out. The first week was a group session, conducted by a pulmonary doctor for 2 hours 30 minutes, which aims to provide facts and information about Sleep Hygiene, OSA, and the importance of using CPAP. The participants also received pamphlets that contain information about OSA and CPAP. During the group session, competence will be strengthened with a lecture that aims at increasing OSA and CPAP knowledge of individuals by presenting key principles of good sleep hygiene and treatment adherence.

At week two, face-to-face individual counseling was conducted and the participants met their counselors for a 20-30 minute discussion of barriers met on using CPAP. This time, the participants were

encouraged to meet with the counselor for the individual session but was not a requirement since SDT respects the autonomous self-regulation of the patients. 12 of 14 participants have attended this session.

Individual follow-up phone calls took place at week three that lasted for about 10-20 minutes. Competence, autonomy, and relatedness were promoted during the follow-up phone calls by eliciting and acknowledging patients' perspectives and emotions before making recommendations in facilitating factors and barriers toward behavior changes. The health care providers have a patient-centered approach and put no pressure on participants about their self-management and CPAP adherence.

Immediately after the intervention, all participants have completed the TSRQ and PCS. Both CPAP adherence and AHI were also measured.

At 4th to 8th week, there was no additional contact with the participants. This was the time to encourage them to maintain behavior changes autonomously. After eight weeks, all participants have completed again the TSRQ and PCS. Both CPAP adherence and AHI were also measured.

The Control Group

The control group only received a pamphlet that contains information about OSA and CPAP. Thereafter, they were advised to make an appointment with their sleep doctors to further discuss their problems with the disease and the CPAP treatment. Measurements on both groups were performed at baseline (T1 = 0), after the end of the intervention (T2 = after 3 weeks), and then at 5-week after the end of the intervention (T3= after 8 weeks).

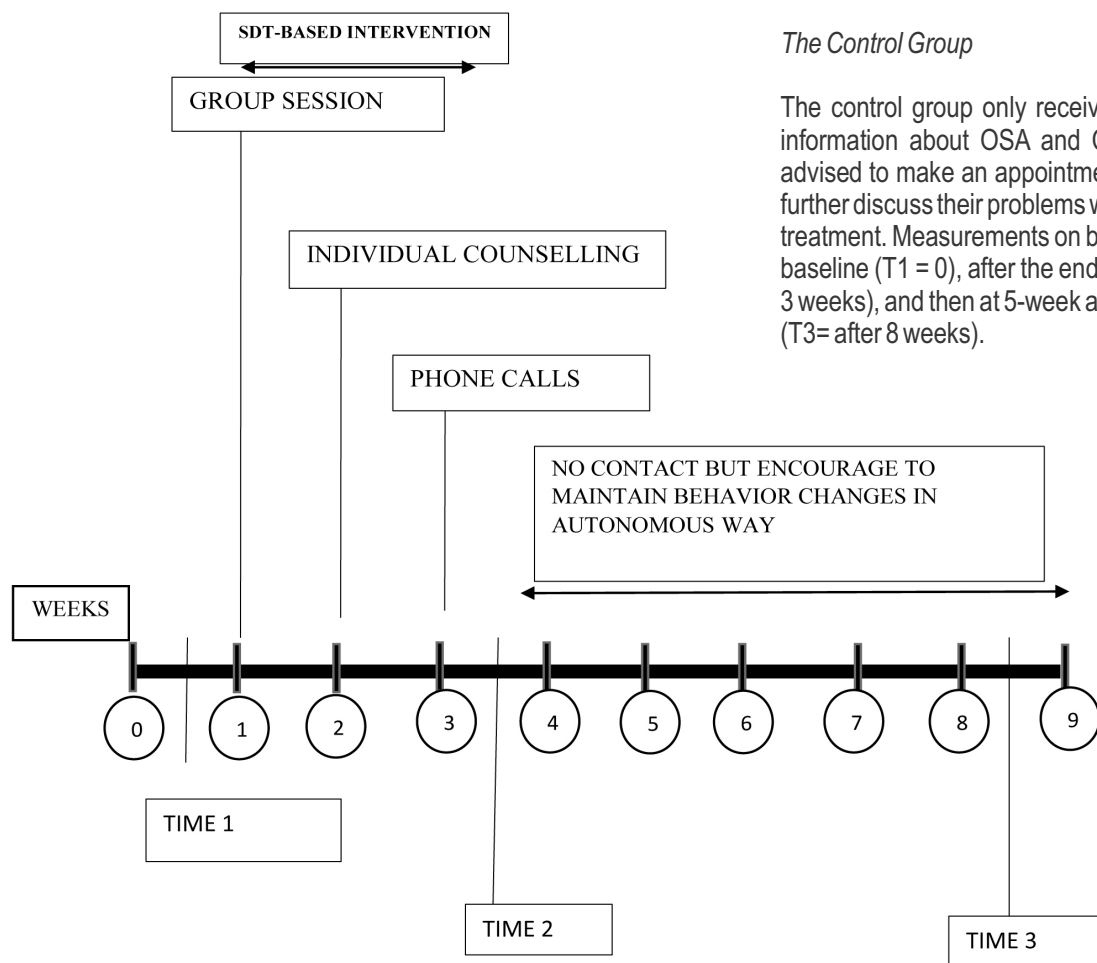


Figure 2. Description of the 3-week SDT-based intervention and measurements that will be performed at baseline (T1 = 0), after the end of the intervention (T2 = after 3 weeks), and then at 5-week after the end of the intervention (T3= after 8 weeks).

Data Analysis

Descriptive statistics were used to describe the measures of perceived competence, treatment self-regulation, treatment adherence, and AHI. Two-way Repeated Measures ANOVA was utilized to compare variables in three periods of measurement. Student's T-test was used to compare the outcomes in the intervention and control groups in terms of the perceived competence and treatment self-regulation in OSA patients. Chi-square test was used to compare differences in CPAP adherence and AHI between periods of measurement.

Results

The total number of participants with OSA was 30, 15 was allocated to the control group and 15 was allocated in the experimental group. The mean age for the control group is 45.4 ± 11.7 and the majority were married (73.30%) and males (60%). Fifteen (100%) are college graduate and most of them are employed (86.70%). In terms of occupation, nurses have the highest number of participants (33.30%) in this group, followed by physicians (20%). Majority of them have a co-morbid diagnosis of hypertension (53.30%).

Table 1. Profile Characteristics of Participants with Obstructive Sleep Apnea

Characteristics	Control (n=15)	Experimental (n=15)	Total (n=30)
Age (years), mean$\pm$sd	45.4 $\pm$ 11.7	42.3 $\pm$ 11.2	43.85 $\pm$ 11.45
Gender, n, %			
Male	9 (60.0)	12 (80.0)	21 (70.00)
Female	6 (40.0)	3 (20.0)	9 (30.00)
Civil Status, n,%			
Single	4 (26.7)	5 (33.3)	9 (30.00)
Married	11 (73.3)	10 (66.7)	21 (70.00)
Educational Attainment, n,%			
College Graduate and higher	15 (100.0)	13 (86.67)	28 (93.3)
College Undergraduate	0 (0.0)	1 (6.7)	1 (3.3)
High School Graduate	0 (0.0)	1 (6.7)	1 (3.3)
Employment Status, n, %			
Employed	13 (86.7)	15 (100.0)	28 (93.3)
Unemployed	2 (13.3)	0 (0.0)	2 (6.67)
Occupation, n, %			
Nurse	5 (33.3)	6 (40.0)	11 (36.67)
Physician	3 (20.0)	3 (20.0)	6 (20.00)
Nursing Attendant	0 (0.0)	2 (13.3)	2 (6.67)
Respiratory Therapist	2 (13.3)	0 (0.0)	2 (6.67)
Administrative Staff	1 (6.7)	0 (0.0)	1 (3.3)
Clinical Assistant	1 (6.7)	0 (0.0)	1 (3.3)
Engineer	0 (0.0)	1 (6.7)	1 (3.3)
Government Employee	0 (0.0)	1 (6.7)	1 (3.3)
HR Officer	0 (0.0)	1 (6.7)	1 (3.3)
Lawyer	0 (0.0)	1 (6.7)	1 (3.3)
Medical Student	1 (6.7)	0 (0.0)	1 (3.3)
Team Leader	1 (6.7)	0 (0.0)	1 (3.3)
None	1 (6.7)	0 (0.0)	1 (3.3)
Lifestyle,n,%			
Social Drinker	8 (53.3)	11 (73.3)	19 (63.3)
Never	7 (46.7)	4 (26.7)	11 (36.67)
Comorbidities, n, %			
Hypertension	8 (53.3)	11 (66.7)	18 (60.00)
DM & Hypertension	2 (13.3)	2 (13.3)	4 (13.3)
Hypertension and Hyperlipidemia	0 (0.0)	1 (6.7)	1 (3.3)
None	5 (33.3)	2 (13.3)	7 (23.3)

For the experimental group, the mean age is 42.3 ± 11.2 . Most of them are also married (66.70). In this population, 13 (86.67%) are college graduates who happened to be employed (100%) with nursing as the highest number in their occupation (40%), and physician (20%) as the second most. Furthermore, the majority have a co-morbid diagnosis of hypertension (66.70%).

CPAP Treatment adherence was higher among the experimental group. However, it was noted that there was no significant difference between the two groups in three different times ($p=0.7081$, $p=0.0870$, $p=0.2403$). Adherence was constant throughout the period among patients in the control group. In terms of AHI, the experimental group is significantly better during Time 3 ($p=0.0181$), as the percentages of none and mild AHI are higher in the experimental group than the control group.

Table 3 showed that adherence scores among non-adherent participants at baseline between the two groups have significant differences during Time 2 ($p=.0001$) and Time 3 ($p=.0001$). The non-adherent patients among the experimental group became adherent after the intervention while among the control group, no improvements were noted. In terms of AHI, there were also significant differences between the two groups during Time 2 ($p=.0152$) and Time 3 ($p=.0022$) where improvement of AHI was noted in the experimental group.

Discussion

Baseline Characteristics of OSA patients

The participants ($n=30$) consisted of a population with a mean age of 43.85, dominated by males, and

Table 2. Control and Experimental Group in terms of CPAP Treatment Adherence and AHI within general population

	Control		Experimental		P value
	n	%	n	%	
Adherence					
Before	10	66.7	9	60.0	0.7081 ^{ns}
Immediately After	10	66.7	13	92.9	0.0870 ^{ns}
After 5 Weeks	10	66.7	12	85.7	0.2403 ^{ns}
AHI (Before)					
None	0	0.0	0	0.0	0.2815 ^{ns}
Mild	0	0.0	0	0.0	
Moderate	9	60.0	6	40.0	
Severe	6	40.0	9	60.0	
AHI (Immediately After)					
None	10	66.7	12	85.7	0.1061 ^{ns}
Mild	1	6.7	2	14.3	
Moderate	4	26.7	0	0.0	
Severe	0	0.0	0	0.0	
AHI (After 5 Weeks)					
None	10	66.7	11	78.6	0.0181*
Mild	0	0.0	3	21.4	
Moderate	5	33.3	0	0.0	
Severe	0	0.0	0	0.0	

Table 3. CPAP Treatment Adherence and AHI among initially identified Non-adherent participants in the Control and Experimental Group

	Control		Experimental		P value
	n	%	n	%	
Adherence					
Before	0	0	0	0	1.000 ^{ns}
Immediately After	0	0	5	83.3	0.0001*
After 5 Weeks	0	0	4	66.7	0.0001*
AHI (Before)					
None	0	0.0	0	0.0	0.5671 ^{ns}
Mild	0	0.0	0	0.0	
Moderate	3	60.0	2	33.3	
Severe	2	40.0	4	66.7	
AHI (Immediately After)					
None	0	0.0	4	66.7	0.0152*
Mild	1	20.0	2	33.3	
Moderate	4	80.0	0	0.0	
Severe	0	0.0	0	0.0	
AHI (After 5 Weeks)					
None	0	0.0	3	50.0	0.0022*
Mild	0	0.0	3	50.0	
Moderate	5	100.0	0	0.0	
Severe	0	0.0	0	0.0	

have the same number for both severe and moderate OSA. Furthermore, the findings of the present study showed 21 (70%) of OSA participants are married. This means that it is noteworthy to consider the patient and partner experiences with CPAP treatment since OSA is a shared problem negatively affecting patients' and partners' sleep, quality of life, and relationship (Doherty, Kiely, Lawless, & McNicholas, 2003). In patients with chronic disease, perceived spousal support and involvement have been associated with both improvements and decrements in adherence to medical treatments (Luster et al., 2014). The results also revealed that majority of the participants have comorbid diagnoses such as hypertension only (60%) and hypertension with diabetes (13.3%). Overwhelming clinical evidence has shown that patients suffering from two very common illnesses – Type 2 diabetes and hypertension – are at much higher risk for OSA (American Academy of Sleep Medicine, 2013). According to the Academy, type 2 diabetics and people with hypertension are much more likely to have obstructive sleep apnea than other people. As a result, they should immediately discuss their risk for sleep apnea with a sleep specialist.

The majority of the participants were college graduates, currently employed as nurses and physicians. Notably, a proportion of participants were health care providers (70%) who may have more healthcare encounters and access to health information is favorable. Hence, public health campaigns will need to engage in various ways to reach out to more population and raise OSA awareness. Sia et al. (2017) found that there was low awareness and poor knowledge of OSA among the general population and the findings suggested that a lot more work needs to be done to improve public awareness and knowledge of OSA. Moreover, the reported large number (96.67%) of participants who are currently employed may convey an idea that these people can afford the high cost of CPAP machine. This is an implication that patients who were diagnosed already but unable to buy a CPAP machine could affect adherence. This is consistent with the study of Ninan and Balachandran (2017) where compliance with CPAP was very low and the most cited reason was the cost of the device. Therefore, the administration must focus on measures to reduce the upfront cost of the device to ensure OSA patients access to CPAP therapy and to increase compliance with CPAP as well.

The effect of SDT-based Intervention on Treatment Self-regulation and Perceived Competence

Over the past years, the findings from the previous studies have demonstrated the role of need support, perceived competence, and autonomous self-regulation in a variety of mental and physical health outcomes including quality of life, tobacco cessation, diabetes management, dental health, and medication adherence (Williams, Grow, Freedman, Ryan, & Deci, 1996; Williams et al., 1998; Munster Halvari & Halvari 2006; Williams et

al, 2009). The results of the present study revealed that perceived competence and treatment self-regulation have high scores at baseline and these scores have been consistent immediately after intervention and five weeks after intervention. The noticeable high scores at the onset maybe because of the nature of work of the participants where majority have a medical background and in good socioeconomic status. The CPAP duration might also affect these high scores where participants were already using this for more than six months, thus made them competent and self-regulated. As expected, the salience of these baseline scores has considerable influence on the outcomes where consistency of high perception was evident in the succeeding timelines. In this regard, the study recommends that the SDT-based intervention should also be applied to other cohorts of people to determine its effectiveness.

In addition, the findings showed that in the experimental group, the relative autonomous index of Time 2 and Time 3 are significantly higher ($p=0.013$) than Time 1, which makes a significant difference across the three different times. To further analyze the data, additional analysis has been conducted to participants who were initially identified as non-adherent at baseline, and scores were determined as they move to different times. When this proportion of patients in both groups were compared, their treatment self-regulation ($p=0.0011$) and perceived competence ($p=0.0001$) scores showed significant differences. This means that those non-adherent participants who received the SDT-based intervention had higher autonomous self-regulation and perceived competence scores after the intervention. Thus, it is worth noting that the results demonstrated support for the SDT whereby perceived competence and self-regulation resulted in greater scores when SDT is applied.

The effect of SDT-based Intervention on CPAP Adherence and Apnea Hypo Apnea Index

Previous positive findings from limited randomized controlled studies suggested a behavioral therapy intervention enhanced CPAP adherence (Weaver & Sawyer, 2010). Similar results of the present study showed that of 14 participants who underwent SDT-based intervention, the adherence rate to CPAP was significantly increased ($p=0.0423$) after the intervention. However, adherence between the groups has no significant difference ($p=0.0870$). This variable has been supplementarily explored by determining non-adherent participants at baseline in both groups and observed their scores after intervention. When this portion of participants was analyzed, the experimental group showed improved adherence compared to the control group making it statistically significant during Time 2 ($p=0.0001$) and Time 3 ($p=0.0001$).

As expected, markedly improvements in AHI after Time 1 in both groups were noted since baseline AHI scores were gathered in

the diagnostic polysomnogram which means that AHI scores were tested without the application of the CPAP machine. The percentage of AHI that has moderate and severe classifications were significantly decreased to none in both groups during Time 2 ($p=0.0001$, $p=0.0003$) and Time 3 ($p=0.0001$, $p=0.0002$). However, AHI in the experimental group was noted to have higher improvements. To establish the accuracy of this result, the proportion of non-adherent participants at baseline in both groups were sorted. The analysis showed significant differences in both groups, where participants in the experimental group had better AHI in Time 2 ($p=0.0152$) and Time 3 ($p=0.0022$). CPAP treatment is highly effective in OSA, but it is associated with limited treatment adherence. Stuck, Leitzbach, and Maurer (2011) concluded that CPAP adherence significantly reduces AHI, which is in line with the current study. They also mentioned that in the selected group of OSA patients, CPAP could not eliminate AHI due to non-adherence with the device. Furthermore, the authors described that AHI is only one measure that is not completely describing the nature of the disease. Nevertheless, the AHI is still one of the most important target measures used in clinical trials and treatment effects are routinely described by a reduction in AHI.

The SDT-based Intervention encompassing the treatment self-regulation, perceived competence, CPAP adherence and AHI.

The experimental group received SDT-based intervention, wherein group sessions, individual sessions, and follow up phone calls were conducted in three different weeks. These three sessions aimed at increasing OSA and CPAP knowledge of individuals by presenting key principles of good sleep hygiene and treatment adherence. Following the SDT (Ryan and Deci, 2000), basic psychological needs (autonomy, competence, and relatedness) were supported during all the interventions to increase self-determined motivation to CPAP use, thereby improving AHI as well.

Moreover, the findings revealed that those initially identified non-adherent participants who received support during all the interventions had increased self-determined motivations bringing out increased adherence and improved AHI scores. While the non-adherent participants in the control group who did not have the opportunity to discuss problems, ask questions, and learn about the management and care for CPAP remained non-adherent. Similar results were found in a study of Ryan, Plant, and O'Malley (1995) on individuals mandated to an 8-week alcohol treatment program. Results found that individuals who had more autonomous self-regulation for the treatment evidenced greater treatment attendance, program completion, and clinician-rated treatment involvement. The theory further argues that by maximizing the patient's experience of autonomy, competence,

and relatedness in health-care settings, the regulation of health-related behaviors is more likely to be internalized, and behavior change will be better maintained (Williams, Deci, & Ryan, 1998). However, these findings suggest additional researches to clearly determine the association of the perceived competence and self-regulation to CPAP adherence and AHI.

Study Limitations

The research was conducted in a single tertiary hospital which lasted for eight weeks only. Eight weeks was a short period for the researcher to provide more autonomous support to the participants. Second, because of the time limit, this research used only a small size of population in a single tertiary hospital. Therefore, to generalize the results for larger groups, the study should involve more participants at different tertiary sleep centers. Third, the study did not determine what type of work they have, to some extent; the participant's type of work might affect the result of the adherence. Evidently, the findings also revealed that majority of the participants have a medical inclination, which might affect their perceptions, and motivations that eventually made them feel competent and autonomously self-regulated in using CPAP. Another limitation of the study was it evaluated only one approach to behavior change that incorporates only the SDT. There are certainly other theories of behavior change that can be applied to treatment adherence in patients with OSA. Furthermore, the study did not determine the level of motivation among participants before the intervention. This would mean patients with higher levels of motivation might have felt better to adhere to CPAP treatment on their own. In addition, other clinical variables for OSA like BMI, Epworth sleepiness scale, Oxygen desaturation index, and lifestyle habits were not included in the study.

Conclusion and Recommendation

The findings of the study suggest that one way of ensuring CPAP adherence among OSA patients is to integrate behavior change approaches like Self-determination Theory to CPAP therapy. In this study, the SDT-based intervention improved measures in the perceived treatment self-regulation, perceived competence, CPAP adherence, and apnea-hypo apnea index among the intervention group but it was not statistically significant when compared to control group. However, those who received SDT-based intervention had significant improvements in the proportion of adherent participants after the intervention. This was not observed in the control group, wherein adherence was consistent to be zero percent after baseline. Also, there were significantly more non-adherent participants who eventually became adherent in the group who received SDT-based intervention. Furthermore, AHI among those who received SDT-based intervention had significantly improved after intervention wherein more percentage of severe AHI from baseline were

decreased to mild and none AHI during time 2 and time 3. This significant improvement was not observed in the control group. This suggests that provision of holistic health teachings and support while respecting their autonomous self-regulation would be beneficial to the CPAP therapy success in the future.

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