CPAP TITRATION STUDY COMPLETION:

A CORRELATIONAL STUDY

A DISSERTATION

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KATELIJNE ACKER, MSN, RN

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DEDICATION

I dedicate this dissertation work to my husband, Norman, who has been a continuous source of love, support, encouragement, and wonderful cooking during the challenges of doctoral education.

In memory of my father, Gabriel Forrez, PhD, and my mother, Marie-Thérèse Forrez-Durieux, former home health nurse.

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ABSTRACT

KATELIJNE ACKER

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Background: Sleep loss is a global public health burden with far-reaching social, economic, and health consequences. Obstructive sleep apnea (OSA) causes fragmented sleep and OSA prevalence in adults, 30-70 years of age, is 26%. About 30% of those drop the recommended CPAP treatment before initiation. In this study, the concept of *CPAP adherence* was expanded to include titration study completion as the first act of adherence. This study targeted a group that is rarely studied: the non-adherers.

Participants: Consecutively sampled, CPAP-naive, newly diagnosed OSA patients (*N*=155) completed a battery of questionnaires the evening of their diagnostic polysomnography, before receiving educational information.

Methods: A predictive correlational study, using logistic regression, was conducted. Using valid and reliable surveys, cognitive concepts assessed were: (a) risk perception, (b) outcome expectancy, (c) self-efficacy, (d) locus of control, (e) health value, and (f) beliefs about OSA and CPAP. Physiological data were gathered from diagnostic sleep study results. Titration completion was assessed 90 days after diagnosis.

Results: Lower OSA self-efficacy scores contributed significantly to titration non-completion prediction (*OR*= 0.95, *p*=.002). The final regression model explained about 31 % of the variance in titration non-completion and 83% of cases were correctly classified. Approximately 24 % of the participants did not complete a titration study. Respiratory disturbance index (RDI) was implicated in titration non-completion prediction.

Conclusion: Participants' beliefs about risks associated with OSA, their CPAP treatment expectations, and their perceived confidence in their ability to use CPAP influence titration non-completion, even measured before OSA diagnosis.

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CHAPTER I

INTRODUCTION

Sleep is critical to health and well-being and sleep loss is a global problem. One of the objectives of Healthy People 2020 is to increase the number of adults who get sufficient sleep and to educate the public about the positive effects of adequate sleep and the treatment of sleep disorders (Office of Disease Prevention and Health Promotion, 2016). Obstructive Sleep Apnea (OSA) results in fragmented sleep, requiring treatment, yet 30% of those who are diagnosed with OSA and are recommended to be treated with continuous positive airflow pressure (CPAP) do not complete a titration study, the first step in treatment initiation. This study will address the OSA positive patients who do not return to complete the titration sleep study and therefore effectively do not start the recommended treatment.

Background

Healthy sleep is of great importance for an individual's biological and psychological wellbeing. Sleep is one of the basic human needs and its importance to human health and healing is clear in the writings of nursing leaders like Florence Nightingale (1860) and Virginia Henderson (1955). The promotion of healthy sleep is a fundamental element of nursing practice. In addition, Redeker and McEnany (2011) posit that nurses are well suited to promote healthy sleep and to help individuals, families, and communities prevent and treat sleep disorders.

The occurrence of sleep-disordered breathing in adults has increased by up to 55% over the last two decades. Its prevalence is like that of asthma and diabetes, but most severe cases are not diagnosed (Peppard et al., 2013; ResMed, 2015). Sleep-disordered breathing is defined by abnormal respiratory patterns and insufficient ventilation during sleep. The three different types

of sleep-disordered breathing are obstructive sleep apnea (OSA), central sleep apnea, and mixed sleep apnea (Colton & Altevogt, 2006; Downey, Rowley, Wickramasinghe, & Gold, 2015; ResMed, 2015). OSA is the most common type and will be the focus of this study.

The OSA diagnosis is made during an overnight sleep study, a polysomnography. This study consists of an electroencephalogram, an electrocardiogram, an electro-oculogram, and an electromyography. Respiratory rate, tidal volume, inspiratory and expiratory volumes are also measured. An apnea is a breathing pause of 10 seconds or more that is caused by the collapse of the upper airway. A hypopnea occurs when the airway collapses partially and the airflow is reduced by 30% for 10 seconds or more. The soft tissue in the back of the throat is the most common cause of the airway obstruction. Apneas and hypopneas are associated with a reduction in oxygen saturation and subsequent awakening of the patient. Based on the results of the polysomnography, an apnea/hypopnea index (AHI) is calculated and represents the number of events that occur each hour. These events include total and/or partial airway collapses and others events where airflow is reduced for >10 seconds (Conley, 2015; Tsara, Amfilochiou, Papagrigorakis, Georgopoulos, & Liolios, 2009).

According to the American Association of Sleep Medicine (AASM) continuous positive airway pressure (CPAP) is accepted as the gold standard for the treatment of OSA. CPAP is the least invasive and most effective treatment and is the treatment that is initially offered. Other treatments include surgery to assist with weight loss or to reduce the size of the uvula, dental surgical procedures, oral appliances, behavioral treatments, and adjunctive treatments like oxygen therapy and pharmacological agents. Of these alternate methods the mandibular advancement devices, which are oral appliances (OA), seem to be the most effective, especially in mild to moderate OSA (American Academy of Sleep Medicine & Adult OSA Task Force, 2009; Conley,

2015; Downey et al., 2015; Randerath et al., 2011). Though OA can be effective, they are usually only offered as a replacement for CPAP to patients with mild to moderate OSA who do not tolerate the CPAP treatment. Nevertheless, CPAP is considered the first line treatment (Downey et al., 2015).

The CPAP device consists of three parts: a mask, tubing, and a motor. The patient wears a mask through which a positive airflow is delivered to the upper airway. The motor generates the airflow that acts as a pneumatic splint and keeps the airway open. Different types of masks are available. They may cover the nose only or both nose and mouth, and they are secured with straps. The tubing connects the blower to the mask (Downey et al., 2015).

The strength of the airflow that is needed to keep the upper airway open during sleep is different for each individual and is determined during a second night sleep study, the titration study. During this study the patient is fitted with a CPAP mask and the optimal positive airflow is determined. The titration study is usually the patient's first experience with CPAP (Salpeci et al., 2013; Sarell, Chomsky, & Shechter, 2013; Wolkove, Baltzan, Kamel, Dabrusin, & Palayew, 2008). Auto-titration, at home unattended titration, is also an option but current guidelines recommend polysomnographic titration (American Association of Sleep Medicine, 2009). Patients who have never used a CPAP device are referred to as being CPAP naive.

Problem of Study

OSA has been associated with cardiovascular disease, impaired glucose metabolism, and other chronic conditions, and has many adverse effects due to lack of sound sleep. The best treatment to date is the application of CPAP during sleep. Many patients that are diagnosed with OSA choose not to complete a titration study, the first step in CPAP treatment initiation. The factors that influence CPAP adherence, including the characteristics of those participants who

complete the titration study and initiate treatment, has been well researched (BaHamman, Houssain, & Al-Asmri, 2016; Crawford, Espie, Bartlett, & Grunstein, 2014; Shapiro & Shapiro, 2010). Research, specifically addressing the OSA positive patients who do not complete a titration study, is scarce (Chapman, Walter, Wooten, & Vaughn, 2013). Few studies investigate the differences between those who do not complete a titration study, and thus effectively reject CPAP, and those who complete the titration study before accepting or rejecting CPAP (Sawyer, Gooneratne et al., 2011).

This study addressed that gap, guided by the knowledge that was gleaned from the CPAP adherence literature. The psychological and demographic characteristics under investigation were based on the CPAP adherence literature due to the lack of titration study completion literature. The present research study will facilitate the development of interventions targeting the first act of CPAP adherence. As a review of extant literature indicates, interventions to increase CPAP adherence are more effective when applied early in the initiation process (Crawford et al., 2014; Olsen, Smith, & Oei, 2008; Olsen, Smith, Oei, & Douglas, 2010; Sawyer, Gooneratne et al., 2011; Skinner et al., 2013).

The purpose of this study was to discern the influence of specific variables on the newly diagnosed, CPAP-naive, OSA patient's completion of a titration study. The study examined the relationship between self-efficacy, health locus of control, beliefs about OSA and CPAP, health value, and titration study completion. The predictive value of these variables was assessed and the relationship between demographic characteristics, including ethnicity, insurance coverage, and titration study completion was included. In addition, the researcher described the demographic and biomedical characteristics of those patients who completed a titration study and of those who did not complete the titration study.

Rationale for the Study

Obstructive Sleep Apnea (OSA) is a condition that results in fragmented sleep. The intermittent reduction in oxygen saturation and the subsequent awakening reduce sleep time and cause increased sympathetic nervous system activation. The reduced gas exchange and the frequent cortical and brainstem arousals influence vascular tone, inflammatory markers, and hormonal changes, which in turn can lead to many health risks. These risks range from cardiovascular problems such as stroke, atrial fibrillation, hypertension, and postoperative complications to impaired glucose metabolism, cognitive impairments, and anatomical and functional changes in the brain stem (Castronovo et al., 2014; Cintra et al., 2014; Colton & Altevogt, 2006; Downey et al., 2015; Iftikhar et al., 2014; Lundblad et al., 2014; Mutter et al., 2014). In addition to the association with chronic conditions, Gami and colleagues (2013) found that OSA is an independent risk factor for sudden cardiac death and most recently OSA was associated with Alzheimer's disease (Liguori et al., 2017).

In addition, daytime sleepiness and cognitive impairment, caused by fragmented sleep, have been associated with an increase in motor vehicle accidents and diminished productivity. Ward and colleagues (2013) found that daytime sleepiness related to untreated OSA is strongly associated with near misses, while untreated OSA itself is associated with motor vehicle crashes. Karimi et al. (2015) assessed neurocognitive function in OSA patients and found that a deficit in sustained attention was associated with motor vehicle accidents in OSA patients.

OSA correlates with an escalation of health care costs (Olsen, Smith, & Oei, 2008; Tzischinsky, Shahrabani, & Peled, 2011). The medical consequences of untreated OSA are many and each one contributes to the economic burden on employers and society. Undiagnosed OSA patients cost $1,950 to $3,899 more in health care than non-OSA patients. OSA patients treated

with CPAP cost $2700-$5200 less that those who have an OSA diagnosis without treatment (Knauert, Naik, Gillespie, & Kryger, 2015). In the United States alone, 42.5 million people over the age of 30 are OSA positive, which explains the impact of OSA on healthcare costs (Knauert et al., 2015).

OSA is a common condition with a prevalence that is comparable to asthma, chronic obstructive pulmonary disease, type II diabetes, and coronary artery disease (Al Lawati, Patel, & Ayas, 2009). The incidence of OSA is steadily rising in the USA, and it is estimated that the overall prevalence of OSA in adults between the ages of 30-70 is 26%, which is a substantial increase over the last two decades (Peppard et al., 2013). These prevalence numbers are based on the diagnosis of moderate to severe OSA (AHI ≥15). Young et al. (2009) found in the follow up of their landmark Wisconsin Sleep Cohort Study (1993) that the prevalence (95% confidence interval) of AHI > 5 was 9% (5.6, 12) for women and 24% (19, 28) for men. These data translate to around 29.5 million people over the age of 30 in the US.

Treatment Adherence

The first step in the treatment of OSA is the completion of a titration study. A review of the literature indicates a lack of research that addresses titration completion. Therefore, this study relied on knowledge gleaned from the CPAP adherence literature.

Poor treatment adherence is a global problem. Approximately 50% of prescribed treatments, medicines, diets, and exercises, are not implemented as prescribed (Sabaté, 2003). To put this information in perspective, an average of 188 million medical visits are fruitless since the patients are not following the advice they receive (DiMatteo, 2004). In his quantitative review of patients' adherence to medical recommendations, DiMatteo (2004) found that non-adherence in pulmonary disease (31.2%), diabetes (32.5%), and sleep disorders (34.5%) are the highest.

Regimen complexity, like the CPAP device, is one factor that influences adherence, but education and socioeconomic status also affect treatment compliance, especially in chronic disease treatment (DiMatteo, 2004).

The phenomenon of poor CPAP adherence has drawn the attention of researchers for over a decade (Aloia, 2011). CPAP adherence is generally defined as nightly use of at least 4 hours. Using this standard, research shows that up to 83% of the patients are non-compliant. Adherence to the CPAP treatment is multifaceted, contextual, related to the first experience of CPAP, and related to prior beliefs about OSA and CPAP. Adherence to CPAP is complex and dependent on many circumstances; it is influenced by socioeconomic factors and by education (Aloia, Arnedt, Stepnowsky, Hecht, & Borelli, 2005; Broström et al., 2010; Campbell, Neill, & Lori, 2012; Crawford et al., 2014; Gagnadoux et al., 2011; Olson, Smith, & Oei, 2008; Sampaio, Pereira, & Winck, 2013; Simon-Tuval et al., 2009; Weaver & Sawyer, 2010). Shapiro and Shapiro (2010) include the device, the patient and the family, the physician, the health care professionals, the health care facility, and governmental policies among the factors that influence adherence.

The initial experiences with CPAP, during the titration study after diagnosis and the first week of at-home use, greatly influence the adherence patterns (Aloia, Arnet, Stachina, & Millman, 2007; Wolkove et al., 2008; Ye et al., 2012). Also, the habit of nightly CPAP use is established during the early days of CPAP treatment, and this routine can predict long-term use (Budhiraja et al., 2007). Many research studies investigating the attitudes and characteristics that could predict adherence to CPAP therapy revealed that adherence is influenced by a variety of different thoughts, cognitions, and feelings (Ward, Hoare, & Gott., 2014; Wild, Engleman, Douglas, & Espie, 2004). Because using a mask through which pressurized air flows can make

sleep difficult, initiation and adherence to CPAP therapy is problematic (Weaver & Grunstein, 2008).

Initiation of the CPAP treatment is a process, which Skinner and colleagues (2013) addressed. The first, important step is the titration, which happens during a second night sleep study. During the titration, the patient is fitted with a CPAP mask and the amount of airflow pressure needed to keep the patient's airway patent is determined. A CPAP trial, usually a few weeks of nightly use, follows the titration night. The CPAP device purchase, and ultimately, the consistent use of CPAP for a minimum of four hours every night are the final steps. For most patients, the titration study is their first experience with CPAP (Salpeci et al., 2013; Sarell et al., 2013).

An average of 30% of patients who are diagnosed with OSA refuse CPAP treatment after the titration study (Salpeci et al., 2013; Sarell et al., 2013; Wolkove et al., 2008). In addition, 18% - 30% of newly diagnosed, CPAP naive patients do not schedule a titration study and, thus, decline the CPAP treatment without experiencing the benefits and/or difficulties (Ayow, Paquet, Dallaire, Purden, & Champagne, 2009; Olsen, Smith, Oei, & Douglas, 2008; Skinner et al., 2013).

Research suggests that biomedical factors such as body mass index (BMI) and AHI, considered alone, do not explain nor predict adherence to CPAP treatment, but psychological factors do explain a substantial portion of the variance (21.8 %) in CPAP adherence (Olsen, Smith Oei, & Douglas, 2008). The patients' health locus of control, their beliefs about OSA and CPAP, their knowledge, and their expectations also influenced their decision to try CPAP therapy (Poulet et al, 2009).

Support for OSA patients after diagnosis and initiation of treatment is often erratic and disjointed, especially when it comes to patient education (Woidtke, 2013). Polysomnography technologists participate in the diagnosing of sleep disorders, but nurses can and do provide continuing care and education. Fernandez, Doña, Raya, and Gallardo (2013) described how regular consulting with a nurse improved CPAP adherence. In addition, several studies indicated that nurse-led follow-up of sleep apnea patients not only leads to similar or increased adherence compared to sleep specialist follow-up, but also showed increased patient satisfaction and a reduction in cost (Antic et al., 2009; Chen et al., 2015; Herrero et al., 2014; Holmdahl, Schöllin, Alton, & Nilsson, 2009; Pendharkar et al., 2016). But the role nurses perform in assisting or supporting sleep apnea patients does not stop there. In their review of the literature, Chai-Coetzer, Antic, and McEvoy (2013) found evidence that supports nurses, with training in sleep medicine, as alternate providers for diagnosis and management of OSA. Sawyer and Weaver (2011) posited that nurses' contributions to assessment, treatment, and long-term management of OSA and its evaluation are meaningful.

No research that addresses the role of nurses in titration study completion was found, but Poulet et al. (2009) revealed that the beliefs about OSA and CPAP held by newly diagnosed CPAP-naive patients influenced their adherence to CPAP at one month. As van Eijk-Hustings and colleagues (2012) indicate, patient education is one of nursing's major contributions to the care and management of patients with chronic conditions. It is, then, befitting that nurses would educate newly diagnosed patients about OSA and CPAP and promote titration completion. Addressing the patients' response to OSA diagnosis and treatment with support and guidance allows nurses to promote healthy sleep.

Theoretical Framework

Pender's Health Promotion Model (Pender, Murdaugh, & Parsons, 2011) is the theoretical framework that supports this study. A reciprocal interaction worldview is the basis of the health promotion model (HPM). This philosophical viewpoint depicts humans as holistic beings who interact with each other and with the environment. This interaction shapes the reality from which people make behavioral decisions. A change in behavior, then, is the result of individual and environmental factors (Fawcett & DeSanto-Madeya, 2013; Pender, Murdaugh, & Parsons, 2011).

Pender developed the Health Promotion Model (HPM) in the late 1970's to explain and predict health-promoting behavior. She later revised it, changing the focus from health protection to health promotion. Central to the model is the progress towards optimal health and the personal fulfillment of individuals or groups.

Pender integrated a holistic nursing perspective with a behavioral sciences perspective in the HPM (McEwen, 2011; Pender, 2006; Pender et al., 2011) and draws from other theories and models such as Bandura's social cognitive theory (1977), and Feather's expectancy value model (1982). The concept of self-efficacy and the notion that behavior is rational and economical are central to the HPM. In the HPM, Pender approaches health from a competence-oriented perspective, and the focus is on wellness and self-actualization. Disease prevention is not central to the HPM, and fear and apprehension are not considered to be motivating emotions (McCullagh, 2013; Pender, Murdaugh, & Parsons, 2015; Sakraida, 2006).

The structure of the HPM consists of three interrelated domains that indicate the propensity to engage in health-promoting behavior. Two domains are considered behavior predictors, the individual's characteristics and experiences, and the behavior's specific cognitions

and affect. The latter are considered major motivators for health-promoting behavior and include the perceived benefits of the behavior, the ability to overcome related barriers, and personal feelings about the specific health-promoting behavior. The influence of others and of circumstances is included in this domain. Individual characteristics include prior behavior and personal factors, such as demographic facts, socioeconomic status, and biological characteristics. The third domain consists of the health-promoting behavior (Pender et al., 2015). The HPM offers a conceptual framework that can guide the development of nursing interventions to improve the health and the quality of life of individuals (McCullagh, 2013; McEwen, 2011). Researchers have used the HPM as a guide to investigate how individuals are motivated to engage in certain health-promoting behavior, to predict specific health behaviors, and to explore bio-psychosocial processes.

In the HPM, Pender posits that cognitive processing is an important aspect of health promotion because the perceptions and the interpretations of life experiences will affect behaviors. Acceptance of CPAP therapy, which is a process, is influenced by many factors and is related to the patients' psychological characteristics and their beliefs about OSA and CPAP. Scheduling and completing the titration study is the first step in this process (Skinner et al., 2013).

Avoiding the negative effects of OSA requires a change in behavior, specifically the nightly application of the CPAP device. Completing the titration study in preparation for CPAP therapy is a positive behavior; the patient is moving towards initiation of a treatment that improves health. This improvement is achieved not only through the elimination of the symptoms of OSA, but also through the elimination of OSA's effect on chronic conditions, resulting in a reduction of adverse outcomes. Initiation of and adherence to CPAP are comparable to a change

in eating habits or the start of an exercise program as a preventative, health-promoting measure. Therefore, completing the titration study is the first step towards initiation.

A diagram (See figure 1) explicates the appropriateness of the HPM as a theoretical foundation for this study. The constructs that comprise the foundation of the model are (a) individual characteristics/experiences, (b) behavioral outcome, and (c) cognitions and affects explicit to the outcome behavior. The concepts of interest for this study are (a) personal factors, (b) perceived self-efficacy, (c) activity-related affect, (d) interpersonal influences, and (e) health-promoting behavior.

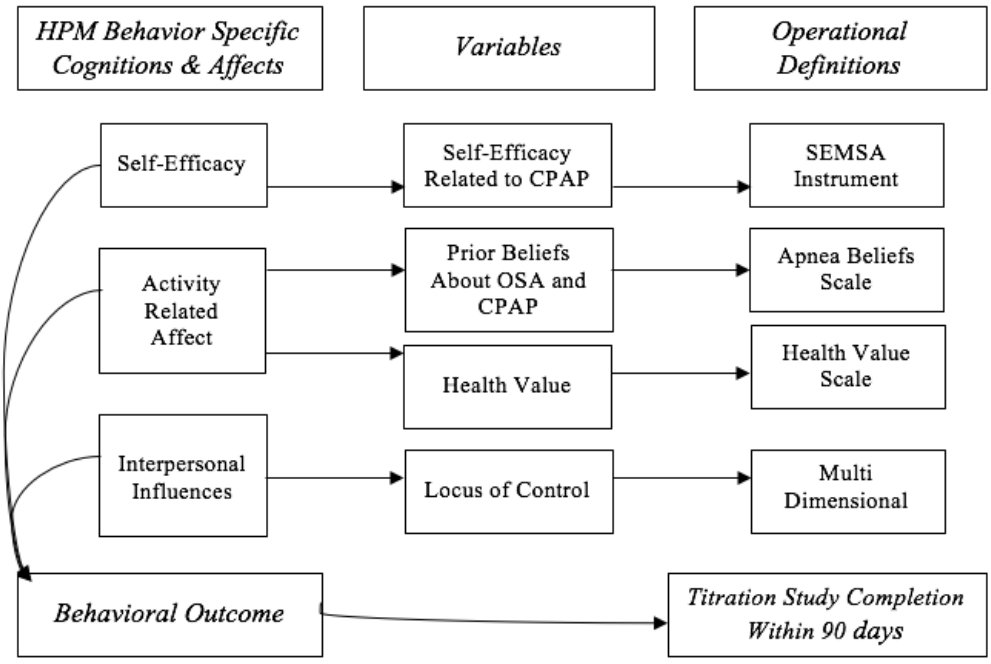

Figure 1.1 Theoretical Model Application Diagram

The HPM is suited as a theoretical foundation for this research. The model was used to explain the use of hearing protection in Mexican-American workers (Kerr, Lusk, & Ronis, 2002)

and to investigate the use of children's bicycle helmets (Coppens & McCabe, 1995), which are both behaviors that promote health. As stated, no research was found that addresses CPAP titration study completion. In addition, no research was found that uses this model to investigate adherence to treatment, though Lannon (1997) made a compelling case to use the HPM to enhance medication compliance.

Assumptions

Adherence to the CPAP treatment involves several of the concepts of the HPM (Olsen, Smith, Oei, & Douglas, 2008) and the relationships among them as defined in the theoretical propositions, or assumptions, of the model. Neither the concepts nor the propositions of the HPM are behavior specific and as McCullagh (2013) explains, some concepts and propositions may be more applicable to certain health behaviors than others. Table 1.1 identifies the propositions that are relevant to the current study.

Table 1.1
Relevant Theoretical Propositions of the Health Promotion Model

4	Perceived competence or self-efficacy to execute a given behavior increases the likelihood of commitment to action and actual performance of the behavior.
5	Greater perceived self-efficacy results in fewer perceived barriers to a specific health behavior.
6	Positive affect toward a behavior results in greater perceived self-efficacy
7	When positive emotions or affect are associated with a behavior, the probability of commitment and action is increased
8	Persons are more likely to commit to and engage in health-promoting behaviors when significant others model the behavior, expect the behavior to occur, and provide assistance and support to enable the behavior.
9	Families, peers, and health care providers are important sources of interpersonal influence that can increase or decrease commitment to and engagement in health-promoting behavior
10	Situational influences in the external environment can increase or decrease commitment to or participation in health-promoting behavior.

14	Persons can modify cognitions, affects and their interpersonal and physical environments to create incentives for health actions.

Note: Adapted from *Health promotion model* (Pender, 2006)

Definition of Terms

The HPM concepts relevant to this research are, (a) perceived self-efficacy, (b) activity related affect, (c) interpersonal influences, (d) health-promoting behavior, and (e) health value. The theoretical and operational definitions of these concepts are explicated in table 1.2.

Table 1.2
Health Promotion Model Concepts and Definitions

Constructs	Concepts	Theoretical definition	Operational Definition
Individual Characteristics and Experiences	Personal Factors	General characteristics that influence health behavior e.g. age, race, ethnicity, health value, socioeconomic status, disease specific indices	As measured in a demographic survey, the health value scale, and as derived from medical chart review, and polysomnography sleep study results for OSA specific information.
Behavior Specific Cognitions and Affect	Perceived Self Efficacy	Judgment of personal capability; self-confidence in performing health behavior successfully	As measured by the Self-Efficacy Measure for Sleep Apnea
	Activity Related Affect	Subjective feelings or emotions prior to, during, and after health behavior	As measured by the Apnea Beliefs Scale and the Health Value scale
	Interpersonal Influences	From family, peers, providers, norms, and social support role models. The perception concerning the behaviors, beliefs, or attitudes of relevant others in regards to the health behavior	Locus of control as measured by the multi-dimensional Health Locus of Control Scale (1976)

Behavioral Outcome	Health promoting behavior	Desired behavioral endpoint	As measured by completion of a titration study within 90 days after OSA diagnosis

Note: Adapted from *Health Promotion Model Manual* in Pender, Murdaugh, & Parsons (2011)

Some concepts require an explication of the thought processes that preceded their definition. Perceived self-efficacy is an individual's confidence to be able to act. Concerning CPAP use, perceived self-efficacy means the ability to use the treatment and overcome barriers (Olsen, Smith, Oei, & Douglas, 2008). Activity-related affect reflects the beliefs that individuals have towards their health and towards OSA and the CPAP treatment. The concept of locus of control or the perception of control of health explains interpersonal influences. The multi-dimensional, locus-of-control scale measures the concept of "powerful others" and indicates which people will impact the behavioral decisions of the individual. Completing a titration study defines the behavioral outcome.

Research Questions

The research questions for this study are:

1. What is the relationship between self-efficacy and the completion of a titration study in newly diagnosed, CPAP naive, OSA patients?
2. What is the relationship between beliefs about OSA and CPAP and the completion of a titration study?
3. What is the relationship between health locus of control and the completion of a titration study?
4. What is the relationship between health value and the completion of a titration study?
5. Do demographic characteristics influence titration study completion?
6. Do biomedical indices influence titration study completion?

7. Can these specific variables predict titration study completion?
8. In addition, this researcher will describe the demographic and biomedical characteristics of those patients who complete a titration study and of those who do not complete the titration study

Limitations

The following limitations for this study were identified:

- The sleep clinics that participated in the research are in the Coastal Bend and Golden Crescent regions, areas designated by the Texas Health and Human Services Commission. Extrapolating the results of the study to the general population may be difficult due to the unique demographic characteristics of the population.
- The instruments that were used in the study are self-report measures. Responses are limited to what individuals are willing to share.
- The instruments are in English so participants with a poorer understanding of the language may not have understood the questions properly.
- The reliability and validity of the Spanish translation of the instruments has not been determined through research.
- The participants were asked to fill out the questionnaire before watching an educational video that is provided to them on the diagnostic night. If some did not comply with this request, their answers may have been influenced by the video.

Summary

Long-term adherence to CPAP treatment for OSA is determined early in the treatment, close to initiation. Initiation of the CPAP treatment is a process that starts with the titration study. This study addresses the newly diagnosed CPAP naive OSA patients who do not complete a

titration study. An average of 30 % of newly diagnosed patients for whom CPAP is recommended as the first line treatment do not show up for a titration study and thus effectively reject this treatment before experiencing its benefits. The influence of self-efficacy, prior beliefs about OSA and CPAP, health value, and the locus of health control have on titration completion is investigated. In addition, the predictive ability of these variables is evaluated. To date no research was found that addresses this step in the initiation process though a few studies have targeted the newly diagnosed CPAP naive population.

CHAPTER II

CHAPTER SUBMITTED FOR PUBLICATION

A Paper Submitted for Publication in the *Sleep* Journal

Katelijne Acker, Elizabeth Restrepo

Abstract

Objectives: Individuals who are diagnosed with obstructive sleep apnea (OSA) are recommended the continuous positive airflow pressure (CPAP) as a first-line treatment. During a second-night sleep study, the titration night, the airflow pressure of the treatment is titrated. Unfortunately, many do not return for a titration study and therefore effectively decline treatment. Research has investigated factors that affect short term and long term adherence to the CPAP treatment, especially the psychological characteristics that could explain CPAP adherence behavior. The purpose of this article is to review the literature related to titration completion as the initiation of treatment, specifically in CPAP-naive patients.

Methods: Electronic searches were conducted in Google Scholar, PubMed Remote, Medline with full text, ProQuest Nursing & Allied Health, and Scopus. Relevant journals were searched, and references of relevant articles, chapters, and books were explored. CPAP adherence research reports from 2000 through 2017 were included for further review.

Results: One article that addressed titration study completion in newly diagnosed OSA patients was found.

Conclusion: A gap in the literature was identified. Research that addresses CPAP naive patients who are newly diagnosed with OSA has not explored the patients' failure to complete a titration

study and their subsequent lack of treatment. Studying this phenomenon could open new avenues to increase CPAP adherence.

Keywords: Sleep Apnea, Obstructive; Continuous Positive Airway Pressure; Polysomnography.

Statement of Significance

Healthy sleep is critical for an individual's biological and psychological wellbeing. Sleep-disordered breathing is a condition that is associated with a myriad of chronic problems. The gold standard for treatment is CPAP and the optimal airflow pressure is traditionally determined during a second-night sleep study, the titration night. Split-night studies may be effective for patients with severe OSA and auto-titration may be as effective as manual titration but a full titration night is still considered the better option to determine the optimal CPAP pressure. Up to one third of newly-diagnosed OSA patients, with a CPAP recommendation, do not return for a titration night and therefore do not start CPAP treatment. This phenomenon has not been addressed in the research literature.

Introduction

The significance of poor adherence to treatment of chronic conditions is well known.[1] In the developed countries, only 50% of the patients for whom a treatment, any treatment, is prescribed, follow the recommended regimen. The adherence rate is even lower in developing countries. Following a diabetic diet, taking blood pressure medication, and implementing the HIV treatment protocol are a few examples of regimens that have low adherence rates. The impact of this non-adherence is shown in a steady rise in the chronic disease burden. The consequences are poor health outcomes and increased health care costs that contribute to current public health concerns. The potential monetary waste adds up to $300 billion per year in the USA alone.[1-3]

When CPAP is the prescribed regimen, the adherence rate shrinks drastically. Many patients do not adhere to the CPAP treatment or they do not initiate it. [4-6] Only 30% of the patients who are diagnosed with OSA and for whom CPAP is prescribed purchase the device, [7] which does not guarantee that they will use it as prescribed. Adherence to CPAP is exceptionally low, and this phenomenon has drawn the attention of researchers during the last decade.[3, 8] This article will review CPAP adherence literature with a focus on research with newly diagnosed, CPAP-naive participants.

Background

The OSA diagnosis is made during an overnight sleep study, a polysomnography. In addition to an assessment of assessment of breathing efficacy, the patient's brain function, cardiac function, eye movement, and limb movement are also evaluated. Respiratory rate, inspiratory and expiratory volumes, and obstructive events are also measured during this overnight study. There are several different types of events that partially or completely occlude the airway and diminish

or prevent airflow. The American Academy of Sleep Medicine (AASM) defines the obstructive events as follows.[9]

An apnea is a breathing pause of 10 seconds or more, that is caused by the collapse of the upper airway and results in a ≥ 90% reduction in airflow. A hypopnea occurs when the airway collapses partially and the airflow is reduced by 30% for 10 seconds or more, associated with a ≤ 3% drop in arterial oxygen desaturation.[10] The soft tissue in the back of the throat is the most common cause of the airway obstruction. Apneas and hypopneas are associated with a reduction in oxygen saturation and subsequent awakening of the patient. Respiratory effort related arousals (RERAs) are events that cause arousal, but do not meet the apnea or hypopnea criteria. Based on the results of the polysomnography, an apnea/hypopnea index (AHI) is calculated and represents the number of events that occur each hour. These events include total and/or partial airway collapses.[11, 12] The respiratory disturbance index (RDI) includes apneas, hypopneas, and RERAs. The RDI is the better criterion for OSA diagnosis and is recommended by the AASM. This index eliminates a 30% under-diagnosis of OSA when using AHI alone.[13]

Per the Centers for Medicare and Medicaid services, a positive obstructive sleep apnea diagnosis is defined by either of these criteria: (a) AHI or RDI ≥ 15 events per hour, (b) documented symptoms of excessive daytime sleepiness, impaired cognition, mood disorders, or insomnia, and (c) documented hypertension, ischemic heart disease, or history of stroke in addition to AHI or RDI between 5 and 14 events per hour.[13] The AASM, also a sleep center credentialing body, has stricter guidelines and defines mild OSA as AHI ≥ 5 events per hour.[14]

The AASM accepts CPAP as the gold standard for the treatment of OSA. CPAP is the least invasive and most effective treatment, and it is the treatment that is initially offered. Other treatments include surgery to assist with weight loss or to reduce the size of the uvula, dental

surgical procedures, oral appliances, behavioral treatments, and adjunctive treatments like oxygen therapy and pharmacological agents. The mandibular advancement devices, which are oral appliances (OA), seem to be the most effective of these alternate methods, especially in mild to moderate OSA.[11, 13, 15-16] Though OA can be effective, they are usually only offered to patients with mild to moderate OSA who do not tolerate CPAP, the first-line treatment.[13]

The CPAP device consists of three parts: a mask, tubing, and a motor. The patient wears a mask through which positive airflow is delivered to the upper airway. The motor generates the airflow that acts as a pneumatic splint and keeps the airway open. Different types of masks are available. They cover the nose only, or both nose and mouth, and they are secured with straps. The tubing connects the blower to the mask.[13]

The strength of the airflow that is needed to keep the upper airway open during sleep is different for each individual and is determined during a second-night sleep study, the titration study. During this study, the patient is fitted with a CPAP mask. For most patients, the titration study is their first experience with CPAP.[17-19] Patients who have never used a CPAP device are described as CPAP-naive.

Methods

Electronic searches were conducted in Google Scholar, Pub Med Remote, Medline with full text, ProQuest Nursing & Allied Health and Scopus. The date range was from 2000 to current and search terms included: (a) continuous positive airway pressure treatment; (b) CPAP-naive; (c) CPAP adherence, and (d) titration study. Relevant Journals were searched, and references of relevant articles, chapters, and books were explored.

CPAP Adherence Defined

Measuring adherence in CPAP therapy is precise as actual mask-on-face-time can be recorded through a variety of methods. Though there is no specific parameter for adherence to CPAP therapy, CPAP use for at least four hours per night, during 70% of the nights, is generally considered adequate. Continuous use of the CPAP treatment for a minimum of one to three months is defined as long-term adherence.[2, 20-22]

Weaver et al. (2007) explored the minimal amount of CPAP needed per night that will have a positive effect.[23] The results indicated that while subjective sleepiness was alleviated after four hours of CPAP use per night for three months, objective sleepiness measures indicated that a minimum of six hours of CPAP per night was needed. The patients' functional status normalized after 7.5 hours of nightly CPAP use for three months. More CPAP is likely to yield better results, but the level of CPAP use that produces the best outcome differs based on disease severity and symptoms and has not yet been clearly defined.[23]

Unlike treatments for other chronic conditions, any use of CPAP provides benefits and is better than no use at all. The improvement in clinical outcomes is positively related to the nightly hours of CPAP therapy but some patients may experience similar benefits with fewer hours of CPAP therapy. Therefore, adherence may be better defined through clinical outcomes versus mask-on-face-time.[24]

Influencing Factors

Many factors affect adherence in general. Adherence can be defined as "the extent to which patients follow the instructions they are given for prescribed treatments" (p. 634)[25] but this definition does not reflect the fluctuation in adherence behavior. The ability and/or willingness of the patients to follow the directives of a treatment plan are often impaired by a variety of

elements that encompass different aspects of the problem. Included are socio-economic factors, the disease characteristics and the treatment itself, the health care environment, and patient-related factors. All these factors influence adherence, often concurrently, and make this challenging patient behavior very complex.[1, 25-26]

CPAP Treatment

The CPAP treatment, itself, is directly linked to non-adherence. Mechanical and practical issues with the device are often a deterrent. The device is cumbersome and up to 60% of patients experience adverse effects like mask leaks, nasal dryness, and pressure intolerance. These effects often are barriers to continued use and cause patients to abandon the CPAP treatment.[26-28] Even advancements like auto-titration CPAP and pressure-relief CPAP have achieved contradictory results in research studies or they did not show enough difference to be clinically significant.[26] Using the CPAP every night requires a lifestyle change, a behavioral change. In addition, the imperative to use this device nightly can be associated with shame and stigmatization,[29] which are deterrents to regular CPAP use.

Race and Ethnicity

Though there is a paucity of research on the influence of race and ethnicity on adherence, the findings indicate that minority populations often are less successful in adhering to the prescribed CPAP regimen.[21,30-32] Several studies reported a lower CPAP adherence among African-American CPAP users compared to White or Hispanic CPAP users.[21,33-34] Most recently, Wallace et al. (2017) confirmed the equivalent adherence in US Hispanics and Whites, with poorer adherence in African-Americans.[35] Adherence among other minorities has not been identified to date. Schwartz et al., (2016) found significantly lower CPAP compliance in African-Americans than in Whites, though the OSA severity did modify the association.[36]

Ethnicity and socio-economic status are often interrelated[37] but Billings et al. (2013) found that sleep duration, as an ethnic characteristic, mediated CPAP adherence among African-Americans.[38] Because little is known about the influence of race and ethnicity on CPAP use and adherence, Sawyer (2013) called for an exploration of ethnic/race characteristics that may influence CPAP use.[39] A review of participants' ethnicity in sleep disorder trials suggests that the number of minority participants is relatively low. This limited participation by minorities could affect the true evaluation of adherence to and effectiveness of a treatment.[40] No research was found that investigates a correlation between ethnicity or socio-economic status and titration completion, though financial constraints could affect the timely completion of a CPAP titration study.

Demographics

Traditional thought was that patient demographics and disease severity indices drive CPAP adherence, but research has revealed that these factors only explain a small amount of variance in adherence. Age and gender do not appear to influence CPAP adherence or there is only a weak relationship, which is often not clinically relevant.[19,21,27,41-47] A review of archived data, investigating return-for-titration rates, showed no difference in return rates between genders. Interestingly, women allowed more time to elapse between the diagnostic and the titration studies than men.[48]

Disease Severity

Disease-specific markers such as the AHI, RDI, and body mass index (BMI) are found to be weakly related to adherence. Several studies indicated an increased adherence rate with more severe markers,[46,49-52] while others report no difference in adherence.[4,19,21,27,32,42,44,53] It is important to note that studies often use different AHI index parameters as inclusion criteria.

Gagnadoux et al. (2011) included patients with an AHI ≥ 30 or an AHI between 5 and 30 with daytime sleepiness and ≥ 2 OSA symptoms.[49] Tarasiuk, Reznor, Greenberg-Dotan, & Reuveni (2012) and Poulet et al. (2009) did not include anyone with an AHI ≤ 15 [44, 52], and Lewis, Seale, Bartle, Watkins, & Ebden (2004) set the AHI parameter at > 10 and included a desaturation index of ≥ 10.[42] These differences in parameters make comparison and generalization of results difficult.

No study was found that indicated an independent relationship between disease-specific markers and CPAP adherence. Disease-specific elements may not significantly affect CPAP adherence, but the severity of the symptoms of OSA and the relief of those symptoms are related to CPAP adherence.[19, 21, 27, 46, 49, 53-55] The relationship between the improvement of the symptoms and increased CPAP use has been shown, but it is unclear whether the improved symptoms spur greater adherence or the greater adherence results in improved symptoms.[2, 51, 54] In addition, disease severity could affect return for titration rates, but no research study exploring this relationship was found.

Socio-economic Status

Socio-economic status is another aspect of the CPAP adherence problem, especially when considering the initiation of the treatment. Even when subsidized, the CPAP treatment is expensive.[56] Brin, Reuveni, Greenberg, Tal, & Tarasiuk (2005) found that only 32% of those who had completed a titration study purchased the CPAP device. But, 62% of the participants who were in the higher income bracket, relative to the average income of the population, did purchase the CPAP device.[7] Some research found that patients were less likely to initiate treatment by purchasing the CPAP device when they were of a lower socio-economic status,[51] but that a financial incentive increased the acceptance of the CPAP treatment by 43 % (p = .02).[52] On the

contrary, others saw no significant association between CPAP adherence and socio-economic status,[41] and Gershon, Hawker, Tomlinson, Leung, & Kendzerska (2015) found that CPAP purchase did not vary with income status.[57] It is noteworthy that the Gershon et al. study was conducted in an area with a universal, single-payer health system, in which diagnostic services and 75% of the CPAP purchase cost were covered.

The research in this area is disparate because the socio-economic status may or may not include income, education, and occupation. In addition, studies have been conducted in different countries with varying financial support for medical expenses. Therefore, the results vary, with some studies indicating no effect from the socio-economic status on initiation or adherence to CPAP.[32, 49-50] Furthermore, insurance restrictions on polysomnography do not correlate with the AASM guidelines,[58] which can greatly impact adherence starting with the completion of a titration study by newly diagnosed, CPAP-naive patients.

Marital Status

Marriage has a positive influence on adherence, and patients with a supportive, collaborating spouse are more likely to adhere to the CPAP treatment.[49, 59] This same positive effect is seen in patients who share their bed with a significant other and have a good relationship with him or her. Concern for the sleep quality of a bed partner also positively affects adherence.[51, 60-61] It is interesting that spousal support was found to be significant only in the wife's support of the husband, not in the husband's support of the wife; and only during the first 6 months after CPAP initiation ($p = .03$).[62] No research was found addressing spousal support for titration completion.

Psychological Attributes

Research also addressed the patient's psychological attributes as possible indicators for adherence. A prospective study found that the psychological factors of health value, internality, and powerful others correctly identified 75 % of the adherers and 53% of the non-adherers. In combination with disease-specific indices, these factors explained 24% of the variance in adherence.[46] In 2006, Tyrell, Poulet, Pépin, and Veale called for more research to "identify factors impeding acceptance" (p. 375), suggesting Becker's Health Belief Model (HBM) as a useful tool.[63] The HBM concepts, such as self-efficacy, risk perception, outcome expectancy, and perceived barriers were used to explore the influence of psychological factors on adherence versus biomedical indices. The results showed that 21.8 % of the variance in adherence was explained by the psychological constructs alone ($R = .48$; $F [4, 70] = 4.88$; $p = .002$), but in combination with the disease-specific indices, the researchers found that 31. 8 % of the variance was explained.[43]

Many psychological characteristics have been investigated. They include (a) self-efficacy, (b) health value, (c) locus of control, (d) perceived risk, (e) outcome expectancies, (f) perceived barriers, (g) decisional balance, (h) coping, (i) motivation, (j) readiness to change, and (k) knowledge and beliefs about OSA and CPAP.[21, 27, 32, 43-44, 46, 51, 55, 64-67] The research has focused on adherence after acceptance of the CPAP treatment, and studies have shown that short-term adherence is an independent predictor of long-term adherence.[20,22] The findings that adherence within a week of the start of the CPAP treatment is predictive of long-term adherence, [27] and that interventions are more effective if implemented early in the CPAP treatment, [21]led researchers to investigate predictors in newly diagnosed OSA patients, often right after the titration study or even before the diagnostic polysomnography (Table 2.1).

Table 2.1
Psychological Characteristics

Citation	Psychological Variables	Point of data collection	Participants	Titration Completion
Sawyer[21]	Risk perception Outcome expectancy Self-efficacy	Before diagnostic study	Enrolled prior to diagnostic study - Average 21 days between dx and titration - CPAP-naive	3 did not titrate 4 refused CPAP at titration
Aloia[27]	Readiness Decisional balance Self-Efficacy	After titration before start of CPAP treatment	Enrolled after CPAP titration - CPAP-naive	n/a
Ye[32]	OSA self-efficacy OSA outcome expectancy OSA risk perception	Before split night study (diagnostic/ titration)	No titration night needed - CPAP-naive status not clear	n/a
Olsen[43]	Self-efficacy Risk perception Outcome expectancy Depression/Anxiety/ Stress	After diagnosis and after scheduled titration night	Surveys filled out at home - CPAP-naive status not clear	14 did not initiate CPAP; unknown if titration completed
Poulet[44]	Health perception Mental health rating OSA knowledge Attitude towards OSA and CPAP	After diagnosis, 1 hour before starting auto-titration	Enrolled after OSA diagnosis - CPAP-naive status not clear	n/a
Wild[46]	Locus of control Health value General self-efficacy	After Dx, prior to titration but after a mask fitting and CPAP familiarization session	Not CPAP-naive.	Not mentioned
Simon-Tuval[51]	Perceived risk	Before diagnostic study	CPAP-naive status not clear	30 of 162 declined the titration (18.5%)

Kreivi[54]	Self-efficacy Willingness	After diagnosis and before CPAP initiation/ trial After CPAP initiation/trial	Enrolled at CPAP trial - not clear if titration is included in trial - CPAP-naive status not clear	Not mentioned
Stepnowsky[55]	Depression/anxiety/stress Anger/hostility Social support Social desirability Coping	After diagnosis and before titration	Participants were admitted for two nights: the diagnostic study and the titration study - CPAP-naive	No attrition
Baron[60]	Self-efficacy Risk perception Outcome expectancy	After diagnosis At titration night prior to titration	Enrolled at the titration appointment - CPAP-naive	n/a
Bakker[64]	OSA Self-efficacy OSA risk perceptions OSA outcome expectancy	After diagnosis and titration	CPAP-naive status varied among participants	n/a
Chapman[65]	Motivation	Before diagnostic study	CPAP-naive status not clear	62 of 145 no titration (43%)*
Wallace[67]	OSA Self-efficacy OSA risk perceptions OSA outcome expectancy	Before diagnostic study and after 1 week of CPAP	CPAP-naive	Not mentioned
Skinner[68]	Depression/ Anxiety/ Stress Fatigue Illness Perception	Before diagnostic study	No titration night, pressure adjusted in meeting before trial (personal communication Olaithe, 2016) - CPAP-naive	78 of 449 declined CPAP trial

Balachandran[69]	CPAP perception	Immediately after titration	CPAP-naive	252 of 1038 did not titrate (24.3%)*
Sawyer[70]	Health Literacy Knowledge of OSA and CPAP OSA outcome expectancy OSA self-efficacy Social support OSA risk perception	After titration	Enrolled after diagnosis and before titration - CPAP-naive	1of 97 did not return for titration – 2 refused CPAP during titration
Shahrabani[73]	Perceived Susceptibility Perceived seriousness Perceived benefits Perceived barriers Cues to action	Before diagnostic study	CPAP-naive status not clear	Not mentioned
Tzinschinsky[83]	Perceived susceptibility Perceived seriousness severity Perceived benefits of CPAP Perceived barriers to CPAP	Before diagnostic study	CPAP-naive	Not mentioned

**There was no differentiation made between those who declined titration and those who chose an alternate treatment.*

Initiation of the CPAP treatment is a process that Skinner and colleagues (2013) addressed.[68] The first important step is the titration, which ideally happens during a second-night sleep study. During the titration, the patient is fitted with a CPAP mask and the amount of airflow pressure needed to keep the patient's airway patent is determined. A CPAP trial, usually a few weeks of nightly use, follows the titration night. The CPAP device purchase, and ultimately, the consistent use of CPAP for a minimum of four hours every night are the final steps. For most patients, the titration study is their first experience with CPAP.[17-18]

Often, psychological characteristics have been evaluated early in the CPAP acceptance process, before the initiation of CPAP treatment after the titration night.[27, 43-44, 60, 68-70] Few studies have addressed truly CPAP-naive patients or have evaluated psychological constructs before the patient has any experience with CPAP, which is before titration (Table 2.1). Chapman, Walter, Wooten, & Vaughn (2008) explored motivation related to titration completion. This was the only study found that addressed this issue.[65]

Self-efficacy, outcome expectations, and risk perception. The definition of the concepts of self-efficacy, outcome expectations, and risk perception are based on Bandura's Social Cognitive Theory (SCT). Self-efficacy indicates the strength of an individual's belief in his or her ability to complete certain tasks or achieve certain goals. It is the confidence in one's ability to act.[71] Outcome expectation is explained as the perceived value or benefit that is the consequence of a behavior.[71] Risk perception reflects the perceived vulnerability to risks related to health, [28] which the HBM, derived from SCT, identifies as perceived susceptibility.[71]

Several health behavior theories and models that have been used to investigate CPAP adherence include self-efficacy, outcomes expectation, and risk perception as concepts. Weaver et al. (2003) developed an instrument that measured these three concepts as subscales: The Self-Efficacy Measure for Sleep Apnea (SEMSA) [28]. The perceived ability to overcome the practical and emotional difficulties inherent to the use of CPAP has proven to play a significant role in CPAP adherence.[27-28, 32, 43, 54, 64, 70, 72] Few studies have explored the perceived self-efficacy of truly CPAP-naive patients, before the titration study (Table 2.1). Wild, Engleman, Douglas, & Espie (2004) studied general self-efficacy, not CPAP-specific self-efficacy, before titration, but after the newly diagnosed patients attended a mask fitting and CPAP familiarization session.[46] It is not

known whether self-efficacy, risk perception, and outcome expectancy measured before any CPAP exposure would predict completion of a titration study.

Perceived barriers. Another concept included in the HBM is perceived barriers. Based on psychological theory, this model was developed in response to public health concerns in the 1950's. The concept of perceived barriers is explained as a potential negative aspect of a recommended behavior. Shahrabani, Tzischinsky, Givati, and Dagan (2014) defined perceived barriers as the "level of an individual's beliefs concerning difficulties caused by OSA treatment, such as inconvenience, unpleasantness, and cost" (p.858). Results of their study indicated that barriers play a significant role ($p < .001$) in the decision not to purchase a CPAP device.[73] No research was found that explored barriers to titration completion.

Health locus of control and health value. Locus of control, an element of Rotter's social learning theory and refers to a person's belief in his or her ability to control life events and is conceptualized as internal control (self) or external control (Wallston, 1992). Wallston (1992) additionally suggested that external beliefs of control are made up of two dimensions: powerful others and chance.[74] The multidimensional health locus of control scale addresses the three dimensions (internal, powerful others, and chance) in the context of health behavior.

Social learning theory explains that the interaction between the value people place on their health and their perceived control over their health influences their health-promoting behavior. Related to OSA, that behavior is the consistent use of the CPAP device. Wallston (1992) contended that self-efficacy and health locus of control are moderated by health value and should be evaluated in combination. Health value, alone, does predicted wellness behavior, but the combination with health locus of control increased the variance in wellness behavior that is explained.[74]

Very few studies have been conducted that explore the effect of locus of control on CPAP adherence. CPAP non-adherers exhibited a lower belief in external control, indicating that neither physicians nor nurses could convince them of the necessity of the CPAP treatment.[75] Wild et al. (2004) found that the powerful others concept, in combination with health value, general self-efficacy, and biomedical indices, accounted for 24% of the variance in CPAP adherence ($R^2 = 0.24$).[46] No other CPAP adherence studies that include the concept of health value were found, indicating a paucity of research that evaluates how the patients perceived control over their health influences adherence.[56]

OSA and CPAP beliefs. The patient's perceptions and beliefs about his health, his condition, and the treatment influence the adherence to any long-term treatment. Sawyer, Deatrick, Kuna, & Weaver (2010) found differences in beliefs and perceptions between adherers and non-adherers. Some of the elements were risk perception, symptom recognition, and treatment goals.[76] The Apnea Beliefs Scale (ABS) and the Apnea Knowledge Scale (AKS) are two tool that were developed to assess the patient's beliefs about and knowledge of OSA and CPAP.[77] A study by Poulet and colleagues (2009) suggested that participants with lower ABS scores, indicating more maladaptive beliefs and attitudes towards OSA and CPAP, had 2.21 times more risk of not adhering ($p = .004$) one month after initiation of the therapy.[44] Interestingly, participants who were younger than the median age of the sample (58 years old) and had negative beliefs about OSA and CPAP were 3.32 times more likely ($p = .02$) to be non-adherent at one month.[44] Relatively few studies have addressed the influence that beliefs of and knowledge about OSA and CPAP have on adherence.[76]

Readiness to change and decisional balance. Decisional balance describes the action of weighing the pros and cons of a behavior. This concept is a core construct of the Trans

Theoretical Model (TTM) that relies on the Model of Decision Making (MDM) developed by Janis and Mann in 1977. The MDM includes categories like instrumental gains, approval, cost, and disapproval. Readiness to change is determined by the point on the continuum of the decisional balance at which a person falls. When the pros outweigh the cons, the person is likely ready to change his behavior.[27, 78] The new behavior, following the treatment directions and using the CPAP device daily, is determined by a person's readiness to change. A study by Aloia, Arnedt, Stepnowsky, Hecht, & Borelli (2005) showed that readiness, measured one week after initiation of the treatment, contributed significantly to the prediction of CPAP adherence after six months (standardized ß = .471, $p < .001$).[27] These findings were confirmed by Stepnowsky, Marler, Palau, & Brooks in 2006.[72]

Coping. The Transactional Model of Stress and Coping (1977) served as the theoretical foundation for the investigation of coping as a characteristic of CPAP adherers. Higher coping scores were associated with greater CPAP use ($r = .607$; $p = .004$).[55] Coping explained an additional 20% of variance in CPAP adherence (adjusted $R^2 = .201$; F [1.15] = 5.95; $p = .028$) beyond the variance that was explained by RDI and Epworth Sleepiness Scale (ESS) scores. But more than just coping, it was the active coping subscale that explained 33.4 % of the variance in adherence (F [4,14] =3.26; p= 0.44).[55] Similar research found no relationship between coping and CPAP adherence.[79] No studies were found that explored coping in relation to titration completion.

Personality. The association of a Type D personality with CPAP adherence has also been explored. This personality type is defined by a tendency to experience negative emotions and social inhibition, mainly due to insecurity and tension.[80-81] Mean objective CPAP adherence in patients with Type D personality tended to be significantly lower ($p < .001$) than adherence in

those without a Type D personality.[80] Other research, however, found no difference in compliance other than a trend to suboptimal adherence in those with a Type D personality.[41]

Adherers vs. Non-adherers

Traditionally CPAP adherence studies indicated the attrition rate, the number of non-adherers, but the focus of most of these studies was on those patients that do adhere to identify the characteristics that predict adherence. One cannot assume that the absence of those characteristics will predict non-adherence. Since a combination of disease-specific markers and certain demographic characteristics can explain variance in adherence, a similar combination of certain characteristics could explain non-adherence. The I-NAP instrument,[70] a tool that was developed to identify those patients at risk for non-adherence, was implemented after the titration study and adherence was measured one month after initiation of CPAP. Some participants (3 %) did not show up for the titration study, though no reason was given.[70] Poulet et al. (2009) found that one third of the participants were non-adherent (≤ 4 hours of CPAP per night) one month after CPAP initiation. They classified 85.7% of non-adherers based on psychological variables such as emotional reactions and their knowledge and beliefs about OSA and CPAP. But their comparison of psychological characteristics between adherers and non-adherers focused on a description of the adherers.[44]

Research has focused on indicators of CPAP adherence as determined after the acceptance of the treatment. Indeed, in a study of CPAP-naive, newly-diagnosed OSA patients, the participants were admitted to the clinical research center and discharged after the titration study, as part of admission to the study.[55] Skinner et al. (2013) described the process of CPAP initiation and included the decisions that patients must make along the way. Completing a CPAP titration study is one of those decisions. Yet, no explanation was provided when 17 % of those

who had been recommended CPAP therapy did not complete a titration study and CPAP trial.[68] Olsen, Smith, Oei, & Douglas (2008) indicated that 18 % of participants did not initiate CPAP, though appointments for titration study were made for each participant. It is not known if they completed the titration study or not.[43] No study was found that addressed those patients who did not complete a titration study and therefore never tried the CPAP treatment.

Summary

Much research has been done on adherence to CPAP treatment. More recently, psychological constructs have been utilized to predict CPAP adherence as early as a week after CPAP initiation. Interventions applied earlier in the treatment initiation process tend to show a positive effect on adherence. Newly diagnosed OSA patients have been the participants in several studies investigating the psychological constructs that could be related to successful initiation of and adherence to CPAP therapy. Nevertheless, CPAP adherence over the last 20 years is at 34.1%, showing no significant improvement, despite several varied efforts.[82]

Perhaps it is time to look at the adherence problem from a different perspective. Instead of exploring and predicting adherence, the characteristics of non-adherence could be explored and predicted, starting at treatment initiation. Self-efficacy has been shown to be related to adherence, but perhaps there are characteristics that negate this positive trait.

The patients who do not complete a titration study, and therefore, do not accept the treatment, even before experiencing it, have been largely ignored. No study has been found that explored the reasons that patients do not complete a titration study. Though most studies indicated the loss of participants due to lack of titration completion, none explored the reasons as to why participants did not return. Prediction of the likelihood that a person will not start CPAP or not adhere to the treatment could lead to interventions that may be more effective.

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CHAPTER III

Methodology

A predictive correlational study design was used to discern the influence of specific factors on the newly diagnosed, CPAP-naive, OSA patient's completion of a titration study. An overview of the CPAP adherence literature indicated that psychological characteristics are useful to predict CPAP adherence (Olsen, Smith, & Oei, 2008; Wild et al., 2004). In this study the concept of adherence was expanded to include titration completion as the first act of adherence. Few studies investigated the difference between those who do not complete a titration study, and thus effectively reject CPAP, and those who complete the titration study before accepting or rejecting CPAP (Sawyer et al., 2011). The relationship between titration-non-completion and (a) perceived self-efficacy, (b) OSA and CPAP beliefs, (c) health locus of control, and (d) health value was investigated and the predictive value of these patient characteristics was evaluated.

Setting

The study was conducted in the South Texas Coastal Bend, a region defined by the Texas Health and Human Services Commission (U.S. Department of Health and Human Services, 2010). Four sleep centers, privately owned businesses, agreed to participate in the research study. Two centers were accredited by the American Association of Sleep Medicine (AASM) and two centers earned accreditation by the Joint Commission (JC). The centers were in the Combined Statistical Areas (CSA) Corpus Christi-Kingsville-Alice and Victoria-Port Lavaca, a nine-county area. CSA's are "groupings of adjacent metropolitan and micropolitan statistical areas that have social and economic ties" (United States Census Bureau, 2015). This nine-county area has an

estimated population of 650,000 of which the majority is Hispanic (56.3%) and 33.8 % is Caucasian (Department of State Health Services, 2015).

Sample

The population of interest was adults, referred for a diagnostic sleep study for the first time. Consecutive sampling, a non-random sampling method, was used. Every potential participant meeting the inclusion criteria was recruited until the appropriate sample size of 119 was achieved. The study was conducted over a six-month period, from November 2016 through May 2017. Inclusion criteria were (a) 18 years of age or older, (b) a new OSA diagnosis, (c) CPAP therapy recommended, and (d) CPAP naiveté. Exclusion criteria were (a) inability to comprehend written English or Spanish, (b) inability to sign the consent form, and (c) previous CPAP experience.

Sample Size

Statistical power refers to the ability of the research design to detect true relationships between the variables (Polit & Beck, 2012). The power indicates the probability that a type II error, retaining the null hypothesis when it is false, will be avoided. The power analysis is important to validate the results of an inquiry. With an a priori power analysis, the Type I error probability α, rejecting the null hypothesis when it is true, and the Type II error probability β can be controlled. Since the power is defined as (1- β), the type II error probability also controls the power of the study (Faul, Erdfelder, Lang, & Buchner, 2007).

The statistical power is affected by the sensitivity of the instruments that are used, the effect size, and the criteria for statistical significance (Murphy, Myors, & Wolach, 2014). Traditionally, the statistical significance levels are set at $p < .05$ or $p < .01$, and in social and behavioral research, a medium effect size is generally sought. Research by Olsen, Smith, Oei, & Douglas (2008) indicated

an *a priori* analysis was performed to determine the needed sample size to achieve a moderate effect size of $r = .03$ if the power were .8 and $\alpha = .05$. In addition, Wild and colleagues (2004) also set the sample size for their study to achieve a power of .8.

According to Cohen (1992), effect size reflects the degree to which a certain phenomenon is present. In a large sample, even a small effect can achieve statistical significance, but will not provide any practical knowledge. Effect size measurement allows the researcher to move from a theoretical statistical significance to a more practical interpretation of the size and impact of an effect (Fritz, Morris, & Richler, 2012). Effect sizes are conventionally referred to as small, medium, or large. Different statistical tests can be used to determine effect size and the values correlating with a small, medium, or large effect depend on which test was used. Several CPAP adherence studies report an a priori or post hoc medium effect size (Olsen, Smith, Oei, & Douglas, 2008; Skinner et al., 2013; Wild et al., 2004).

An *a priori* power analysis was conducted using G*Power, version 3.1, to determine the minimum sample size required to find significance, with a desired level of power set at .80, an α-level at .05, and moderate effect size. Based on the analysis, it was determined that a minimum of 119 participants was required to ensure adequate power for the logistic regression model, which is the statistical test used for the primary analysis. The minimum sample size of 119 required for the primary analysis was also adequate for the preliminary analysis, including the cross-tabulation tests (Cohen, 1988; Erdfelder, Faul, & Buchner, 1996; Faul, Erdfelder, Lang, & Buchner, 2007).

Recruitment

Participants were recruited consecutively, at the time of their diagnostic sleep study. Everyone who came to one of the four sleep centers for a diagnostic polysomnography was approached and informed about the study. When the patient showed interest, a study packet was

given (Appendix A). The primary investigator (PI) or the research assistant (RA) verbally explained the study and its purpose. In addition, a written explanation was provided in the questionnaire packet. A consent form was included in the packet and was explained to potential participants. The consent informed the potential participants about their right to discontinue participation at any time and about the anonymity and confidentiality of their answers and any information collected from their medical record. Either the PI or the RA reviewed the questionnaires with the prospective participants and explained how to fill out the Likert-type scales. Potential participants were then left alone to look over the materials and to decide whether they would participate. Participants filled out the surveys in private and sealed their responses in the provided envelope.

Protection of Human Subjects

Approval for this study was obtained from the Texas Woman's University Institutional Review Board (IRB) and from Texas A&M University-Corpus Christi IRB. In addition, the PI completed the Collaborative Institutional Training Initiative's human subject training modules, addressing protection of human subjects participating in research studies. The RA also completed the appropriate training (Appendix B). The participating sleep centers provided signed letters of approval for the study and confirmation of the center's cooperation (Appendix C). The PI also signed a Health Insurance Portability and Accountability Act (HIPAA) confidentiality agreement for each of the sleep centers, thus protecting the confidentiality of the participants' identity and health information. Potential participants were informed that participation was voluntary, that all information would be kept confidential, and that data would be de-identified for analysis. The identifiable data, the surveys, and demographic data from the records were placed in a locked

cabinet in the PI's locked office at the College of Nursing and Health Sciences (CONHS) at Texas A&M University-Corpus Christi (TAMUCC).

Instruments

Four instruments were used to collect data about the psychological characteristics under investigation. They were: (a) the self-efficacy measure for sleep apnea (SEMSA), (b) the apnea beliefs scale (ABS), (c) the multidimensional health locus of control scale (MHLC), and (d) the health value scale (HV).

Self-Efficacy Measure for Sleep Apnea

The self-efficacy measure for sleep apnea (SEMSA) instrument was developed specifically to measure the patient's self-efficacy related to CPAP adherence. This instrument is a self-administered questionnaire, at a fifth-grade reading level, based on Bandura's social cognitive theory (1977). Concepts that influence health-promoting behavior are assessed on three subscales, 27 items. The 4-point scale for perceived risk responses ranges from 1 (very low) to 4 (very high). The outcome expectancies and self-efficacy subscales utilize 4-point measures with responses from 1 (not at all true) to 4 (very true). The mean of non-missing item responses is calculated for each subscale. According to Weaver and colleagues (2003), the use of the mean prevents distortion from the missing scores.

Six experts in self-efficacy instrument development and OSA rated each item for clinical relevance and demonstrated content validity (Weaver et al., 2003). The instrument has strong psychometric properties. Each subscale exhibited a Cronbach's coefficient α between .85 and .89, and the total instrument had an internal consistency coefficient $\alpha = .92$ (Weaver et al., 2003). The reliability and the validity of this instrument have been confirmed in many studies (Dudley, Bakker, Simonelli, & Patel, 2014; Olsen, Smith, Oei, & Douglas, 2008; Sawyer, Canamucio et

al., 2011; Stepnowsky et al., 2002). A Spanish version of the SEMSA instrument exists, but it was translated for use in Colombia. The appropriateness of its use in the South Texas Spanish population is yet to be determined. Therefore, a resident of the Texas Coastal Bend who was fluent in English and Spanish translated all four instruments to Spanish. That translation was used in the present study. Only two participants filled out the Spanish version of the questionnaires.

Apnea Beliefs Scale

The Apnea Beliefs Scale (ABS) is at a sixth-grade reading level and measures the patient's beliefs about OSA and CPAP. Smith, Lang, Sullivan, and Warren (2004), the authors of this scale, explained that a literature review and a consultation with a sleep investigation unit informed the items for this scale. The following concepts were thought to be essential for compliance and were addressed in the scale: (a) perceived impact of OSA, (b) trust in medical staff, (c) outcome expectations, (d) CPAP acceptance, (e) openness to new experiences, (f) commitment to change, (g) willingness to ask for help, (h) attitude toward health, and (i) self-confidence (Smith et al., 2004).

The ABS is a 5-point Likert-type scale with 24 items. The scale ranges from 1 (strongly disagree) to 5 (strongly agree). Half of the statements are worded negatively to prevent response bias (Smith et al., 2004). The ABS scores, ranging from 24 to 120, are calculated by summing the responses after item reversal, where this was appropriate. Lower scores indicate a more negative attitude towards compliance with CPAP treatment (Smith et al., 2004). Psychometric evaluation of this instrument indicated adequate internal consistency with a Cronbach's coefficient $\alpha = .75$ (Smith et al., 2004). Though this instrument is not widely used, it was used successfully in at least one study (Poulet et al., 2009).

Multidimensional Health Locus of Control Scales

Wallston, Wallston, and DeVillis (1978) developed the health locus of control (MHLC) multidimensional scale, based on Rotter's social learning theory (1954), which is an expectancy value theory. Whereas locus of control can be perceived as a personality trait, Wallston (1992) posits, health locus of control (MHLC) is considered a "disposition to act in a certain manner in health-related situations" (p. 185). Wallston (1992) recommended that the measurement of MHLC to predict subsequent health behavior should be done in combination with the measurement of perceived health value (HV). MHLC, alone, explained only a small percent of the variance in health behavior while HV and MHLC, combined, were more predictive. In addition, Wallston (1998) stated that this "admonition to assess HV along with MHLC only pertains to those studies that are attempting to predict health behavior" (para. 15). The rationale is that Rotter's social learning theory, the theoretical basis of this instrument, posits that the potential to engage in health behavior is influenced by the interaction of expectancy and health value. The purpose of this study is to predict the lack of titration study completion and describe those patients who do not complete the titration study. Therefore, it is necessary to include HV as a concept for investigation.

Wallston (2005) explained that the validity of the MHLC scales is difficult to summarize in a short statement, and he claimed that there is enough evidence in the published literature to confirm that the scales measure what they are intended to measure, an individual's health locus of control beliefs. In addition, the validity of these scales does depend on the purpose for which researchers want to measure health locus of control. As Wallston (2005) claimed, the scales have shown a moderate validity.

The MHLC instrument measures three different dimensions of control: powerful others, internality, and chance. The instrument has three versions. Version A and B are similar and version C is condition specific. Cronbach's coefficient α for these versions ranges from .67 to .77. Combination of the equivalent versions of the scales, A and B, resulted in a reliability coefficient of .83 to .86 (Wallston & Wallston, 1981). The A and B versions, each comprised of 18 items measured on a 6-point Likert-type scale, ranging from 1 (strongly disagree) to 6 (strongly agree), were developed to allow for pretest/posttest research designs and are used both for healthy people and for people suffering from chronic diseases. Version C, also consisting of 18 items on a 6-point Likert-type scale, is condition specific and has an acceptable reliability coefficient $\alpha \geq .70$ (Wallston, Stein, & Smith, 1994). Version A was used in the present study because the surveys were filled out before a diagnosis was made. The reading level of the scales was not identified

The health locus of control scale has been widely used but only two studies that included MHLC as a concept in relation to OSA or CPAP could be found. Wild et al. (2004) included MHLC among the psychological factors they investigated and Tanahashi, Nagano, Yamaguchi, Kubo, and Sudo (2012) used MHLC in combination with other concepts to predict CPAP adherence. Neither of these studies reported the results of instrument reliability analysis.

Health Value Questionnaire

Lau, Hartmann, and Ware (1986) developed the 4-item Likert-type scale. No reading level was identified for this scale. The items are written so that a high score is awarded to placing high value on health and a low score for low value. Two items are negatively worded. A 7-response scale and a 5-response scale have both been used. In this study, the 5-response scale was used to provide more uniformity with the other instruments, which made filling out the survey

easier for the participants. The coefficient alpha reliability for the health value scale varies from .63 to .73, as it was used across populations. There was no indication whether this reliability was related to the 7-response scale or the 5-response scale. The size of coefficient alpha is determined by the number of items in the scale and by the inter-item correlations. Therefore, this reliability is acceptable for a scale that consists of only four items (Gliem & Gliem, 2003; Lau et al., 1986).

Data Collection

Potential participants were informed about the research study at the time of their diagnostic sleep study. The participants were asked to answer the survey questions before watching an educational video that instructs patients about OSA and clarifies and demonstrates the purpose and use of the CPAP device. This procedure ensured that each patient responded to the questions from his or her personal knowledge and beliefs. A general information questionnaire addressing (a) ethnicity, (b) native tongue, (c) education, (d) work status, (e) income, (f) marital status, (g) insurance, (h) referring provider, and (i) previous CPAP experience was included. Data collected from the patient's medical record included: (a) sleep study results, (b) height, (c) weight, (d) BMI, (e) birthday, (f) diagnostic study date, (g) OSA diagnosis and recommendation for treatment, and (h) titration study date (Appendix D).

Wild et al. (2004) checked for CPAP adherence three months after the diagnostic study. Olsen, Smith, Oei, and Douglas (2008) allowed a timespan of four months, after completion of the diagnostic study, to complete the titration study and start CPAP treatment. Participants that did not have the titration study completed within the set timeframe were considered non-adherent. The researcher's analysis of pilot study data (Acker, 2016) showed that 95.1% of participants, who were recommended the CPAP treatment and completed the titration study, did so within three months of the diagnostic study. In fact, most patients who completed a titration study did so

within 29 days of the diagnostic study (Acker, 2016). Based on the pilot study data and the fact that titration completion is an outcome for this study, which does not include CPAP initiation, the timeframe within which the titration study should be completed was set at three months. Data collection continued until the required sample size was achieved.

Data Analysis

Two hundred thirty surveys were collected from four sleep centers, over a 6-month period. Data were manually entered into an Excel Spreadsheet. Manual verification of the data was done in 20% increments. If an entry mistake was found in 20% of randomly selected data, corrections were made and another 20% was selected randomly. Randomly selecting and verifying 20% of the data at a time continued until no entry errors were found. The fourth 20% of randomly selected data had no entry errors resulting in eighty percent of the data being verified. The Statistical Package for Social Sciences (SPSS), version 24.0, was used to analyze the collected data.

Data Preparation

Invalid data. Checking for invalid cases or values is a critical part of data preparation. Invalid data reflect inaccurate, inattentive, or careless response values. Cases that exhibit these types of responses can seriously bias a study. The appropriate procedure for handling invalid data is typically case removal, which often results in the reduction of the sample size. The following critical removal reasons were assessed.

- Duplicate cases can occur when respondents take a survey more than once. Unique identifiers (e.g. participant ID, IP address, email address) are required to isolate whether respondents may have been duplicated in the data. Duplicated cases will bias the results

of a study and should be removed (Johnson, 2005). The survey data were entered into SPSS manually and no duplicate cases were found.

- Impossible values refer to values that lie outside the theoretical range for that variable. A few impossible values, errors in data entry, were found. Because every survey was coded, the researcher could go back to each case with impossible values and determine the correct values.
- Respondents who did not consent were excluded from the study for ethical reasons (U.S. Dept. of Health & Human Services, 2010). Consent was provided through signing the consent form. Several participants filled out the survey, but did not sign the consent form (n = 5, 2.2%), and were excluded from the study.
- The cases that did not meet the inclusion criteria were excluded. The reasons for exclusion were (a) the sleep study was not a diagnostic sleep study (n = 7, 3.1%), (b) the diagnosis was negative for OSA (n = 25, 10.9%), (c) CPAP was not the recommended treatment (n = 42, 18.3%), and (d) the participant had used CPAP before and, thus, was not CPAP naive (n = 25, 10.9%).
- Sometimes, research participants did not complete the survey or stopped responding to items in the questionnaire for a variety of reasons. It is recommended that respondents who stopped participating in a survey should be removed if they did not complete more than 50% of the questionnaire (Johnson, 2005). The question LOC18 (50% through the survey) and ABS15 (65% through the survey) were used as removal criteria. Participants who dropped off at 50 % (n = 2) were removed.

In addition to eliminating cases for critical removal reasons, several cases (n = 6) were excluded because neither the diagnostic study data nor the biomedical data were available, and no outcome

data would be appropriable. After a check for invalid data and removal of the appropriate cases, a total number of 155 valid cases remained.

Missing data. Missing data can have a profound effect on a study's validity depending on the extent of the missing data within a dataset (Little & Rubin, 2002). After preparing the data for analysis, the researcher performed a missing data analysis. The three pie charts below summarize the frequency and percentage of missing data by variable, by case/observation, and for individual values. The third pie chart represents the full data matrix and was used to evaluate the 5% threshold of the proportion of missing values.

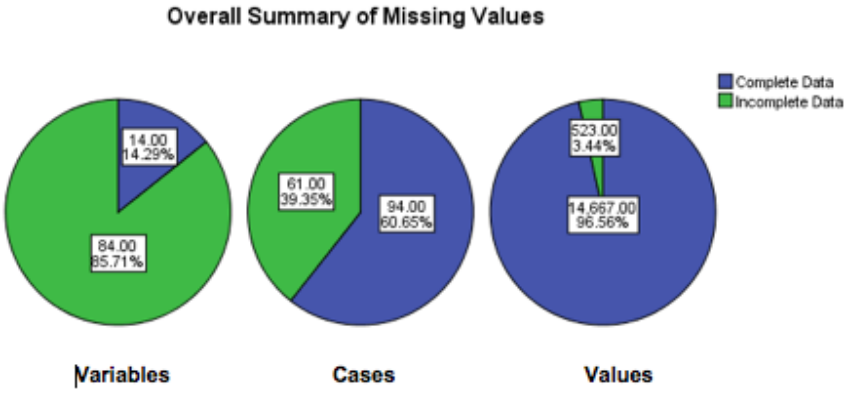

Figure 3.1. Missing values

To assess whether the pattern of missing values indicated missing completely at random (MCAR), Little's MCAR test was conducted. The null hypothesis of Little's MCAR test is that the pattern of the data is MCAR and follows a χ^2 distribution. Using an expectation-maximization algorithm, the MCAR test estimates the univariate means and correlations for each of the variables (Little & Rubin, 2002). The results revealed that the pattern of missing values in the data was not MCAR, χ^2 (2787) = 3072.603, $p < .001$.

Though the pattern of missing data is not MCAR, the proportion of missing data in the sample is within the 5% threshold. List-wise or pair-wise deletion, which is common in most analyses, will not bias estimates and will not lead to an increase in the probability of committing Type I and Type II errors (Little & Rubin, 2002; Newman, 2014). Pair-wise deletion, or available case analysis, minimizes the loss of data that would occur in list-wise deletion and maximizes available data for each individual analysis. Given the lower moderate sample size (N = 155), pairwise deletion was used for all analyses.

Recoding and computing variables. Several variables were recoded because they were worded negatively to reduce response bias (Smith et al., 2004). In the HV questionnaire, items two and three were reverse coded and approximately half of the items in the ABS were also reverse coded. The items that were reverse coded in the ABS are: (a) ABS1, (b) ABS3, (c) ABS5, (d) ABS9, (e) ABS10, (f) ABS13, (g) ABS14, (h) ABS16, (i) ABS17, (j) ABS18, and (k) ABS19.

Variables were created that reflect the total score (sum) on the HV and the ABS scales. As Wallston (1992) explained, there is no composite score for Health Locus of Control and the items for each of the MHLC scales were summed to make three variables: LOC internal, LOC powerful others, and LOC chance. The means of the three scales, included in the SEMSA instrument, were calculated to create three variables: (a) perceived risks, (b) outcome expectancies, and (c) self-efficacy. Weaver et al., (2003) indicated that OSA self-efficacy is, then, the sum of these variables.

The variable, days-elapsed-between-diagnostic-and-titration-studies, was recoded into a new outcome variable, which indicated whether the time elapsed between the diagnostic study and the titration study was > 90 days. Creating this variable was necessary because anyone who

completed the titration study beyond the 90-day interval, or who did not complete the titration study at all, was considered titration-not-completed, the population of interest.

After evaluating the frequencies of the categorical variables, the researcher recoded several variables into variables with fewer categories because some categories had very low frequencies. A relatively even split among the levels was required to use the Chi-Square test. The expected count in 80% of the squares should be greater than five (Morgan, Leech, Gloeckner, & Barrett, 2013). As Mertler and Vannatta (2013) explained, logistic regression relies on the goodness-of-fit test to assess the fit of the model (p. 297). The categorical variables that were recoded into variables with fewer categories were:

- Education: Trade, technical or vocational training (n = 15) and some college, associate's degree (n = 46) categories formed the post-secondary non-university category. In addition, the four-year degree
  (n = 19) and the post-graduate degree (n = 10) categories were collapsed to form the higher education category
- Marital status: Married (n = 100) was combined into one category with living with partner (n = 10).
- Employment: The part time (n = 14) and full time (n = 71) categories were combined to form the working category
- Ethnicity: The Black/African American (n = 6), Asian (n = 1), Pacific Islander (n = 1), and Multiple (n = 11) categories were combined to form the Other category.

Reliability. The reliability of the instruments was examined based on this study's sample. An item on the ABS scale was left off during the process of combining instruments into one

document, which was not noticed until data analysis. However, the question itself was not pertinent to the research questions and no information was missed that was relevant to the study. Cronbach's alpha was calculated to determine if the measure was still reliable without the missing item. The new alpha was .62.

Table 3.1 presents the reliability of each of the instruments. The reliability of the MHLC scales and the SEMSA scales compared to those suggested by the authors of these instruments (Wallston, 1992; Weaver et al., 2003). The reliability for the HV scale is low and may be due to the small number of items in the scale. The Cronbach's Alpha for the ABS based on this study's sample is lower than the reliability (α = .75) as reported by Smith et al. (2004), this could be due to the one missing item.

Table 3.1
Instrument Reliability Statistics

Scale	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
Health Value	0.524	0.525	4
LOCinternal	0.698	0.712	6
LOCchance	0.682	0.683	6
LOCpowerful others	0.731	0.730	6
ApneaBeliefs	0.617	0.657	23
PerceivedRisks	0.867	0.866	8
OutcomeExpectancy	0.915	0.918	9
Selfefficacy	0.915	0.915	9
SEMSA_total	0.939	0.939	26

Outliers. Outliers are atypical responses or observations compared to the rest of the data and can significantly affect correlations between variables. Outliers cannot lightly be eliminated and may warrant further analysis (Adams & Lawrence, 2015). Logistic regression models are sensitive to outliers and extreme values should be identified (Mertle & Vannatta, 2013). Box plots

divide the data based on two inner fences and two outer fences. The usual interquartile range (IQR) is Q1-Q3 represented by the full box. The inner fences are defined by Q1-1.5 IQR and Q3+1.5 IQR. Similarly, the outer fences are Q1-3 IQR and Q3+3 IQR. The whiskers of a box plot show the data within the inner fences. A mild outlier falls between the inner and outer fences while an extreme outlier falls beyond the outer fences (Dawson, 2011). Mertler and Vannatta (2015) stated that in larger samples (N >100) the outer boundaries of acceptable data points can be extended a little beyond the inner fences. This means that mild outliers can be acceptable while extreme outliers need to be investigated.

In this sample (N = 155), two extreme outliers were identified in the weight variable (Fig. 3.2) and one extreme outlier was identified in the O2 saturation variable (Fig. 3.3). These outliers represented two cases (106 and 135) and the two variables (weight and O_2 saturation) were recoded to eliminate these two cases. Though these two cases were also identified as mild outliers in several other variables, the cases were only eliminated from analysis in the variables where they were identified as extreme outliers (weight and O2 saturation).

Descriptives. Because there was little variation in their distributions, four categorical variables were only used to describe the sample and were not evaluated as potential predictive factors. These variables were (a) language spoken, (b) health insurance available, (c) sleep study covered by insurance, and (d) referring professional.

Stockburger (1998) explained that categorical variables with more than two levels need to be recoded into a dichotomous "dummy variable" for each level, to make the results of the logistic regression interpretable. The researcher made the decision to treat two categorical variables at the ordinal level of measurement, education and household income, as continuous

variables. The different levels of these variables are ranked and are meaningful. Treating them as continuous variables facilitated their use in the logistic regression model.

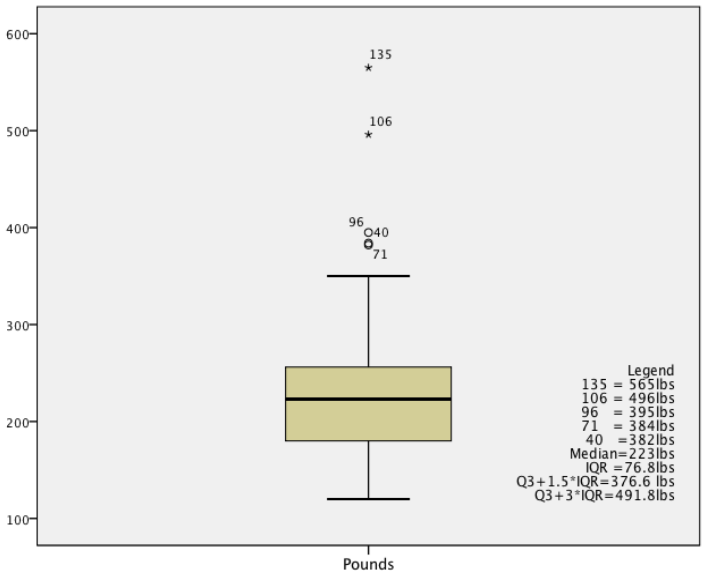

Figure 3.2. Patient Weight Box Plot

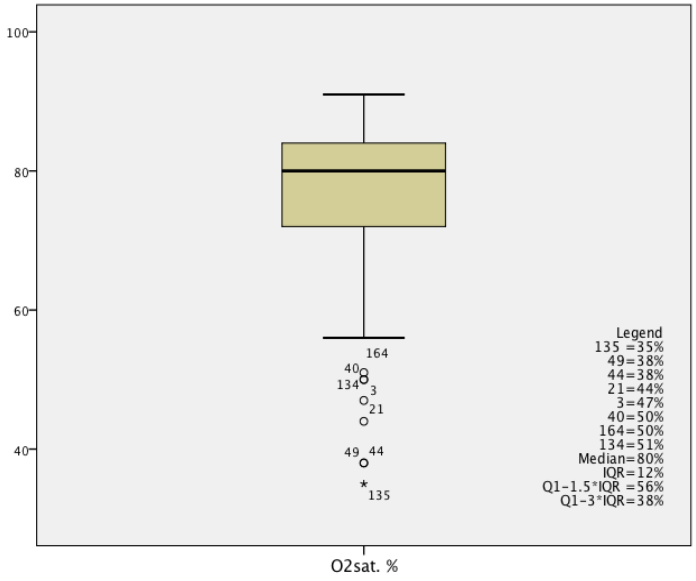

Figure 3.3. Patient O_2 Saturation Box Plot

Normality. The primary analysis was logistic regression, which does not require the variables to be normally distributed. The assumption of normality therefore, was only evaluated for the preliminary analysis and to identify outliers, which play a role in logistic regression analysis. Histograms, Q-Q plots, and box plots (Appendix E), in addition to the Shapiro-Wilk (S-W) test of normality, were used to evaluate whether each continuous variable met the required assumptions for the use of inferential statistics in the preliminary analysis. Table 3.2 shows the S-W results. The S-W statistic tests the null hypothesis that the distribution of the population is normal. A statistically significant result indicates that the population is not normally distributed (Mertler & Vannatta, 2013).

Table 3.2
Shapiro-Wilk Tests of Normality

	Statistic	df	Sig.
Height	0.980	155	0.024
Weight	0.906	155	0.000
Body Mass Index	0.915	155	0.000
Apnea Hypopnea Index	0.871	155	0.000
Resp. Disturb. Index	0.940	155	0.000
O2sat%	0.865	154	0.000
Age	0.973	155	0.004
Perceived risk	0.988	146	0.229
Outcome expectancy	0.962	147	0.000
Self-efficacy	0.966	146	0.001
Sleep apnea self-efficacy	0.971	127	0.008
Health value	0.961	149	0.000
Locus of control: internal	0.966	149	0.001
Locus of control: chance	0.984	143	0.086
Locus of control: powerful others	0.993	149	0.704
Beliefs about OS and CPAP	0.937	131	0.000

The Shapiro Wilk statistic is reported because the Kolmogorov-Smirnov test of normality is sensitive and will flag violations in normality even if there is only a slight deviation from a

normal distribution, especially in smaller samples (Lampariello, 2000). All continuous variables, except perceived risk, LOC internal, and LOC chance, showed a statistical significance and therefore are not normally distributed, but none of the histograms and the Q-Q plots showed extreme deviation from normality. There was no need to evaluate the skewness since all continuous variables were either normally distributed or had an approximately normal distribution.

The researcher made the decision not to transform the approximately normal variables because the dependent variable is a categorical variable and the statistical procedure to predict titration study completion is logistic regression. When using logistic regression, the assumptions that (a) the predictor variables are normally distributed, (b) there is linearity, and (c) there is homoscedasticity are not required (Mertler & Vannatta, 2013).

Preliminary Analysis

The preliminary analysis included a description of the sample, the relationships among the demographic variables, and the relationships among the independent variables (IV).

Description of the sample. Frequencies and percentages were calculated for the categorical demographic variables (Table 3.3) and descriptive statistics - mean, median, standard deviation, and minimum and maximum values - were gathered on all continuous variables (Table 3.4). The final sample consisted of 155 participants (82 male and 73 female) with a mean age of 54.19 ± SD of 14.32 years (range 21- 80 years old). Their mean BMI was 36.7 ± SD 9.8 (range 20.0 – 81.8) and their mean RDI was 45.82 ± SD 28.08 (range 5.2 – 169.9). Most were Hispanic (*n* = 72, 46.8%) or White (*n* = 62, 40.3%). A majority of the participants were married or living with a partner (*n* = 110; 71%). Of the participants, 56.7 % were employed (*n* = 85), 25.3 % were retired (*n* = 38), and 18% (*n* = 27) were unemployed.

Table 3.3

Categorical Variables: Descriptive Statistics

	Frequency	Percent	Valid percent
Gender			
Male	82	52.9	52.9
Female	73	47.1	47.1
Total	155	52.9	100.0
Ethnicity			
White	62	40.0	40.3
Hispanic	72	46.5	46.8
Other	20	12.8	12.9
Total	154	99.4	100.0
Marital status			
Married, living with partner	110	71.0	71.0
Single	45	29.0	29.0
Total	155	100.0	100.0
Employment			
Unemployed	27	17.4	18.0
Employed	85	54.8	56.7
Retired	38	24.5	25.3
Total	150	96.8	100.0
Medicare/Medicaid			
Yes	65	41.9	45.1
No	79	51.0	54.9
Total	144	92.9	100.0

Note. *N* not equal to 155 reflects missing data

Three categorical variables - insurance, sleep study covered, and referring professional - were not included as potential predictors because there was very little variation in distribution among the categories. Most of the participants had some type of health insurance (*n* = 153, 97.5%) and the sleep study was covered by insurance for most (*n* = 133, 84.7%), though a few people could not recall whether the cost of the study was covered (*n* = 14, 8.9%). The family physician referred many participants (*n* = 140, 89.2 %). A Nurse Practitioner (NP) or Physician

Assistant (PA) referred a small portion (n = 12, 7.6%), and a sleep specialist referred just a few participants (n = 2, 1.3%).

Table 3.4
Continuous Variables: Descriptive Statistics

	N	Mean	St. Deviation	Minimum	Maximum
Age	155	54.19	14.32	21.0	80.0
Inches	155	66.17	4.34	49.0	76.0
Pounds	155	228.39	65.40	120.0	565.0
Body mass index	155	36.70	9.80	20.0	81.8
Apnea hypopnea index	155	33.35	28.35	1.2	167.6
Res. disturbance index	155	45.82	28.08	5.2	169.9
O_2 saturation %	154	76.58	10.99	35.0	91.0
Education	149	2.66	0.94	1	4.0
Household income	142	2.56	0.93	1	4.0

Note. *N* not equal to 155 reflects missing data

Relationships between variables. The relationship between the variables was examined to develop an understanding of the data and the characteristics of the sample. This understanding is important because the statistical analysis that was used for the primary analysis, logistic regression, is sensitive to multicollinearity or correlations among the predictor variables.

Multicollinearity limits the proportion of the variance in the DV that can be explained by a combination of IVs (Mertler & Vannatta, 2013). Therefore, possible correlations among the predictor variables were explored. The Pearson's Chi-Square test was used to examine associations among categorical demographic variables. The one-way ANOVA was used to evaluate variances between groups, and Pearson's Product Moment Correlation was used to explore relationships among the independent variables.

Relationship between demographic variables. Cross tabulations using Pearson's Chi-Square test were conducted to examine associations between (a) gender, (b) ethnicity, (c) marital

status, (d) employment, and (e) Medicare/Medicaid (Appendix F). The results of these analyses had no bearing on the research questions.

A series of one way between groups analysis of variance (Appendix G) explored the impact of each categorical demographic variable (gender, ethnicity, marital status, employment, and Medicare/Medicaid) on each continuous demographic variable (age, height, weight, BMI, AHI, RDI, O2 Sat., education, and household income).

The null hypothesis in a one-way ANOVA states that there is no difference between the groups. One-way ANOVA is considered a robust test because it tolerates violations to normality assumptions well. Norman (2010) contends that the central limit theorem indicates that means are approximately normally distributed without regard to the original distribution, in sample sizes greater than five or ten per group (p.628). Also, theory and data show that parametric statistics examining differences between means, in samples greater than five, do not require the assumption of normality (Norman, 2010). Similarly, the assumption of equal variances can be violated without affecting the results of the ANOVA analysis (Mertler & Vannatta, 2013).

As indicated above, the continuous variables approximated a normal distribution. Levene's test of equality of variances was conducted within ANOVA to evaluate homogeneity of variances. The null hypothesis for the Levene's test states that the variances in the groups are equal. A statistically significant result ($p < .05$) indicates a violation of the assumption of homogeneity of variances. Statistically significant results for the Levene's test were found in 9 of the 55 analyses (Table 3.5). The fact that the variables approximate a normal distribution and that a few variables lack equality of variance, will not result in an increased chance of unjustly rejecting the null hypothesis (Morgan et al., 2013).

Table 3.5

Levene's test of Equality: Statistically Significant Results

Independent Variable	F	df1	df2	Sig.
Dependent Variable: Age				
Employment	6.189	2	147	**.003
Medicare/Medicaid	5.157	1	142	*.025
Dependent Variable: BMI				
Gender	6.067	1	153	*.015
Medicare/Medicaid	4.041	1	142	*.046
Dependent Variable: AHI				
Gender	4.962	1	153	*.027
Dependent Variable: Education				
Gender	8.151	1	147	**.005
Ethnicity	3.122	2	145	*.047
Marital Status	6.234	1	147	*.014
Medicare/Medicaid	5.434	1	138	*.021

Note:*Indicates statistical significance at $p < .05$; **at $p < .01$

When conducting the ANOVA, the strength of the associations, the effect size, is also obtained. Mertler and Vanatta (2013) explain that eta squared (η^2) is a measure of the magnitude of the relationship between IV and DV and indicates the proportion of the variance in the DV that is explained by the IV (p.125). An effect size of .5 or greater indicates a substantial part of the variance in the DV is explained by the IV.

Post Hoc analysis guards against an increased chance of rejecting the null hypothesis. Tukey HSD (honestly significant differences) test was conducted for those ANOVA that compared the means of more than two groups and were statistically significant; to identify which group combination was significantly different. The results of these ANOVA indicated some statistically significant differences in means between groups However, none of these variables influenced titration non-completion, therefore, the differences in means were not relevant to the aims of this study.

Relationship between demographic variables and the outcome variable. Independent samples *t*-tests were conducted to compare the mean scores between the titration completed and the titration not completed groups for the following variables: (a) age, (b) height, (c) weight (d) BMI, (e), AHI, (f) RDI, (g) O_2 saturation, (h) education, and (i) household income.

The Levene's test for equality of variance indicated no statistically significant results in any of the t-tests, meaning that the assumption of equality in variance was met. Cohen's *d* was calculated to indicate effect size. As shown in table 3.6, the RDI of those participants who did not complete a titration study within 90 days was statistically significantly lower (M = 37.76, SD = 23.08) than the RDI of those who did (M = 48.35, SD = 29.10), t (153) = 2.022, p = .045.

Table 3.6
Means, Standard Deviation, t-Tests, and Cohen's d for Continuous Demographic Variables by Titration Completion Within 90 days

Variable		*n*	*M*	*SD*	*t*	*p*	*d*
Age					-.339	.735	.06
	Completed	118	53.97	13.92			
	Not completed	37	54.89	15.71			
Height					1.326	.187	.24
	Completed	118	66.43	4.08			
	Not completed	37	65.35	5.04			
Weight					-.717	.474	.13
	Completed	116	222.60	54.96			
	Not completed	37	230.16	58.30			
BMI					-.680	.497	.13
	Completed	118	36.39	10.10			
	Not completed	37	37.65	8.81			
AHI					1.582	.116	.31
	Completed	118	35.36	29.18			
	Not completed	37	26.95	24.84			
RDI					2.022	*.045	.40
	Completed	118	48.35	29.10			
	Not completed	37	37.76	23.08			
O_2 Saturation					-1.653	.100	.32

	Completed	117	76.07	10.60			
	Not completed	36	79.36	9.88			
Education					-.085	.933	.02
	Completed	115	2.66	.972			
	Not completed	34	2.68	.843			
House Hold Income					-.550	.583	.12
	Completed	111	2.54	.951			
	Not completed	31	2.65	.877			

Note: *Indicates statistical significance at $p < .05$

Cross tabulations, using Pearson's Chi-Square test, were conducted to examine associations between (a) gender, (b) ethnicity, (c) marital status, (d) employment, and (e) Medicare/Medicaid (Table 3.7) and titration completion within 90 days. No statistically significant associations were found.

Table 3.7

Frequencies, Percentages, Pearson's Chi-Square, for Demographic Variables by Titration Completion within 90 Days

	Titration Completion within 90 days					
	Completed		Not Completed			
Variable	*n*	*%*	*n*	*%*	χ^2	*p*
Gender					0.29	.59
Male	61_a	51.7	21_a	56.8		
Female	57_a	48.3	16_a	43.2		
Ethnicity					2.07	.36
White	50_a	42.4	12_a	33.3		
Hispanic, Latino	55_a	46.6	17_a	47.2		
Other	13_a	11.0	7_a	19.4		
Marital Status					0.09	.76
Married, Living with Partner	83_a	70.3	27_a	73.0		
Single	35_a	29.7	10_a	27.0		
Employment					2.00	.37
Unemployed	20_a	17.5	7_a	19.4		
Employed	68_a	59.6	17_a	47.2		

Retired	26_a	22.8	12_a	33.3		
Medicare/Medicaid					0.70	.40
Yes	48_a	43.2	17_a	51.5		
No	63_a	56.8	16_a	48.5		

Note. For each row category, pairs with different superscripts differed significantly, $p < .05$.

Relationships between the independent variables. Pearson's Product Moment Correlations were conducted to test for existing correlations between the continuous independent variables because logistic regression is sensitive to high correlations among the predictor variables. Among the assumptions that must be met are: (a) a linear relationship, (b) similar distributions, (c) interval level data, (d) no outliers, and (e) normal distributions. All the variables had a distribution approximating normal and scatterplots showed linear relationships. The data were at the interval level of measurement and extreme outliers were removed. The variables only approximated a normal distribution. However, Chok (2010) contended that the use of the Pearson's product moment correlation leads to an increase in statistical power and is appropriate to use for moderately non-normal distributions. Because the variables did not meet all the assumptions for the parametric Pearson's Product Moment Correlation test, the non-parametric correlation test, Spearman's rho, used for data that are not normally distributed, was also calculated.

The results show several correlations with statistical significance (Table 3.8) though the strength of the correlations varied. Hinkle, Wiersma, and Jurs (1990) defined the strength of a correlation as follows: very high ($r = .90$ to 1.00), high ($r = .70$ to .90), moderate ($r = .50$ to .70), low ($r = .30$ to .50), and negligible ($r = .00$ to .30). A moderate positive correlation is found between perceived risk and outcome expectancy ($r = .56$, $n = 145$, $p < .0001$), between outcome

expectancy and self-efficacy (r = .65, n =146, p < .001), and between OSA and CPAP beliefs and self-efficacy (r = .52, n = 129, p < .001).

Table 3.8
Pearson's Product–Moment Correlation Between Independent Variables

Variable	1	2	3	4	5	6	7	8	9
1. Health value	-								
2. Internal LOC	.118	-							
3. Chance LOC	**.276	.076	-						
4. Powerful others LOC	*.179	**.343	*.209	-					
5. OSA & CPAP beliefs	**.271	.147	-.155	.055	-				
6. Perceived risk	**.245	-.081	-.062	-.002	.168	-			
7. Outcome expectancy	**.282	**.218	-.102	.116	**.334	**.559	-		
8. Self-efficacy	.107	.161	.029	.066	**.516	**.316	**.647	-	
9. OSA self-efficacy	**.242	.124	-.040	.044	**.425	**.709	**.918	**.830	-

Note: *p < .05, **p < .01.

There were high positive correlations between perceived risk (r = .709, n = 127, p < .001), outcomes expectancy (r = .918, n = 127, p < .001), self-efficacy (r = .830, n = 127, p < .001), and OSA self-efficacy. This finding is to be expected because the sum of these three variables' mean score is the OSA self-efficacy variable. A statistically significant but negligible negative correlation existed between health value and chance LOC (r = -.28, n = 139, p = .001), indicating that high levels of chance LOC correlate with low levels of health value. A weak, positive correlation was revealed between powerful others LOC and health value (r = .179, n = 144, p = .032). The positive correlation of OSA and CPAP beliefs with outcome expectancy (r =

.33, n = 129, p <.001) and with OSA self-efficacy (r = .43, n =116, p <.001) were found to be weak.

The Spearman's Rho test (Table 3.9) indicated that the strength of the correlations was congruent with the Pearson's product moment correlations. As the pattern was similar, and the same problematic variables were identified in both sets of correlations, the individual subscales of OSA self-efficacy were not used in the final multiple logistic regression model.

Table 3.9
Spearman's Rho Correlation Between Independent Variables

Variable	1	2	3	4	5	6	7	8	9
1. Health value	-								
2. Internal LOC	.114	-							
3. Chance LOC	**-.309	.015	-						
4. Powerful others LOC	**.222	**.348	*.126	-					
5. OSA & CPAP beliefs	**.234	.111	*-.178	.051	-				
6. Perceived risk	**.247	-.063	-.053	.013	.129	-			
7. Outcome expectancy	**.293	**.256	-.135	.111	**.331	**.538	-		
8. Self-efficacy	.072	**.221	.029	.075	**.511	**.274	**.581	-	
9. OSA self-efficacy	**.220	.147	-.042	.071	**.401	**.718	**.886	**.756	-

Note: *p < .05, **p < .01.

Primary Analysis

To examine the predictive ability of (a) health value, (b) chance health locus of control, (c) powerful others health locus of control, (d) internal health locus of control, (e) OSA and CPAP beliefs, (f) perceived risk, (g) outcome expectancy, (h) self-efficacy, and (i) OSA self-

efficacy for titration non-completion within 90 days of the diagnostic study, while controlling for RDI scores, several logistic regressions were calculated.

When the dependent variable is categorical or dichotomous, and there is a mixture of continuous and categorical independent variables, logistic regression is the appropriate statistical test to predict group membership (Burns & Burns, 2008). Logistic regression calculates the probability of success over the probability of failure. In this study, titration non-completion is the group of interest and therefore the success group. The coefficient β measures each predictor's independent contribution to variation in the dependent variable and the outcome of logistic regression is a probability of belonging to one of two groups (Burns & Burns, 2008). The Wald statistic tests the significance of each predictor's contribution and a lenient significance level ($p < .05$ or $p < .1$) can be used because the Wald statistic is considered rather conservative (Mertler & Vannatta, 2013). The calculated odds ratio, *Exp(β)*, is the measure of an association between the predictor and the outcome with a one-unit increase in the predictor. An odds ratio (OR) of 1 indicates no effect, OR > 1 denotes an effect from the predictor, higher odds of the outcome. OR < 1 denotes lower odds of the outcome (Szumilas, 2010).

Nagelkerke's R^2 indicates the proportion of variability in the DV for which the predictor variables that are included in the model are responsible (Mertler & Vannatta, 2013). The Nagelkerke R^2, which can range from 0 to 1 (Bewick, Cheek, & Ball, 2005) was calculated to indicate the predictor variables' usefulness for predicting the outcome variable and thus, measured the effect size.

As shown in table 3.10, the overall model predicting titration non-completion from OSA and CPAP beliefs, while controlling for RDI, was statistically significant, $\chi^2(2) = 13.285$, $p = .001$, Nagelkerke's $R^2 = .149$. Participants with lower RDI scores were more likely to not

complete a titration study within 90 days of the diagnostic study compared to participants who completed the titration study (*OR* = .981, *p* = .038), as were participants with more maladaptive beliefs, lower Apnea and OSA beliefs scores (*OR* = .891, *p* = .009).

Table 3.10
Simple Logistic Regression Analysis Using OSA & CPAP Beliefs to Predict Titration Non-Completion Within 90 Days

						95% CI	
Predictor	*β*	*SE*	*Wald*	*OR*	*p*	*LL*	*UL*
RDI	-.020	.009	4.323	.981	.038	.963	.999
OSA & CPAP beliefs	-.116	.044	6.890	.891	.009	.817	.971

Note. $\chi^2(2) = 13.285$, $p = .001$, Nagelkerke's $R^2 = .149$

The model predicting titration completion within 90 days from perceived risk, while controlling for RDI (Table 3.11), revealed significant results, $\chi^2(2) = 8.441$, $p = .015$, Nagelkerke's $R^2 = .088$. Participants with lower perceived risk scores were more likely to not complete the titration study compared to those who completed the titration study (*OR* = .485, *p* = .024).

Table 3.11
Simple Logistic Regression Analysis Using Perceived Risk to Predict Titration Non-Completion Within 90 Days

						95% CI	
Predictor	*β*	*SE*	*Wald*	*OR*	*p*	*LL*	*UL*
RDI	-.014	.009	2.516	.986	.113	.970	1.003
Perceived risk	-.781	.347	5.073	.458	.024	.232	.904

Note. $\chi^2(2) = 8.441$, $p = .015$, Nagelkerke's $R^2 = .088$

Also, the model predicting titration completion within 90 days from outcome expectancy while controlling for RDI (Table 3.12), demonstrated statistically significant results, $\chi^2(2) = 11.748$, $p = .003$, Nagelkerke's $R^2 = .119$. Participants with lower perceived risk scores were

more likely to not complete the titration study compared to those who completed the titration study (*OR* = .449, *p* = .004).

Table 3.12
Simple Logistic Regression Analysis Using Outcome Expectancy to Predict Titration Non-Completion Within 90 Days

						95% CI	
Predictor	*β*	*SE*	*Wald*	*OR*	*p*	*LL*	*UL*
RDI	-.016	.009	3.349	.984	.067	.968	1.001
Outcome expectancy	-.800	.868	3.106	.449	.004	.259	.780

Note. $\chi^2(2) = 11.748$, $p = .003$, Nagelkerke's $R^2 = .119$

The model predicting titration completion within 90 days from self-efficacy while controlling for RDI (Table 3.13), also indicated statistically significant results, $\chi^2(2) = 11.753$, $p = .003$, Nagelkerke's $R^2 = .120$. Participants with lower self-efficacy scores were more likely to not complete the titration study compared to those who completed the titration study (*OR* = .453, *p* =.005).

Table 3.13
Simple Logistic Regression Analysis Using Self-Efficacy to Predict Titration Non-Completion Within 90 Days

						95% CI	
Predictor	*β*	*SE*	*Wald*	*OR*	*p*	*LL*	*UL*
RDI	-.014	.009	2.656	.986	.103	.970	1.003
Self-efficacy	-.792	.280	2.703	.453	.005	.261	.785

Note. $\chi^2(2) = 11.753$, $p = .003$, Nagelkerke's $R^2 = .120$

Lastly, the model predicting titration completion within 90 days from OSA self-efficacy while controlling for RDI (Table 3.14), displayed statistically significant results, $\chi^2(2) = 14.021$, $p = .001$, Nagelkerke's $R^2 = .164$. Participants with lower OSA self-efficacy scores were more likely to not complete a titration study compared to those who completed the titration study (*OR* = .955, *p* =.002).

Table 3.14
Simple Logistic Regression Analysis Using OSA Self-Efficacy to Predict Titration Non-Completion Within 90 Days

						95% CI	
Predictor	*β*	*SE*	*Wald*	*OR*	*p*	*LL*	*UL*
RDI	-.019	.010	3.458	.981	.063	.962	1.001
OSA Self-efficacy	-.046	.015	5.097	.955	.002	.927	.984

Note. χ^2 (2) = 14.021, p = .001, Nagelkerke's R^2 = .164

The models predicting titration completion from (a) health value, (b) health locus of control-chance, (c) health locus of control-powerful others, and (d) health locus of control-internal, while controlling for RDI, were not statistically significant, $p > .05$.

The different combinations of the individual statistically significant predictors also produced models that were not statistically significant.

To examine the impact, on titration completion, of (a) health value, (b) chance health locus of control, (c) powerful others health locus of control, (d) internal health locus of control, (e) OSA and CPAP beliefs, and (f) OSA self-efficacy, while controlling for RDI, a single multiple logistic regression model was produced. Risk perception, outcome expectancy, and self-efficacy were not included, because of multicollinearity. As shown in table 3.15, the model was significant, χ^2 (7) = 24.492, p = .001, Nagelkerke's R^2 = .309. Results indicated that the only significant predictor of titration non-completion is OSA self-efficacy (*OR* = .944, p = .005).

Table 3.15
Multiple Logistic Regression Analysis Predicting Titration non-Completion within 90 Days

						95% CI	
Predictor	β	SE	Wald	OR	p	LL	UL
RDI	-.019	.011	3.027	.981	.082	.960	1.002
Health Value	.044	.092	.228	1.045	.633	.873	1.251
Internal LOC	-.083	.059	1.946	.921	.163	.820	1.034
Chance LOC	-.037	.062	.354	.964	.552	.853	1.089
Powerful others LOC	.016	.055	.085	1.016	.771	.913	1.131
OSA & CPAP beliefs	-.098	.061	2.601	.906	.107	.804	.1.021

OSA self-efficacy	-.057	.021	.7822	.944	.005	.907	.983

Note. χ^2 (7) = 24.492, p = .001, Nagelkerke's R^2 = .309

Summary

A quantitative, non-experimental design was used to determine whether specific demographic factors and psychological characteristics influenced the completion of a titration study in newly diagnosed OSA, CPAP naive patients. Research questions were used to guide the analysis of the relationship between the variables. People with previous CPAP experience were excluded from the study. Guidelines of the Texas Woman's University Denton IRB and Texas A & M University Corpus Christi IRB provided human subject protection. Four instruments were administered, descriptive statistics were used to describe the sample, and inferential statistics were used to analyze the data.

CHAPTER IV

CPAP TITRATION COMPLETION: A CORRELATIONAL STUDY

A Paper Submitted for Publication in the *Behavioral Sleep Medicine* Journal

Katelijne Acker, Elizabeth Restrepo

Abstract

Background: Sleep loss is a global public health burden with far-reaching social, economic, and health consequences. Obstructive sleep apnea (OSA) causes fragmented sleep and OSA prevalence in adults, 30-70 years of age, is 26%. About 30% of those drop the recommended CPAP treatment before initiation. In this study, the concept of *CPAP adherence* was expanded to include titration study completion as the first act of adherence. This study targeted a group that is rarely studied: the non-adherers.

Participants: Consecutively sampled, CPAP-naive, newly diagnosed OSA patients (*N*=155) completed a battery of questionnaires the evening of their diagnostic polysomnography, before receiving educational information.

Methods: A predictive correlational study, using logistic regression, was conducted. Using valid and reliable surveys, cognitive concepts assessed were: (a) risk perception, (b) outcome expectancy, (c) self-efficacy, (d) locus of control, (e) health value, and (f) beliefs about OSA and CPAP. Physiological data were gathered from diagnostic sleep study results. Titration completion was assessed 90 days after diagnosis.

Results: Lower OSA self-efficacy scores contributed significantly to titration non-completion prediction (*OR*= 0.95, *p*=.002). The final regression model explained about 31 % of the variance in titration non-completion and 83% of cases were correctly classified. Approximately 24 % of

the participants did not complete a titration study. Respiratory disturbance index (RDI) was implicated in titration non-completion prediction.

Conclusion: Participants' beliefs about risks associated with OSA, their CPAP treatment expectations, and their perceived confidence in their ability to use CPAP influence titration non-completion, even measured before OSA diagnosis.

Background

Poor sleep is a global public health burden and greatly impacts the community. The consequences of sleep loss are far from benign. Environmental disasters such as the nuclear meltdown in Chernobyl, the grounding of the Exxon Valdez, and the explosion of the Challenger have been partially attributed to sleep loss (Altevogt & Colton, 2006). Lack of sound sleep affects cognitive performance and has resulted in medical errors, motor vehicle crashes, and work-related injuries. Sleep loss negatively affects the quality of life, an effect that escalates to impact family and community (Altevogt & Colton, 2006). The economic effect is impressive and includes not only the health care-related costs of the associated mental and chronic conditions, but the loss of productivity, and related non-medical costs (Hillman & Lack, 2013).

Obstructive Sleep Apnea (OSA), one of the three most prevalent sleep disorders, results in fragmented sleep and is associated with cardiovascular disease, impaired glucose metabolism, and other chronic conditions. Most recently it was associated with Alzheimer's disease (Liguori et al., 2017). The best treatment, to date, is the application of continuous positive airflow pressure (CPAP) during sleep.

CPAP adherence is a well-researched topic. Psychological constructs and behaviors that could be related to successful initiation of and adherence to CPAP therapy were investigated, especially in newly diagnosed OSA patients (BaHamman, Hussain, & Al-Asmri 2016; Crawford, Espie, Bartlett, & Grunstein, 2014; Shapiro & Shapiro, 2010). Because early interventions to increase adherence were found to be more successful, these constructs and behaviors were utilized to predict CPAP adherence as early as one week after treatment initiation. Nevertheless, CPAP adherence is reportedly 34.1%, showing no significant improvement over the past 20 years, despite several varied efforts (Rotenburg, Vicini, Pang, & Pang, 2016).

Research exploring the differences between CPAP adherers and non-adherers has mainly focused on the adherers and their characteristics. The population of interest for this study was the titration not-completed group, the non-adherers. The concept of *CPAP adherence* was expanded to include the completion of the titration study, contending that adherence starts at titration completion. The purposes of this study were to discern the influence of specific cognitive concepts and patient characteristics, on the newly diagnosed, CPAP-naive, OSA patient's completion of a titration study and to evaluate the contribution of these concepts to the prediction of titration non-completion.

We hypothesized, based on CPAP adherence research, that risk perception, outcome expectancy, and self-efficacy, in addition to prior beliefs about OSA and CPAP, would influence titration completion. Biomedical indices were not expected to affect titration completion, but we anticipated that there would be an impact from socio-economic factors.

Pender's Health Promotion Model (HPM) was the theoretical framework for this study. Pender approaches health from a competence-oriented perspective. Cognitive processing is an important aspect of health promotion because the perceptions and the interpretations of life experiences will affect subsequent behaviors. The model includes components of the health belief model (HBM), risk perception, outcome expectancy, and self-efficacy, which Olsen, Smith, Oei & Douglas (2008) identified as predictive of CPAP adherence. Pender contends that in addition to these specific cognitions, activity-related affects, and interpersonal influences dictate the health-promoting behavior. Pender also includes individual characteristics as influencing factors. Progress towards optimal health is central to HPM.

The following HPM concepts were evaluated as predictors of titration non-completion: (a) risk perception, outcome expectancy, and self-efficacy (OSA specific self-efficacy); (b)

activity related affects (beliefs about OSA and the CPAP treatment, and health value); (c) interpersonal influences (health locus of control); (d) individual characteristics (biomedical indices and socio-economic and cultural attributes); and (e) health-promoting behavior (titration completion). Completing a titration study is considered the earliest act of adherence to the prescribed treatment. To date, little research was found to evaluate adherence at this stage.

Methods

This predictive correlational study was conducted in four sleep centers in South Texas. Every person who came to the sleep clinics for a diagnostic polysomnography over a six-month period from November, 2016 to May, 2017, was approached and informed about the study. Participants were asked to complete a paper and pencil survey before watching an educational video that instructs patients about OSA and both clarifies and demonstrates the purpose and use of the CPAP device. Approval for this study was obtained from the Texas Woman's University Institutional Review Board (IRB) and from the Texas A&M University-Corpus Christi IRB. Consent was obtained from the participants prior to data collection.

Participant inclusion criteria were (a) age 18 years or older, (b) having a new OSA diagnosis, (c) having CPAP therapy recommended, and (d) CPAP naiveté. Exclusion criteria were (a) inability to comprehend written English or Spanish, (b) inability to sign the consent form, and (c) having had previous CPAP experience.

Instruments

Primary Outcome Measure. The primary outcome measure was the completion of a titration study within 90 days of the diagnostic study. Demographic information was collected and data were gathered from the patients' medical records including: (a) sleep study results, (b) recommendations for treatment, and (c) titration study date.

Self-Efficacy Measure for Sleep Apnea. The self-efficacy measure for sleep apnea (SEMSA) instrument is at a fifth-grade reading level and was developed by Weaver et al. (2003) specifically to measure the patient's self-efficacy related to CPAP adherence. Concepts that influence health-promoting behavior, perceived risk, outcome expectancies, and self-efficacy, are assessed on three subscales, a total of 27 items (Weaver et al., 2003). Cronbach's coefficient α for the subscales for this study was between 0.87 and 0.92, and $\alpha = 0.94$ for the total instrument.

Apnea Beliefs Scale. The Apnea Beliefs Scale (ABS) is at a sixth-grade reading level and measures the patient's beliefs about OSA and CPAP. Concepts that are thought to be essential for adherence, such as (a) perceived impact of OSA, (b) trust in medical staff, (c) outcome expectations, (d) CPAP acceptance, (e) openness to new experiences, (f) commitment to change, (g) willingness to ask for help, (h) attitude to health, and (i) self-confidence are addressed (Smith, Lang, Sullivan, & Warren, 2004). For this study, the ABS instrument's Cronbach's coefficient alpha was .62.

Multidimensional Health Locus of Control scales (MHLC). Health locus of control can be perceived as an inclination to act in a certain way when making health decisions (Wallston, 1992). The MHLC instrument measures three different dimensions of control: (a) powerful others, (b) internality, and (c) chance. Cronbach's coefficient alpha for this study was .70 for internal LOC, .68 for chance LOC, and .73 for powerful others LOC.

Health Value Questionnaire. Wallston (1992) recommended that the measurement of MHLC to predict subsequent health behavior should be done in combination with the measurement of perceived health value (HV) because MHLC alone explained only a small percent of the variance in health behavior while HV and MHLC combined were the most predictive. The Health Value (HV) scale, a four item Likert-type scale, was developed by Lau,

Hartmann, and Ware (1986). A high score is awarded to placing high value on health and a low score for placing low value on health. Cronbach's coefficient alpha for this study was .62.

Sample

An a priori power analysis was conducted using G*Power, version 3.1, to determine the minimum sample size required to find significance, with a desired level of power set at .80, an α-level at .05, and a moderate effect size. A minimum of 119 participants was required to ensure adequate power for the logistic regression (Cohen, 1988; Erdfelder, Faul, & Buchner, 1996; Faul, Erdfelder, Lang, & Buchner, 2007).

The final sample consisted of 155 participants (82 male and 73 female) with a mean age of 54.19 ± SD of 14.32 years (range 21- 80 years old). Their mean BMI was 36.7 ± SD 9.8 (range 20.0 – 81.8) and their mean RDI was 45.82 ± SD 28.08 (range 5.2 – 169.9). Most were Hispanic (*n* = 72, 46.8%) or White (*n* = 62, 40.3%). A small percentage (12.9%) of the sample consisted of multiple, different ethnicities, including African American (3.9%), Asian (.6%), and others (1.3%), while 7.1 % claimed a mixed ethnic background. A majority of the participants were married or living with a partner (*n* = 110; 71%). Of the participants, 56.7 % were employed (*n* = 85), 25.3 % were retired (*n* = 38), and 18% (*n* = 27) were unemployed. Most participants were covered with health insurance (*n* = 151; 98%), with 45% having Medicare or Medicaid. Sample characteristics are presented in Tables 1 and 2.

Analysis

Crosstabulations, using Pearson's Chi-Square test, and independent samples *t*-tests were conducted to examine associations between demographic variables and titration completion within 90 days. There were no statistically significant differences in demographic and biomedical

indices, between those participants who completed the titration study within 90 days and those participants who did not, with the exception the respiratory disturbance index (RDI).

The RDI for participants who did not complete a titration study within 90 days (M = 437.76, SD = 23.09) was lower than for participants who completed the study (M = 48.35, SD = 29.10), t (153) = 2.02, p = .045 (figure 4.1). Because the relationship between RDI and titration-non-completion was statistically significant, RDI was included in the regression model as a covariate.

Relationships among the following predictor variables were assessed using Pearson's product moment correlations coefficient: (a) health value, (b) LOC-chance, (c) LOC- powerful others, (d) LOC- internal, (e) OSA and CPAP beliefs, (f) risk perception, (g) outcomes expectations, (h) self-efficacy, and (i) OSA self-efficacy. A significant correlation existed between risk perception, outcome expectancy, and self-efficacy and the total score for these three variables, OSA self-efficacy ($p < .01$). Therefore, OSA self-efficacy was used as covariate in the logistic regression model.

Logistic regression was conducted to determine the impact of certain factors on the likelihood that participants would not complete the titration study. The full model, containing all seven predictors, (a) RDI, (b) health value, (c) LOC chance, (d) LOC internal, (e) LOC powerful others, (f) OSA and CPAP beliefs, and (g) OSA self-efficacy, was statistically significant χ^2 (7, N = 109) = 24.49, p = .001, indicating that the predictors, as a set, could distinguish between participants who completed and those who did not complete a titration study. The model explained 30.9% (Nagelkerke R Square) of the variance in titration non-completion and correctly classified 83.5 % of cases (96.5% for completion and 37.5% for non-completion). Regression coefficients are presented in table 3. Wald statistics indicate that only OSA-specific self-efficacy

made a significant contribution to prediction of titration non-completion (p = .005). Findings suggest that an increase in OSA self-efficacy diminished the likelihood of dropping the treatment before completing a titration study (*OR* = .94)

Discussion

The purpose of this study was to explore the influence of cognitive concepts and patient characteristics on titration completion, using a theory-based, health-promotion model, and to predict titration non-completion. The results revealed that lower scores for risk perception, outcome expectancy, and self-efficacy indicated an increased likelihood that the titration study would not be completed. This result is congruent with the findings from earlier CPAP adherence studies (Olsen, Smith, Oei, & Douglas, 2008; Sawyer et al., 2014) in which higher scores for these same concepts predicted increased adherence. These findings support the usefulness of OSA-specific self-efficacy, as measured by the SEMSA instrument, to predict titration non-completion in newly-diagnosed OSA, CPAP naive patients.

The patients' perceptions and beliefs about their health, their condition, and the specific treatment influence adherence to any long-term treatment. Lower ABS scores, in this study, indicated a statistically significant increased likelihood that the titration study would not be completed (*OR* = .891, p = .009), but the ABS scores did not contribute significantly to the prediction of titration non-completion when combined with other cognitive factors. Similarly, previous research found that lower ABS scores, indicating maladaptive beliefs and attitudes towards OSA and CPAP, affected CPAP adherence (Poulet et al., 2009). Of note is the fact that this study only used 23 of the 24 items on the ABS scale. At the time of the diagnostic study, participants did not know whether they were OSA positive and could not answer the item that

referred to the effect of OSA on their lives. Cronbach's alpha (α = .62) was calculated to determine the reliability of this instrument for this study.

While earlier researchers found that biomedical indices, or disease severity, differed between CPAP adherers and non-adherers (Aloia, Stepnowsky, Hecht, & Borelli, 2005; Campbell, Neill, & Lory, 2012; Poulet et al., 2009), we found no difference in biomedical indices between the titration not-completed and the titration completed groups, except for RDI. A less severe diagnosis could influence patients not to complete the titration study and forgo the CPAP treatment. Some studies found a weak, but clinically non-relevant relationship between demographic characteristics and CPAP adherence (Olson, Smith Oei, & Douglas, 2008; Ye, et al., 2012) but the present study revealed no difference in demographics or socio-economic attributes between the titration-completed and titration not-completed groups.

Limitations

There may be limited generalizability of study findings due to sample size. Therefore, a larger more diverse sample with a correspondingly larger group of participants, who do not complete titration, would decrease the error margin. In addition, instruments used in this study identified certain variables that are not likely to influence titration completion. The use of other instruments could identify additional, influential variables, or deliver a more accurate assessment of the current variables, and provide an improved model to predict titration non-completion.

Implications

This study adds to the CPAP-adherence knowledge by extending the concept of CPAP non-adherence, as explored by Sawyer and colleagues (2014), to include titration-non-completion. In this study, 24 % of the participants did not complete a titration study, which is congruent with the findings in the literature (Ayow, Paquet, Dallaire, Purden, & Champagne,

2009; Olsen, Smith, Oei, & Douglas, 2008; Skinner et al., 2013). Auto-titration, titration at home and unattended, is an option but polysomnographic titration provides access to support and guidance from the start. Means, Edinger, and Husain (2004) discovered that patients who underwent attended (polysomnographic) titration studies, on average, used the CPAP more hours per night than those who had unattended titration studies and whose first CPAP exposure was not supervised.

The results of this study revealed that titration non-completion was influenced by OSA-specific self-efficacy and OSA severity, factors that are known to influence CPAP adherence. This outcome should not lead to the assumption that the same patient characteristics, proven to predict CPAP adherence after titration, also influence titration completion. Further exploration of factors that could predict titration non-completion is warranted. The present study only examined whether a participant completed a titration study or not. Perhaps, there are factors beyond demographic, biomedical, or psychological attributes that influence titration completion and are independent from the participant. These could be investigated in future research. Insurance rules and regulations, and health care access are some factors that come to mind.

Researchers indicated that beliefs about OSA and the CPAP treatment influence adherence (Poulet et al., 2009), which we found to be true relative to titration non-completion. The results of the present study indicate that people with more maladaptive beliefs are less likely to complete the titration study. Providing accurate information about OSA, the associated risks, and the expected benefits of the CPAP treatment could increase titration completion. An educational intervention at the time of diagnosis could make a difference.

In addition, researchers discovered that OSA patients report a lack of education and support from their providers, whether sleep specialist or primary care provider (Adusumilli et al.,

2017). Most of the participants in this study were referred to the sleep centers by their primary care providers, whether physicians or nurse practitioners, and these providers are in a unique position to not only educate their patients about the effects of sleep apnea, but also stress the need to comply with the suggested treatment. Because the prevalence of OSA has increased dramatically over the last decade and limited clinical resources result in delayed treatment, models with nurse providers should be investigated to effect titration completion. Models with alternate providers were investigated and researchers learned that provisions of follow-up care for OSA patients in the primary care setting, or led by nurses, was more cost effective and not inferior to sleep specialist's care (Antic et al., 2009; Chen et al., 2015; Sánchez-de-la-Torre et al., 2016).

When nurses provided guidance, with individualized education before treatment, and home visits after initiation of CPAP, adherence improved significantly (Chen et al., 2015). Hilbert and Yaggi (2017) described a patient-centered approach in obstructive sleep apnea. This strategy to improve adherence includes elements like patient specific needs and the understanding of patient values and preferences to guide treatment decisions. In addition, such an approach comprises enhanced patient education and support; the promotion of patient engagement; and increased access to and coordination and continuity of care. Adding the determination and assessment of patient-centered outcomes describes a process for which nurses are ideally suited. Hu, Yu, Liu, and Tsao (2017) found that the perceived burden of the CPAP device was considerably less and the participants' quality of life related to OSA improved after an educational intervention provided by nurses.

This type of support, starting at diagnosis and not after CPAP has been initiated, could increase titration completion and subsequent CPAP adherence. Community and public health

nurses are in an ideal position to provide this patient-oriented, health-promoting support. To better prepare nurses to take on this public health service, nursing education will need to include sleep physiology and pathology at both the undergraduate and at the graduate levels.

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Tables

Table 1

Categorical Variables: Descriptive Statistics

	Frequency	Percent	Valid percent
Gender			
Male	82	52.9	52.9
Female	73	47.1	47.1
Total	155	52.9	100.0
Ethnicity			
White	62	40.0	40.3
Hispanic	72	46.5	46.8
Other	20	12.9	13.0
Total	154	99.4	100.0
Marital status			
Married, living with partner	110	71.0	71.0
Single	45	29.0	29.0
Total	155	100.0	100.0
Employment			
Unemployed	27	17.4	18.0
Employed	85	54.8	56.7
Retired	38	24.5	25.3
Total	150	96.8	100
Medicare/Medicaid			
Yes	65	41.9	45.1
No	79	51	54.9
Total	144	92.9	100.0
Titration completion within 90 days			
Yes	118	76.1	76.1
No	37	23.9	23.9

Note. N not equal to 155 reflects missing data

Table 2

Continuous Variables: Descriptive Statistics

	N	Mean	St. Deviation	Minimum	Maximum
Age	155	54.19	14.32	21.0	80.0
Inches	155	66.17	4.34	49.0	76.0
Pounds	155	228.39	65.40	120.0	565.0
Body mass index	155	36.7	9.80	20.0	81.8
Apnea hypopnea index	155	33.35	28.35	1.2	167.6
Resp. disturbance index	155	45.82	28.08	5.2	169.9
O_2 saturation %	154	76.58	10.99	35.0	91.0
Education	149	2.66	0.94	1.0	4.0
Household income	142	2.56	0.93	1.0	4.0
Perceived risk	146	2.35	0.64	1.0	4.0
Outcome expectations	147	2.84	0.74	1.0	4.0
Self-efficacy	146	2.70	0.76	1.0	4.0
OSA self-efficacy	127	68.57	15.31	26.0	97.0
Health value	149	15.36	2.99	8.0	20.0
LOC-internal	149	26.42	5.16	6.0	36.0
LOC-chance	143	17.04	5.37	6.0	36.0
LOC-powerful others	149	21.16	5.92	6.0	36.0
OSA &CPAP beliefs	131	81.22	6.71	70.0	103.0

Note. N not equal to 155 reflects missing data

Table 3

Multiple Logistic Regression Analysis Predicting Titration Non-Completion within 90 Days

						95% CI	
Predictor	*β*	*SE*	*Wald*	*OR*	*p*	*LL*	*UL*
RDI	-.019	.011	3.027	.981	.082	.960	1.002
Health Value	.044	.092	.228	1.045	.633	.873	1.251
Internal LOC	-.083	.059	1.946	.921	.163	.820	1.034
Chance LOC	-.037	.062	.354	.964	.552	.853	1.089
Powerful others LOC	.016	.055	.085	1.016	.771	.913	1.131
OSA & CPAP beliefs	-.098	.061	2.601	.906	.107	.804	1.021
OSA self-efficacy	-.057	.021	.7822	.944	.005	.907	.983

Note. $\chi^2(7) = 24.492$, $p = .001$, Nagelkerke's $R^2 = .309$

Figures

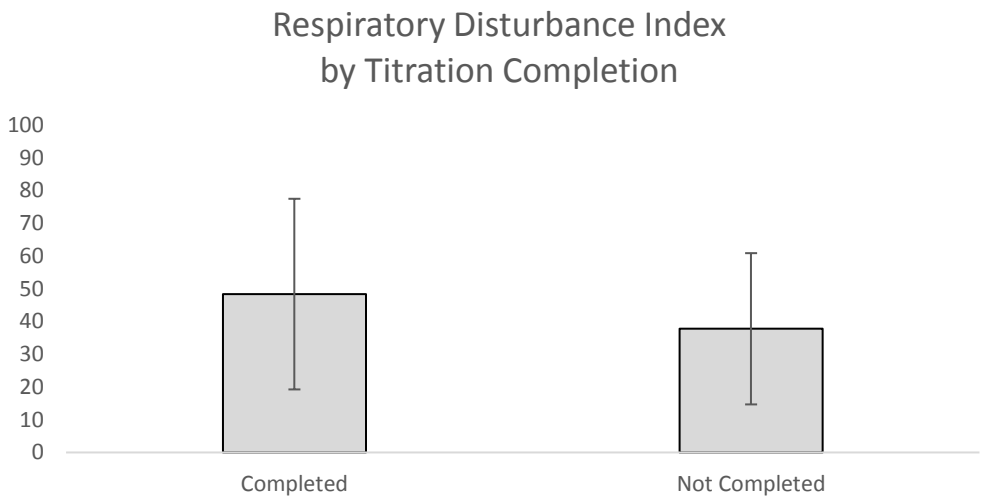

Figure 1. Respiratory disturbance index

CHAPTER V

DISCUSSION

This study focused on newly-diagnosed, CPAP-naive patients, who do not complete a titration study and, therefore, do not accept CPAP, even before experiencing this treatment. Results demonstrated that 23.9% of the participants did not complete a titration study within the 90-day time limit. Demographic variables and most biomedical indicators were not implicated in the prediction of titration study non-completion. The cognitive variables of health locus of control, health value, and beliefs about OSA and CPAP contributed to the prediction of titration non-completion but their contribution was not statistically significant. Analysis revealed that the respiratory disturbance index (RDI) of participants who did not complete a titration study was significantly lower than the RDI of those participants who completed the titration study. OSA specific self-efficacy was the only predictor that contributed significantly to titration non-completion prediction (p = .005). Participants exhibiting more self-efficacy were more likely to complete the titration study compared to those who showed less self-efficacy.

Overview of Findings

Demographics and Titration Non-Completion

Previous research reported equivalent adherence to CPAP in White and Hispanic participants (Wallace et al., 2017). Extrapolating these results to include titration completion, as the first indication of adherence, a similar, equivalent titration non-completion rate was found in Hispanic and White participants. A small percentage (12.9%) of the sample consisted of multiple, different ethnicities, including African American (3.9%), Asian (.6%), and others (1.3%), while

7.1 % claimed a mixed ethnic background. Likewise, titration completion did not differ for this group.

The influence of socio-economic status on adherence is varied (Gershon et al., 2015; Tarasiuk et al., 2005) because the indicators included in the research have not been consistent (Gagnadeaux et al., 2011; Galeteke Puzzo, Priegnitz, Anduleit, & Randerath, 2011; Sawyer, 2013). This study included employment status, household income, and education level as socio-economic indicators and the results suggested no significant difference between the titration completed and titration not-completed groups. Marital status did not have the same positive effect on titration completion that it was found to have on CPAP adherence (Baron et al., 2011; Baron, Gunn, Czajkowski, Smith, & Jones, 2012; Cartwright, 2008; Gagnadeaux et al., 2011; Ward et al., 2013).

Most of the participants had some type of health insurance and the participants who did not have Medicare/Medicaid (54.9%) were not asked for specifics about their insurance companies. Only 76.1% of the sample completed the titration study within 90 days. Varying insurance company regulations and differences in coverage/approval for a titration study could play a role in the lack of titration completion within the set time frame.

Only a weak, often clinically extraneous, correlation exists between a participant's age/gender and CPAP adherence but many previous studies found no difference between CPAP adherers and non-adherers (Aloia et al., 2005; Gulati, Masood, Davies, Quinnell, & Smith, 2017; Lewis et al., 2004; Olsen, Smith, Oei, & Douglas, 2008; Poulet et al., 2009; Sawyer, Gooneratne et al., 2011; Smolley et al., 2010; Wild et al., 2004; Woehrle, Graml, & Weinreich, 2011; Wolkove et al., 2008). Similar results were observed in the current study. There was no statistically significant difference in age, or gender, between the titration completed and titration

not-completed groups. However, results suggest that RDI varies significantly with gender ($p = .001$). RDI in men ($M = 52.61$; $SD = 26.53$) was greater than in women ($M = 38.19$; $SD = 27.98$), and disease severity was found to influence titration non-completion.

Disease-Specific Indicators and Titration Non-Completion

In the CPAP adherence research literature, biomedical indices, or disease severity, differed between adherers and non-adherers, but an independent relationship between biomedical indices and CPAP adherence was not found (Aloia et al., 2005; Gagnadeaux et al., 2011; Kreivi, Virkkula, Letho, & Brander, 2010; Olsen, Smith, Oei, & Douglas, 2008; Platt et al., 2009; Sawyer, Canamucio et al., 2011; Stepnowsky et al., 2002; Wild et al., 2004; Wolkove et al., 2008). The results of this study revealed no difference in biomedical indices between the two groups, except for RDI. A less severe diagnosis could influence patients to not pursue the titration study.

Health Value and Titration Non-Completion

The theoretical approach to this study was from a health promotion perspective. When viewing OSA in association with lifestyle conditions like diabetes and cardio-vascular disease, health value was an important concept to explore. While those participants who understood the risks of OSA and acknowledged the value of the CPAP treatment tended to value their health more, the relationship was weak and health value was not a good predictor of titration non-completion.

Beliefs About OSA/ CPAP and Titration Non-Completion

The patients' perceptions and beliefs about their health, their condition, and the treatment influence adherence to any long-term treatment. This observation was found to be true for adherence to the CPAP treatment as well (Sawyer et al., 2010; Ward et al., 2013). In an earlier

study, lower ABS scores indicated more maladaptive beliefs and attitudes towards OSA and CPAP (Poulet et al., 2009). The current study's results revealed that such negative thoughts and beliefs about OSA and CPAP affected titration study completion. Participants with lower OSA and CPAP beliefs scores were more likely not to complete the titration study (*OR*= .891, *p*=.009). But, these maladaptive beliefs were not predictive of titration non-completion when controlling for other cognitive factors.

Health Locus of Control and Titration Non-Completion

HLOC has not been widely investigated in CPAP adherence literature. Wild et al. (2004) examined the predictive abilities of health locus of control and health value and identified HLOC-internal and HLOC-powerful others as predictors of CPAP adherence. However, in the present study, HLOC did not affect titration completion. No difference was found between titration completed and titration non-completed groups, in any aspect of health locus of control.

OSA Self-Efficacy and Titration Completion

Health behavior concepts and cognitive factors have been used to explore CPAP adherence. OSA specific self-efficacy combines the perception of the risks related to OSA with the individual's expectations of the treatment and his or her ability to achieve results (Sawyer, 2013). Previously, CPAP adherence literature determined that higher OSA self-efficacy scores contributed to the prediction of CPAP adherence (Baron et al., 2011; Olsen, Smith, Oei, & Douglas, 2008; Sawyer, Canamucio et al., 2011; Sawyer et al., 2014). The results of the present analysis confirmed the involvement of OSA self-efficacy in titration non-completion prediction, as well. Risk perception, outcome expectancy, and self-efficacy individually affected titration non-completion, with lower scores suggesting a greater likelihood of titration non-completion compared to titration completion.

Prediction of Titration Non-Completion

Though the apnea/hypopnea index (AHI) is often cited as an OSA diagnostic criterion, it was the more comprehensive respiratory disturbance index (RDI) that was implicated in the prediction of titration study completion. No other biomedical indices, nor demographic characteristics, differed significantly between the titration not-completed and titration completed groups. Health value, locus of control -internal and locus of control-powerful others were involved in the prediction of CPAP adherence in earlier research (Wild et al., 2004), but in the present study, these factors were not significant in titration non-completion prediction. Because higher scores on behavioral variables (risk perception, outcome expectancy, and self-efficacy) increased the likelihood of CPAP adherence in previous research, the assumption that lower scores on those same variables would affect the prediction of titration non-completion was not supported. OSA specific self-efficacy, as measured by the SEMSA instrument, made the only significant contribution to the prediction of titration non-completion.

The conclusions based on the results of this study are the following:

1. Titration non-completion is likely influenced by misguided beliefs and opinions about OSA and its treatment, CPAP.
2. Disease severity influences titration completion.
3. Risk perception, outcome expectancy, and the perception of one's ability to overcome barriers contribute to the prediction of titration study non-completion.
4. Demographic and socio-economic indicators are not necessarily a deterrent to titration completion.

Limitations

This study is not without limitations. The sleep clinics that participated in the research were in the Coastal Bend and Golden Crescent regions of Texas. Extrapolating the results of the study to the general population may be difficult due to the unique demographic characteristics of the population.

The instruments that were used in the study are self-report measures. Responses were limited to what individuals were willing to share. The limited reliability of some instruments and the moderate sample, with a relatively low number of titration-not-completed participants, may have implications on the overall predictive qualities of the concepts under investigation. The apnea beliefs scales as used in this study had 23 items compared to the original instrument's 24 items. The missing item asked about the participant's OSA diagnosis. Because the participants were asked to fill out the surveys before their diagnostic study, this question would have been irrelevant to them. No information pertinent to the current research was lost. Also, the instruments were in English, though a Spanish translation was available, and participants with a poorer understanding of the language may not have understood the questions properly. The reliability and validity of the Spanish translation of the instruments has not been determined through research. Though this could be a limitation of this study, only two participants filled out the Spanish version of the surveys. In addition, one of these was only 30 % filled out and was therefore removed.

Though *a priori* analysis indicated that the sample size was adequate, a larger sample size (> 400) is recommended for logistic regression. In addition, the Wald statistic, which tests the significance of individual coefficients in the model, is less reliable in smaller samples and explanatory variables may, incorrectly, be deemed not important (Bewick et al., 2005).

Implications

This study expanded the concept of CPAP adherence to include titration study completion as the first indication of adherence. Auto-titration has shown equivalency to polysomnographic titration in long-term (>180 days) outcomes (Kushida et al., 2011), but polysomnographic titration provides the access to support and guidance from the start. Means and colleagues (2004) discovered that patients who underwent attended (polysomnographic) titration studies, on average, used the CPAP more hours per night than those who had unattended titration studies and whose first CPAP exposure was not supervised. Initial exposure to CPAP, under supervision of qualified personnel, allows for immediate troubleshooting and reinforcement of the benefits (Weaver & Grunstein, 2008). This could promote improved adherence, as research found that long-term CPAP adherence is established in the first few weeks of CPAP use (Balachandran, Yu, Wroblewski, & Mokhlesi, 2013; Budhiraja et al., 2007; Turnbull, Bratton, Craig, Kohler, & Stradling, 2016).

Completing the titration study is, then, the first act of adherence and elements affecting titration completion may differ from those factors affecting adherence to the CPAP treatment. Current findings encourage the exploration and discovery of characteristics that influence completion of the recommended titration study. In the present study, almost a fourth of the participants did not comply with the suggested treatment. These findings are put in perspective when considering that the prevalence of OSA is around 38 % and increases with age, sometimes as high as 90% for men and 78% for women in the elderly population (Senaratna et al., 2017).

The escalation of chronic diseases, like diabetes and hypertension, and the subsequent use of health care dollars, all associated with OSA, emphasize the importance of titration completion. Lower RDI, indicating milder OSA, influenced titration completion, but even mild OSA induces

sleep fragmentation and is associated with significant morbidity (Young, Peppard, & Gottlieb, 2002). Though few people with mild OSA experience excessive daytime sleepiness, which is suggested to be the most important symptom of OSA, an association exists between OSA and incident diabetes (Franklin & Lindberg, 2015). In addition, self-reported snoring, often a mild form of OSA, is a predictor of developing hypertension (Franklin & Lindberg, 2015). Also, patients with mild OSA, who use CPAP four or more hours per night, can see a reduction in BP, thus reducing the odds of cardiovascular and cerebrovascular events (Bratton, Stradling, Barbé, & Kohler, 2014). Any action to improve titration completion and subsequent CPAP adherence is a worthwhile effort, even for patients with a mild form of OSA.

Implications for Practice

Beliefs about OSA and the CPAP treatment influence adherence (Poulet et al., 2009; Ward et al., 2013), which was also true for titration non-completion. The results of the present study indicate that people with more maladaptive beliefs are less likely to complete the titration study. Providing accurate information about OSA, the risks associated with it and the expected benefits of the CPAP treatment increase titration completion. An educational intervention at the time of diagnosis could make a difference.

Most of the participants in this study were referred to the sleep centers by their primary care providers, whether physicians or nurse practitioners. These providers are in a unique position to educate patients about the effects of sleep apnea and the need to comply with the suggested treatment. Yet, few physicians are involved in support programs in general (Andersson, Garfield, Eliasson, Jackson, & Raynor, 2014) and OSA patients report a lack of education and support from their providers, whether sleep specialist or primary care provider (Adusumilli et al., 2017). Prevalence of OSA has increased dramatically over the last decade and limited clinical resources

result in delayed treatment. To alleviate the long waiting times, models with alternate providers have been investigated (Antic et al., 2009; Chen et al., 2015; Sánchez-de-la-Torre et al., 2016). Sanchez-de-la-Torre et al. (2016) found that the provision of follow-up care for OSA patients in the primary care setting or led by nurses was not inferior to sleep specialists' care and was more cost effective. When nurses provided guidance with individualized education before treatment, and conducted home visits after initiation of CPAP, adherence improved significantly (Chen et al., 2015). This type of support, starting at diagnosis and not only after CPAP has been initiated, could increase titration completion and subsequent CPAP adherence. But this finding means that nurses at the undergraduate and at the graduate level will need to be better educated on sleep physiology and pathology.

Implications for Education

Nurse-led care for adults with OSA is not inferior to physician-led care (Gong et al., 2017) and approximately 40% of AASM accredited sleep centers use NP's in clinical roles. Unfortunately, there is a deficiency in sleep-specific education for nurse practitioners (Colvin et al., 2014) and for baccalaureate-prepared registered nurses. Including a curriculum on sleep and chronobiology in nursing education is not only important for people with OSA and the pre-and post-diagnostic care, but for every patient with sleep problems. Problems with sleep and circadian rhythm are common in healthy people and are likely to result in illness (Lee et al., 2004). Nursing education should cover sleep disorders and the care for patients with sleep disorders in more depth, to better prepare future nurses for their increasingly important role in sleep medicine.

Implications for Research.

The present study included completing the titration study as the first act of adherence and investigated specific factors that affect titration completion. To date, few studies in the CPAP

adherence literature have focused on those patients who do not initiate the treatment. Sawyer et al. (2014) assessed the risk of non-adherence in post-titration participants, which does not include up to 30% of non-adherers, as defined in this study. Some of the same patient characteristics and health behaviors found to influence CPAP adherence by Olsen, Smith, Oei, and Douglas (2008) and Sawyer et al. (2014) also contributed to titration non-completion. Though statistical significance was established, the effect size was small (Nagelkerke's $R^2 = .309$), which is congruent with previous findings for CPAP adherence prediction at three months after CPAP initiation (Sawyer et al., 2014). These findings should not lead to the assumption that other factors that affect CPAP adherence will also influence titration completion. The exploration of the titration study non-completion phenomenon is warranted.

Disease-specific elements may not significantly affect CPAP adherence, but the severity of the symptoms of OSA and the relief of those symptoms are related to CPAP adherence (Aloia et al., 2005; Gagnadoux et al., 2011; Kreivi et al., 2010; Platt et al., 2009; Sawyer, Gooneratne et al., 2011; Stepnowsky et al., 2002; Wild et al., 2004; Wolkove et al., 2008). But, in this study, the participants with a lower RDI, indicating milder OSA, were more likely not to complete the titration study, and, as a result, would not experience the relief of symptoms nor the benefit of the treatment. Further investigation will allow providers to better guide newly diagnosed patients.

Maladaptive beliefs about OSA and CPAP influenced titration non-completion. These findings are consistent with existing CPAP adherence research. The OSA specific domain of the Social Cognitive Theory questionnaire, used by Sawyer et al. (2014), significantly contributed to the prediction of CPAP adherence. Replication studies could guide the development of an educational intervention, immediately after diagnosis, to dispel myths and untruths. This would allow informed decision making and potentially improved titration completion rates.

The development of an instrument that predicts titration non-completion and addresses the factors that influence titration completion would complement the I-NAP instrument of CPAP adherence prediction.

A qualitative inquiry of the perspectives of those who failed to complete a titration study would provide insight. The personal characteristics may be only a small part of what drives decision making in this situation. Understanding the experience of being diagnosed with OSA and making treatment decisions related to a known difficult treatment could guide development of effective interventions.

Lastly, the moderate sample size, though adequate per the a priori power analysis, with a relatively low number of titration-not-completed participants, may have diminished the overall predictive qualities of the concepts under investigation. Similar research in a larger sample and a more diverse population is proposed.

Summary

OSA specific self-efficacy predicted titration non-completion in newly-diagnosed, CPAP-naive patients. Condition severity and beliefs about OSA and CPAP influenced titration completion but were not predictive. Additional research is needed to understand the determinants of non-adherence, starting with titration non-completion, and develop targeted interventions.

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APPENDIX A

Questionnaire Packet

Dear Participant, Querido participante,

I invite you to participate in a research study that investigates patients' knowledge and beliefs about obstructive sleep apnea and its treatment I am currently enrolled in the Doctor of Philosophy (PhD) program at Texas Woman's University in Denton and I am writing my dissertation.

Lo invito a participar en un estudio de investigación que examina el conocimiento y la opinión del paciente sobre la Apnea obstructiva del sueño y su tratamiento. Actualmente estoy inscrita en el programa del Doctorado en Filosofía y Letras (PhD) en Texas Women's University en Denton y estoy escribiendo mi tesis.

The purpose of this research is to learn about patients who come for a diagnostic study for the first time. In this study you will be asked to fill out a questionnaire today. That will take about 10-15 minutes. There is more information about this below.

El propósito de este estudio es para aprender acerca de los pacientes que vienen a un estudio diagnostico por primera vez. En este estudio le pediré que llene una encuesta hoy mismo que tomará de 10 a 15 minutos. Hay más información en la siguiente página.

Thank you so much for reading through this packet and then making your decision. When you agree to participate please sign the next page. If you have any questions you can ask the sleep center's staff. You can also call or email me. I have listed my contact information below.

Muchas gracias por leer este paquete y por hacer su decisión. Cuando esté de acuerdo en participar favor de firmar en la siguiente página. Si tiene algunas preguntas usted puede hacerlas al personal en el centro del sueño. Igual me puede llamar personalmente o mandarme un correo electrónico. He enumerado mi información de contacto.

Sincerely, Atentamente,

Katelijne Acker

Katelijne Acker, MSN, RN

361-825-2178
Katelijne.Acker@Tamucc.edu

TEXAS WOMAN'S UNIVERSITY
CONSENT TO PARTICIPATE IN RESEARCH

Title of the study: CPAP Titration Study Completion: A Correlational Study

Investigator

This dissertation study is conducted by [redacted], MSN, RN, as a requirement for the degree of Doctor of Philosophy in nursing science in the graduate school of Texas Woman's University. Email: [redacted] ; phone: [redacted]

Advisors

[redacted] PhD, RN email: [redacted]
[redacted] PhD, RN email: [redacted]
[redacted] PhD, RN email: [redacted]

Explanation and Purpose of the Research

A titration study is a second sleep study. During this study the patient is treated for obstructive sleep apnea and the treatment settings are adjusted to fit the individual patient.
The purpose of this dissertation study is to learn about people who will have a sleep study for the first time. The researcher wants to learn what they know and believe about their health, about obstructive sleep apnea, and about the treatment for sleep apnea.

Description of Procedures

If you agree to participate in this study, you will be asked to fill out a survey. This will take about 10-15 minutes. Some information from your sleep center record is needed. Signing this form gives the primary investigator ([redacted]) permission to collect your height, weight, your score on the sleep evaluation survey, and you sleep studies results. This information is used to describe the group of people who fill out this survey.

Potential Risks

Loss of confidentiality is a risk. There is a potential risk of loss of confidentiality in all email, downloading, electronic meetings and Internet transactions.
The researcher will protect your information to the extent that is allowed by law. The surveys will be coded; your name will not be on them. Your confidential information and this consent form will be stored securely and separately from the surveys in a locked cabinet, in a locked office. The researcher has a signed confidentiality agreement with this sleep center.
Coercion is a risk. You can choose not to participate in this research study at any time, even when you have already started filling out the survey.
The researcher will try to prevent any problem that could occur because of this research. You should let the researcher ([redacted]) know at once if there is a problem and she will help you. However, TWU does not provide medical services or financial assistance for injuries that might happen because you are taking part in this research.

Approved by the
Texas Woman's University
Institutional Review Board
Approved: October 7, 2016

_____
Initials

"This research" consists of consenting to take the survey and filling out the survey and has nothing to do with the sleep study itself.

Participation and benefits

Your participation in this study is optional. Your choice to participate or not participate will not affect your sleep study experience. There are no direct benefits to you.

Questions regarding this study

You will be given a copy of this signed and dated consent form to keep. If you have any questions about the research study you should ask the researcher; her phone number is at the top of this form. If you have questions about your rights as a participant in this research or the way this study has been conducted, you may contact the Texas Woman's University Office of Research and Sponsored Programs at 940-898-3378 or via e-mail at IRB@twu.edu

Name: _____ Date: _____

Signature: _____

TEXAS WOMAN'S UNIVERSITY

CONCENTIMIENTO PARA PARTICIPAR EN INVESTIGACIÓN

Título del estudio CPAP Finalización del estudio de valoración, Estudio descriptivo.

Investigador

Este estudio de tesis es llevado a cabo por [redacted] MSN, RN, como requisito para la licenciatura del Doctorado en Filosofía y Letras en ciencia de la enfermería de la escuela de posgrado de Texas Women's University. Correo electrónico: [redacted]; teléfono: [redacted]

Asesores

[redacted], PhD, RN	correo electrónico: [redacted]
[redacted] PhD, RN	correo electrónico: [redacted]
[redacted] PhD, RN	correo electrónico: [redacted]

Explicación y Propósito del Estudio de Investigación

El estudio de titulación es un estudio de sueno secundario. Durante este estudio el paciente recibirá tratamiento para la apnea obstructiva del sueño y los ajustes del tratamiento serán equilibrados para acomodar a cada paciente individualmente. Este estudio tiene como objetivo aprender sobre la gente que tendrá un estudio del sueño por primera vez. La investigadora quiere aprender lo que saben y creen sobre su salud, lo que saben y creen de Apnea obstructiva del sueño, y sobre el tratamiento de Apnea del sueño.

Descripción del Estudio

Si usted está de acuerdo en participar en este estudio, se le pedirá que llene una encuesta. Esto llevara de 10 a 15 minutos. Los resultados de su estudio del sueño se tomaran de su historial médico. Alguna información de su centro del sueño es necesaria. Al firmar esta forma, usted le dará permiso a la investigadora ([redacted]) de recopilar información sobre su estatura, peso, su puntuación en la evaluación del sueño, y sus resultados del estudio del sueño. Esta información se utiliza para describir el grupo de las personas que llenan esta encuesta.

Riesgos Potenciales

La pérdida de confidencialidad es un riesgo. Existe un riesgo potencial en la perdida de confidencialidad en todo correo electrónico, descarga electrónica, juntas electrónicas, y transacciones sobre el Internet. Su investigadora protegerá su información hasta el punto permitido por ley. Las encuestas serán codificadas; su nombre no aparecerá en ellas. Su información confidencial y esta forma serán almacenadas en forma segura y

separadas de las encuestas un armario bajo llave, dentro de una oficina cerrada con llave. La investigadora ha firmado un acuerdo de confidencialidad con este centro del sueño.
La coerción es un riesgo. Usted puede elegir no participar en este estudio de investigación a cualquier momento, aun cuando ya ha empezado a llenar la encuesta. La investigadora tratara de prevenir cualquier problema que podría ocurrir en esta investigación. Usted debe dar a conocer a la investigadora, Sra. Acker, inmediatamente si hay algún problema y ella la ayudara.
Sin embargo, Texas Women's University no proporciona servicios médicos ni asistencia financiera por lesiones que pueden suceder con su participación en este estudio. "Este estudio" consiste en su consentimiento en tomar y llenar la encuesta y no tiene nada que ver con el estudio del sueño.

Participación y Beneficios

Su participación en este estudio es opcional. Su elección en participar o no participar no afectara su experiencia del estudio del sueño. No hay ningún beneficio directo para usted.

Preguntas sobre este estudio

Usted será dado una copia de este consentimiento con su firma y fecha para que usted lo mantenga. Si usted tiene cualquier pregunta sobre este estudio de investigación pregunte a la investigadora. El número de teléfono está incluido en este formulario. Si usted tiene preguntas sobre sus derechos como participante en este estudio o la manera en el cual este estudio ha sido llevado a cabo, usted puede ponerse en contacto con las oficinas de estudios y programas patrocinados de Texas Women's University por teléfono a 940-898-3378.

Nombre: _____ Fecha: _____

Firma: _____

Code: _____

A. Demographic Information

1. What is your birthday? _____/_____/_____

2. What is your gender? Male □ Female □ Other □

3. What is your native language?
   - English ☐
   - Spanish ☐
   - Other ☐ explain: _____

4. How would you classify yourself?
   - White ☐
   - Hispanic/Latino ☐
   - Black/African American ☐
   - Native American/American Indian ☐
   - Asian ☐
   - Pacific Islander ☐
   - Other ☐ Explain: _____

5. What is the highest level of education that you have accomplished?
   - Some high school ☐
   - High school graduate or equivalent (GED) ☐
   - Trade/technical/vocational training ☐
   - Some college/ associate degree ☐
   - Four-year degree ☐
   - Post-graduate degree ☐

6. What is your current marital status?
   - Married ☐
   - Living with partner ☐
   - Single ☐

7. What is your current household income?
   - <10,000 ☐
   - 10,000-50,000 ☐
   - 50,000-100,000 ☐
   - >100,000 ☐

8. What is your employment status?
   - Unemployed ☐
   - Part time ☐
   - Full time ☐
   - Retired ☐

9. Do you have health insurance? Yes ☐ No ☐
   Is your insurance Medicaid/Medicare? Yes ☐ No ☐
   Is the sleep study covered by your insurance? Yes ☐ No ☐ Not sure ☐

10. Who referred you for this sleep study?
    - Sleep specialist ☐
    - Family physician ☐
    - Nurse Practitioner/Physician Assistant ☐

11. Have you had a sleep study before? Yes ☐ No ☐ What kind? _____

12. Have you ever used a CPAP device before? Yes ☐ No ☐

13. A follow up phone call is unlikely but may be needed. Will you agree to be contacted? Yes ☐ No ☐

    Contact phone number: home: _____ cell: _____

Code: _____

B. Health Value Scale

This part of the survey asks about your beliefs about health in general. Please circle the number that represents your level of agreement with the statement.

	Strongly Disagree	Disagree	Not sure/ neutral	Agree	Strongly Agree
If you don't have your health you don't have anything.	1	2	3	4	5
There are many things I care about more than my health	1	2	3	4	5
Good health is of only minor importance in a happy life	1	2	3	4	5
There is nothing more important than good health	1	2	3	4	5

C. Multidimensional Health Locus of Control Scale

Each item below is a belief statement with which you may agree or disagree. Under each statement is a scale, which ranges from strongly disagree (1) to strongly agree (6).
For each item we would like you to circle the number that represents the extent to which you agree or disagree with that statement. The more you agree with a statement, the higher will be the number you circle. The more you disagree with a statement; the lower will be the number you circle. Please make sure that you answer EVERY ITEM and that you circle ONLY ONE number per item. This is a measure of your personal beliefs; obviously, there are no right or wrong answers.

1= Strongly disagree (SD)	4=Slightly agree (A)
2= Moderately disagree (MD)	5= Moderately agree (MA)
3= Slightly disagree (D)	6= Strongly agree (SA)

		SD	MD	D	A	MA	SA
1	If I get sick, it is my own behavior that determines how soon I get well again.	1	2	3	4	5	6
2	No matter what I do, if I am going to get sick, I will get sick.	1	2	3	4	5	6
3	Having regular contact with my physician is the best way for me to avoid illness.	1	2	3	4	5	6
4	Most things that affect my health happen to me by accident.	1	2	3	4	5	6
5	Whenever I don't feel well, I should consult a medically trained professional.	1	2	3	4	5	6
6	I am in control of my health.	1	2	3	4	5	6
7	My family has a lot to do with my becoming sick or staying healthy.	1	2	3	4	5	6
8	When I get sick, I am to blame.	1	2	3	4	5	6
9	Luck plays a big part in determining how soon I will recover from an illness.	1	2	3	4	5	6
10	Health professionals control my health.	1	2	3	4	5	6
11	My good health is largely a matter of good fortune.	1	2	3	4	5	6
12	The main thing, which affects my health, is what I myself do	1	2	3	4	5	6
13	If I take care of myself, I can avoid illness.	1	2	3	4	5	6

Code: _____

		SD	MD	D	A	MA	SA
14	Whenever I recover from an illness, it's usually because other people (for example, doctors, nurses, family, friends) have been taking good care of me.	1	2	3	4	5	6
15	No matter what I do, I 'm likely to get sick.	1	2	3	4	5	6
16	If it's meant to be, I will stay healthy.	1	2	3	4	5	6
17	If I take the right actions, I can stay healthy	1	2	3	4	5	6
18	Regarding my health, I can only do what my doctor tells me to do.	1	2	3	4	5	6

D. Apnea Belief Scale

This part of the survey asks about your beliefs about sleep apnea and continuous positive airway pressure (CPAP). Answer each of these questions by circling the number that best represents your answer.

		Strongly Disagree	Disagree	Not sure/ neutral	Agree	Strongly Agree
1	If things become too much I generally do not go through with them.	1	2	3	4	5
2	CPAP is "the answer" to my sleep apnea.	1	2	3	4	5
3	Sleep apnea gets in the way of my friendships.	1	2	3	4	5
4	I intend to use the CPAP machine all night every night.	1	2	3	4	5
5	I believe using the CPAP mask will be a nuisance.	1	2	3	4	5
6	I am willing to ask for help when it is required.	1	2	3	4	5
7	CPAP is the best treatment for my health problems.	1	2	3	4	5
8	I am willing to follow the directions of medical staff "to the letter".	1	2	3	4	5
9	I believe that using CPAP is very confusing.	1	2	3	4	5
10	Wearing the CPAP mask will make falling asleep hard.	1	2	3	4	5
11	Once I make a decision, I stick with that decision.	1	2	3	4	5
12	Wearing the CPAP mask will improve the quality of my sleep.	1	2	3	4	5
13	I find it stressful to use new machinery or technology.	1	2	3	4	5
14	Good health is secondary to being able to do what I want in life.	1	2	3	4	5
15	I enjoy trying new things, like snorkeling.	1	2	3	4	5
16	I don't believe I have a sleep problem.	1	2	3	4	5
17	I find it embarrassing to ask for help.	1	2	3	4	5
18	Sleep apnea is my major health problem.	1	2	3	4	5
19	I believe that CPAP will make little difference to my sleep	1	2	3	4	5

Code: _____

		Strongly Disagree	Disagree	Not sure/ neutral	Agree	Strongly Agree
20	I want to improve my health.	1	2	3	4	5
21	I am confident that I will be able to use the CPAP machine as taught.	1	2	3	4	5
22	I would try anything that I thought might help my sleep apnea.	1	2	3	4	5
23	I believe that I know what is the best treatment for me.	1	2	3	4	5

E. Self Efficacy Measure for Sleep Apnea

This part of the survey asks you about sleep apnea and continuous positive airway pressure (known as CPAP), a treatment for sleep apnea. Please put a (✓) in the box under your answer to each question. Pick only one answer for each question. Please try to be as careful as possible. All information will be kept confidential.

1a	My chances of having high blood pressure compared to people my own age and sex who do not have sleep apnea are:	Very low ☐	Low ☐	High ☐	Very high ☐
2a	My chances of falling asleep while driving compared to people my own age and sex who do not have sleep apnea are:	Very low ☐	Low ☐	High ☐	Very high ☐
3a	My chances of having a heart attack compared to people my own age and sex who do not have sleep apnea are:	Very low ☐	Low ☐	High ☐	Very high ☐
4a	My chances of having difficulty concentrating compared to people my own age and sex who do not have sleep apnea are:	Very low ☐	Low ☐	High ☐	Very high ☐
5a	My chances of falling asleep during the day compared to people my own age and sex who do not have sleep apnea are:	Very low ☐	Low ☐	High ☐	Very high ☐
6a	My chances of having an accident because of falling asleep while driving compared to people my own age and sex who do not have sleep apnea are:	Very low ☐	Low ☐	High ☐	Very high ☐
7a	My chances of being depressed compared to people my own age and sex who do not have sleep apnea are:	Very low ☐	Low ☐	High ☐	Very high ☐
8a	My chances of having problems with sexual desire or sexual performance compared to people my own age and sex who do not have sleep apnea are:	Very low ☐	Low ☐	High ☐	Very high ☐
1b	If I do use CPAP I will decrease my chances of having an accident while driving.	Not at all true ☐	Barely true ☐	Somewhat true ☐	Very true ☐
2b	If I use CPAP then I will not snore.	Not at all true ☐	Barely true ☐	Somewhat true ☐	Very true ☐
3b	If I do not use CPAP I will be less alert during the day.	Not at all true ☐	Barely true ☐	Somewhat true ☐	Very true ☐

Code: _____

4b If I use CPAP then my job performance will improve	Not at all true	Barely true	Somewhat true	Very true
	☐	☐	☐	☐
5b If I use CPAP my relationship with my significant other and friends will improve	Not at all true	Barely true	Somewhat true	Very true
	☐	☐	☐	☐
6b If I use CPAP my bed partner will sleep better.	Not at all true	Barely true	Somewhat true	Very true
	☐	☐	☐	☐
7b If I use CPAP I will feel better.	Not at all true	Barely true	Somewhat true	Very true
	☐	☐	☐	☐
8b If I use CPAP I will be more active.	Not at all true	Barely true	Somewhat true	Very true
	☐	☐	☐	☐
9b If I use CPAP my desire and sexual performance will improve.	Not at all true	Barely true	Somewhat true	Very true
	☐	☐	☐	☐
1c I would use CPAP, even if it made me feel claustrophobic	Not at all true	Barely true	Somewhat true	Very true
	☐	☐	☐	☐
2c I would use CPAP, even if it will take me longer to get ready for bed.	Not at all true	Barely true	Somewhat true	Very true
	☐	☐	☐	☐
3c I would use CPAP nightly, even when I traveled.	Not at all true	Barely true	Somewhat true	Very true
	☐	☐	☐	☐
4c I would use CPAP, even if I have to wear a tight mask on my face at night.	Not at all true	Barely true	Somewhat true	Very true
	☐	☐	☐	☐
5c I would use CPAP, even if it made my nose stuffy.	Not at all true	Barely true	Somewhat true	Very true
	☐	☐	☐	☐
6c I would use CPAP, even if it were a bother.	Not at all true	Barely true	Somewhat true	Very true
	☐	☐	☐	☐
7c I would use CPAP, even if it disturbed my bed partner's sleep	Not at all true	Barely true	Somewhat true	Very true
	☐	☐	☐	☐
8c I would use CPAP, even if it made me feel embarrassed.	Not at all true	Barely true	Somewhat true	Very true
	☐	☐	☐	☐
9c I would use CPAP, even if I had to pay for some of the cost.	Not at all true	Barely true	Somewhat true	Very true
	☐	☐	☐	☐

Code: _____

A. Informacion Demografica

1. Cuando es su cumpleaños? ____/____/____

2. Cuál es su género? Masculino □ Femenino □ Otro □

3. Cuál es su lengua materna?
   - ingles ☐
   - español ☐
   - otro ☐ explique: _____

4. Como se clasifica usted?
   - raza blanca ☐
   - hispano/latino ☐
   - raza negra/afroamericano ☐
   - nativo americano/indio americano ☐
   - asiático ☐
   - islas del pacífico ☐
   - otro ☐ explique: _____

5. Cuál es el nivel más alto de educación que usted ha recibido?
   - Algún instituto ☐
   - Graduado de preparatoria o equivalente (GED) ☐
   - Entrenamiento de comercio/técnico/profesional ☐
   - Alguna educación superior/Grado asociado ☐
   - licenciatura ☐
   - maestria o doctorado ☐

6. Cuál es su estado civial actual?
   - Casado ☐
   - Viviendo con un compañero ☐
   - Soltero ☐

7. Cuál es su ingreso corriente de su hogar?
   - <10,000 ☐
   - 10,000-50,000 ☐
   - 50,000-100,000 ☐
   - >100,000 ☐

8. Cuál es su Estado de Empleo?
   - Desempleado ☐
   - Medio tiempo ☐
   - Tiempo completo ☐
   - Retirado ☐

9. Tiene usted seguro médico? Sí ☐ No ☐
   Su seguro es Medicaid/Medicare? Sí ☐ No ☐
   Su seguro cubre el estudio de sueño? Sí ☐ No ☐ No estoy seguro ☐

10. Quien lo refirió a este estudio de sueño?
    - Especialista de sueño ☐
    - Médico general ☐
    - Practicante de enfermería/ Asistente médico ☐

11. Ha tenido un estudio de sueño? Si ☐ No ☐ Que tipo? _____

12. Ha tenido una presión positiva continua en la vía aérea? Sí ☐ No ☐

13. Un seguimiento de llamada no es probable pero puede ser necesaria.
    Está de acuerdo en recibir llamada por teléfono? Sí ☐ No ☐
    Teléfono de contacto: casa: _____ celular: _____

Code: _____

B. Escala del valor de la salud

Esta parte de la encuentra hace preguntas sobre sus creencias sobre la salud en general. Favor de marcar con un círculo el número que representa su nivel de acuerdo con la declaración.

	Muy en desacuerdo	No estoy de acuerdo	No estoy seguro-neutral	De acuerdo	Muy de acuerdo
Si no tiene salud no tiene nada	1	2	3	4	5
Hay muchas otras cosas que me importan más que mi salud	1	2	3	4	5
La buena salud es solamente de menor importancia para una vida feliz	1	2	3	4	5
No hay nada más importante que la buena salud	1	2	3	4	5

C. Locus de Salud Multidimensional de la Escala de Control

Cada artículo que sigue es una breve declaración en cual usted puede estar de acuerdo o no estar de acuerdo. Bajo cada declaración hay una escala que oscila de "muy en desacuerdo" (1) a "muy de acuerdo" (6). Por cada declaración nos gustaría que hiciera un círculo en el número que representa el grado a la que usted está de acuerdo o no está de acuerdo con esa declaración. Lo mas de acuerdo que este con la declaración, mayor será el número. Lo menos de acuerdo que este con la declaración, menor será el número. Favor de contestar CADA PREGUNTA y haga SOLAMENTE UN CIRCULO por declaración. Esta es una medida de su creencia personal, no hay respuestas incorrectas.

1= Muy de desacuerdo (SD)	4= Ligeramente de acuerdo (A)
2= Moderadamente en desacuerdo (MD)	5= Moderadamente de acuerdo (MA)
3= Ligeramente en desacuerdo (D)	6= Muy de acuerdo (SA)

		SD	MD	D	A	MA	SA
1	Si me enfermo, es mi comportamiento el que determina que tan pronto me sienta bien.	1	2	3	4	5	6
2	No importa mi comportamiento. Si me voy a enfermar, me voy a enfermar.	1	2	3	4	5	6
3	El contacto regular con mi médico es la mejor manera de prevenir enfermedades.	1	2	3	4	5	6
4	La mayoría de las cosas que afectan mi salud me pasan por accidente.	1	2	3	4	5	6
5	Cuando no me siento bien, debería consultar a alguien con formación médica profesional.	1	2	3	4	5	6
6	Yo estoy en control de mi salud.	1	2	3	4	5	6
7	Mi familia tiene mucho que ver con mis enfermedades o con mantenerme saludable.	1	2	3	4	5	6
8	Cuando me enfermo, es mi culpa.	1	2	3	4	5	6
9	La suerte juega un papel importante en determinar que tan pronto me recuperare de una enfermedad.	1	2	3	4	5	6
10	Los profesionales de la salud controlan mi salud.	1	2	3	4	5	6
11	Mi buena salud es en gran medida una cuestión de buena fortuna.	1	2	3	4	5	6

Code: _____

		SD	MD	D	A	MA	SA
12	La cosa principal que afecta mi salud es lo que yo mismo hago.	1	2	3	4	5	6
13	Si yo me cuido, yo evito enfermedades.	1	2	3	4	5	6
14	Cuando yo me recupero de una enfermedad, por lo general es porqué otra gente (por ejemplo médicos, enfermeras, familia, amigos) me han dado buen cuidado.	1	2	3	4	5	6
15	No importa lo que hago, soy propenso a enfermarme.	1	2	3	4	5	6
16	Si es lo que debe ser, yo me mantendré saludable.	1	2	3	4	5	6
17	Si yo tomo las medidas adecuadas, me puedo mantener saludable.	1	2	3	4	5	6
18	Respecto a mi salud, solo puedo hacer lo que mi médico me dice.	1	2	3	4	5	6

D. Escala de Creencia de la Apnea

Esta parte de la encuesta hace preguntas sobre sus creencias de la apnea del sueño y la presión positiva continua en la vía aérea. Conteste cada pregunta haciendo un círculo en el número que mejor represente su respuesta.

		Muy en desacuerdo	No estoy de acuerdo	No estoy seguro-neutral	De acuerdo	Muy de acuerdo
1	Si las cosas se vuelven demasiado, por lo general no las termino.	1	2	3	4	5
2	La presión positiva continua en la vía aérea es la respuesta para mi apnea del sueño.	1	2	3	4	5
3	La apnea del sueño se interpone con mis amistades.	1	2	3	4	5
4	Tengo la intención de utilizar la máquina de presión positiva continua en la vía aérea toda la noche todas las noches.	1	2	3	4	5
5	Yo creo que el usar la máscara de presión positiva continua en la vía aérea será una molestia.	1	2	3	4	5
6	Estoy dispuesto a pedir ayuda cuando sea necesario.	1	2	3	4	5
7	La presión positiva continua en la vía aérea es el mejor tratamiento para mis problemas de salud.	1	2	3	4	5
8	Estoy dispuesto a seguir las instrucciones del personal médico al pie de la letra.	1	2	3	4	5
9	Yo creo que el uso de la presión positiva continua en la vía aérea es muy confuso.	1	2	3	4	5
10	El uso de la máscara hará de caer dormido muy difícil.	1	2	3	4	5
11	Una vez que haga una decisión, me quedo con esa decisión.	1	2	3	4	5

Code: _____

		Muy en desacuerdo	No estoy de acuerdo	No estoy seguro-neutral	De acuerdo	Muy de acuerdo
12	El uso de la máscara de la presión positiva continua en la vía aérea mejorara la calidad me mi sueño.	1	2	3	4	5
13	Lo encuentro lleno de tensión el usar nueva maquinaria o tecnología.	1	2	3	4	5
14	La buena salud es secundaria para ser capaz de hacer lo que quiero hacer en la vida.	1	2	3	4	5
15	Me gusta probar cosas nuevas, como bucear.	1	2	3	4	5
16	Yo no creo que tenga problema con el sueño.	1	2	3	4	5
17	Me da vergüenza pedir ayuda.	1	2	3	4	5
18	La apnea del sueño es mi mayor problema de salud.	1	2	3	4	5
19	Yo creo que la presión positiva continua en la vía aérea hará poca diferencia en mi sueño.	1	2	3	4	5
20	Yo quiero mejorar mi salud.	1	2	3	4	5
21	Estoy seguro que yo podre usar la maquina do presión positiva continua en la vía aérea como fui enseñado.	1	2	3	4	5
22	Me gustaría probar cualquier cosa que podría ayudar a mi apnea del sueño.	1	2	3	4	5
23	Yo creo que yo sé que tratamiento es mejor para mí.	1	2	3	4	5

E. Medida de la Eficacia Propia de la Apnea del Sueño

Esta parte de la encuesta hace preguntas sobre la apnea del sueño y la presión positiva continua en la vía aérea como tratamiento de la apnea del sueño. Favor de marcar (✓) su respuesta en la caja apropiada. Solo una respuesta por pregunta, sea lo más cuidadoso posible. Toda la información será confidencial.

9a	Mis posibilidades de tener alta presión sanguínea comparada a otra gente de mi edad y sexo que no padece de apnea del sueño son:	Muy bajo ☐	Bajo ☐	Alto ☐	Muy alto ☐
10a	Mis posibilidades de quedar dormido cuando manejando comparada a otra gente de mi edad y sexo que no padece de apnea del sueño son:	Muy bajo ☐	Bajo ☐	Alto ☐	Muy alto ☐
11a	Mis posibilidades de padecer un ataque al corazón comparado a otra gente de mi edad y sexo que no padece de apnea del sueño son:	Muy bajo ☐	Bajo ☐	Alto ☐	Muy alto ☐
12a	Mis posibilidades de tener dificultad para concentrarme comparada a otra gente de mi edad y sexo que no padece de apnea del sueño son:	Muy bajo ☐	Bajo ☐	Alto ☐	Muy alto ☐
13a	Mis posibilidades de quedarme dormido comparada a otra gente de mi edad y sexo que no padece de apnea del sueño son:	Muy bajo ☐	Bajo ☐	Alto ☐	Muy alto ☐

Code: _____

14a Mis posibilidades de tener un accidente por quedarme dormido cuando manejando comparada a otra gente de mi edad y sexo que no padece de apnea del sueño son:	Muy bajo	Bajo	Alto	Muy alto
	☐	☐	☐	☐
15a Mis posibilidades de estar deprimido comparada a otra gente de mi edad y sexo que no padece de apnea del sueño son:	Muy bajo	Bajo	Alto	Muy alto
	☐	☐	☐	☐
16a Mis posibilidades de tener dificultad con el deseo sexual o rendimiento sexual comparada a otra gente de mi edad y sexo que no padece de apnea del sueño son:	Muy bajo	Bajo	Alto	Muy alto
	☐	☐	☐	☐
10b Si si uso la presión positiva continua en la vía aérea voy a disminuir mis posibilidades de tener un accidente cuando maneje.	Nada cierto	Apenas cierto	Algo cierto	Muy cierto
	☐	☐	☐	☐
11b Si si uso la presión positiva continua en la vía aérea no voy a roncar.	Nada cierto	Apenas cierto	Algo cierto	Muy cierto
	☐	☐	☐	☐
12b Si no uso la presión positiva continua en la vía aérea seré menos alerto durante el día.	Nada cierto	Apenas cierto	Algo cierto	Muy cierto
	☐	☐	☐	☐
13b Si si uso la presión positiva continua en la vía aérea mi desempeño en el trabajo mejorara.	Nada cierto	Apenas cierto	Algo cierto	Muy cierto
	☐	☐	☐	☐
14b Si si uso la presión positiva continua en la vía aérea mi relación con mi pareja y con mis amigos mejorara.	Nada cierto	Apenas cierto	Algo cierto	Muy cierto
	☐	☐	☐	☐
15b Si si uso la presión positiva continua en la vía aérea mi pareja de cama dormirá mejor.	Nada cierto	Apenas cierto	Algo cierto	Muy cierto
	☐	☐	☐	☐
16b Si si uso la presión positiva continua en la vía aérea me sentiré mejor.	Nada cierto	Apenas cierto	Algo cierto	Muy cierto
	☐	☐	☐	☐
17b Si si uso la presión positiva continua en la vía aérea seré más activo.	Nada cierto	Apenas cierto	Algo cierto	Muy cierto
	☐	☐	☐	☐
18b Si si uso la presión positiva continua en la vía aérea mi deseo sexual o rendimiento sexual mejorara.	Nada cierto	Apenas cierto	Algo cierto	Muy cierto
	☐	☐	☐	☐
10c Yo usaría la presión positiva continua en la vía aérea aun que me haga sentir claustrofobo.	Nada cierto	Apenas cierto	Algo cierto	Muy cierto
	☐	☐	☐	☐
11c Yo usaría la presión positiva continua en la vía aérea aun que me tarde más en prepararme para la cama.	Nada cierto	Apenas cierto	Algo cierto	Muy cierto
	☐	☐	☐	☐
12c Yo usaría la presión positiva continua en la vía aérea todas las noches aun cuando viaje.	Nada cierto	Apenas cierto	Algo cierto	Muy cierto
	☐	☐	☐	☐
13c Yo usaría la presión positiva continua en la vía aérea incluso si tengo que usar una máscara apretada en mi cara por la noche.	Nada cierto	Apenas cierto	Algo cierto	Muy cierto
	☐	☐	☐	☐

Code: _____

14c Yo usaría la presión positiva continua en la vía aérea, incluso si hace que mi nariz se tape.	Nada cierto	Apenas cierto	Algo cierto	Muy cierto
	☐	☐	☐	☐
15c Yo usaría la presión positiva continua en la vía aérea, incluso si fuera una molestia.	Nada cierto	Apenas cierto	Algo cierto	Muy cierto
	☐	☐	☐	☐
16c Yo usaría la presión positiva continua en la vía aérea, incluso si le molesta el sueño a mi pareja de cama.	Nada cierto	Apenas cierto	Algo cierto	Muy cierto
	☐	☐	☐	☐
17c Yo usaría la presión positiva continua en la vía aérea, incluso si me hace sentir avergonzado.	Nada cierto	Apenas cierto	Algo cierto	Muy cierto
	☐	☐	☐	☐
18c Yo usaría la presión positiva continua en la vía aérea, incluso si tengo que pagar una parte del costo.	Nada cierto	Apenas cierto	Algo cierto	Muy cierto
	☐	☐	☐	☐

APPENDIX B

IRB Approval

Institutional Review Board
Office of Research and Sponsored Programs
P.O. Box 425619, Denton, TX 76204-5619
940-898-3378
email: IRB@twu.edu
http://www.twu.edu/irb.html

DATE: October 7, 2016

TO: Ms. Katelijne Acker
Nursing

FROM: Institutional Review Board (IRB) - Denton

Re: Approval for CPAP Titration Study Completion: A Correlational Study (Protocol #: 19185)

The above referenced study has been reviewed and approved by the Denton IRB (operating under FWA00000178) on 10/7/2016 using an expedited review procedure. This approval is valid for one year and expires on 10/7/2017. The IRB will send an email notification 45 days prior to the expiration date with instructions to extend or close the study. It is your responsibility to request an extension for the study if it is not yet complete, to close the protocol file when the study is complete, and to make certain that the study is not conducted beyond the expiration date.

If applicable, agency approval letters must be submitted to the IRB upon receipt prior to any data collection at that agency. A copy of the approved consent form with the IRB approval stamp is enclosed. Please use the consent form with the most recent approval date stamp when obtaining consent from your participants. A copy of the signed consent forms must be submitted with the request to close the study file at the completion of the study.

Any modifications to this study must be submitted for review to the IRB using the Modification Request Form. Additionally, the IRB must be notified immediately of any adverse events or unanticipated problems. All forms are located on the IRB website. If you have any questions, please contact the TWU IRB.

cc. Dr. Anita Hufft, Nursing
Dr. Elizabeth Restrepo, Nursing
Graduate School

Institutional Review Board
Office of Research and Sponsored Programs
P.O. Box 425619, Denton, TX 76204-5619
940-898-3378
email: IRB@twu.edu
http://www.twu.edu/irb.html

DATE: February 16, 2017

TO: Ms. Katelijne Acker
Nursing

FROM: Institutional Review Board - Denton

Re: Notification of Approval for Modification for CPAP Titration Study Completion: A Correlational Study (Protocol #: 19185)

The following modification(s) have been approved by the IRB:

Araceli Colmenero is added as a student research assistant. Human subjects training has been completed and her certificate has been submitted to the IRB.

cc. Dr. Elizabeth Restrepo, Nursing

FOR COMPLIANCE OFFICE USE ONLY:	
IRB#	95-16
Date Received:	

Institutional Review Board (IRB) Authorization Agreement

Texas A&M University-Corpus Christi

TEXAS A&M UNIVERSITY CORPUS CHRISTI
RESEARCH & GRADUATE STUDIES

Name of Institution or Organization Providing IRB Review *(Institution/Organization A)*	Texas Woman's University
IRB Registration #	IRB00000829
Federalwide Assurance (FWA) #	FWA00000178

Name of Institution or Organization Relying on the Designated IRB *(Institution/Organization B)*	Texas A&M University - Corpus Christi
IRB Registration #	#IORG0000876
Federalwide Assurance (FWA) #	FWA #00011281

The Officials signing below agree Institution/Organization B may rely on the designated IRB for review and continuing oversight of the human subjects research described below: (*check one*)

☒ This agreement is limited to the following specific protocol(s):

Name of Research Project:	CPAP Titration Completion: A Correlational Study
Name of Principal Investigator:	Katelijne Acker
Sponsor or Funding Agency:	n/a
Award Number, if any:	

☒ Other

Describe: TWU IRB Protocol # 19185

The review performed by the designated IRB will meet the human subject protection requirements of Institution B's OHRP-approved FWA. The IRB at Institution A will follow written procedures for reporting its findings and actions to appropriate officials at Institution B. Relevant minutes of IRB meetings will be made available to Institution B upon request. Institution B remains responsible for ensuring compliance with the IRB's determinations and with the Terms of its OHRP-approved FWA. This document must be kept on file by both parties and provided to OHRP upon request.

(Institution/Organization A)

Signature of IRB Official:	Jennifer Martin
Typed Name:	Jennifer Martin, PhD
Title:	Interim Provost and Vice President for Academic Affairs
Date:	10/12/16

(Institution/Organization B)

Signature of IRB Official:

Typed Name: Luis Cifuentes, Ph.D.

Title: Vice-President for Research, Commercialization and Outreach

Date: 10 14. 16

APPENDIX C

Protection of Human Subjects in Research

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI)

SOCIAL AND BEHAVIORAL RESPONSIBLE CONDUCT OF RESEARCH CURRICULUM COMPLETION REPORT

Printed on 10/19/2014

LEARNER	Katelijne Acker (ID: 4458087)
DEPARTMENT	Nursing
EMAIL	kacker1@twu.edu
INSTITUTION	Texas Woman's University
EXPIRATION DATE	

SOCIAL AND BEHAVIORAL RESPONSIBLE CONDUCT OF RESEARCH : This course is for investigators, staff and students with an interest or focus in **Social and Behavioral** research. This course contains text, embedded case studies AND quizzes.

COURSE/STAGE:	RCR/1
PASSED ON:	10/19/2014
REFERENCE ID:	14287337

REQUIRED MODULES	**DATE COMPLETED**	**SCORE**
Responsible Conduct of Research (RCR) Course Introduction	10/19/14	No Quiz
Research Misconduct (RCR-SBE)	10/19/14	5/5 (100%)
Data Management (RCR-SBE)	10/19/14	5/5 (100%)
Authorship (RCR-SBE)	10/19/14	5/5 (100%)
Peer Review (RCR-SBE)	10/19/14	5/5 (100%)
Mentoring (RCR-Interdisciplinary)	10/19/14	5/5 (100%)
Conflicts of Interest (RCR-SBE)	10/19/14	5/5 (100%)
Collaborative Research (RCR-SBE)	10/19/14	5/5 (100%)
ELECTIVE MODULES	**DATE COMPLETED**	**SCORE**
Case Study - In the Field, No One Will Know (RCR-Humanities)	10/19/14	3/3 (100%)

For this Completion Report to be valid, the learner listed above must be affiliated with a CITI Program participating institution or be a paid Independent Learner. Falsified information and unauthorized use of the CITI Program course site is unethical, and may be considered research misconduct by your institution.

Paul Braunschweiger Ph.D.
Professor, University of Miami
Director Office of Research Education
CITI Program Course Coordinator

CITI PROGRAM

Completion Date 14-Sep-2014
Expiration Date 13-Sep-2017
Record ID 13958964

This is to certify that:

Araceli Colmenero

Has completed the following CITI Program course:

Human Research (Curriculum Group)
Students conducting no more than minimal risk research (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

University of Texas at San Antonio

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?w5149eeff-354d-4b9b-9729-d9b59887c4b5-13958964

APPENDIX D

Letters of Agreement

Bay Area Sleep
Evaluation Center, LLC.

Bay Area Sleep Evaluation Center

ACCREDITED BY THE AMERICAN ACADEMY OF SLEEP MEDICINE
6000 South Staples St. 408 Corpus Christi, TX 78413
www.basectx.com
Office: (361)852-9200 Fax: (361)852-9204

Attn: Texas Woman's University-Denton Institutional Review Board
Texas A&M Corpus Christi Institutional Review Board

I have spoken with Katelijne Acker about her study titled "CPAP Titration Study Completion: a Descriptive Study". I understand that she will ask the patients to fill out a survey and will also need to collect information from the patient's records. I grant her permission to conduct her study at the Bay Area Sleep Evaluation Center. I have the authority to do so.

If I have any further questions about this research study I understand that Katelijne Acker can be reached at (361) 779-0872 or via e-mail at katelijne.acker@tamucc.edu. I also understand that if I have any questions regarding this IRB approval I can contact Nicki Cohen, Chair of the TWU Institutional Review Board, at (940) 898- 2523 or via e-mail at ncohen@twu.edu. Dr. Yolanda Keys is the vice chair of the IRB at Texas A&M Corpus Christi and can be reached at (361) 825-0557 or via email at Yolanda.Keys@tamucc.edu.

Roxanne & Richard Vela
Owners
Bay Area Sleep Evaluation Center
6000 S. Staples St. #408
Corpus Christi Texas 78413
(361) 852-9200

TEXAS A&M UNIVERSITY
CORPUS CHRISTI

COLLEGE OF NURSING AND HEALTH SCIENCES
6300 OCEAN DRIVE, UNIT 5805
CORPUS CHRISTI, TEXAS 78412-5805
O 361.825.2648 • F 361.825.2484

August 26, 2016

To: Mr. and Mrs. Vela
From: Katelijne Acker, MSN, RN
Re: Sleep Apnea research study

Dear Mr. and Mrs. Vela,

After successfully defending my research proposal my professors and I agreed that the title of my study should be altered. In the permission letter you signed the title indicates that the study is descriptive. To better reflect the purpose of the study we decided that the title should be changed to 'CPAP Titration Completion: A Correlational Study'. The change in the title does not indicate any change in the study protocol or its purpose but attempts to convey the true purpose of the study.

I appreciate your willingness to let me gather data at the Bay Area Sleep Evaluation Center and I look forward to a fruitful cooperation.

Sincerely,

Katelijne Acker

Katelijne Acker, MSN, RN

Christiancare
SLEEP CENTER, LLC

Attn: Texas Woman's University-Denton Institutional Review Board
Texas A&M Corpus Christi Institutional Review Board

I have spoken with Katelijne Acker about her study titled "CPAP Titration No Shows: a Descriptive Study". I understand that she will ask the patients to fill out a survey and will also need to collect information from the patient's records. I grant her permission to conduct her study at the Christian Care Sleep Centers Center. I have the authority to do so.

If I have any further questions about this research study I understand that Katelijne Acker can be reached at (361) 779-0872 or via e-mail at katelijne.acker@tamucc.edu. I also understand that if I have any questions regarding this IRB approval I can contact Nicki Cohen, Chair of the TWU Institutional Review Board, at (940) 898- 2523 or via e-mail at ncohen@twu.edu. Dr. Yolanda Keys is the vice chair of the IRB at Texas A&M Corpus Christi and can be reached at (361) 825-0557 or via email at Yolanda.Keys@tamucc.edu.

Gino Avolio
General Manager
Christian Care Sleep Centers

4455 SPID Suite #6
Corpus Christi Texas 78411
(361) 723-2130

1702 US Hwy 181 Suite A 10
Portland Texas 78374
(361) 704-6789

TEXAS A&M UNIVERSITY
CORPUS CHRISTI

College of Nursing and Health Sciences
6300 Ocean Drive, Unit 5805
Corpus Christi, Texas 78412-5805
O 361.825.2648 • F 361.825.2484

August 26, 2016

To: Ms. Maraist
From: Katelijne Acker, MSN, RN
Re: Sleep Apnea research study

Dear Ms. Maraist,

After successfully defending my research proposal my professors and I agreed that the title of my study should be altered. In the permission letter you signed the title indicates that the study is descriptive. To better reflect the purpose of the study we decided that the title should be changed to 'CPAP Titration Completion: A Correlational Study'. The change in the title does not indicate any change in the study protocol or its purpose but attempts to convey the true purpose of the study.

I appreciate your willingness to let me gather data at Chrisitan Care Sleep Centers and I look forward to a fruitful cooperation.

Sincerely,

Katelijne Acker

Katelijne Acker, MSN, RN

Premier Sleep Disorders Center
Sleep sound • Sleep safe • Sleep well
111 North Park Drive
Victoria, Texas 77901
Phone: (361) 572-9654 Fax: (361) 485-2233

July 12, 2016

Attn: Texas Woman's University-Denton Institutional Review Board
Texas A&M Corpus Christi Institutional Review Board

I have spoken with Katelijne Acker about her study titled "CPAP Titration Study Completion: a Descriptive Study". I understand that she will ask the patients to fill out a survey and will also need to collect information from the patient's records. I grant her permission to conduct her study at the Premier Sleep Disorders Centers. I have the authority to do so.

If I have any further questions about this research study I understand that Katelijne Acker can be reached at (361) 779-0872 or via e-mail at katelijne.acker@tamucc.edu. I also understand that if I have any questions regarding this IRB approval I can contact Nicki Cohen, Chair of the TWU Institutional Review Board, at (940) 898- 2523 or via e-mail at ncohen@twu.edu. Dr. Yolanda Keys is the vice chair of the IRB at Texas A&M Corpus Christi and can be reached at (361) 825-0557 or via email at Yolanda.Keys@tamucc.edu.

Deyanira Morgan
Premier Sleep Disorders Centers

111 Northpark Dr.
Victoria, Texas 77901
(361) 572-9654

2621 Hwy 35 North
Rockport, Texas 78382
(361) 729-1827

TEXAS A&M UNIVERSITY
CORPUS CHRISTI

College of Nursing and Health Sciences
6300 Ocean Drive, Unit 5805
Corpus Christi, Texas 78412-5805
O 361.825.2648 · F 361.825.2484

August 26, 2016

To: Ms. Morgan
From: Katelijne Acker, MSN, RN
Re: Sleep Apnea research study

Dear Ms. Morgan,

After successfully defending my research proposal my professors and I agreed that the title of my study should be altered. In the permission letter you signed the title indicates that the study is descriptive. To better reflect the purpose of the study we decided that the title should be changed to 'CPAP Titration Completion: A Correlational Study'. The change in the title does not indicate any change in the study protocol or its purpose but attempts to convey the true purpose of the study.

I appreciate your willingness to let me gather data at the Premier Sleep Disorder Centers and I look forward to a fruitful cooperation.

Sincerely,

Katelijne Acker

Katelijne Acker, MSN, RN

TORR
SLEEP CENTER

4639 Corona Suite 45
Corpus Christi, TX 78411
361-852-8298Fax: 361-852-8453

Joint Commission
Accredited Since 2010

Attn: Texas Woman's University-Denton Institutional Review Board
Texas A&M Corpus Christi Institutional Review Board

I have spoken with Katelijne Acker about her study titled "CPAP Titration study completion: a Descriptive Study". I understand that she will ask the patients to fill out a survey and will also need to collect information from the patient's records. I grant her permission to conduct her study at the Torr Sleep Center. I have the authority to do so. If I have any further questions about this research study I understand that Katelijne Acker can be reached at (361) 779-0872 or via e-mail at katelijne.acker@tamucc.edu. I also understand that if I have any questions regarding this IRB approval I can contact Nicki Cohen, Chair of the TWU Institutional Review Board, at (940) 898- 2523 or via e-mail at ncohen@twu.edu. Dr. Yolanda Keys is the vice chair of the IRB at Texas A&M Corpus Christi and can be reached at (361) 825-0557 or via email at Yolanda.Keys@tamucc.edu.

Raymond Aguilar
President

Torr Sleep Center
4639 Corona Drive
Corpus Christi Texas 78411-5401
(361) 813-8954

TEXAS A&M UNIVERSITY
CORPUS CHRISTI

COLLEGE OF NURSING AND HEALTH SCIENCES
6300 OCEAN DRIVE, UNIT 5805
CORPUS CHRISTI, TEXAS 78412-5805
O 361.825.2648 • F 361.825.2484

August 26, 2016

To: Mr. Aguilar
From: Katelijne Acker, MSN, RN
Re: Sleep Apnea research study

Dear Mr. Aguilar,

After successfully defending my research proposal my professors and I agreed that the title of my study should be altered. In the permission letter you signed the title indicates that the study is descriptive. To better reflect the purpose of the study we decided that the title should be changed to 'CPAP Titration Completion: A Correlational Study'. The change in the title does not indicate any change in the study protocol or its purpose but attempts to convey the true purpose of the study.

I appreciate your willingness to let me gather data at the TORR Sleep Center and I look forward to a fruitful cooperation.

Sincerely,

Katelijne Acker

Katelijne Acker, MSN, RN

APPENDIX E

Biomedical Data Collected from Medical Record

Additional Information

Collected from the medical record

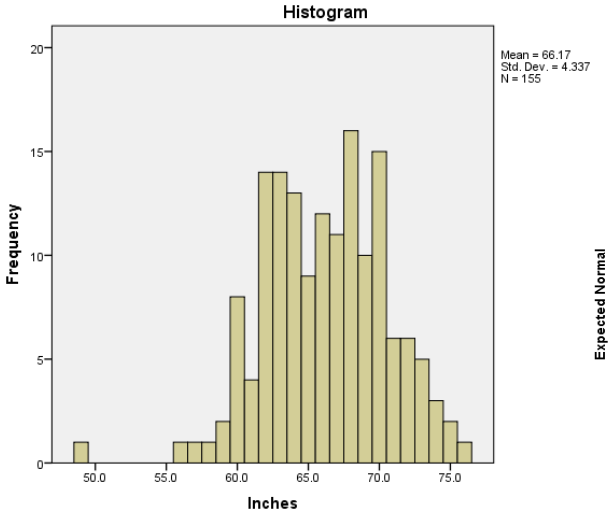
1. Epworth Sleepiness Scale Score: _____
2. Study Date: ____/____/____
3. Diagnostic study: Yes ☐ No ☐
4. Split night study: Yes ☐ No ☐
5. Height: Weight: BMI:
6. AHI: RDI: Lowest O2 Sat:
7. OSA Diagnosis: Yes ☐ No ☐
8. CPAP recommended: Yes ☐ No ☐
9. CPAP Titration Study Completed: Yes ☐ No ☐

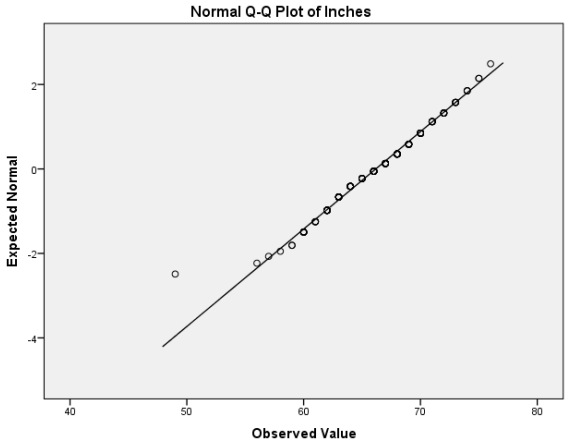
   Date: _____/____/_____
10. Copy of Patient Satisfaction Survey Included?

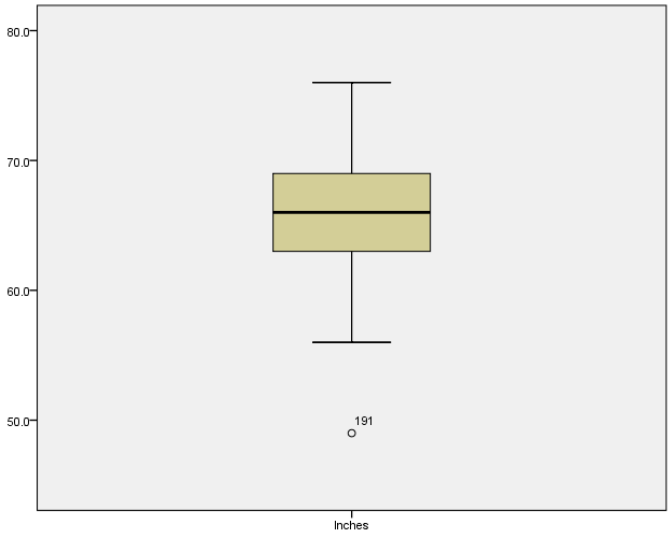
APPENDIX F

Histograms, Q-Q Plots, and Box Plots for Continuous Variables

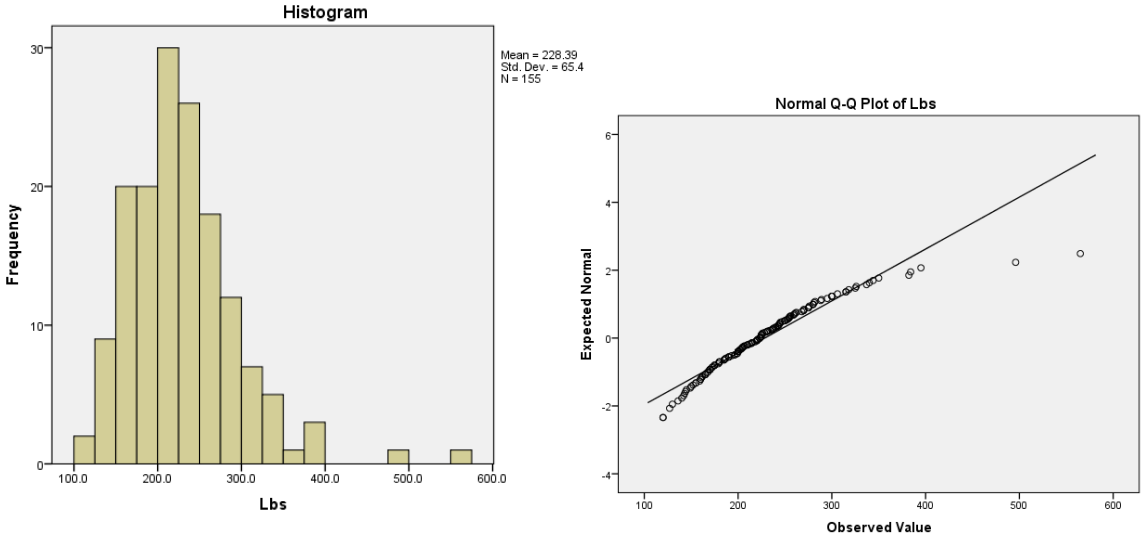
Height

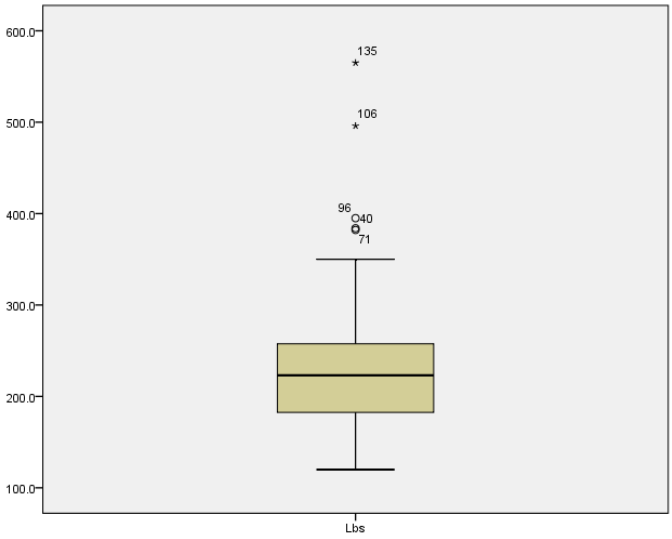

Histogram
Mean = 66.17
Std. Dev. = 4.337
N = 155
Frequency
Inches


Normal Q-Q Plot of Inches
Expected Normal
Observed Value

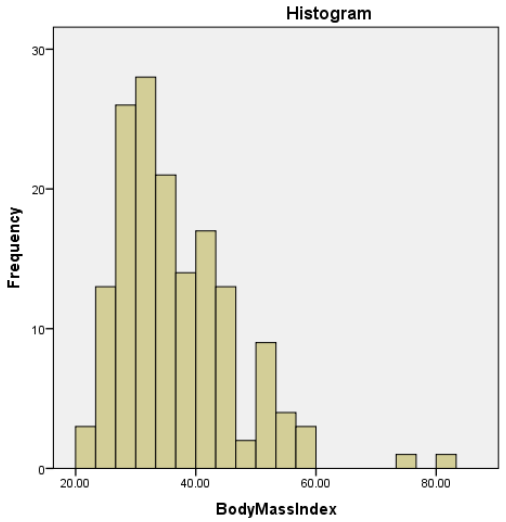

191
Inches

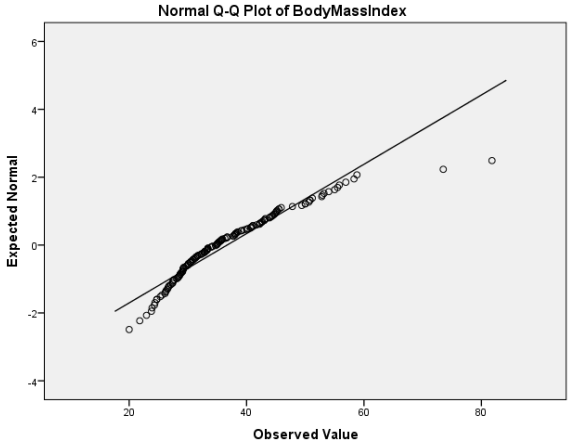
Weight

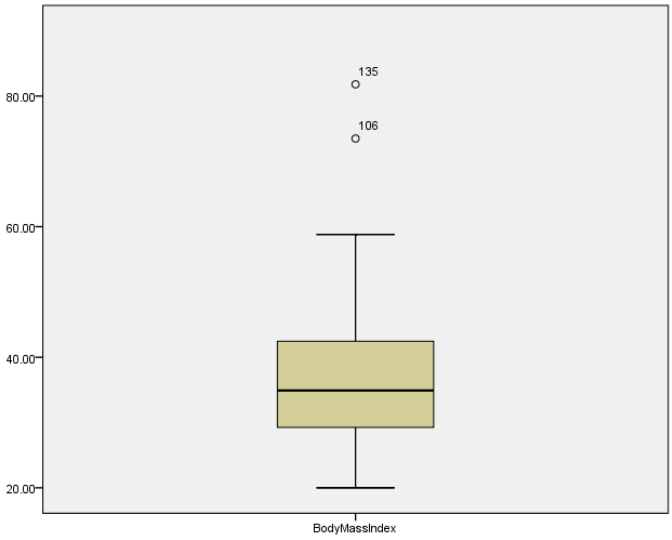

Histogram
Mean = 228.39
Std. Dev. = 65.4
N = 155
Frequency
Lbs
Normal Q-Q Plot of Lbs
Expected Normal
Observed Value


135
106
96
40
71
Lbs

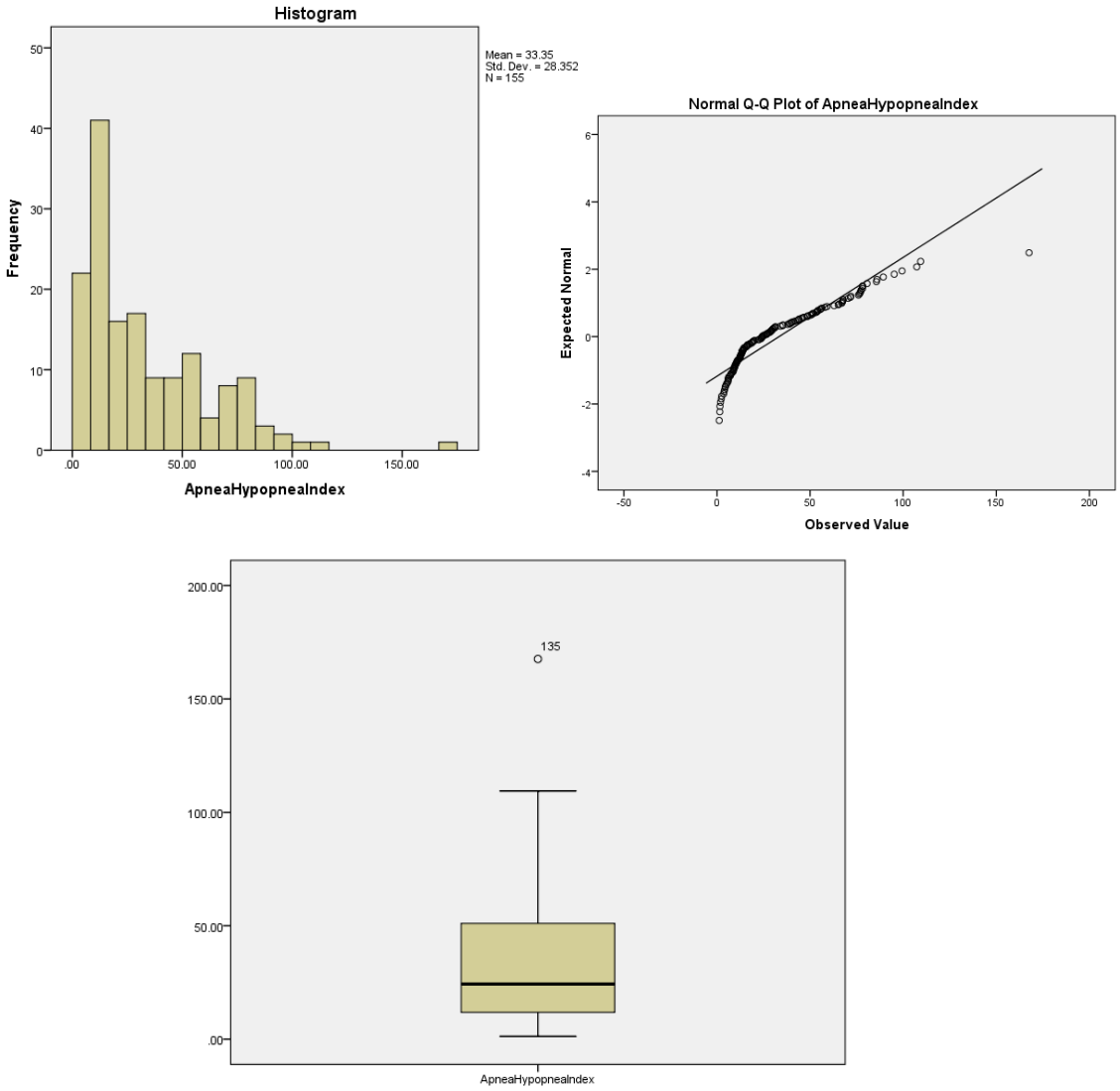
BMI


Histogram
Mean = 36.69
Std. Dev. = 9.793
N = 155
Frequency
BodyMassIndex

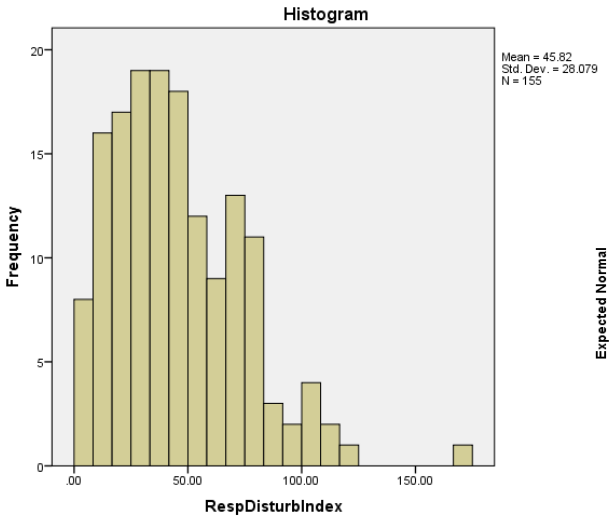

Normal Q-Q Plot of BodyMassIndex
Expected Normal
Observed Value

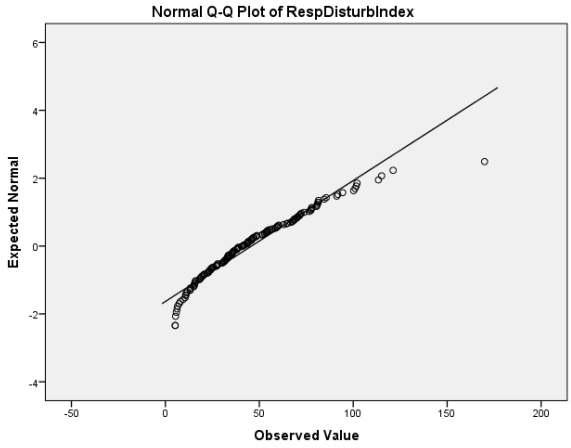

135
106
BodyMassIndex

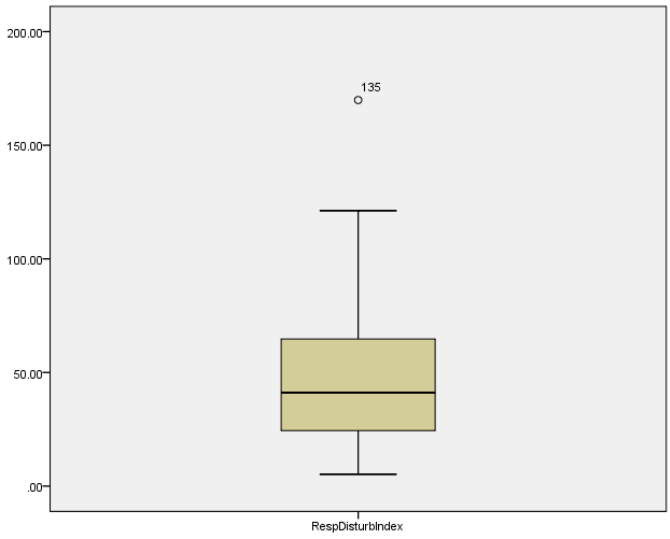
AHI


Histogram
Mean = 33.35
Std. Dev. = 28.352
N = 155
Frequency
ApneaHypopnealndex
Normal Q-Q Plot of ApneaHypopnealndex
Expected Normal
Observed Value
135
ApneaHypopnealndex

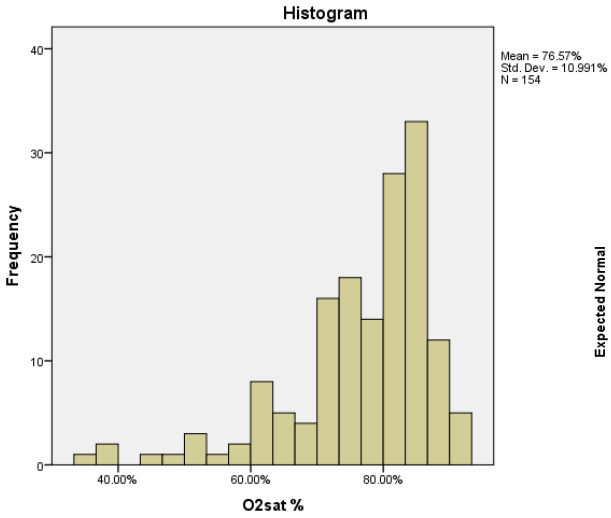
RDI

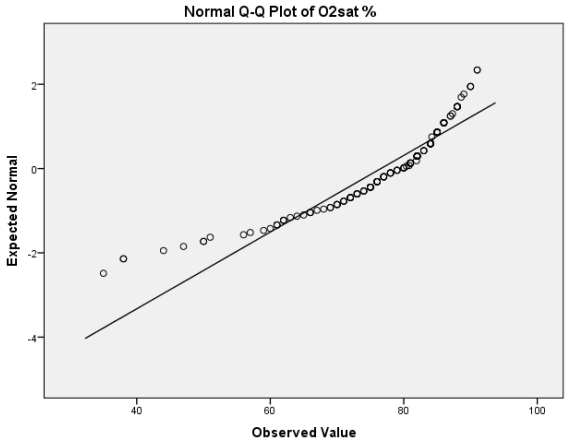


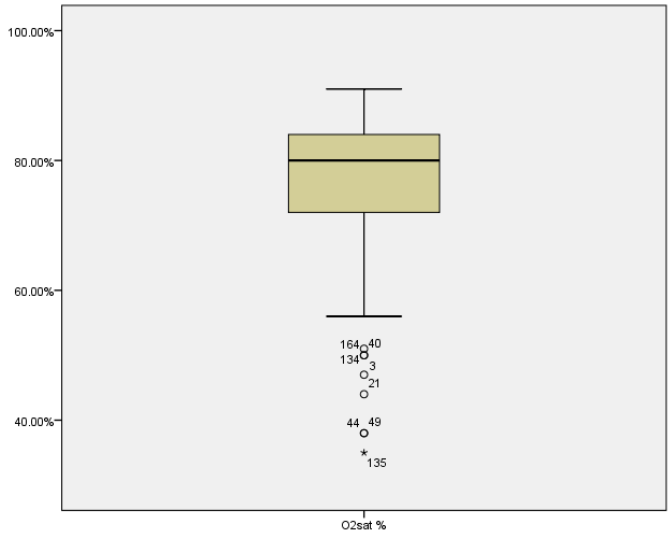




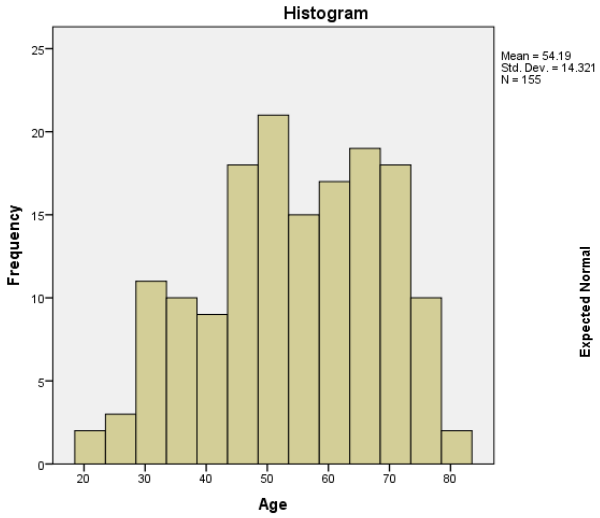
O2 Saturation

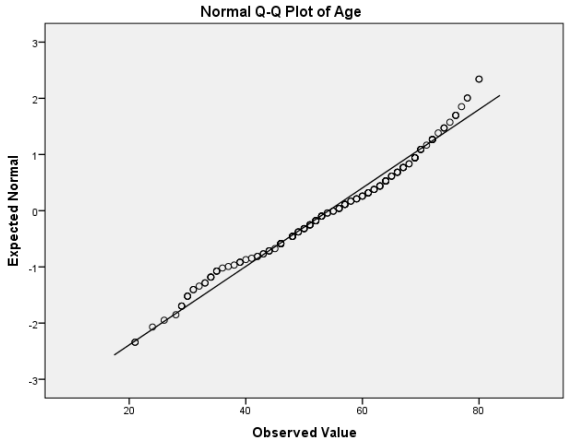

Histogram
Mean = 76.57%
Std. Dev. = 10.991%
N = 154
Frequency
O2sat %

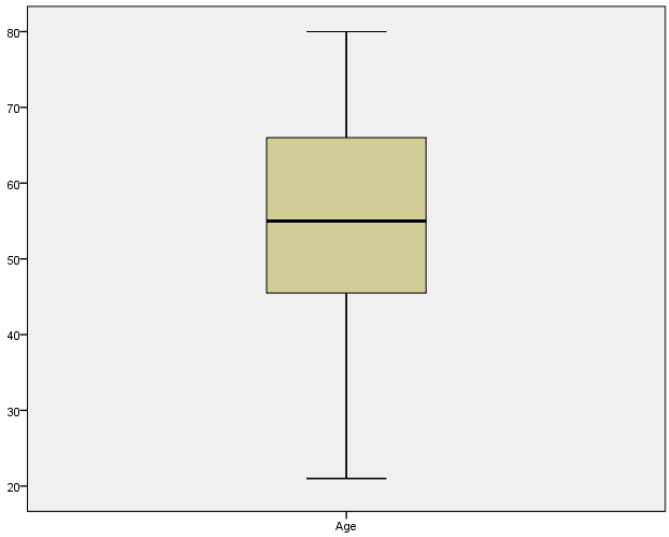

Normal Q-Q Plot of O2sat %
Expected Normal
Observed Value


O2sat %

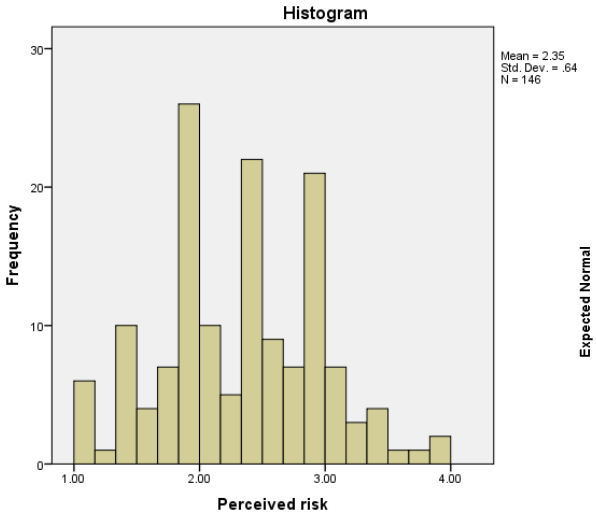
Age

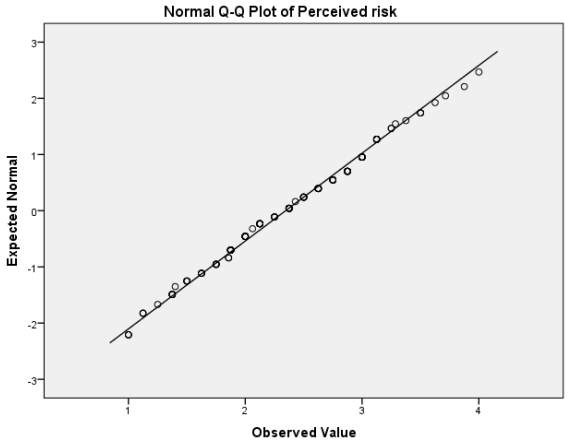






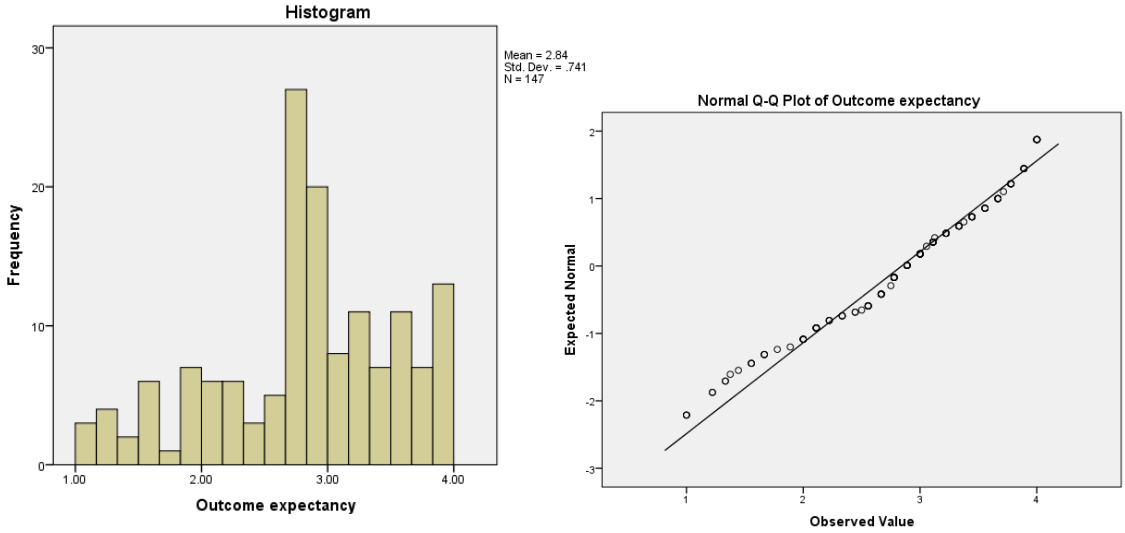
Perceived Risk

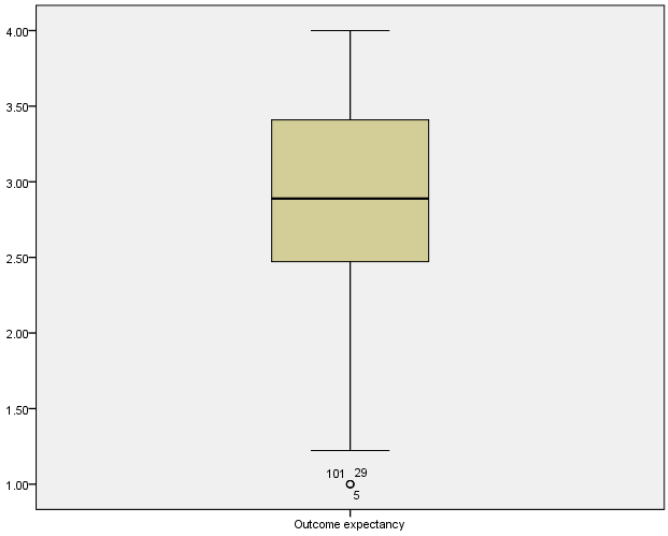

Histogram
Mean = 2.35
Std. Dev. = .64
N = 146
Frequency
Perceived risk


Normal Q-Q Plot of Perceived risk
Expected Normal
Observed Value

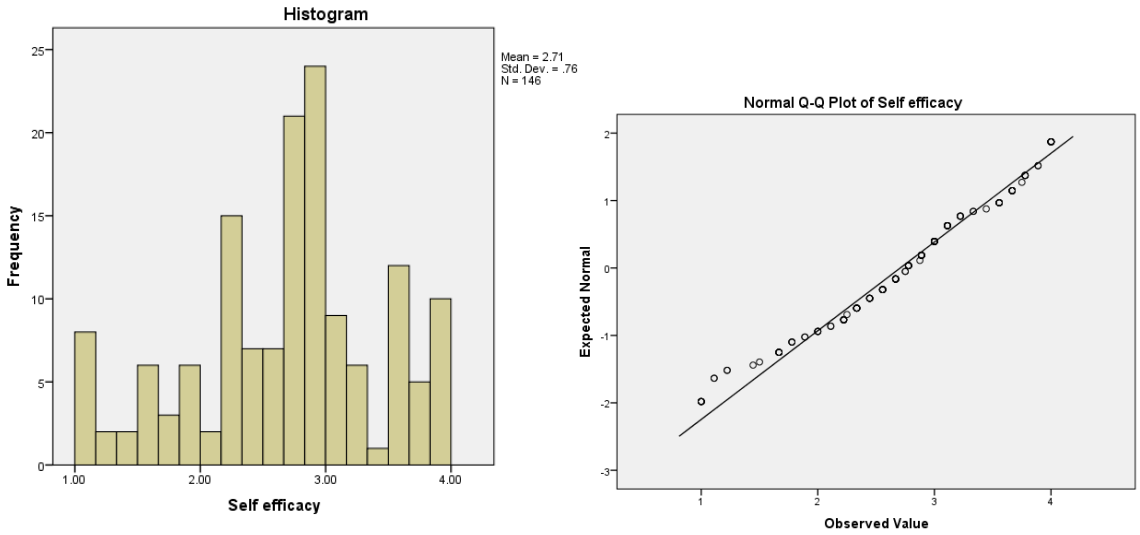

Perceived risk

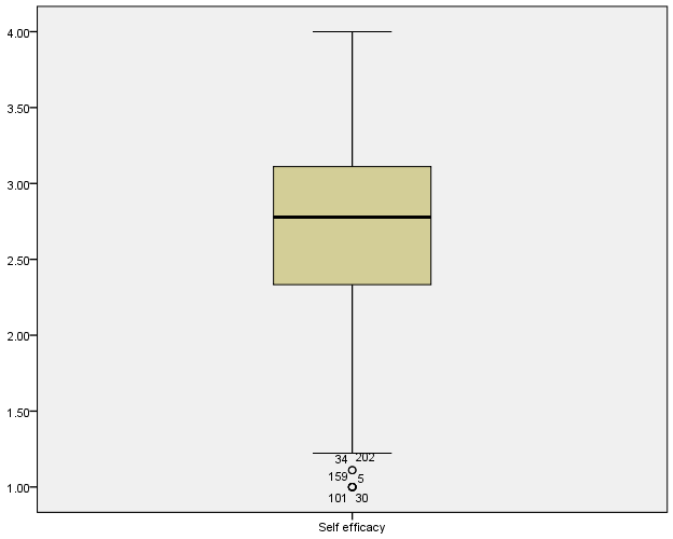
Outcome Expectancy



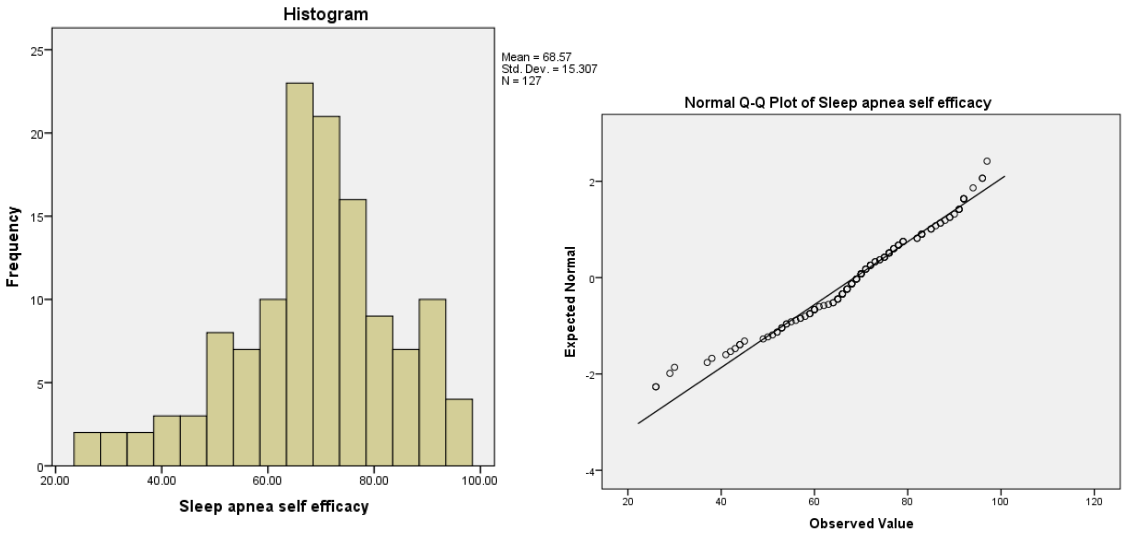


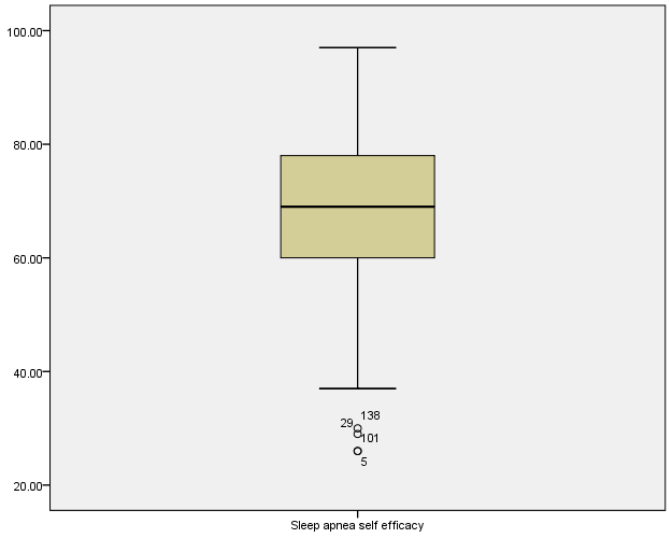
Self-Efficacy



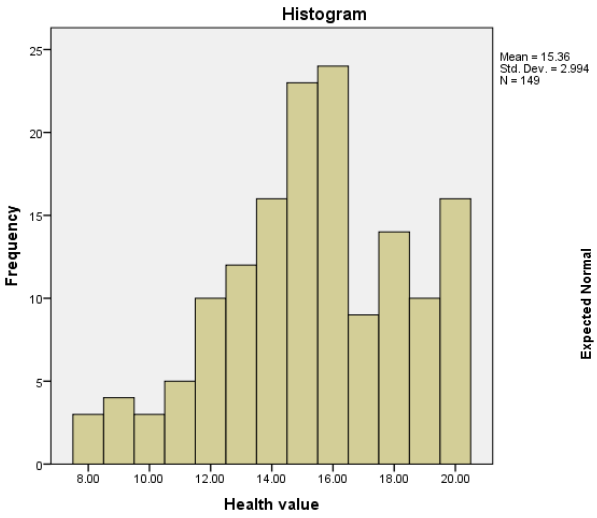


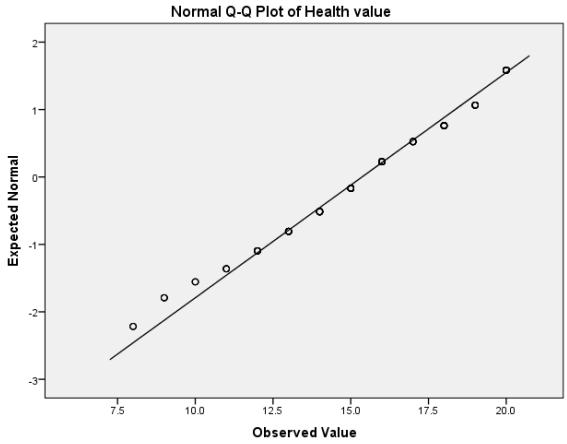
Sleep Apnea Self-Efficacy



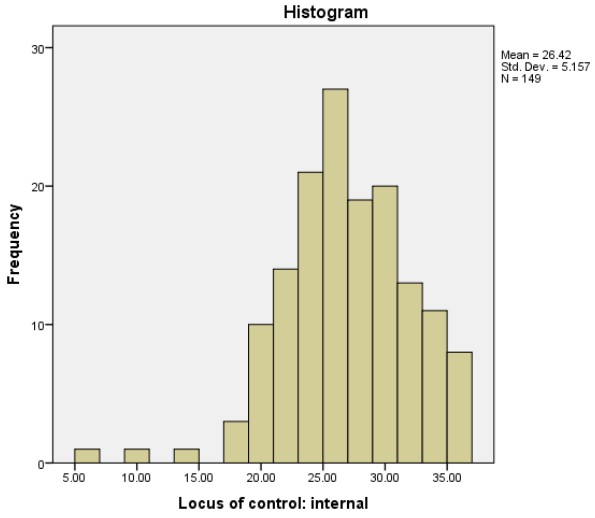


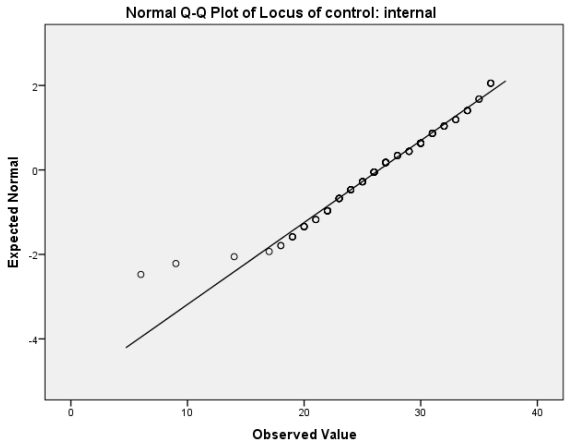
Health Value

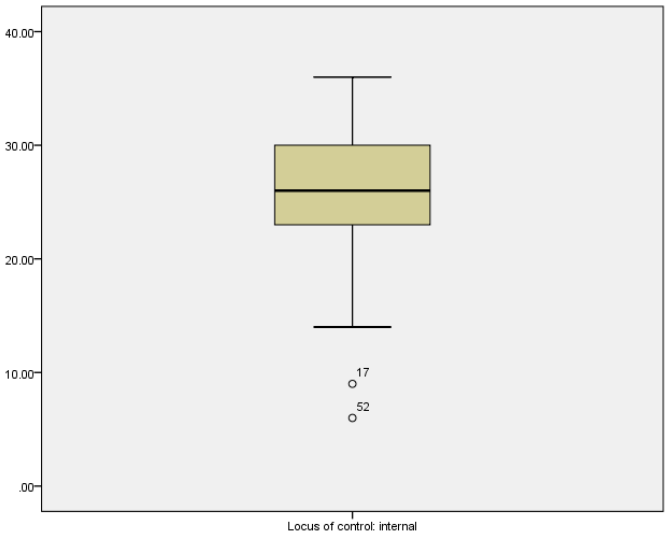




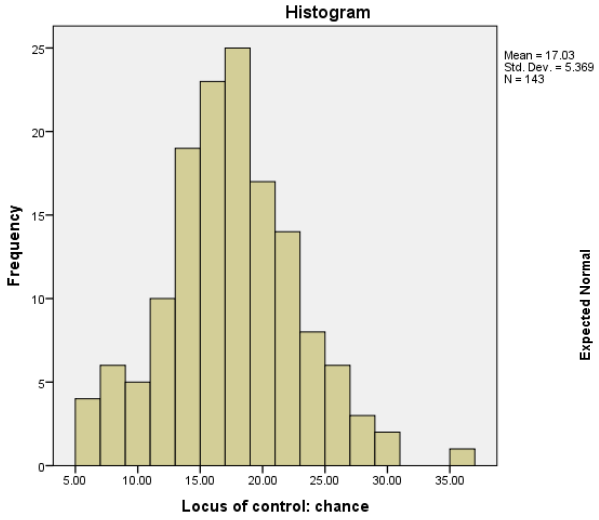
Internal Locus of Control

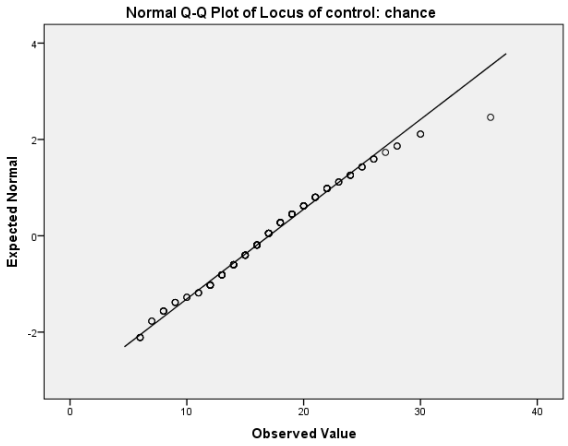


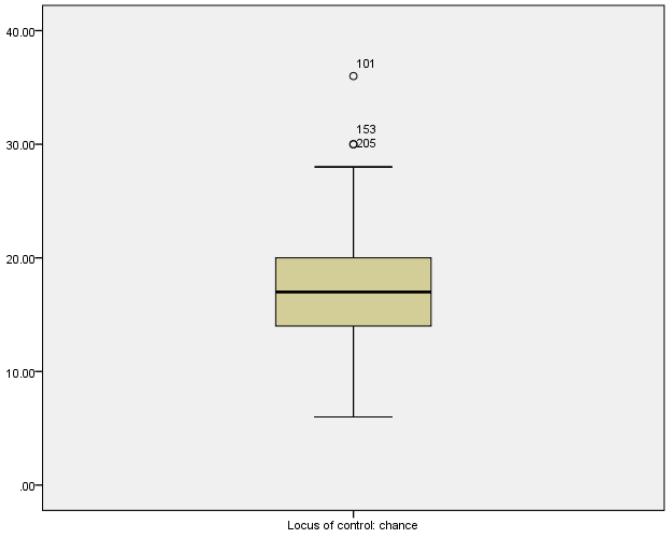




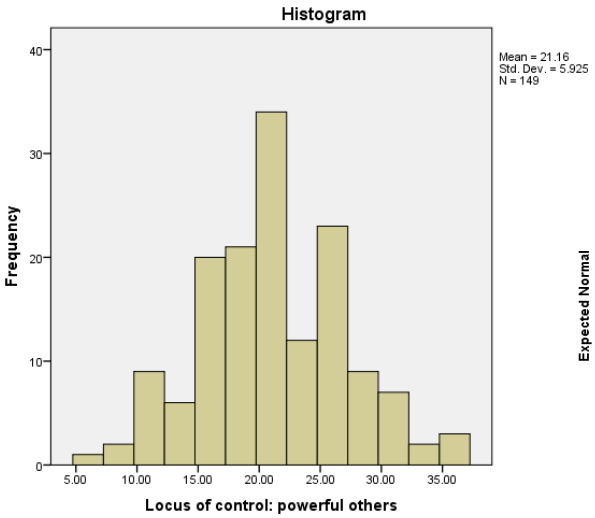
Chance Locus of Control

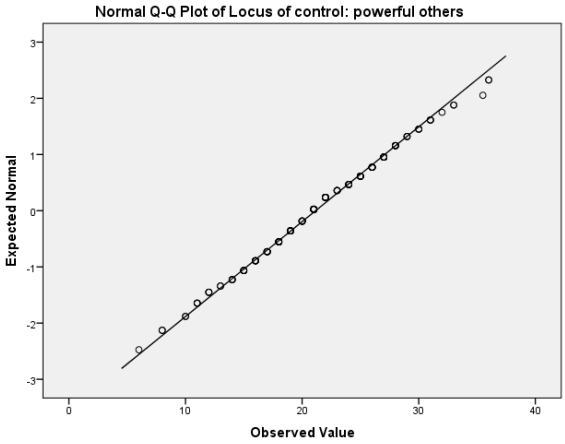


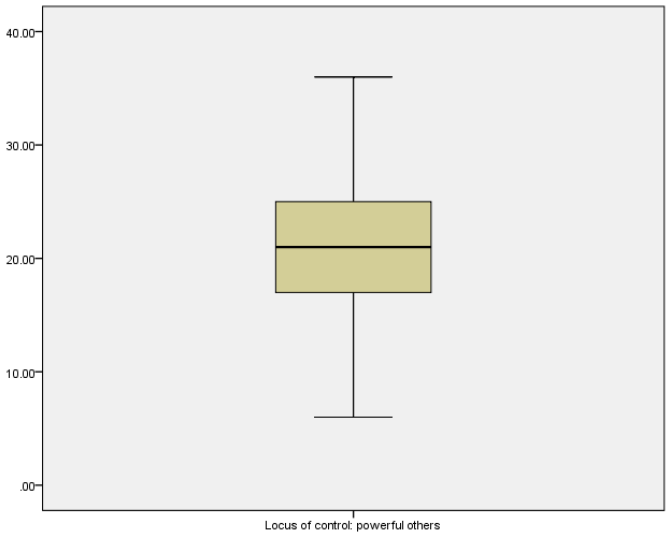




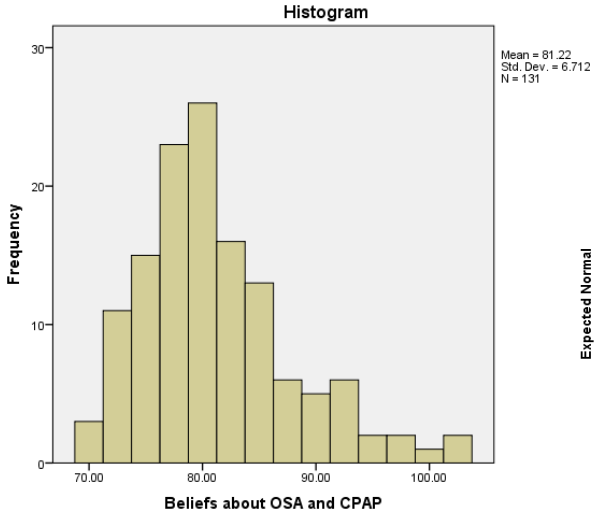
Powerful Others Locus of Control

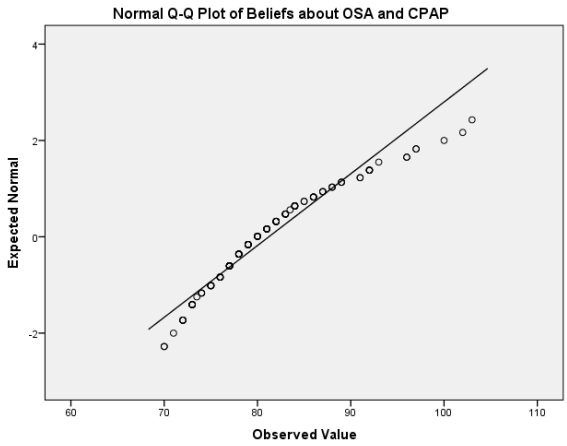


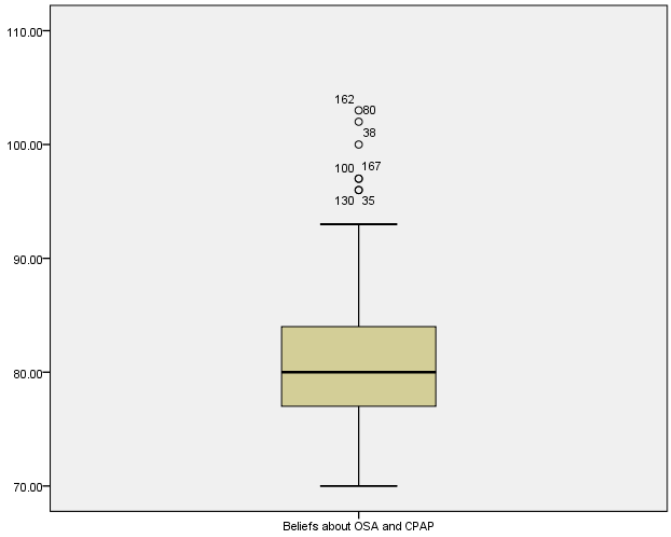




Beliefs about OSA and CPAP







APPENDIX G

Pearson's Chi-Square Cross Tabulations

Relationships Between Demographic Variables by Ethnicity Using Pearson's Chi-Square

	Ethnicity							
	White		Hispanic, Latino		Other			
Variable	*n*	%	*n*	%	*n*	%	χ^2	*p*
Gender							1.54	.464
Male	33_a	52.2	40_a	55.6	8_a	40.0		
Female	29_a	46.8	32_a	44.4	12_a	60.0		
Marital Status							5.63	.060
Married, living with partner	50_a	80.6	49_a	68.1	11_a	55		
Single	12_a	19.4	23_a	31.9	9_a	45.0		
Employment							9.86	.043
Unemployed	5_a	8.3	$16_{a, b}$	22.9	6_b	31.6		
Employed	34_a	56.7	41_a	58.6	9_a	47.4		
Retired	21_a	35.0	13_a	18.6	4_a	21.1		
Medicare/Medicaid							.213	.899
Yes	26_a	45.6	30_a	45.5	8_a	40.0		
No	31_a	54.5	36_a	54.5	12_a	60.0		

Note. For each row category, pairs with different subscripts differed significantly, $p < .05$.

Relationships Between Demographic Variables by Gender Using Pearson's Chi-Square

	Gender					
	Male		Female			
Variable	*n*	%	*n*	%	χ^2	*p*
Ethnicity					1.54	.464
White	33_a	40.7	29_a	39.7		
Hispanic, Latino	40_a	49.4	32_a	43.8		
Other	8_a	9.9	12_a	16.4		
Marital Status					5.82	.016
Married, living with partner	65_a	79.3	45_b	61.1		
Single	17_a	20.7	28_b	45.0		
Employment					1.48	.478
Unemployed	12_a	14.8	15_a	21.7		
Employed	49_a	60.5	36_a	52.2		
Retired	20_a	24.7	18_a	26.1		
Medicare/Medicaid					1.67	.196
Yes	30_a	40.0	35_a	50.7		
No	45_a	60.0	34_a	49.3		

Note. *For each row category, pairs with different subscripts differed significantly, $p < .05$.*

Relationships Between Demographic Variables by Marital Status Using Pearson's Chi-Square

	Marital status					
	Married, living with partner		Single			
Variable	*n*	%	*n*	%	χ^2	*p*
Ethnicity					5.63	.060
White	50_a	45.5	12_b	27.3		
Hispanic, Latino	49_a	44.5	23_a	52.3		
Other	11_a	10.0	9_a	20.5		
Gender					5.82	.016
Male	65_a	59.1	17_b	37.8		
Female	45_a	40.9	28_b	62.2		
Employment					16.16	.000
Unemployed	11_a	10.2	16_b	38.1		
Employed	66_a	61.1	19_a	45.2		
Retired	31_a	28.7	7_a	16.7		
Medicare/Medicaid					5.81	.016
Yes	41_a	39	24_b	61.5		
No	64_a	61.0	15_b	38.5		

Note. For each row category, pairs with different subscripts differed significantly, $p < .05$.

Relationships Between Demographic Variables by Employment Using Pearson's Chi-Square

	Employment							
	Unemployed		Employed		Retired			
Variable	*n*	%	*n*	%	*n*	%	χ^2	*p*
Gender							1.48	.478
Male	12_a	44.4	49_a	57.6	20_a	52.6		
Female	15_a	55.6	36_a	42.4	18_a	47.4		
Marital Status							16.16	.000
Married, living with partner	11_a	40.7	66_b	77.6	31_b	81.6		
Single	16_a	59.3	19_b	22.4	7_b	18.4		
Ethnicity							9.86	.043
White	5_a	18.5	$34_{a, b}$	40.5	21_b	55.3		
Hispanic, Latino	16_a	59.3	41_a	48.8	13_a	34.2		
Other	6_a	22.2	9_a	10.7	4_a	10.5		
Medicare/Medicaid							53.49	.000
Yes	18_a	72.0	15_b	18.3	29_a	85.3		
No	7_a	28.0	67_b	81.7	5_a	14.7		

Note. *For each row category, with different subscripts differed significantly, $p < .05$.*

Relationships Between Demographic Variables by Medicare/Medicaid Using Pearson's Chi-Square

	Medicare/Medicaid					
	Yes		No			
Variable	*n*	%	*n*	%	χ^2	*p*
Ethnicity					.213	.899
White	26_a	40.6	31_a	39.2		
Hispanic, Latino	30_a	46.9	36_a	45.6		
Other	8_a	12.5	12_a	15.2		
Gender					1.67	.196
Male	30_a	46.2	45_a	57.0		
Female	35_a	53.8	34_a	43.0		
Employment					53.49	.000
Unemployed	18_a	29.0	7_b	8.9		
Employed	15_a	24.2	67_b	84.8		
Retired	29_a	46.8	5_a	6.3		
Marital status					5.81	.016
Married, living with partner	41_a	63.1	64_b	81.0		
Single	24_a	36.9	15_b	19		

Note. *For each row category, with different subscripts differed significantly, $p < .05$.*

APPENDIX H

One-Way Analysis of Variance

Means and Standard Deviations for Age by Categorical Demographic Variables

Variable	*n*	*M*	*SD*	*F*	*p*	η^2
Gender				3.62	.686	.001
Male	82	54.63	13.71			
Female	73	53.70	15.05			
Ethnicity				3.66	.028	.046
White	62	57.58	14.32			
Hispanic, Latino	72	52.49	13.51			
Other	20	49.05	15.21			
Marital status				2.85	.094	.018
Married, living with partner	110	55.43	13.78			
Single	45	51.18	15.31			
Employment				31.49	.000	.300
Unemployed	27	48.19	15.08			
Employed	85	49.80	12.38			
Retired	38	67.47	8.93			
Medicare/Medicaid				21.85	.000	.133
Yes	65	59.54	15.47			
No	79	48.97	11.63			

Means and Standard Deviations for Height by Categorical Demographic Variables

Variable	*n*	*M*	*SD*	*F*	*p*	η^2
Gender				123.90	.000	.447
Male	82	68.90	3.11			
Female	73	63.11	3.37			
Ethnicity						
White	62	67.47	4.02	5.08	.007	.063
Hispanic, Latino	72	65.32	4.31			
Other	20	65.05	4.54			
Marital status				4.95	.028	.031
Married, living with partner	110	66.66	4.21			
Single	45	64.98	4.46			
Employment				1.77	.175	.023
Unemployed	27	65.04	4.26			
Employed	85	66.77	4.22			
Retired	38	65.95	4.57			
Medicare/Medicaid				2.38	.125	.016
Yes	65	65.60	4.54			
No	79	66.71	4.08			

Means and Standard Deviations for Weight by Categorical Demographic Variables

Variable	*n*	*M*	*SD*	*F*	*p*	η^2
Gender				6.67	.011	.042
Male	82	240.96	61.13			
Female	73	214.26	67.54			
Ethnicity				.99	.373	.013
White	62	226.41	66.07			
Hispanic, Latino	72	224.28	55.87			
Other	20	247.20	91.91			
Marital status				3.98	.048	.025
Married, living with partner	110	221.75	60.02			
Single	45	244.61	75.27			
Employment				6.06	.003	.076
Unemployed	27	257.42	81.54			
Employed	85	230.91	62.44			
Retired	38	202.09	52.27			
Medicare/Medicaid				.02	.893	.000
Yes	65	230.62	78.74			
No	79	229.11	55.85			

Means and Standard Deviations for Weight by Categorical Demographic Variables
With Extreme Outliers removed

Variable	*n*	*M*	*SD*	*F*	*p*	η^2
Gender				10.55	.001	.065
Male	81	237.81	54.41			
Female	72	209.39	53.57			
Ethnicity				.17	.847	.002
White	61	221.99	56.63			
Hispanic, Latino	72	224.28	55.87			
Other	19	230.48	54.87			
Marital status				3.36	.069	.022
Married, living with partner	109	219.34	54.16			
Single	44	237.33	57.93			
Employment				5.29	.006	.068
Unemployed	26	245.59	54.63			
Employed	84	227.75	55.58			
Retired	38	202.09	52.27			
Medicare/Medicaid				.70	.406	.005
Yes	63	221.10	58.05			
No	79	229.11	55.85			

Means and Standard Deviations for BMI by Categorical Demographic Variables

Variable	*n*	*M*	*SD*	*F*	*p*	η^2
Gender				1.84	.177	.012
Male	82	35.69	8.79			
Female	73	37.82	10.76			
Ethnicity				3.09	.048	.039
White	62	34.81	9.33			
Hispanic, Latino	72	37.11	8.92			
Other	20	40.87	13.03			
Marital status				10.19	.002	.062
Married, living with partner	110	35.13	8.74			
Single	45	40.50	11.20			
Employment				9.14	.000	.111
Unemployed	27	42.93	11.88			
Employed	85	36.23	9.31			
Retired	38	32.92	7.32			
Medicare/Medicaid				.78	.379	.005
Yes	65	37.63	11.52			
No	79	36.17	8.29			

Means and Standard Deviations for AHI by Categorical Demographic Variables

Variable	*n*	*M*	*SD*	*F*	*p*	η^2
Gender				10.37	.002	.063
Male	82	40.07	27.90			
Female	73	25.80	27.11			
Ethnicity				.73	.483	.010
White	62	31.99	27.19			
Hispanic, Latino	72	32.84	25.41			
Other	20	40.61	40.46			
Marital status				.03	.865	.000
Married, living with partner	110	33.60	28.04			
Single	45	32.74	29.41			
Employment				3.34	.038	.043
Unemployed	27	45.72	36.60			
Employed	85	31.43	26.51			
Retired	38	28.76	24.17			
Medicare/Medicaid				.075	.784	.001
Yes	65	34.43	30.79			
No	79	33.10	27.65			

Means and Standard Deviations for RDI by Categorical Demographic Variables

Variable	*n*	*M*	*SD*	*F*	*p*	η^2
Gender				10.84	.001	.066
Male	82	52.61	26.53			
Female	73	38.19	27.98			
Ethnicity				.24	.790	.003
White	62	47.52	29.10			
Hispanic, Latino	72	44.24	23.33			
Other	20	46.84	40.11			
Marital status				.99	.321	.006
Married, living with partner	110	47.26	26.88			
Single	45	42.30	30.85			
Employment				2.42	.093	.032
Unemployed	27	56.73	36.24			
Employed	85	43.69	25.70			
Retired	38	43.83	25.45			
Medicare/Medicaid				.05	.824	.000
Yes	65	46.10	31.58			
No	79	45.02	26.25			

Means and Standard Deviations for O2 Sat. by Categorical Demographic Variables

Variable	*n*	*M*	*SD*	*F*	*p*	η^2
Gender				.63	.429	.004
Male	81	75.90	10.83			
Female	73	77.13	11.19			
Ethnicity				.34	.716	.004
White	62	77.36	10.74			
Hispanic, Latino	72	75.79	10.88			
Other	19	76.60	12.69			
Marital status				2.32	.130	.015
Married, living with partner	110	77.42	10.68			
Single	44	74.45	11.58			
Employment				2.70	.071	.036
Unemployed	26	73.51	13.01			
Employed	85	76.34	10.38			
Retired	38	79.78	10.35			
Medicare/Medicaid				.20	.657	.001
Yes	64	75.91	12.25			
No	79	76.75	10.40			

Means and Standard Deviations for O2 Sat. by Categorical Demographic Variables ***with Extreme Outliers Removed***

Variable	*n*	*M*	*SD*	*F*	*p*	η^2
Gender				1.38	.241	.009
Male	81	75.90	10.83			
Female	72	77.90	10.07			
Ethnicity				.78	.461	.010
White	62	77.36	10.74			
Hispanic, Latino	72	75.79	10.88			
Other	18	78.90	7.95			
Marital status				1.19	.278	.008
Married, living with partner	110	77.42	10.68			
Single	43	75.37	9.97			
Employment				1.97	.143	.026
Unemployed	25	75.05	10.59			
Employed	85	76.34	10.38			
Retired	38	79.78	10.35			
Medicare/Medicaid				.01	.915	.000
Yes	63	76.56	11.18			
No	79	76.75	10.40			

Means and Standard Deviations for Education by Categorical Demographic Variables

Variable	*n*	*M*	*SD*	*F*	*p*	η^2
Gender				.001	.979	.000
Male	80	2.66	.83			
Female	69	2.67	1.07			
Ethnicity				2.98	.054	.039
White	61	2.89	.84			
Hispanic, Latino	68	2.5	1.00			
Other	19	2.53	.96			
Marital status				2.13	.147	.014
Married, living with partner	106	2.74	.88			
Single	43	2.49	1.08			
Employment				9.25	.000	.115
Unemployed	25	2.04	.79			
Employed	85	2.89	.87			
Retired	36	2.58	.97			
Medicare/Medicaid				4.18	.043	.029
Yes	61	2.48	1.01			
No	79	2.80	.85			

Means and Standard Deviations for Household Income by Categorical Demographic Variables

Variable	*n*	*M*	*SD*	*F*	*p*	η^2
Gender				2.77	.098	.019
Male	76	2.68	.88			
Female	66	2.42	.98			
Ethnicity				6.30	.002	.084
White	60	2.82	.87			
Hispanic, Latino	62	2.48	.90			
Other	19	2.00	1.00			
Marital status				16.96	.000	.108
Married, living with partner	102	2.75	.85			
Single	40	2.08	.97			
Employment				20.02	.000	.227
Unemployed	22	1.59	.73			
Employed	84	2.82	.82			
Retired	33	2.52	.83			
Medicare/Medicaid				10.37	.002	.073
Yes	55	2.27	.99			
No	79	2.78	.84			

APPENDIX I

Curriculum Vitae

CURRICULUM VITAE

Katelijne Acker
IH 342 b
361-825-2178
Katelijne.Acker@tamucc.edu

Education

Degree	Dates	Major	Institution and Location
PhD	May 2018	Nursing Science	Texas Woman's University, Denton, Texas
Masters of Science in Nursing	August 2010	Leadership in Nursing Systems	Texas A&M University - Corpus Christi, Texas
Teaching Certificate in Nursing	September 1978-June 1979	Teaching	Higher National Institute for Technical Education in Diest, Belgium
Graduate Hospital Nurse	September 1974-June 1977	Nursing	Saint Elizabeth Institute for Nursing in Leuven, Belgium

Dissertation

CPAP titration completion: A correlational study

Capstone

- System Process for Correcting Specimen Labeling
- Specimen Labeling Errors: "Any is Too Many" Awareness Campaign
- Patient Safety and Specimen Identification: an educational PPT presentation

Professional Certification/Licensure

Graduate Hospital Nurse. Issued by St. Elizabeth Institute of Nursing, Belgium, June 1977. License no. 47.973

Teaching Certificate in Nursing. Issued by Belgian Ministry of Education, June 28, 1979

Commission on Graduates of Foreign Nursing Schools Certificate, issued by CGFNS, November 1985. ID no. 473090

Registered Nurse. Issued by the Board of Nurse Examiners for the State of Texas, August 22, 1986. License no. 533261

Master of Science in Nursing Issued by Texas A&M University Corpus Christi, Texas August 2010

Employment

Academic Employment

Dates	Title	Institution or Business
Fall 2009	Assistant to clinical faculty	Texas A&M University Corpus Christi, College of Nursing and Health Sciences
Spring 2010	Graduate Student Worker	Positional Therapy Company, employed through TAMUCC Business Innovation Center
Fall 2010-present	Clinical Assistant Professor	Texas A&M University Corpus Christi, College of Nursing and Health Sciences
Fall 2016-present	BSN Face to Face Track Coordinator	Texas A&M University Corpus Christi, College of Nursing and Health Sciences

Clinical Employment

Dates	Rank or Title	Institution or Business
1977-1981	RN - Staff on Cardiovascular Floor	Catholic University of Louvain (K.U.L.) Hospital, Belgium:
1981-1983	RN - Staff in Intensive Care Unit	Catholic University of Louvain (K.U.L.) Hospital, Belgium:
1983-1986	Assistant Supervisor of Intensive Care Unit	Catholic University of Louvain (K.U.L.) Hospital, Belgium:
1986-1990	RN - Staff in Cardio Vascular Intensive Care Unit	Spohn Shoreline Hospital, Corpus Christi, Texas
1991-1994	RN-Staff	Staff Relief: Per Diem ICU Nursing Agency, Corpus Christi, Texas
2006-2008	Legal Consulting	Review of Medical records and consulting
2009-2010	Legal Consulting	Contract work for the legal profession (reviewing medical records)
2009-2010	Substitute School Nurse	Flour Bluff ISD, Corpus Christi, Texas

TEACHING

Courses Taught at Texas A&M University-Corpus Christi

Undergraduate

NURS 3614-01 Fundamentals of Nursing Practice/Course Manager

NURS 3614-01	Fundamentals of Nursing Practice/ Clinical Instructor
NURS 3614 E01	Fundamentals of Nursing Practice Online Course Manager/ Clinical Instructor
NURS 3150	Nursing Issues I Course Manager
NURS 4150	Nursing Issues II Course Manager
NURS 3435	Health Assessment Clinical Instructor
NURS 5362	Leadership Theories/Nursing practice Clinical Instructor
NURS 4390	Dimensions in Nursing: Success/Course Manager

SCHOLARSHIP/CREATIVE ACHIEVEMENTS

Presentations at Professional Meetings

September 2016	Retrospective Analysis of newly Diagnosed Obstructive Sleep Apnea (OSA) Patient Data	2016 Community Engagement and Healthcare Improvement Conference
May 2014	The Healthy Migrant Paradox	TWU Annual Colloquium
February 2014	Internal Migration in China: an integrated review	Southern Nursing Research Society
December 2013	Keynote Speaker (invited)	TWU Annual Colloquium Sigma Theta Tau, Eta Omicron Chapter, Induction Ceremony
August 2010	Patient Safety and Specimen Identification: an educational presentation (referred)	Driscoll Children's Hospital Corpus Christi, TX

Honors and Awards

CONHS at TAMUCC Research Utilization Grant ($1500)

Most Influential Professor, Spring 2012 Cohort at College of Nursing and Health Phi

Graduate Research Award, College of Nursing and Health Sciences at Texas A&M

Kappa Phi Honor Society Induction (spring 2014)

Golden Key Honor Society Induction (spring 2014)

Sciences at Texas A&M University-Corpus Christi, TX (August 2013)

University-Corpus Christi, TX (August 2010)

Sigma Theta Tau International Honor Society Induction (August 2010)

PROFESSIONAL SERVICE

Service Activities for the Component, College, University

College Activities	Dates of Service
CONHS Template Task Force	September 2016-present
Dean Search Committee	August 2016- Summer 2017
Student clinical Evaluation Task Force	August 2016- December 2016
Attrition Report Task Force	August 2016- present
Course managers Committee Chair	August 2016-present
Task Force Bylaws Review	September 2013-2015
Task Force E-line Policy Development	September 2013- 2015
Course Coordinator Committee	September 2013-August 2016
E-Line Committee	September 2013-present
Simulation Committee	October 2011-present
CONHS Undergraduate Committee	September 2010-present
Undergraduate Clinical Committee	January 2011-present
Admission, Progression, Graduation Committee	January 2011- August 2013
CONHS Undergraduate Committee	January 2011-present
University Activities	Dates of Service
Undergraduate Council	November 2014- August 2016
Faculty Senate	May 2016- present
Veterans Affairs Committee	September 2017- present

Service to the Profession

Activities	Dates of Service
STTI, Eta Omicron Chapter - Officer- treasurer, delegate	May 2012-August 2017
Texas Nursing Association Day at the State Capitol	April 2013

Service to the Community

Activities	Dates of Service
Safe and Drug Free Schools and Communities Health Care Advisory Committee in Flour Bluff ISD - Co-chair	2010-214
Safe and Drug Free Schools and Communities Health Care Advisory Committee in Flour Bluff ISD - member	2014-present

OTHER

Significant Professional Development Activities

Fall 2017	Dissertation Defense	TWU	Denton, TX
Fall 2016	IRB application/data collection	TWU	Denton, TX
Summer 2016	Dissertation Proposal Defense	TWU	Denton, TX
Spring 2016	Candidacy Defense	TWU	Denton, TX

Fall 2015	NURS 6034 Synthesis	TWU	Denton, TX
	NURS 6173 Nursing Research Instrumentation	TWU	Denton, TX
Summer 2015	NURS 6024 Qualitative Nursing Research	TWU	Denton, TX
	NURS 6903 Theoretical Framework for Nursing Research		
Spring 2015	NURS 6014 Quantitative Nursing Research	TWU	Denton, TX
	NURS 6903 Data Applications Health Promotion		
Fall 2014	NURS 6004 Nursing Research	TWU	Denton, TX
	NURS 6933 Analysis of Nurse Generated Data		
Summer 2014	NURS 6053 Exploring Scholarship	TWU	Denton, TX
Feb. 2014	Texas Team Summit	TNA	Dallas. TX
Feb. 2014	Enhancing value based care: Generating new knowledge	SNRS Conference	San Antonio, TX
Spring 2014	NURS 6023 Philosophy of Nursing Science	TWU	Denton, TX
	NURS 6002 Multicultural Nursing		
Nov. 2013	Give back to move forward	STTI Convention	Indianapolis IN
Fall 2013	NURS 6323 Informatics and research	TWU	Denton, TX
	LS 5553 Electronic info retrieval		
Summer 2013	LS 5533 Internet research for non-LS majors	TWU	Denton, TX
Summer 2013	NURS 5273 Measurement and Assessment in Nursing	TWU	Houston, TX
Spring 2013	NURS 6903 Women and Family in China	TWU	Denton, TX
	NURS 6043 Policy Power and Politics		
Spring 2013	NURS 6623 Systematic Inquiry in Nursing	TWU	Houston, TX
Fall 2012	NURS 6613 Intro clinical investigation in nursing	TWU	Houston, TX
Fall 2012	NURS 6033 Ethical Dimensions of nursing	TWU	Denton, TX
Fall 2010	NURS 5353 Theory/Concepts: Nurse educator	TAMUCC	Corpus Christi, TX

APPENDIX J

Signature Page

TEXAS WOMAN'S UNIVERSITY
DENTON, TEXAS

NOVEMBER 21, 2017

To the Dean of the Graduate School:
I am submitting herewith a dissertation written by Katelijne F. Acker entitled "CPAP Titration Study Completion: A Correlational Study." I have examined this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy with a major in Nursing.

_____
Dr. Elizabeth Restrepo, Major Professor

We have read this dissertation and recommend its acceptance:

_____
Dr. Patti Hamilton

_____
Dr. Sara Baldwin

_____
Dr. Anita Hufft
Dean of the College of Nursing

Accepted:

_____
Dean of the Graduate School