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Differences in Perceptions of the Diagnosis and Treatment of Obstructive Sleep Apnea and Continuous Positive Airway Pressure Therapy Among Adherers and Nonadherers

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Abstract

Obstructive sleep apnea (OSA) patients' consistent use of CPAP is critical to realizing improved functional outcomes and reducing untoward health risks associated with OSA. We conducted a mixed methods concurrent, nested study to describe OSA patients' beliefs and perceptions of the diagnosis and CPAP treatment that importantly differentiate adherent from nonadherent patients prior to and after the first week of treatment when the pattern of CPAP use is established. Guided by social cognitive theory, themes were derived from 30 interviews conducted post-diagnosis and after one week CPAP use. Directed content analysis followed by categorization of participants as adherent/nonadherent from objectively measured CPAP use preceded across-case analysis among 15 participants with severe OSA. Beliefs and perceptions that differed between adherers and nonadherers included OSA risk perception, symptom recognition, self-efficacy, outcome expectations, treatment goals, and treatment facilitators/barriers. Our findings suggest opportunities for developing and testing tailored interventions to promote CPAP use.

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Obstructive sleep apnea (OSA), characterized by repetitive nocturnal upper airway collapse resulting in intermittent oxyhemoglobin desaturation and sleep fragmentation, contributes to significant disabling sequelae, including daytime sleepiness, impaired cognitive and executive function, mood disturbances, and increased cardiovascular and metabolic morbidity (Al Lawati, N.M., Patel, S., Aya, N.T., 2009; Harsch, et al., 2003; Nieto, et al., 2000; Peppard, Young, Palta, Skatrud, 2000). The prevalence of OSA, based on minimal diagnostic criteria (apnea/hypopnea index [AHI] of 5 events/hour) has been estimated at 2% in females and 4% in males in the U.S. (Young, et al., 1993). More recently, large U.S. cohort studies have provided further evidence of the prevalence of OSA, estimating that roughly one in five adults, with a mean body mass index (BMI) of at least 25, has at least mild OSA and one in 15 adults, with a mean BMI of at least 25, has at least moderate OSA (Young, Peppard, Gottlieb, 2002). Continuous positive airway pressure therapy (CPAP) is the primary medical treatment for adults with OSA, eliminating repetitive, nocturnal airway closures, normalizing oxygen levels, and effectively improving daytime impairments (Gay, Weaver, Loubé, & Iber, 2006; Sullivan, Barthón-Jones, Issa, Eves, 1981; Weaver & Grunstein, 2008).

Adherence to CPAP is recognized as a significant limitation in the effective treatment of OSA, with average adherence rates ranging from 30-60% (Engleman, Martin, & Douglas, 1994; Kribbs et al., 1993; Krieger, 1992; Reeves-Hoche, Meck, & Zwillich, 1994; Sanders, Gruendl, & Rogers, 1986; Weaver et al., 1997). Nonadherent users begin skipping nights of CPAP use during the first week of treatment and their hourly use of CPAP is significantly shorter than those who apply CPAP consistently (Aloia, Arnedt, Stanchina, & Millman, 2007; Weaver et al., 1997). Those patients who are nonadherent during early treatment, generally remain nonadherent over the long-term (Aloia, Arnedt, Stanchina, & Millman, 2007; Krieger, 1992; McArdle et al., 1999; Weaver et al., 1997). The return of symptoms and other manifestations of OSA with even one night of non-use underscores the critical nature of adherence to CPAP (Grunstein et al., 1996; Kribbs et al., 1993).

Many studies have explored what factors predict adherence to CPAP (Engleman et al., 1996; Engleman, Martin, et al., 1994; Kribbs et al., 1993; Massie, Hart, Peralez, & Richards, 1999; McArdle et al., 1999; Meurice et al., 1994; Reeves-Hoche, et al., 1994; Rosenthal et al., 2000; Schweitzer, Chambers, Birkenmeier, & Walsh, 1997; Sin, Mayers, Man, & Pawluk, 2002). Self-reported side effects of CPAP do not distinguish between adherers and nonadherers and subjective sleepiness, severity of OSA as determined by apnea-hypopnea index, and severity of nocturnal hypoxia are inconsistently identified as weak correlates of CPAP adherence (Weaver & Grunstein, 2008). While the majority of these studies have focused on physiological variables and patient characteristics as predictors of adherence, recent studies have identified psychological and social factors and cognitive perceptions, such as self-efficacy, risk perception, and outcome expectancies, as determinants of CPAP use (Aloia, Arnedt, Stepnowsky, Hecht, & Borrelli, 2005; Lewis, Seale, Barle, Watkins, & Ebdén, 2004; Russo-Magno, O'Brien, Panciera, & Rounds, 2001; Stepnowsky, Bardwell, Moore, Ancoli-Israel, & Dimsdale, 2002; Stepnowsky, Marler, & Ancoli-Israel, 2002; Wild, Engleman, Douglas, & Espie, 2004). Social and situational variables have been suggested as influential on CPAP adherence, with those who live alone, have had a recent life event, and experienced problems with CPAP on the first night of exposure having lower adherence to CPAP (Lewis, et al., 2001). Support group attendance has also been identified as contributing to higher CPAP use in older men (Russo-Magno, et al., 2001). Both these studies suggest that social support is

an important factor to decisions to use CPAP yet the sociostructural context of accepting and adhering to CPAP treatment has not been described from the perspective of the patient in the extant literature. Other recent studies have identified that early experiences with CPAP (i.e., first week) are an important influence on patients' perceptions and beliefs about the OSA diagnosis and treatment with CPAP (Aloia, Arnedt, Stepnowsky, et al., 2005; Stepnowsky, Bardwell, et al., 2002).

The collective published evidence suggests that early experiences with CPAP, combined with patients' perceptions and beliefs about OSA and CPAP and the balance of their sociostructural facilitators/barriers are critical factors that influence patients' decisions to use CPAP over the long-term. To date, there are relatively few studies that have systematically examined the influence of disease and treatment perceptions and beliefs on CPAP adherence. As the first week of CPAP treatment is critically influential on OSA patients' decisions to use CPAP, it is imperative that the contextual experiences and underlying beliefs and perceptions of the diagnosis and treatment be described. There are no published studies that have addressed this significant gap in the scientific literature. Furthermore, no study has directly explored patient perspectives, employing qualitative methodology, both at diagnosis and with treatment, to more fully describe contextual factors that importantly differentiate CPAP adherers and nonadherers. Our study addresses several important questions: (a) What are adult OSA patients' beliefs and perceptions about OSA, the associated risks, and treatment with CPAP prior to treatment use; (b) What are the consequences of these beliefs and perceptions on the use of CPAP; (c) What are the beliefs and perceptions of adults with OSA after one week of CPAP use, including perceived benefits of treatment, effect of treatment on health, and perceived ability to adapt to CPAP; and (d) Do differences exist between adherers and nonadherers with regard to their beliefs and perceptions at diagnosis and with treatment use that may, in part, explain differences in CPAP adherence outcomes. Our study findings provide the first published description of beliefs of those who adhere and those who choose not to adhere to CPAP treatment. These findings contribute to understanding patient treatment decisions regarding CPAP use and suggest opportunities for identifying those at risk for nonadherence to CPAP and for developing tailored interventions to promote CPAP use.

Conceptual Framework

Acceptance and consistent use of CPAP is influenced by a multitude of factors, as has been evidenced in previous studies examining predictors of CPAP adherence (Weaver & Grunstein, 2008). It is therefore important to approach the phenomenon of CPAP adherence from a multifactorial perspective that addresses the complex nature of this particular health behavior. The application of social cognitive theory has been widely applied in studies of adoption, initiation, and maintenance of health behaviors (Bandura, 1977; Bandura, 1992; Schwarzer & Fuchs, 1996). The core determinants of the model include knowledge, perceived self-efficacy, outcome expectations, health goals, and facilitators/barriers. The model posits that health-promoting behaviors are primarily influenced by patients' self-efficacy, or their belief in their ability to exercise control over personal health habits, which influences other critical determinants: knowledge, outcome expectations, goals, and perceived facilitators and impediments (Bandura, 2004)(Figure 1). Knowledge of health risks and specific benefits relative to health behaviors is a necessary determinant for health behaviors, but rarely does knowledge alone promote change in behaviors. Outcome expectations, or the expectancies one holds for investing in a particular health behavior, are evaluated by the individual in terms of costs and benefits, including physical, social, and psychological. With the anticipation of benefits outweighing costs of a health behavior, individuals are inclined to perceive the health behavior as favorable and personal goals, short- and long-term, can be established to guide adoption of the health behavior. This cascade of health behavior determinants does not occur in isolation, but is influenced by barriers and facilitators that derive from personal, social, and

environmental circumstances. As the individual identifies facilitators for the health behavior and overcomes barriers, belief in one's ability to successfully change or adopt a health behavior (i.e., perceived self-efficacy) increases.

Recognizing that individuals exist within a collective agency or community, the construct of self-efficacy is not confined solely to personal capabilities. Although there are commonalities in the basic concepts of self-efficacy across cultures, the “cultivated identities, values, belief structures, and agentic capabilities are the psychosocial systems through which experiences are filtered” (Bandura, 2002, p. 273). Bandura suggests that the application of social cognitive theory must be situated in context, recognizing that “human behavior is socially situated, richly contextualised, and conditionally expressed” (2002, p. 276). From this conceptual perspective and in a predominantly qualitative research paradigm, we examined patients’ perceptions, beliefs, and experiences within their own context to permit an explicit description of salient factors that influenced OSA patients’ decisions to use or not use CPAP.

Method

Design

Using a concurrent nested mixed method design, we conducted a longitudinal study of newly-diagnosed OSA patients, extending from initial diagnosis through the first week of home CPAP treatment, including two individual interviews with participants and one week CPAP adherence data. The less dominant quantitative method was nested within the predominant qualitative method, which permitted an enriched description of the participants and a more in-depth analysis of the overall phenomenon of interest, CPAP adherence (Creswell, Plano Clark, Gutmann, & Hanson, 2003). In contrast to a triangulation design, the concurrent nested study design emphasizes one methodology and the data are mixed at the analysis phase of the study (Creswell, et al., 2003).

Participants

Adults with suspected OSA were recruited from a sleep clinic at an urban VA medical center during a 5-month enrollment period. With high clinical suspicion of OSA, one sleep specialist referred potential participants to the study. Our purposive sampling strategy was to include (a) patients that provided detailed information during their initial clinical visit and were willing to openly discuss their health and health care; (b) had at least moderate OSA (apnea-hypopnea index [AHI] ≥ 15 events/hour)(American Academy of Sleep Medicine Task Force, 1999) and were prescribed CPAP treatment; (c) initially accepted CPAP for home use; and (d) were able to speak and understand English. To ensure study-referred patients would be prescribed CPAP treatment based on Veterans Health Administration CPAP prescribing guidelines in place during study enrollment, patients with mild OSA (AHI 5-15 events/hour) were not included. We excluded participants who had current or historical treatment with CPAP or any other treatment for OSA, a previous diagnosis of OSA, refusal of CPAP treatment by the participant prior to any CPAP exposure (i.e., in-laboratory CPAP titration sleep study), and those who required supplemental oxygen in addition to CPAP and/or required bilevel positive airway pressure therapy for effective eradication of sleep-disordered breathing events during their in-laboratory CPAP titration sleep study.

Previous studies have identified decisions to adhere to CPAP emerge by the second to fourth day of treatment (Aloia, Arnedt, Stanchina, et al., 2007; Weaver, et al., 1997). Therefore, it is possible that patients’ beliefs, perceptions, and experiences during the first several experiences with CPAP may significantly influence short- and long-term CPAP adherence patterns. For this reason, we did not include individuals who refused CPAP treatment prior to any CPAP experience as we sought to describe salient factors preceding and during initial CPAP exposure.

The protocol was approved by the research site and affiliated-University's institutional review boards. All participants provided informed consent prior to participating in any study activities.

Procedure

After study enrollment, each participant had two in-laboratory, full-night sleep studies (i.e., polysomnogram). The first sleep study was a diagnostic study and the second sleep study was to determine the therapeutic CPAP pressure necessary required to eradicate the obstructive sleep apnea events. All sleep studies were performed and scored using standard criteria (American Academy of Sleep Medicine Task Force, 1999; Rechtschaffen & Kales, 1968). The AHI, a measure of disease severity in OSA, was computed from the diagnostic PSG as the number of apneas and/or hypopneas per hour of sleep. The therapeutic CPAP pressure, the pressure required to eliminate hypopneas and apneas, was determined on a manual CPAP titration PSG performed one-week (7.9 ± 6.9 days) after the diagnostic PSG.

Semi-structured interviews—Semi-structured interviews, conducted by one study investigator, were scheduled with participants at two intervals, within one-week of diagnosis and after the first week of treatment at home with CPAP (Figure 2). All interviews were conducted in an informal, private room at the medical center to ensure privacy, participant comfort, and promote open sharing of information (Streubert Speziale & Carpenter, 2003). In order to minimize attrition, participants were offered the opportunity to schedule interviews at an alternative location or by telephone if transportation difficulties or ambulatory limitations precluded study participation.

Interview guides, consisting of specific questions and probes (i.e., prompts to encourage focus on the particular issue of interest) were used for each interview to ensure a consistent sequence and set of questions were addressed across participants. A funnel approach was used in the development and execution of the interview guides. This approach begins with broad questions and gradually progresses to focused questions specific to the phenomenon of interest in order to promote sharing of experiences by the participants (Tashakkori & Teddlie, 1989). The first interview focused on perceptions of the diagnosis, perceived health effects of the diagnosis, pre-treatment perceptions of CPAP, and the social and cultural precedents that led to the participant seeking medical care for their sleep problem(s) (Table 1). The second interview focused on perceived effects of treatment with CPAP, supportive mechanisms or barriers to using CPAP, and how beliefs and perceptions about the diagnosis, associated risks of the diagnosis, and the treatment experience may have affected CPAP adherence (Table 2). Interviews were digitally audio-recorded and transcribed to an electronic format by a professional transcriptionist not affiliated with the study. Field notes were maintained by the interviewer before and after each interview to describe the environment of the interview, describe the participant at the time of the interview, and note any aberrations from the planned interview guide that occurred and a description of such aberrations. The field notes not only served as a descriptive context of the interview, but also served as interviewer reflexivity notations (i.e., interviewer biases, suppositions, and presuppositions of the research topic). The purpose of maintaining reflexivity notations was to ensure interviewer-imposed assumptions did not take precedent over the participant's described experience.

CPAP adherence—Daily CPAP use was objectively measured using the Respiroics RemStar Pro® CPAP system, a standard of clinical care at the sleep center. This system contains software (Respiroics Encore® SmartCard™) that measures and records nightly CPAP mask-on time onto a microchip contained in the SmartCard™. CPAP use was defined as periods when the device was applied for more than 20 minutes at effective pressure. One-week CPAP adherence data was downloaded at the time of the second semi-structured interview. Graphic adherence data was used as a probe to discuss specific occurrences of CPAP

non-use. The objectively measured CPAP adherence data was also used to identify adherent (≥ 6 hrs/night CPAP use) and nonadherent participants (< 6 hrs/night CPAP use). A cut-point of six hours/night was selected a priori to describe adherers and nonadherers to CPAP treatment, as recent evidence suggests six or more hours of CPAP use per night is necessary to improve both functional and objective sleepiness outcomes (Weaver et al., 2007).

Analysis

A sequential analysis was conducted, with qualitative directed content analysis of interview data followed by quantitative descriptive analysis of the CPAP adherence data. By sequentially analyzing the data, the priority of the individual as informant was emphasized and the investigators were blinded to CPAP adherence until the final analysis procedure, a mixed methods analysis, was conducted (Figure 3). By dividing the participants into categories of adherent (i.e., ≥ 6 hrs/night CPAP use) and nonadherent (i.e., < 6 hrs/night CPAP use), we examined across-case consistencies in sub-themes and themes in order to describe the contextualized experience of adhering or not adhering to CPAP treatment.

Each transcript was read in its entirety, highlighting, extracting, and condensing text from individual interviews that addressed individual beliefs, perceptions, and/or experiences during diagnosis and early treatment with CPAP. This process of text analysis brought forward the manifest content of the qualitative data (Graneheim & Lundman, 2004). These responses were separated from the interview text, identified by participant identification number, and entered into an analysis table. Abstraction, or the process of taking condensed, manifest data and interpreting the underlying meaning (i.e., latent meaning), followed as participant responses were then described in a condensed format and interpreted for meaning within a thematic coding process. Trustworthiness was enhanced as the likelihood of investigator bias was minimized by first highlighting relevant text for coding, extracting relevant text from complete interviews transcripts, and then coding the meaning units for theory-driven categories or themes and further for sub-themes (Hsieh & Shannon, 2005).

The overarching, theory-derived themes were initially determined by applying the broad determinants of health as described in the study's conceptual framework, social cognitive theory (Bandura, 2004). These themes included knowledge, perceived barriers and facilitators, perceived self-efficacy, outcome expectations, and goals. Using social cognitive theory as an overarching organizing framework for the study permitted the investigators to examine the applicability of the theoretical framework to the phenomenon of CPAP adherence and further elaborate on previous findings suggesting the framework's concepts as measurable predictors of CPAP-related health behaviors (Aloia, Arnedt, Stepnowsky, et al., 2005; Stepnowsky, Bardwell, et al., 2002; Wild, Engleman, Douglas, & Espie, 2004). Emergent sub-themes were identified as thematic content analysis progressed. The sub-themes were then categorized within the overarching conceptual framework themes (Table 3). We designed the analysis strategy to be consistent with other recent empiric studies of CPAP adherence while permitting a more robust, narrative description of what these theoretically-derived variables mean from the perspective of the OSA patient.

Theme definitions were developed by the investigators and reviewed by an expert qualitative methodologist and an expert in the research application of theoretical constructs. One study investigator, blinded to CPAP adherence data, coded all interview data for the study. Valid application of the themes was examined by an independent expert coder. Coded interviews were independently re-coded by the expert coder to establish validity and reliability of the application of the codes to the interview data. All extracted interview data was eligible for recoding; approximately 15% of each total interview data was randomly selected for expert recoding. Agreement of the study coder and the expert coder was 94%, meeting the established criteria of 80% agreement for acceptance of the coded data. Where differences in application

of codes were identified, code definitions were reviewed by coders, discussion of specific application of the code(s) was held, and mutual agreement was achieved in all instances of coding differences.

After all interview data was coded for themes, the investigators used the one-week CPAP adherence data to separate adherers and nonadherers (i.e., ≥ 6 hours CPAP use/night and < 6 hours CPAP use/night, respectively). Descriptive statistics were used in the analysis of one-week CPAP adherence data (mean $\pm$ standard deviation [SD]). Across-case analysis of themes and sub-themes was then examined from an integrative perspective, using adherent and nonadherent as anchors, or as a unique descriptive qualifier, to identify common perceptions, beliefs, and experiences within the groups of interest. The across-case analysis, which examined both qualitative and quantitative data sets as complementary within an analysis matrix, gave rise to cases that had common descriptive aspects.

Results

With the recurrence of themes in the content analysis phase, data saturation was reached at 15 participants and the sampling procedure was considered complete. The participants were all veterans, predominantly middle-aged (53.9 ± 12.7 years) males (88%) (Table 4). The participants were well-educated, with 93% ($n=14$) of the sample achieving a high school education or higher. The sample, on average, had severe OSA (AHI 53.5 ± 26.5 events/hr) with an oxygen nadir of 66.4% ($\pm 13.2\%$). The average CPAP pressure setting was 10.7 ± 1.6 cmH₂O. Average CPAP use over the first seven days of CPAP treatment was 4.98 ± 0.5 hours/night. Sorting on CPAP adherence (i.e., ≥ 6 hrs/night CPAP use and < 6 hrs/night CPAP use), there were six adherers and nine nonadherers. Interview I was conducted after the diagnostic PSG on average at day 9 (range 2-28 days) and interview II was conducted after at least one week of CPAP treatment (number of days from day one of CPAP use, 18 [range 7-47 days]).

Adherers and Nonadherers to CPAP

Knowledge and perceived health risks—Knowledge, or the “knowing” an individual has about the health risks and benefits of health behaviors (Bandura, 2004) was a predominant theme in both interviews for all participants. Saturation on nearly every knowledge theme suggests that participants identified having an understanding of OSA and CPAP is an important part of the experience of being diagnosed with OSA and treated with CPAP. Adherent participants related their knowledge of risks and benefits of CPAP to their own outcome expectations after being diagnosed with OSA. For some participants, knowledge of OSA being simply more than snoring was a first step in recognizing OSA as a syndrome with health implications. One participant described, “I knew sleep apnea existed, but it just never dawned on me how serious it was in my case . . . I just didn't pay any attention to it. I just figured I was going to snore for the rest of my life.”

For many participants, “putting the whole picture together” after receiving education about OSA and CPAP treatment, helped them understand they not only were experiencing symptoms of OSA on a daily basis, but their overall health and quality of life was impacted by OSA. During the first interview, participants were provided with a summary of their sleep study results. The combination of education about the OSA diagnosis and treatment with CPAP and relating their own diagnosis to their daily health and functioning was important to adherent participants’ formulation of accurate beliefs and perceptions of OSA and CPAP. These beliefs served to motivate or facilitate adherent participants’ determination to pursue CPAP after diagnosis.

I didn't know anything really, how the CPAP worked or anything like that. I just knew that there was a disease called sleep apnea and that a lot of people have it and people

don't realize it . . . I really still didn't know anything about it til after I went through the test [diagnostic polysomnogram] . . . Five is normal and thirty is severe and I'm doing ninety/hour [breathing events]. You know that literally scared the hell right out of me because all I could think of is I'm going to die in my sleep.

. . . then when you told me about driving, being tired, I remembered that every time we take off on a long trip, the first hour I got to pull over and rest. So it all came together. So I figured maybe I do have it [OSA].

For many adherent participants, knowledge of health risks associated with OSA was limited to “being sluggish” or “having low energy levels.” For some, their perception of OSA was only relative to “falling asleep when I sit down.” Participants who “put the whole picture together,” relating their diagnosis to their own health status, were motivated to accept CPAP treatment from the outset. For example, one participant said, “it's [OSA] got to take a toll in the long run on a lot of things, like high blood pressure...I'm hoping that it helps me to drop my high blood pressure.” These perceptions provided hope for adherent participants that expanded beyond the management of their OSA to other disease and health experiences.

...if I have more energy and I'm not so sluggish...then...because I go to the local high school track and get in five or six laps, walking around the track...I will have more energy to do those kinds of things that keep you healthy.

Post-treatment, there was less emphasis on knowledge-based themes among adherent participants, suggesting a shift from knowledge of risks and benefits of OSA to perceptions derived from actual experience of the costs and benefits of CPAP treatment.

Nonadherent participants' knowledge at diagnosis was not different from adherent participants' knowledge. However, those with knowledge that served as a barrier, rather than a facilitator, to getting to diagnosis were less likely to pursue a diagnostic sleep study in a timely fashion. This was particularly true for those who had inaccurate knowledge and perceptions of OSA, such as OSA is a condition of “simple snoring.” Even though many acknowledged they probably had OSA, the snoring was the “problem” that defined OSA, not apneic events and resultant untoward health and functional outcomes. As one participant described,

...my brother does it [snores] and he stopped [breathing] all the time in the middle of the night, my father did it, you know and I do it. I knew I do it so it's been a while, I mean, I don't remember not being a loud snorer...Like I said, my condition is hereditary. I'm sure my oldest son has it and I'm sure my youngest son is going to end up with it. My brother had it and my father had it, you know, my mother probably had it cause she's a snorer...I didn't think it was serious of a problem cause it's [snoring, stops in breathing] something that I had experienced for so many years.

Furthermore, describing early knowledge of “having to wear a mask” for the treatment of OSA served as a barrier to both seeking diagnosis and treatment for some. This perception was not consistent among only nonadherers though, as many of the participants expressed concerns about the anticipated treatment of their OSA. Reconciling the diagnosis with their symptoms and experiences, with their established goals for treatment use, and with achieving outcome expectations that facilitated positive perceptions of the experience was critical to distinguishing those who accepted and used CPAP from those who did not.

Goal-setting and outcome expectancies—Outcome expectancies are the expected or anticipated costs and benefits for healthful habits/behaviors that support or deter from an individual's investment in the behavior (Bandura, 2004). Among the participants, post-diagnosis outcome expectancies that were consistently met were highly influential on participants' decisions to use CPAP. For example, after being diagnosed with OSA, one

participant brought all his experienced symptoms into perspective, relating them to his OSA. With treatment, he was hopeful that these symptoms would resolve. He stated that “it seems like sleep apnea basically causes all those problems...So I figure if I can get this taken care of [by wearing CPAP], basically the problems will subside.” Making sense of symptoms in terms of treatment outcome expectancies helped adherers commit to trying CPAP, believing that CPAP was going to be a positive experience. One participant summarized his perception of symptoms and outcome expectations like this: “but without me even trying it I know that what I’m experiencing and how it’s affected me and that I want to be...I want to get better if I can and so there’s nothing going to keep me away from getting a CPAP.”

A particularly important described perception by participants was their early response to CPAP as influential on future use/continued use of CPAP. These early, first experiences were helpful to formulating realistic and personally important outcome expectancies for CPAP use. One participant describes his response to CPAP after wearing CPAP for the first time in the sleep laboratory during his second sleep study (i.e., CPAP sleep study).

But being like I got relief the first night I was at the hospital. I drove home...that morning after they woke me up, I went down I got breakfast and I’m driving home I’m saying to myself, gee, I feel great and I only got from one o’clock to six, you know, I feel so much better and I felt so much better that whole day...I felt so good after that five hours of sleep with the machine on that it sold me.

For adherent participants, having a positive response to CPAP during the sleep study night with CPAP was highly motivating for them to use CPAP at home. Furthermore, this early response set the stage for participants to develop an early commitment to the treatment, even when faced with barriers. Persistent, positive responses to CPAP throughout the early treatment period (i.e., one week) reinforced participants outcome expectancies and helped them formulate a perception of the treatment that was conducive to long-term use.

Goals for improved health and for achieving certain health behaviors are an important part of being successful with any health behavior. According to Bandura (2004), individuals set goals for their personal health, including establishing concrete plans or strategies they have for achieving those goals. Goal-setting among adherent CPAP users focused on “how best to adapt to using CPAP” or identifying “solutions to difficulties with use of CPAP.” These goals were established so that adherent CPAP users were able to achieve their outcome expectations. Goal-setting was not specifically discussed by adherent participants before using CPAP. With exposure to and experience with CPAP, adherent participants first identified that using CPAP was important and thereafter, identified “tricks and techniques” to successfully use CPAP. Whether these strategies originated from the participant or were a collaborative effort between participant and a support source, having a plan that addressed how best to adapt to CPAP promoted continued effort directed at using CPAP, as described by several adherent participants:

I guess the first night I put it on I sort of got a little feeling of claustrophobia but I pushed it out of my mind, saying to myself, “don’t let this [bother you], this is a machine that is going to help you, you got to wear it,” so I just put it in my mind that I was going to wear it.

As this participant described, it was important for him to devise a way that he could use the treatment in order to realize his overall health goals. Similarly, one participant found that he could not fall asleep with CPAP at full pressure. He emphasized the importance of using CPAP to treat his OSA, but he equated using CPAP to “a tornado blowing through your nose.” He recalled being taught about several features on the CPAP machine that might alleviate this sensation. After testing a few “tricks” on the CPAP machine, he found that he was able to fall asleep on a lower pressure setting while the pressure increased to full pressure setting after he

was asleep (i.e., ramp function). By setting an immediate goal, to get to sleep while wearing CPAP, he was able to achieve his longer term goal to wear CPAP each night. The long-term goal of adherent participants was to feel better or sleep better, but the immediate goal was to “be able to wear CPAP.”

For nonadherers, a negative experience during their CPAP sleep study led them to have an undesirable outlook on CPAP and the overall treatment of OSA. For example, one participant described experiencing no immediate response to CPAP during the CPAP sleep study; therefore, he didn't expect to experience any response to treatment over a more extended period of time.

...I still had the same kind of sleep, I thought. As a matter of fact I thought it took...that night it took me longer to get to sleep than it did on the first sleep study [without CPAP]...I believe my sleep was still the same type of sleep that I always get, even though, you know, the machine was supposed to make me sleep better...I still woke up in the same condition that I usually wake up in, is what I'm trying to say. I didn't feel any more vigorous or alert or anything after that first night.

Participants' description of their considerations for using CPAP consistently included, “what are the down sides of using CPAP?” Combining early negative perceptions of the treatment and early negative experiences with CPAP, nonadherers tended to see the drawbacks of using the treatment as far outweighing any benefits of using the treatment. One participant described both negative perceptions and negative experiences which caused him to believe that CPAP treatment outcome expectancies were not “worth” the torment of using the treatment.

No, I didn't think I couldn't do it from the beginning...I was believing it was gonna do something more than what it did and it didn't do anything...I'm not getting sleep, I'm still getting up tired. I guess I expected more from it and I didn't get anything, not anything that I could see anyway...No, just a bunch of bother-ation and I didn't get any sleep.

Among participants who did not adhere, the goal-oriented theme was not present after diagnosis. Nonadherers did not articulate specific goals for attaining treatment and furthermore, they did not describe strategies to be able to wear CPAP after one week of CPAP treatment. For nonadherers, establishing treatment-related goals for use of CPAP was not a priority.

Facilitators and barriers of CPAP use—Perceived facilitators and barriers can be personal, social, and/or structural. Although perceived facilitators and barriers are influential on health behaviors, this process is mediated by self-efficacy (Bandura, 2004). Therefore, the existence of a barrier, in and of itself, may not be particularly influential on an individual's behavior if their self-efficacy is high. Consistent with this conceptual perspective, some participants identified barriers that were particularly troublesome to using CPAP but were vigilant users of CPAP in lieu of these barriers. Conversely, those who described numerous facilitators to using CPAP treatment were not necessarily adherent to CPAP.

Adherent participants were less focused on potential or actual facilitators and barriers to using CPAP over time than nonadherers. When adherent participants discussed facilitators and barriers, their overall descriptions were positive, with facilitators being the focus of their experience after using CPAP for one week. No adherent participants emphasized barriers to using CPAP after one week of treatment. Furthermore, when faced with barriers, adherent participants described perceptions of the treatment as important and identified a belief in their ability to overcome the barrier. For example, one participant experienced a sensation of not being able to breathe during his second night of CPAP use at home but his ability to use CPAP was influenced by his commitment to “needing” the treatment.

Because it was like I couldn't breathe and even though the machine was on, it was like I was paralyzed and this happened every time when I tried to go back to sleep...how many times? Three more times that very same night until I was getting really anxious because every time I would try to go to sleep...after a while I would get that anxiety again. Finally, I prayed. I got up and I prayed real hard, asked God to really help me with this and...I was right to sleep. Ever since then, I pray every night and have no problems.

As this example demonstrates, barriers and facilitators are not independent determinants of health behavior. Participants described situations and experiences that were labeled as either a facilitator or barrier, but the actual behavioral outcome of getting to diagnosis and using CPAP was not necessarily reflective of such experiences being a barrier or facilitator.

The facilitating experiences described by adherent participants centered on social interactions that provided motivation and facilitation of their CPAP use. Facilitating experiences included descriptions of social support, shared experiences of CPAP use with other CPAP users, and recognition that their own improvement as a result of CPAP treatment was an important influence on social relationships. Social relationships and the ability to be fully engaged in social interactions during their first week of CPAP use was described as a facilitator to ongoing treatment as described by several adherent participants:

I see the difference. People see the difference. My wife sees the difference. My kids see the difference . . . that helps . . . I think that's 50% of it. People telling you that you have changed and things are getting better and you look a lot better and you sound a lot better and you act a lot better, because when you have feedback like that you know it's [CPAP] helping.

. . . our relationship [with spouse] is getting better and better . . . I think since the sleep machine it's even been more because some things that irritate me, I would speak on and it would cause like a little bit of friction, as it happens in couples. But since I've had the sleep machine, I've been letting the minor things go, things that irritate me or I would complain about before . . . communication, our relationship, so we've been able to talk more and enjoy each other even more since then [starting CPAP]. Yeah, I like the machine, I really do, and I like what it's doing . . .

Adherent participants clearly emphasized the importance of improved social relationships as a result of their CPAP treatment. Many recognized such improvements after a close friend or family member suggested the improvement was notable.

Nonadherent participants emphasized barriers rather than facilitators to using CPAP after being diagnosed with OSA. After using CPAP for one week, nonadherers identified few, if any, actual barriers to treatment. Unlike adherent participants, nonadherers did not discuss social interactions as an important part of their post-CPAP treatment experience. Nonadherent participants also identified themselves as single, divorced, or widowed, with the exception of one participant. Nonadherers did not discuss their social networks (i.e., friends, family outside of their residence, co-workers) as important to their experiences of being diagnosed with OSA and starting CPAP treatment.

Perceived self-efficacy—Perceived self-efficacy is the belief that one can exercise control over their own health habits, producing desired effects by their health behaviors (Bandura, 2004). This over-arching theme was meaningfully described by participants and represented by several sub-themes that were important to both adherers and nonadherers in the study. Within these descriptions, participants offered experiences with being diagnosed with OSA and using CPAP that led to their belief in themselves, or lack thereof, to use or not use the treatment.

Adherers in the sample described generally positive perceived self-efficacy regarding future use of CPAP. Among adherers, having a positive belief in their ability to use CPAP from the outset persisted and became increasingly frequent from diagnosis to early CPAP treatment, even if they first doubted their ability to use the treatment. As one participant described, the first thought of wearing a mask during sleep was not appealing, but with a positive first experience with CPAP, the participant was increasingly confident that CPAP was going to be a part of his life:

I think I seen the masks sitting there and I thought to myself, I hope I don't have to wear one of those things . . . then they came in and said now we're going to put the CPAP on you and I said okay and they put the CPAP on me and when they came back into the room I felt great when I woke up at six . . . they had to wake me up at six o'clock because I was sleeping and you know, I think I felt after that, I didn't care what it was if I got that much sleep from one o'clock to six without getting up, I was going to wear or do whatever I had to do to do it [wear CPAP] . . .

Adherent participants also described that they planned to incorporate CPAP into their daily routine, suggesting an underlying positive belief in their ability to accomplish the health behavior of using CPAP. Recognizing that using CPAP would necessitate additional daily “work,” adherers had well-defined plans of incorporating the added demands to their daily schedule.

I have to just add some things that I have to do in order to keep the CPAP machine clean and to make sure that it's dry and each week I have to disinfect it, but once I did it, once I decided I was gonna do it, I just went in the bathroom, did the whole thing, it only took about twenty minutes, twenty-five minutes, and I was all done... and getting up in the morning and doing the daily cleaning, you know, that's not a negative but it's just something I have to make an adjustment to [each day].

Nonadherent participants described having largely negative experiences with CPAP during the first exposure (i.e., CPAP sleep study) or during the early phase of home CPAP use. Few nonadherent participants experienced benefits with treatment and nonadherers described unsuccessful or absence of problem-solving efforts with CPAP difficulties. These negative experiences were important areas of concern with regard to their perceived ability to use CPAP over the long-term (perceived self-efficacy). For example, one participant had such an extremely negative experience during the first week he was exposed to CPAP, he firmly doubted his ability to ever use CPAP:

I couldn't breathe in [with mask on] . . . This thing [CPAP], I had to suck in to get a breath out of it. Last night I got a good night's sleep but I woke up, then I was claustrophobic . . . I felt like I was stuck under a bed someplace and couldn't get out and then I woke up . . . When I wore it the whole night through I wasn't sleeping so that's one of the reasons [I won't use CPAP], like I didn't sleep with it on; it was too aggravating.

Each participant described “getting used to CPAP” with the first several times they used CPAP. With unsuccessful experiences during this period of “getting used to CPAP,” participants either identified resources to help improve their experience or made decisions to use CPAP less or not at all. For all participants, early experiences with CPAP contributed to their belief in their own abilities to “get used to CPAP.”

Individuals who had difficulty “fitting CPAP into their lives” were challenged to be adherent to the treatment. When CPAP was seen as not fitting into a life routine, participants offered doubts as to their ability to continue to use the treatment. One participant described having a routine of falling asleep with television. With CPAP, she had difficulty watching television and therefore she experienced more difficulty getting to sleep. Although she continued to try

to use CPAP, she expressed that using CPAP was generally “annoying” to her. The complexities presented by using CPAP within the constraints of her “normal” routine were likely to increasingly influence doubt in her ability to use CPAP.

Married and Unmarried CPAP Users

With the emerging emphasis placed on social support and social networks by adherers in the study, we explored how the social context of daily life impacted on perceptions of OSA and CPAP treatment by examining married (n=7) and unmarried (n=8) participants’ responses. Using married and unmarried status from self-reported demographic characteristics as anchors, or as a unique descriptive qualifier, we sorted the sub-themes within an analysis matrix to identify common perceptions, beliefs, and experiences within these qualifier groups. We included all participants who identified themselves as married or common law married as married; all participants who identified themselves as single, divorced, or widowed were included as unmarried.

These groups described different experiences both with diagnosis and CPAP treatment. Married participants offered descriptions of social support resources within immediate proximity that were positive facilitators of seeking diagnosis and starting/staying on treatment. Married participants ascribed to positive beliefs in their ability to use CPAP with early treatment use, often described in conjunction with a CPAP problem-solving episode that was collaboratively resolved with their partner/spouse. Married participants described overwhelmingly positive early responses and experiences with CPAP treatment. Their outcome expectations were consistent across time, with generally positive responses to CPAP anticipated prior to exposure and positive responses experienced after exposure to treatment. Married participants also identified success in “fitting CPAP into their lives.” These participants were able to identify far more benefits from CPAP than difficulties with CPAP that enhanced their ongoing commitment to use CPAP. Married participants discussed proximate support sources (i.e., spouse, living partner, proximate family members) as important to providing feedback about their response to treatment, trouble-shooting difficulties, and positive reinforcement for persistent use of CPAP.

Unmarried participants, including single, divorced, and widowed individuals, commonly identified friends or co-workers as motivating factors (facilitators) to seek diagnosis but less social influence/facilitation of treatment use after one week of CPAP therapy. Without the presence of an immediate social support person(s), unmarried participants did not emphasize important social interactions with actual wearing of CPAP. After one week of treatment on CPAP, unmarried participants described less confidence in their ability to use CPAP and described less “response” to CPAP than those participants who were married. Unmarried participants described few facilitators of treatment use with the first week of CPAP therapy. Nearly all unmarried participants identified “self-driven” reasons for pursuing treatment and there was an absence of social sources of support, or “cheerleaders and helpful problem-solvers” while using CPAP during the first week.

Typologies of Adherent and Nonadherent CPAP Users

Described differences in beliefs, perceptions, and experiences of being diagnosed with OSA and early treatment with CPAP were explicit between adherers and nonadherers to treatment. Adherers perceived health and functional risks of untreated OSA, had positive belief in their ability to use CPAP from early in the diagnostic process, had clearly defined outcome expectations, had more facilitators than barriers as they progressed from diagnosis to treatment, and identified important social influences and support sources for pursuing both diagnosis and persisting with CPAP treatment. Nonadherers described not knowing the risks associated with OSA, perceived fewer symptoms of their diagnosis, did not have clearly defined outcome

expectations for treatment, identified fewer improvements with CPAP exposure, placed less emphasis on social support and socially-derived feedback with early CPAP treatment, and perceived and experienced more barriers to CPAP treatment. As a result of the across-case analysis in which important differentiating consistencies and differences in the described experience of being diagnosed with OSA and early treatment with CPAP participants were identified, we suggest typologies, or descriptive profiles, of persons with CPAP-treated OSA (Table 5). The typologies we propose are consistent with previous empiric studies of CPAP adherence, in that predictive relationships between risk perception, outcome expectancies, perceived self-efficacy, and social support with CPAP use have been identified. Our study findings extend the previous findings by illuminating the importance of contextual meaning persons derive from their experiences, beliefs, and perceptions when progressing from diagnosis with OSA to treatment with CPAP. Furthermore, the typologies succinctly describe critical differences between these groups of CPAP-treated OSA persons that support the development of patient-centered or tailored adherence interventions that importantly recognize individual differences.

Discussion

This is the first study to apply a predominantly qualitative method to describe individual beliefs and perceptions of the diagnosis of OSA and treatment with CPAP relative to short-term CPAP adherence. Our findings are consistent with previous, empiric studies with regard to the overall applicability of social cognitive theory to the phenomenon of CPAP adherence. The findings from our study uniquely extend these previous findings by illuminating the importance of the individual experiences, beliefs, and perceptions as influential on decisions to pursue diagnosis and treatment of OSA. Furthermore, the described differences between adherers and nonadherers in our study suggest critical tailored or patient-centered intervention opportunities that may be developed and tested among patients who are newly diagnosed with OSA and anticipate CPAP treatment. The major findings of the study include: (a) adults described and assigned meaning to being diagnosed with OSA and treated with CPAP, which in turn influenced their decisions to accept or reject treatment and the extent of CPAP use; and (b) differences in beliefs and perceptions at diagnosis and with CPAP treatment were identified among CPAP adherers and nonadherers and further described in the social context of married and unmarried CPAP users. The described differences between these groups provide data to support the first published typology, or descriptive profile, of CPAP adherers and nonadherers.

Theoretically-derived variables, such as the determinants of health behaviors described in social cognitive theory and applied in our study, are operational concepts that help us understand OSA patients' perceptions and beliefs about OSA and CPAP and may guide interventions to improve adherence to CPAP. Framed by Bandura's social cognitive theory (1977), differences among adherers and nonadherers to CPAP can be defined across social cognitive theory determinants of health behaviors: (a) knowledge, (b) perceived self-efficacy, (c) outcome expectancies and goals, and (d) facilitators and barriers. As previous studies have demonstrated, psychosocial constructs, such as those consistent with social cognitive theory, provide possibly the most explained variance, to date, among adherers and nonadherers (Aloia, Arnedt, Stepnowsky, et al., 2005; Engleman & Wild, 2003; Stepnowsky, Bardwell, et al., 2002; Weaver et al., 2003). Furthermore, recent intervention studies to promote CPAP adherence have applied similar theoretical constructs with some positive findings (Aloia et al., 2007; Richards, Bartlett, Wong, Malouff, & Grunstein, 2007). As our study suggests, decisions to use CPAP are individualized and at least in part dependent on the patient's support environment and early experiences with and beliefs about CPAP. As early commitments to use or not use CPAP predict long-term use (Aloia, Arnedt, Stanchina, et al., 2007; Weaver et al., 1997), it is critically important to understand and examine opportunities to intervene on factors that influence early commitments to use CPAP. This insight will potentiate the development

of patient-centered and tailored interventions to improve CPAP adherence at the individual level while collectively promoting the health outcomes of the OSA population.

Our study confirms that social cognitive theory is applicable to the unique health behavior of using CPAP treatment. Indeed, the interacting determinants of health as described by Albert Bandura (1977) in relationship to decisions to accept and use CPAP were clearly described by our study participants. This affirmation suggests that any one measured domain within the model (i.e., barriers, facilitators, outcome expectancies) is not likely to identify persons at risk for nonadherence to CPAP. Rather, our study findings support the complex and reciprocating nature of the theoretical model as it applies to this health behavior and offers clarity to our understanding of CPAP adherence as a multi-factorial, iterative decision-making process. It is therefore important to ascertain an understanding of the context of the individual from the initial diagnosis through early treatment use in order to address the complex nature of the problem of adherence to CPAP and identify those likely to be nonadherent to the treatment.

The experience and perception of symptoms contributed to the participants' motivation to seek diagnosis, commitment to seek treatment after diagnosis, and adherence to CPAP treatment. Although studies that have examined pre-treatment symptoms, particularly subjective sleepiness, have produced inconsistent results with regard to subsequent CPAP use, these studies have measured symptoms on quantitative scales that define specific scenarios of "impairment" related to the symptom of interest (i.e., Epworth Sleepiness Scale, Functional Outcomes of Sleep Questionnaire, Stanford Sleepiness Scale) (Engleman et al., 1996; Hui et al., 2001; Janson, Nøges, Svedberg-Randt, & Lindberg, 2000; Kribbs et al., 1993; Lewis, et al., 2004; McArdle et al., 1999; Sin, et al., 2002; Weaver et al., 1997). Yet, perceptions of need relative to one's experience of symptoms was relevant to decisions to pursue both diagnosis and treatment. Consistent with perceptions that influence medicine-taking behavior (Hansen, Holstein, & Hansen, 2009), particular situations necessitated the pursuit of diagnosis and use of the treatment. The experience of symptoms and the impact of symptoms on daily life were highly variable among participants and not readily amenable to discrete categorization yet understanding "particular situations" is important insight to explaining adherence to CPAP.

Recognizing and acknowledging that perceived symptoms are part of a disease process and logically linked to the diagnosis of OSA was important to the participants of our study and to their commitment to move forward from diagnosis to treatment, consistent with Engleman and Wilds' findings (2003). A recent intervention study to promote CPAP adherence incorporated specific strategies that address "personalization" of OSA symptoms (Aloia, Arnedt, Riggs, et al., 2004; Aloia et al., 2007). Results of this randomized controlled trial showed lower CPAP discontinuation rates among those subjects who were in the motivational enhancement and education group when compared with "usual care," suggesting the importance of assisting persons diagnosed with OSA to make the connection between the objectively measured disease/diagnosis and their lived experience of the disease (Aloia et al., 2007). Personalizing symptoms, recognizing the impact of symptoms on daily function, and identifying the "meaning of disease" in terms of the perception of one's own health were clearly described by participants in our study, with adherent and nonadherent participants clearly expressing differences in their experiences of having OSA, including the impact of functional impairment on social relationships. From these differing perspectives, participants defined outcome expectations and health risks associated with OSA in different ways, possibly influencing their eventual decision to use or discontinue CPAP.

The described importance of participants' early experiences with CPAP and their initial response to CPAP treatment, both during the CPAP sleep study and during the first week of CPAP use, were influential on participants' interest in continuing to use CPAP. Our study results are consistent with Van de Mortel and colleagues' (2000) findings in which

nonadherent, CPAP-treated OSA patients had complaints about their sleep study experience and described “major” problems on the night of their CPAP titration. Similarly, Lewis (2004) found that problems identified on the first night of CPAP use, albeit on autotitrating CPAP, were consistent with lower CPAP use. Not only has the initial experience with CPAP been identified as important to subsequent CPAP adherence, but also the initial response to CPAP on the first night of treatment has been correlated with subsequent CPAP adherence (Drake et al., 2003). The importance of promoting a positive initial experience with CPAP and providing anticipatory guidance about outcome expectations is highlighted by our findings.

The significance of social support, both proximate and within the broader social network, was an important facilitator of CPAP use among adherers in our study. Differences between the experiences of married and unmarried individuals with OSA revealed the described importance of an immediate, proximate source of support for CPAP use, consistent with previous findings that those CPAP users who lived alone were significantly less likely to use their CPAP than those who lived with someone (Lewis, et al., 2004). Not only are immediate sources of support important for continued use of CPAP, but also shared experiences with CPAP from less immediate social sources. Participants in our study described social relationships as motivators to seek diagnosis, provide positive reinforcement for persisting with treatment use, and a source for sharing “tips” on managing OSA and CPAP. Studies exploring reasons for nonadherence to anti-tuberculosis drugs have similarly identified the importance of social influences on seeking treatment and using treatment (Naidoo, Dick, & Cooper, 2009). Among CPAP-treated OSA patients, intervention studies that included feedback to subjects, positive reinforcement, inclusion of a support person, and assistance with trouble-shooting difficulties resulted in higher CPAP adherence among subjects in the intervention groups as compared with placebo or usual care groups (Aloia et al., 2001; Chervin, Theut, Bassetti, & Aldrich, 1997; Hoy, Vennelle, Kingshott, Engleman, & Douglas, 1999). Confirming the applicability of these intervention strategies, the described experiences of participants in our study provide empiric support for adherence interventions that include a support person, provide early feedback to patients and positive reinforcement, and assist with trouble-shooting difficulties in the early treatment period, specifically aimed at the initial CPAP experience.

Barriers to subsequent CPAP use that were identified by participants of our study included the process of having to put a mask on every night, aesthetic issues with mask/headgear use, inconvenience of having to use a machine to sleep, and daily routines that were disrupted by CPAP. Consistent with previous studies (Engleman, et al., 1994; Hui et al., 2001; Massie, et al., 1999; Sanders, et al., 1986), side effects of CPAP were not emphasized by participants as barriers to CPAP use. Although identified barriers did not necessitate nonadherence to CPAP in our study, it was important for individuals who experienced such barriers to identify positive reasons to use CPAP and successfully mitigate barriers, often with the help of others.

This study has several limitations. First, although the sample size of 15 was adequate for a qualitative study, there was limited power to conduct any exploratory quantitative analyses. Although not the objective of this study, quantitative exploration of commonly-used measures of subjective sleepiness, functional impairment, and adherence to CPAP correlated with descriptive quantitized typologies of adherent and nonadherent CPAP users would further support the findings of the study. Study participants included predominantly male veterans with severe OSA who had relatively high educational preparation. Examining this typology in a larger, more heterogeneous sample of OSA patients is needed. As the relationship of gender, disease severity, symptom perception, and disease-specific literacy with CPAP adherence has not been clearly defined, replicating this study in a more diverse sample and expanding concurrently-measured quantitative outcomes would be informative and supportive of typology refinement or expansion. Finally, in order to reduce the potential confounding effect of clinically-delivered psychoeducation, we enrolled participants referred to the study from a

single clinical provider with limited participant-provider interaction at the first pre-diagnostic evaluation. However, participants were potentially contacted by telephone or had unscheduled visits at the sleep center that were not controlled for in any way in our study.

Our mixed methods, exploratory study, employing a predominantly qualitative methodology, achieved saturation of themes regarding the diagnosis of OSA and nightly CPAP use during the first week of treatment. The study results are consistent with previous studies of CPAP, even when adherence has, in many previous studies, been defined as four hours/night of use rather than six hours/night of use as in our study. With recent evidence suggesting better outcomes with longer nightly CPAP use (Stradling & Davies, 2000; Weaver et al., 2007; Zimmerman, Arnedt, Stanchina, Millman, & Aloia, 2006), applying a definition of CPAP adherence as six hours versus four hours, likely contributed to more robust differences in described beliefs and perceptions among adherers and nonadherers. The results of our study provide the first published, narrative descriptions of CPAP adherers and nonadherers which support an overall composite of characteristics that may be useful in identifying specific subgroups of patients that are most likely to benefit from tailored interventions to lessen the risk for subsequent CPAP nonadherence. To date, studies have provided adherence promotion interventions to unselected groups, possibly minimizing variation of response between intervention and control groups. Future adherence interventions studies will likely identify more robust differences in response to interventions by delivering tailored interventions to those who are identified prospectively as high risk for treatment failure due to nonadherence.

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Figure 1.
Social Cognitive Theory Health Determinants – Pathways of Influence of Self-efficacy on Health Behaviors

Figure 2.
Study Design

Figure 3.
Sequential Analysis Procedure

Table 1

Post-diagnosis Interview Guide

CONCEPT**TOPIC/QUESTION****CONCEPT:** Perceptions and Knowledge of Diagnosis**TOPIC/QUESTION**

How did you know about sleep disorders and the sleep center before coming to your first appointment?

Before being told that you have OSA, had you heard of OSA? If so, what did you know about OSA?

What do you now understand about OSA?

After having your sleep study, what are your thoughts about OSA and what it means to you?

CONCEPT: Perceived Effects of Diagnosis**TOPIC/QUESTION**

How do you believe OSA affects you in your daily life?

CONCEPT: Sociocultural Precedents and Influences on Health, Illness/Disease, and Care Seeking**TOPIC/QUESTION**

Do you know anyone else who has been diagnosed with OSA? If so, how did that impact on you coming to the sleep center?

Why did you seek care from the sleep center?

Is there anyone who influenced you to seek care for this problem?

Is there anyone that has helped you understand what OSA is? If so, how does this affect your desire to receive treatment?

What has your experience with a health care system been like to this point?

Does sleep, sleeping, and/or the sleep environment have any specific meaning(s) to you? To your family? Your spouse/significant other/bed partner?

Table 2**One Week Post-CPAP Use Interview Guide****CONCEPT****TOPIC/QUESTION****CONCEPT:** Perceived effects and knowledge of treatment with CPAP**TOPIC/QUESTION**

Have you been using continuous positive airway pressure treatment (CPAP) for the treatment of your OSA?

How would you describe your use of CPAP?

Are you experiencing any improvements in the way that you feel since you have started using CPAP?

When did you first learn about CPAP?

Who first described CPAP to you?

What did you think when you first learned about CPAP? First saw CPAP? First used CPAP in the sleep laboratory?

What do you see as the most important reason for using CPAP in the short-term? In the long-term?

CONCEPT: Supportive mechanisms or barriers to incorporating CPAP into daily life**TOPIC/QUESTION**

How has the first week of CPAP treatment gone for you?

What kinds of problems using CPAP are you experiencing?

What has prevented your regular use of CPAP?

What has been helpful in your regular use of CPAP?

CONCEPT: Sociocultural perspectives of health-related decisions to use or not use CPAP**TOPIC/QUESTION**

Do you believe CPAP treatment is a treatment you can [continue to] use? Did this belief change since you first learned of your diagnosis? Since starting CPAP?

Do you envision yourself using CPAP over the next 3 months? Over the next year? Over the next 5 years?

Do you have any concerns about the CPAP unit and your sleep [ability or quality] or your sleep environment that may affect your CPAP use?

How does the diagnosis of OSA and treatment with CPAP affect or been affected by those around you?

Table 3

Social Cognitive Theory Determinants of Health as Categorizing Framework for Themes from Content Analysis¹

DETERMINANT OF HEALTH BEHAVIOR CATEGORY
THEMES DERIVED FROM CONTENT ANALYSIS
DETERMINANT OF HEALTH BEHAVIOR CATEGORY: Knowledge
THEMES DERIVED FROM CONTENT ANALYSIS
Fear of death
Gathering information about OSA/CPAP gives rise to determining the importance of getting to treatment and decisions to accept/reject treatment
Most immediate impact of OSA on daily life [single symptom] as a motivator to pursue diagnosis and treatment
Justifying symptoms provides explanation for not pursuing diagnosis and/or treatment
OSA impacts not only health but also quality of life
Pervasive effects of OSA on life
Sleepiness plays a limited role in life and can be accommodated
Perceived health effects of a disorder are important to valuing diagnosis/treatment
Associating health risks and functional limitations with OSA contributes to recognizing OSA as a health problem with significant effects on overall well-being
Perception of seriousness of symptoms influenced by perceived effects symptoms have on individual [health risks] and those around individual [social network]
Perceived health risks of OSA
Information provided to individual and applicability of information influences individual's assumptions of responsibility for OSA and CPAP treatment
Symptoms of OSA have impact on social roles, functions, and relationships
DETERMINANT OF HEALTH BEHAVIOR CATEGORY: Perceived Barriers and Facilitators
THEMES DERIVED FROM CONTENT ANALYSIS
Social influences as motivators to recognize health problem, seek diagnosis/treatment, and use CPAP
Objective measures of OSA important to healthcare decision-making
Differences in perception of urgency of treatment between patient and provider influences valuing of diagnosis and treatment by patient
Social networks contribute to treatment acceptance but not necessarily to treatment use
Perceived seriousness of symptoms influenced by perceived effects of symptoms on individual [health risks] and those around individual
Social networks provide support, help problem-solved health concerns, and are sources of health-related information
Commonality of symptoms of OSA promotes perception of normalcy: Barrier to seeking diagnosis/treatment
Social influences as motivators to recognize health problem, seek diagnosis and treatment, and use treatment
Silent symptoms: Fear of what it means if symptoms of OSA are undetectable
Family and social networks contribute to health beliefs about sleep
Expectations of health delivery versus the actual delivery of healthcare services impact on the importance individual's place on their health and the value they place on their relationship with healthcare providers
DETERMINANT OF HEALTH BEHAVIOR CATEGORY: Perceived Self-efficacy
THEMES DERIVED FROM CONTENT ANALYSIS
Knowledge and information provided to individual and applicability of information influences individual's assumption of responsibility for OSA and CPAP treatment
Early response to CPAP, consistent or inconsistent with outcome expectations, facilitates or is a barrier to treatment use
Early experience with CPAP is a source of support or a barrier to belief in own ability to use treatment
Fitting treatment into life
Problem-solving difficulties/routinization of CPAP responsibilities contribute to disease management

DETERMINANT OF HEALTH BEHAVIOR CATEGORY**THEMES DERIVED FROM CONTENT ANALYSIS**

DETERMINANTS OF HEALTH BEHAVIOR CATEGORY: Outcome Expectations**THEMES DERIVED FROM CONTENT ANALYSIS**

Understanding why symptoms exist and associating specific symptoms with a diagnosis provides hope that treatment will address experienced symptoms and improve overall quality of life

Expectations of treatment outcomes are facilitators of treatment initiation and use

Early response to CPAP, consistent or inconsistent with outcome expectations, facilitates or is a barrier to using treatment

DETERMINANTS OF HEALTH BEHAVIOR CATEGORY: Goals**THEMES DERIVED FROM CONTENT ANALYSIS**

Problem-solving difficulties/routinization of CPAP responsibilities contribute to disease management

¹ Themes derived from participant text data were categorized as a determinant of health behavior from Bandura's Social Cognitive Theory. Themes are not mutually exclusive. Definitions of broad categories from Bandura, 2004. Theme definitions mutually agreed upon by investigators of the study and applied to the directed content analysis procedure by a single investigator acting as the primary coder of text data.

Table 4

Sample Description

Characteristic	Frequency (%)
	(n=15)
Sex	
Males	13 (87%)
Females	2 (13%)
Race/Ethnicity	
African American	9 (60%)
Caucasian	5 (33%)
Other	1 (7%)
Marital Status	
Married	7 (47%)
Single	3 (20%)
Divorced	3 (20%)
Widowed	2 (13%)
Highest Education	
Middle School	1 (7%)
High School	7 (47%)
2 Yr College	4 (27%)
4 Yr College or higher	3 (20%)
Shift Work	3 (20%)
Employed	6 (40%)
Retired	6 (40%)
	Mean $\pm$ SD ¹
Age, y	53.9 $\pm$ 12.7
Weight, lbs.	248.9 $\pm$ 68.7
AHI, events/hr	53.5 $\pm$ 26.5
O2 Nadir, %	66.4 $\pm$ 13.2
CPAP Pressure, cmH2O	10.7 $\pm$ 1.6
One-week CPAP	4.98 $\pm$ 0.5
Adherence	

¹ SD Standard deviation

Table 5

Typologies of Adherent and Nonadherent CPAP Users

Adherent CPAP User	Nonadherent CPAP User
Define risks associated with OSA	Unable to define risks associated with OSA
Identify outcome expectations from outset	Describe few outcomes expectations
Have fewer barriers than facilitators	Do not recognize own symptoms
Facilitators less important later with treatment use	Describe barriers as more influential on CPAP use than facilitators
Develop and define goals and reasons for CPAP use	Facilitators of treatment absent or unrecognized
Describe positive belief in ability to use CPAP even with potential or experienced difficulties	Describe low belief in ability to use CPAP
Proximate social influences prominent in decisions to pursue diagnosis and treatment	Describe early negative experiences with CPAP, reinforcing low belief in ability to use CPAP
	Unable to identify positive responses to CPAP during early treatment