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Experience of Women with a Diagnosis of Obstructive Sleep Apnea (OSA): A Dissertation

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Experience of Women with a Diagnosis of Obstructive Sleep Apnea (OSA)

A dissertation presented

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Dedication

This dissertation study is dedicated to the multitude of women living with diminished health-related quality of life related to undiagnosed or undertreated obstructive sleep apnea. The poignant comments and pleas for more awareness shared with me by the women in this study will not go unheard. With their help, I dedicate myself and my research to increasing awareness of the impact of OSA on women.

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ABSTRACT

EXPERIENCE OF WOMEN WITH A DIAGNOSIS OF OBSTRUCTIVE SLEEP APNEA

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This qualitative descriptive (QD) study examined the experience of the woman newly diagnosed with obstructive sleep apnea (OSA). The study employed Leventhal's Self-Regulatory Theory to understand women's illness representation of OSA, cognitive and emotional coping, and situational appraisal skills in coming to terms with OSA. The specific aims were to: 1) Describe the illness representation of women with a recent diagnosis (within one year) of OSA; 2) Describe the cognitive perceptions and emotional response to diagnosis and treatment of OSA in this sample of women; and, 3) Describe the meaning of OSA and the coping strategies used by this sample of women.

The overarching theme of this study of a *life-altering diagnosis* required participants to process the health threatening information in both a conceptual and concrete process for dealing with both the physical and emotional aspects. The first two subthemes that emerged were *Making sense of it,* and *Making it work* as the women came to terms with their symptoms, diagnosis, and adapted to their treatment. For this sample of women, both acceptance (acknowledging the diagnosis of OSA and embracing treatment), and denial (not convinced of

diagnosis or need for treatment, seeking alternatives) were factors in how they made sense of the situation. The making it work subtheme dealt with the women's experiences adapting to treatment both physically and emotionally, including the appraisal, reconsideration and adjustments when they encountered difficulties and delays. A fluid iterative process included women participants describing how they appraised their situation often moving back and forth between acceptance, denial, seeking alternatives, struggling with treatment and moving forward. In both of these subthemes, family support and the stigma of OSA and CPAP were involved in how the women accepted and adapted to treatment. The third subtheme that emerged was *Paying it forward* as many women felt the obligation to help themselves by adapting a healthier lifestyle for themselves, their families and to assist others impacted by OSA. Women spoke of paying it forward by offering information and support to others not yet diagnosed, or are struggling with diagnosis and treatment. Many of these women were staunch advocates for other women to be tested, for HCPs to be more aware, to be more attuned to women's sleep history, and to refer women for treatment. Implications of these findings include enhancing recognition and awareness by women of OSA symptoms, the need for diagnostic evaluation, and partner awareness as an important component of diagnosis and successful treatment for women.

Study findings support recognition of women's presentation of OSA including unusual symptoms for earlier diagnosis and treatment. Sleep partner awareness and support appear to be relevant to women in acceptance of a life altering diagnosis. Further exploration of modifiable factors such as prompt diagnosis and individualized treatment of women with OSA could also impact potential co-morbidities. Provision of further education and awareness by HCPs and insurance companies that women may not present with classic symptoms of OSA is also needed. Targeted interventions specific to women's experiences with OSA include development of screening tools, care guidelines and treatments that enhance applicability, acceptability, and

patient satisfaction. Future advocacy work will also require supporting women in “paying it forward” to help other women diagnosed with OSA.

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Chapter I

State of the Science

Introduction

Current estimates indicate sleep disturbed breathing (SDB) or Obstructive Sleep Apnea (OSA) affects 22 million Americans. Approximately 80% of Americans with moderate to severe OSA have not been diagnosed (American Sleep Apnea Association (ASAA), 2012). The incidence of OSA is expected to rise in Americans due to an aging population and the steady growth of obesity in the U.S. (Finucane et al., 2011; Lam, Mak, & Ip, 2012). A national sleep survey in 2005 to assess the prevalence of individuals at risk for OSA indicated that as many as 25% of Americans were at high risk for OSA with increases associated with aging until about age 65 (D. M. Hiestand, Britz, Goldman, & Phillips, 2006). Study respondents identified at high risk for OSA were more likely to report sleep disturbances, negative impact on Quality of Life (QOL), and the presence of chronic medical conditions (D. M. Hiestand et al., 2006).

OSA is the most common form of sleep disordered breathing (SDB) previously described to affect middle-aged and older, overweight or obese males prone to snoring (Young, Evans, Finn, & Palta, 1997). In reality, OSA is a multifaceted entity that has been related to airway anatomy and physiology and possibly other etiologies under study, that leads to airway collapse and can affect anyone (American Sleep Apnea Association (ASAA), 2012; Dahlqvist et al., 2007; Guilleminault, Tilkian, & Dement, 1976; Isono, 2012; White, 1995). The overall prevalence for mild to severe SDB is 26% for all individuals aged 30-70 in the most recent period of measurement, 2007-2010 (Peppard et al., 2013). An increased prevalence of SDB occurring between 14-55% in the last two decades was based on subgroup age categories, with the larger increase noted in younger men and women (Peppard et al., 2013). The prevalence of

moderate to severe SDB in older adults has been increasing to 17% for men and 9% for women at ages 50-70 compared to 10% for men and 3% for women ages 30-49 (Peppard et al., 2013). A 2014 cross-sectional study of adults with OSA (n = 823) found the prevalence of OSA to be 4.01% in men and 2.61% in women (Pan, Wang, & Wang, 2014), a less than 2:1 ratio.

The most common symptoms associated with OSA include loud snoring, cessation of breathing, lack of restful sleep and excessive daytime sleepiness (EDS). OSA has been diagnosed when an individual suffers more than five episodes of apnea (lasting longer than 10 seconds) or hypopnea per hour, as measured by the apnea-hypopnea index (AHI) (The Report of an American Academy of Sleep Medicine Task Force, 1999). The severity of OSA has been further categorized by the AHI as mild OSA (5-15 episodes/hour), moderate OSA (16-30 episodes/hour), and severe OSA (more than 30 episodes/hour) (The Report of an American Academy of Sleep Medicine Task Force, 1999).

Traditionally OSA has been considered a "man's disease" which leads to women experiencing under-diagnosis, under-treatment and under-representation in OSA research (Resta et al., 2003; Ye, Pien, & Weaver, 2009). Data has indicated that OSA is underreported in women (Shepertycky, Banno, & Kryger, 2005; Young, 1993), who also experience delays in diagnosis and treatment (Ye et al., 2009). Women have also been under-represented in studies of OSA diagnosis despite identifying a similar ratio of 2-3:1 in men to women noted as far back as the mid-1990s (Young, Hutton, Finn, Badr, & Palta, 1996). Lack of diagnosis in women who need proper treatment has resulted in serious health and life-threatening diseases including cardiovascular (CVD), cognitive dysfunction, liver disease, diabetes, cancer, and health-related quality of life (HR-QOL) (See Appendix D). An additional concern includes the lack of appropriate measures to identify presenting findings and symptoms of OSA by women (Redline, Kump, Tishler, Browner, & Ferrette, 1994; Resta et al., 2003) such as snoring behaviors, EDS,

obesity, and hypertension (HTN) (Baldwin et al., 2001; D. M. Hiestand et al., 2006; Kapsimalis & Kryger, 2009; Larsson, Lindberg, Franklin, & Lundback, 2003; Redline et al., 1994; Resta et al., 2003). Women have also faced additional sociocultural threats to diagnosis that result from failure to report symptoms that might lead to a diagnosis and treatment of OSA. The rates of women diagnosed with OSA could be improved by prompt recognition of female-related presenting symptoms.

To date, little is known about the diagnosis of OSA from the perspective of women including the meaning and appraisal of the illness representation, cognitive perceptions and emotional responses, and coping strategies used. Diagnosis and treatment of OSA can diminish the morbidity and mortality associated with this sleep disorder (Kapsimalis & Kryger, 2009; Ye et al., 2009; Yeboah et al., 2011; Young et al., 1993). A lack of awareness by the healthcare provider (HCP) in recognizing the differences in illness representation in women has also raised barriers to seeking diagnosis and treatment. With potentially 25% of American women at high risk for OSA, heightened awareness is needed by primary care practitioners (PCP) to refer women for evaluation and treatment in light of the increased morbidity and mortality associated with OSA (Kapsimalis & Kryger, 2009). As the woman struggles with formulating a representation for what OSA might mean to her life, she may raise barriers to seeking diagnosis and treatment. The knowledge gap that this study addressed was exploration of the women's experience of diagnosis, specifically their perspectives on illness representation, threat appraisal and coping strategies that could assist in earlier diagnosis and successful treatment.

Purpose and Aims

Therefore, the purpose of this study was to explore women's experiences with the diagnosis of OSA. The study was conducted using Leventhal's Self- Regulatory Theory (Howard Leventhal & Johnson, 1983) as the guiding framework. The specific aims were to:

1. describe the illness representation of women with a recent diagnosis (within one year) of OSA
2. describe the cognitive perceptions and emotional response to diagnosis and treatment of OSA in this sample of women
3. describe the meaning of OSA and the coping strategies used by this sample of women.

Review of the Literature

A review of current literature on OSA will discuss historical perspectives, challenges to women including gender differences in presentation, sociocultural and healthcare provider barriers, and treatment referral and response. The meaning or illness representation of OSA to the newly diagnosed woman, perceived health threats, emotional response, and methods of coping and assessment will be presented.

Historical perspective

In the 1970s, Guilleminault and colleagues published extensively on sleep disordered breathing (including what would become known as Obstructive Sleep Apnea), noting only 5% of patients met the criteria of extreme morbid obesity associated with Pickwickian patients (Guilleminault et al., 1976). OSA was originally seen as a predominately male disorder from initial research conducted in the 1970s and 1980s (Resta et al., 2003). These original studies reported male/female ratios of 8:1 or 10:1 for SDB /OSA (Phillips et al., 2008; Resta et al., 2003; Young et al., 1993). Screening instruments were likewise developed with male reported symptoms in mind (Beaudreau et al., 2011; Redline et al., 1994; Resta et al., 2003; Ye et al., 2009).

The 1994 epidemiologic Cleveland Family Study of sleep apnea by Redline and colleagues assessed the associations of gender; sleep disordered breathing (SDB), and symptoms. The study compared differences in symptoms and referrals for 36 subjects with confirmed OSA with subjects' relatives (N = 196) and with neighbors including neighbors' families (N = 157).

Of the entire sample, the known OSA male to female sample ratio was 8:1 while the community sample of relatives and neighbors ratio of SDB was 2:1. SDB in the known sample was 38% in males (n = 31) and 15% in females (n = 5), while in relatives and neighbors it was 26% in males (n = 41) and 13% females (n = 24). Redline (1994) reported females were found to consistently under-report symptoms of snoring, snorting/gasping and apnea 2-3 times less compared to males (*OR* 1.80, 1.92, 3.13 respectively). SDB was also found to be more common in older women and frequently occurred in non-obese women (Redline et al., 1994). This original study evolved into the largest world-wide family study of sleep apnea (N = 2284 individuals from N = 361 families) that also included genetics and phenotype testing (dbGaP, 2012).

A ground-breaking study, the Wisconsin Sleep Cohort Study, initiated by Young and colleagues (1993) reported the prevalence of OSA in women was almost half that of men (4% for men and 2% for women). This prospective longitudinal study examined the history of cardiopulmonary disease and its association with sleep disorders in state employees. The initial research included subjects (N = 3513) who completed a sleep questionnaire including n = 602 of these participants who underwent polysomnography (PSG), an overnight sleep study used to diagnose OSA. A purposive sample of habitual snorers (75%) and a random selection of non-snorers (25%) underwent a repeat PSG 7-14 days later (n = 40). Although the findings confirmed OSA was more prevalent in men, women were found under-diagnosed with 2% meeting the minimal criteria for SDB versus 4% of men, or a male/female ratio of 2:1 (Young et al., 1993). This work led to gender bias concerns in the diagnosis and treatment of women with SDB or OSA.

Using the same cohort while matching males and females for severity of OSA, Young and colleagues (1996) showed women had different presenting symptoms, while snoring was the most sensitive and strongest predictor of OSA among symptoms reported by males and females.

They concluded that women might have different symptoms than men that could be missed especially as clinical guidelines and screening instruments were developed primarily for men, resulting in less frequent referral for treatment (Young et al., 1996). Young and colleagues (1997) also estimated that even with access to a specialty sleep disorders clinic, as many as 80% of middle-aged men and women with moderate to severe OSA went undiagnosed (Young et al., 1997).

A prospective cohort study, the 1994 Sleep Heart Health Study investigated SDB and OSA as potential risk factors for cardiovascular disease development (Quan et al., 1997). This large study drew subjects from other ongoing studies including the Atherosclerosis Risk in Communities Study (N = 1750) (The ARIC Investigators, 1989), Cardiovascular Health Study (N = 1350) (Fried et al., 1991), Framingham Heart Study (N = 1000) (Dawber, Kannel, & Lyell, 1963), New York Hypertension Cohorts (N = 1000) (James, Toledano, Datz, & Pickering, 1995; Schnall, Schwartz, Landsbergis, Warren, & Pickering, 1992), Tucson Epidemiologic Study of Airways Obstructive Diseases and the Health and Environment Study (N = 900) (Lebowitz & Burrows, 1975) and the Strong Heart Study (N = 600) (E. T. Lee et al., 1990) for a total of 6600 participants, age forty and older (Quan et al., 1997). This study was sufficiently powered to assess OSA/SDB as risk factors in the development of cardiovascular disease (CVD) including major events such as stroke and myocardial infarction (MI) (Quan et al., 1997). Multiple avenues of investigation resulted from this very large study related to OSA and co-morbidities, including nocturia and CVD (Parthasarathy et al., 2012), quality of life (Baldwin et al., 2010; Baldwin et al., 2001), and research into stroke (Redline et al., 2010).

Illness representation of OSA

OSA diagnosis in women

Women have faced several threats to proper recognition and treatment of OSA. Studies showed women with unusual presenting symptoms (Shepertycky et al., 2005), including insomnia and sociocultural factors (Castillo, Goparaju, & Bianchi, 2014; Guilleminault, Palombini, Poyares, & Chowdhuri, 2002; Phillips et al., 2008; Quintana-Gallego et al., 2004; Redline et al., 1994; Shepertycky et al., 2005; Valipour et al., 2007; Venn, 2007; Young, 1993), may lead HCPs away from a diagnosis of OSA or delay the diagnosis. A recent study (N = 176; n = 24 women) of gender differences in treatment suggested that women have lower ability to function with the effects of OSA, suffering more apneic episodes with associated daytime sleepiness (16.8 vs. 14.5, p = 0.032, effect size = 0.49), increased mood disturbances (21.0 vs. 11.9, z = −2.68, p = 0.007), and exhibit more decreased cognitive functioning (12.8 vs. 15.0, p = 0.002, effect size = 0.72), than men at baseline (even with adjustment for age, body mass index (BMI), and AHI) (Ye et al., 2009). After treatment, the differences were no longer statistically significant for daytime sleepiness (p = 0.221), mood disturbances (p = 0.193), and functional capacity (p = 0.168), and women displayed greater improvement in overall function (38% vs. 23%, p = 0.040, effect size = 0.47) when compared with men (Ye et al., 2009). Women have been known to underreport symptoms of OSA, possibly due to sociocultural barriers for reporting symptoms not seen as socially desirable, such as snoring (Quintana-Gallego et al., 2004; Redline et al., 1994; Shepertycky et al., 2005; Venn, 2007). Women, once correctly diagnosed, similarly responded to treatment as men, achieving the benefits of treatment such as improved QOL (Marklund, Stenlund, & Franklin, 2004; Tomfohr, Ancoli-Israel, Loredo, & Dimsdale, 2011; Woehrle, Graml, & Weinreich, 2011; Ye et al., 2009). I will now explore the differences in women and OSA as reported in recent literature in more detail.

Menopause. OSA has been often associated with the onset of menopause and associated weight gain. Menopause has been a time when women complain of sleep disturbances and when OSA may first be diagnosed (Bixler et al., 2001; Hachul et al., 2014; Hall et al., 2012; Resta et al., 2003; Young, Finn, Austin, & Peterson, 2003). A seminal study by Bixler (2001) investigated the effects of gender on the prevalence of SDB in women, specifically examining the impact of menopause and hormone replacement therapy (HRT), adjusting for age and obesity. This very large prevalence study (N = 16583) of randomly selected individuals enrolled 12,219 women and 4364 men in phase I interviews, followed by phase II PSG (n = 1000 women; n = 741 men). A low prevalence of OSA at 0.06% was found in premenopausal women (n = 503) and 0.05% of postmenopausal women on HRT (n = 183). Postmenopausal women without HRT (n = 314) were significantly more likely to have OSA (2.7% vs. 0.6%; RR = 4.7 [1.2, 14.5], p = 0.02). Menopause was felt to be a significant risk factor for OSA in women while post-menopausal women taking HRT were associated with a reduced risk (Bixler et al., 2001).

The Wisconsin Sleep Cohort Study cautioned that menopause was not found to be associated with diminished sleep quality when measured by PSG, or even a strong predictor of specific SDB symptoms (Young et al., 2003). This large study (N = 589) recommended that peri-and menopausal women who complained of sleep disturbances be evaluated for OSA instead of attributing their symptoms to menopause (Young et al., 2003). Contrary to Young and colleagues, a 2014 Brazilian population–based study by Hachul and colleagues (2014) (N = 535; n = 339 premenopausal, n = 53 early postmenopausal, n = 118 late postmenopausal, n = 25 using HRT) discovered after adjusting for confounding factors, postmenopausal women (n = 196) spent more time in non-rapid eye movement (NREM) Stage 3 deep sleep (N3) ($p < 0.05$), had higher AHI ($p < 0.01$) and lower oxygen saturation at basal, mean and minimum levels ($p <$

0.001). This study's findings suggested that menopause has a small significant impact on sleep (Hachul et al., 2014).

The SWAN Sleep Study, a subsidiary of the original Study of Women's Health Across the Nation (SWAN), was a cross-sectional study of sleep in midlife women (Hall et al., 2012). The SWAN Sleep Study evaluated a multiethnic sample of menopausal women (Caucasian, *n* = 158; African-American, *n* = 125; Chinese, *n* = 57), for associations between objective and subjective measures of sleep and metabolic syndrome (Hall et al., 2012). Metabolic syndrome was associated, after covariate adjustment, with sleep efficiency (*OR* = 2.06, 95% CI [1.08-3.93]), Non-Rapid Eye Movement (NREM) beta power (*OR* = 2.09, 95% CI [1.09, 3.98]), and AHI (*OR* 1.86, 95% CI [1.40, 2.48]). Study results also remained significantly associated with metabolic syndrome regardless of race (Hall et al., 2012).

Another study associated with the SWAN Sleep Study by Appelhans and colleagues (2013) evaluated sleep duration and weight change in midlife women (Caucasian, *n* = 139; African-American, *n* = 116; Chinese, *n* = 55) (Appelhans et al., 2013). Using PSG, actigraphy, sleep diaries (and accounting for confounding variables including AHI), although BMI increased from 29.6 (*SD* = 7.8) kg/m(2) to 30.0 (*SD* = 8.0) kg/m(2) over an average of 4.6 years (*SD* = 1.0), no significant longitudinal associations were found between sleep duration and annual BMI change for unadjusted (actigraphy, estimate = 0.02, 95% CI [-0.04, 0.09]; diary, estimate = -0.03, 95% CI [-0.11, 0.04]), partially adjusted (actigraphy, estimate = 0.03, 95% CI [-0.05, 0.11]; diary, estimate = -0.06, 95% CI [-0.14, 0.03]), or fully adjusted models (actigraphy, estimate = 0.06, 95% CI [-0.03, 0.14]; diary, estimate = -0.04, 95% CI [-0.13, 0.04]). Cross-sectional associations between sleep duration and BMI were independent of SDB (actigraphy, estimate = 0.07, 95% CI [-0.05, 0.18]; diary, estimate = -0.02, 95% CI [-0.15, 0.10]) (Appelhans et al., 2013). Also from the SWAN Sleep Study, Kline and colleagues (2014) assessed sleep hygiene

behaviors between women without SDB or insomnia (n = 530), with insomnia (n = 33), with SDB (n = 49), and both insomnia and SDB (n = 15) by evaluating diary- recorded positive (regular exercise, same out-of-bed time daily) and negative (long daytime naps, caffeine or alcohol consumption near bedtime, smoking) behaviors known to impact sleep. Women with SDB in this study tended to be older (late perimenopausal), higher BMI, experienced more chronic health conditions and depressive symptoms, the only difference noted between women with and without SDB was the significant finding that women with SDB were less physically active (*OR* 0.52, 95% CI [0.27, 0.98]) (Kline et al., 2014).

Gender differences. Studies have been done to examine airway differences as a possible explanation for OSA differences in women. Gender differences were identified by Dahlqvist (2007) who examined 801 consecutive snoring men (n = 596) and women (n = 205). Men were found to have large tonsils, a higher tongue, and a wide uvula as independent factors associated with an AHI > 15. Women, who also displayed large tonsils similar to men, exhibited mandibular retrognathia (the mandible recedes in relation to the frontal plane of the forehead) as an independent factor associated with AHI > 15 (Dahlqvist et al., 2007). This risk factor difference could potentially aid the diagnosis of OSA in women by a simple airway examination and use of a template to measure mandibular retrognathia (Dahlqvist et al., 2007).

Selected morphometric parameters were measured in women with suspected OSA (N = 71), including neck circumference, lower costal, midabdomen, and hip circumferences, cricomental distance and retrognathia in a prospective study of inter-observer reliability for predictive modeling (Gjevre, Taylor-Gjevre, Reid, Skomro, & Cotton, 2013). Higher reliability coefficients were reported for neck circumference (*ICC* 0.78); lower costal and midabdominal circumference (*ICC* 0.95); and hip circumference (*ICC* 0.81) than cricomental distance (*ICC* 0.04) and retrognathia (*ICC* 0.17) in women with AHI $\geq$ 5 (OSA) (n = 50) (Gjevre et al., 2013).

The findings supported the use of BMI ($p < 0.001$), and neck ($p < 0.001$), lower costal ($p < 0.001$), midabdominal ($p < 0.001$), and hip circumference ($p < 0.004$) as predictive measurements for women with OSA rather than cricomental distance ($p = 0.016$) and retrognathia ($p = 0.247$) (Gjevre et al., 2013).

Lim and colleagues (2014) evaluated anthropometric measurements in a Korean study ($N = 151$; $n = 32$ women). Among female OSA subjects ($n = 18$), BMI ($p = 0.05$) and waist circumference (WC) ($p = 0.008$) were elevated but only waist-hip ratio (WHR) ($p = 0.001$) was significantly correlated with AHI. Neck circumference (NC) was found not to be a good predictor of OSA in women ($p = 0.614$) (Lim et al., 2014).

Sleep bruxism. Sleep bruxism (SB), defined as teeth grinding and clenching during sleep, has been classified as a type of sleep disorder (American Academy of Sleep Medicine, 2005) that can be associated with malocclusion (Hosoya et al., 2014). The association of malocclusion and SB (Sari & Sonmez, 2001) and malocclusion and OSA/SDB (Caprioglio, Zucconi, Calori, & Troiani, 1999; Guilleminault & Quo, 2001) has been reported in much of the early research done in children. More recently, Carvalho and colleagues (2014) found both intra- and interobserver reliability was good in a small study ($N = 56$) to determine the feasibility of dentists recognizing dental malocclusion associated with SBD (Carvalho et al., 2014). Although this study was done in children, it might have applicability for adults.

SB can be exacerbated by caffeine and excessive alcohol intake, gastroesophageal reflux (GERD), stress, anxiety, and OSA (Ohayon, Li, & Guilleminault, 2001). Hosoya and colleagues (2014) ($N = 83$) studied patients with OSA ($n = 67$, $n = 18$ females) and healthy volunteers without OSA/SB ($n = 16$, $n = 8$ females) with overnight PSG in the first study to show a positive correlation between OSA and SB. OSA patients also having SB (47.8%) was significantly higher versus the control group (*OR* 3.96, 95 % CI [1.03, 15.20]; $p < 0.05$) as more apnea/hypopnea and

oxygen desaturation events occurred in the subjects with SB (4.6 $\pm$ 10.5 events/hour) compared to the control group (0.1 $\pm$ 0.2 events/hour) (Hosoya et al., 2014). While gender analysis was not done in this study, SB might prove to be another avenue of exploration to identify women with OSA.

Patients with OSA often exhibit both SB and gastroesophageal reflux disease (GERD). In a retrospective medical record analysis of subjects with OSA based on ethnicity and gender (N = 300) the prevalence of nocturnal GERD (35%) and SB (26%) was higher than in the general population (Hesselbacher, Subramanian, Rao, Casturi, & Surani, 2014). Females in this study (n = 150) had the highest association between SB and GERD (p = 0.01), especially African-American females (p = 0.05), and women with GERD also scored high on association with restless legs (p = 0.0499) and insomnia (p = 0.004) (Hesselbacher et al., 2014). In a large prospective, cross-sectional multicenter study in Turkey (N = 1104), Basoglu and colleagues (2014) evaluated the prevalence of GERD in OSA (n = 957) and non-OSA (n = 147) subjects including OSA-related risk factors for GERD. Women with OSA were found to have increased prevalence of GERD (46%) versus men (35.7%) (p = 0.002) including multivariate linear regression analysis which displayed a significant correlation with waist (p = 0.024), hip circumference (p = 0.021) and EDS (p = 0.001) in women (Basoglu et al., 2014). Similar to OSA, GERD has been associated with obesity.

Obesity and OSA

A clearly established link exists between OSA and obesity (Deng et al., 2014; Isono, 2012; Ong, O'Driscoll, Truby, Naughton, & Hamilton, 2012; Parekh, Green, & Majeed, 2012; S. R. Patel, 2005; Ralls & Grigg-Damberger, 2012; Soylu et al., 2012). The 2008 Global Burden of Metabolic Risk Factors of Chronic Disease Collaborating Group statistics showed an estimated 1.46 billion adults world-wide had BMI of 25 kg/m^2 or greater (overweight) including obesity in

205 million men and 297 million women (Finucane et al., 2011). In the U.S., from 1986 -2006, a large scale study (N = 120877) of dietary intake and weight gain in men and women, measured in four-year increments, showed an average weight gain of 3.35 pounds (-4.1 to 12.4 pounds) (Mozaffarian, Hao, Rimm, Willett, & Hu, 2011). Based on these statistics, an increased number of persons with obesity are estimated to experience OSA.

Statistically significant differences ($p < 0.001$) in measurement including BMI, neck circumference, and waist circumference cutoff points were found in a study of patients with OSA by Soylu and colleagues (2012). Significant risk factor measures for the development of OSA were calculated as a BMI > 27.77 kg/m^2 for males and > 28.93 kg/m^2 for females, a neck circumference index > 40 cm for males and > 36 cm for females, and a waist circumference index > 105 cm for males and > 101 cm for females (Soylu et al., 2012). Deng and colleagues (2014) sought correlation between OSA severity and gender, age, and obesity in a large Chinese study (N = 2353; n = 378 women). Women were found to have increased severity of OSA associated with age only in the 45-53 age range (unstandardized partial regression coefficient 1.07, 95% CI [1.00, 1.13]) but BMI was a prominent risk for women of all ages ($p < 0.001$) (Deng et al., 2014).

A reciprocal effect from OSA may also influence obesity by factors such as sleep fragmentation and duration (Ong et al., 2012; S. R. Patel, 2005; Risso et al., 2012), intermittent hypoxic episodes associated with OSA (S. R. Patel, 2005), dietary habits resulting from neurohormonal control mechanisms for satiety and hunger, and changes in energy expenditure during sleep and wake periods (Ong et al., 2012). In addition to the impact of intermittent episodes of hypoxia, individuals with very shortened sleep duration (n = 11) demonstrated a significant effect (p = 0.01) on lower mean oxygen saturation levels after adjusting for gender, age, AHI, and BMI. (Risso et al., 2012). AHI was higher in very short sleepers (n = 11; 50.18 $\pm$

30.86 events/hour) compared with intermediate sleepers (n = 56; 20.36 $\pm$ 14.68 events/hour; p = 0.007) and sufficient sleepers (n = 45; 23.21 $\pm$ 20.45 events/hour; p = 0.02) (Risso et al., 2012). These complex sleep-associated mechanisms may be related to the development and/or reinforcement of obesity (Ong et al., 2012) including genetic links between obesity and sleep apnea (S. R. Patel, 2005).

A more direct risk factor for obesity and women with OSA involves excessive adipose tissue in the neck and diminished upper airway patency (Ralls & Grigg-Damberger, 2012; Simpson et al., 2010). Isono (2009) reviewed the relationship of obesity to the pharyngeal airway structure and neural regulation of pharyngeal musculature. Specifically, obesity narrows the airway through increased soft tissue mass. Increased visceral fat decreases total lung volume, and increases pharyngeal collapse affecting neural compensation, which is lost during sleep (Isono, 2012). Although the effects have been less pronounced in women, women tend to experience increases in visceral fat at the time of menopause, making them more susceptible to these anatomical changes (Bixler et al., 2001; Isono, 2009, 2012).

OSA and Co-morbidities

Major associations have been identified between OSA and cardiovascular disease (CVD) (e.g. HTN, stroke, dysrhythmias, hyperlipidemia) (Asha'ari, Hasmoni, Ab Rahman, Yusof, & Lope Ahmad, 2012; Campos-Rodriguez et al., 2014; Chang et al., 2013; Chao et al., 2014; Gunnarsson et al., 2014; Hudgel, Lamerato, Jacobsen, & Drake, 2012; Levy et al., 2012; Marin et al., 2012; Marrone, Lo Bue, Salvaggio, Dardanoni, & Insalaco, 2012; Monahan & Redline, 2011; Nakashima et al., 2013; Redline et al., 2010; Won et al., 2012) as documented in the literature. Recent studies have proposed links between OSA and associated health problems including aortic dissection (Inami, Seino, Bessho, & Mizuno, 2012; X. Zhang et al., 2014), diabetes (Cizza et al., 2013; Elizur et al., 2013), thromboembolism (Kezban et al., 2012). Pan

and colleagues (2014) also found positive associations between OSA, age, alcohol consumption, asthma, hypertension and diabetes (Pan et al., 2014).

Cardiovascular Disease. The incidence of stroke has been positively associated with male gender (Hudgel et al., 2012; Redline et al., 2010). As part of the Sleep Heart Health Study, Redline and colleagues (2010) undertook a prospective study of men and women (N = 5422; n = 2960 female) without stroke and followed them for a median of 8.7 years. During this time, ischemic strokes (n = 193; 3.5%) occurred within the population. Men were found to have increased hazard ratios (1.86 – 2.86, 95% CI [1.1–7.4]) for all ranges of OSA (mild to severe) while women were at higher risk in the severe OSA category only (Redline et al., 2010). Cognizant of the lack of research in women, Campos-Rodriguez and colleagues' (2014) prospective, observational clinical cohort study of women (N = 967) investigated the role of OSA and the impact of treatment with CPAP on the incidence of stroke and coronary heart disease (CHD). This study found untreated OSA to be associated with increased long-term incidence of both stroke and CHD (*HR* 4.04, 95% CI [2.01, 8.12]), after adjustment for confounders, only incident stroke retained a significant relationship with untreated OSA (*HR* 6.44, 95% CI [1.46, 28.34]), treatment with CPAP displayed no difference with the non-OSA control group (adjusted *HR* 0.84, 95% CI [0.7, 0.93]) suggesting that OSA treated with CPAP may decrease stroke and/or CHD in women (Campos-Rodriguez et al., 2014). Carotid artery stenosis has been found to predispose persons for stroke. Gunnarsson and colleagues (2014) followed subjects with OSA (N = 790, n = 44% female) from the Wisconsin Sleep Cohort over a 13-year period assessing carotid artery intima-media thickness (IMT) and plaque development via ultrasound measurement. After adjustment for age, sex, BMI, SBP, smoking, and use of lipid-lowering, antihypertensive, and antidiabetic medications, baseline AHI independently predicted future carotid IMT (p = 0.049), plaque presence (*OR* 1.55, 95% CI [1.02, 2.35]; p =

0.041) and plaque score (*OR* 1.30, 95% CI [1.05, 1.61]; $p = 0.018$). AHI independently predicted future carotid plaque presence ($p = 0.012$) and plaque score ($p = 0.039$), but not IMT ($p = 0.608$) in cumulative risk factor-adjusted models indicating future CVD risk associated with OSA (Gunnarsson et al., 2014)

Atrial fibrillation (AF) as a common dysrhythmia has been associated with OSA. A nationwide population-based longitudinal cohort study ($N = 579521$) of subjects without cardiac arrhythmias or significant co-morbidities was narrowed to subjects with SDB ($n = 4082$, 36.2% female) and controls without SDB ($n = 575439$, 48.8% female) and followed until new onset of AF (Chao et al., 2014). During the nearly 10-year follow-up, Chao and colleagues (2014) found new onset AF occurred ($n = 4023$, 0.7%) and was higher in subjects with SDB ($p < 0.001$), after adjustment for age and sex, SDB was a significant risk factor of AF (*HR* 1.536). The AF risk increased with increasing clinical severity of SDB requiring CPAP use (*HR* 4.507, $p = 0.003$) suggesting SDB alone, without comorbidities, was a risk factor for AF (Chao et al., 2014).

Aortic dissection (AD) is a deadly outcome (40% immediate mortality) of rupture of the inner aortic wall allowing blood flow between the layers and forcing them apart, Zhang and colleagues (2014) performed a cross-sectional analysis of subjects with Stanford's Type B AD ($N = 82$, 14.6% female) and controls ($N = 116$, 25.9% female) and tested them for OSA. Subjects with Stanford's Type B AD had higher AHI ($p = 0.001$) and mean 4% oxygen desaturation index (ODI) ($p = 0.005$) and a lower SaO_2 during sleep ($p = 0.005$) than controls. When logistic regression was performed, OSA was independently associated with Stanford's Type B AD (*OR* 1.063, 95% CI [1.010-1.120]; $p = 0.020$) suggesting the need to evaluate patients with AD for OSA and CPAP treatment (X. Zhang et al., 2014).

Diabetes. The relation between diabetes and OSA was the subject of a study ($N = 96$) by Cizza and colleagues (2013) that studied obese men ($n = 36$) and premenopausal women ($n =$

74) who reported sleeping less than 6.5 hours/night in a cross-sectional analysis of a randomized, prospective interventional trial from the Sleep Extension Study. Analysis of data occurred from baseline collection prior to diagnosis with OSA, 60% of subjects had abnormal respiratory disturbance index (RDI $\geq$ 5) and the severity of their OSA was significantly linked with the 44% who had impaired glucose metabolism (fasting glucose: $R = 0.325$, $p = 0.001$) and/or insulin resistance (fasting insulin levels: $\rho = 0.217$, $p = 0.033$) (Cizza et al., 2013). OSA and diabetes were significantly associated (*OR* 2.89, 95% CI [2.19, 3.83]) in a study of U.S. adults (N = 38638, n = 20452 women) with OSA (n = 823, n = 357 women) (Pan et al., 2014). But OSA may impair glucose regulation in non-diabetics as well. A small study (N = 7) of non-diabetic patients with moderate–to–severe OSA found severe nocturnal hypoxemic episodes correlated to decreased glucose variability, especially during REM sleep, which might impair nocturnal glucose regulation (Elizur et al., 2013). A multinational prospective study, the European Sleep Apnoea Cohort (European Sleep Apnoea Database) (ESADA) provided data for a cross-sectional analysis of OSA severity and the effect on HbA1c levels in nondiabetic subjects (N = 5294, n = 1572 women). After adjustment for confounders, AHI (standardized β 0.158; $p < 0.001$) and associated nocturnal hypoxemia predicted HbA1c with AHI 34.7-147.3/hour (severe OSA) associated significantly with higher HbA1c levels ($\geq$ 6.0%) (*OR* 2.12, 95% CI [1.53, 2.94]), suggesting that OSA is independently associated with insulin resistance and impaired glucose tolerance (Kent et al., 2014).

Cognitive Impairment. Cognitive impairment and OSA was studied by Yaffe and colleagues (2011) in a prospective analysis of 298 women over the age of 65 without dementia to determine if a relationship existed between SDB and cognitive impairment. Over the course of five years, Yaffe found that elderly women with SDB had increased risk of developing cognitive impairment primarily associated with hypoxia but not with sleep fragmentation or duration of

sleep (Yaffe et al., 2011). A prospective community-based cohort study of aging women (*N* = 302) followed over five years found SDB and SDB-related hypoxemia were risk factors for functional decline in older women (Spira et al., 2014). Women with moderate-to-severe OSA (AHI $\geq$ 15) at baseline had more than twice the odds of increased difficulties in instrumental activities of daily living (IADL) (adjusted *OR* 2.22, 95% CI [1.09, 4.53]) and of incident IADL difficulty (adjusted *OR* 2.43, 95% CI [1.00, 5.92]) compared to women with mild or no OSA (AHI $\leq$ 5) (Spira et al., 2014).

In a matched control cohort study (*N* = 8484) Chang and colleagues (2013) studied men and women recently diagnosed with OSA and no history of dementia (*n* = 1414) over a five year period. After adjusting for other risk factors, the patients with OSA were more likely to develop dementia (95% CI [1.26-2.31]; $p < 0.01$) and women were most at risk (adjusted *HR* 2.38, 95% CI [1.51, 3.74]; $p < 0.001$), with a 3.20 times greater risk after the age of 70 (95% CI [1.71, 6.00]) including first 2.5 years of follow-up (adjusted *HR* 2.04, 95% CI [1.35, 3.07]) (Chang et al., 2013). They concluded that OSA may be an age-, time- and gender-dependent risk for dementia (Chang et al., 2013).

A study of men with OSA was conducted to examine cognitive and structural deficits by comparing sleep deprivation and intermittent hypoxemia in treatment-naïve OSA subjects (*n* = 17) with control subjects (*n* = 15) (Canessa et al., 2011). After consistent treatment of OSA, statistically significant improvements were noted in short-term memory ($p = 0.002$), long-term memory ($p < 0.001 – 0.01$), attention and executive-functioning ($p < 0.001 – 0.03$) and increased gray matter ($p < 0.05$) especially in the hippocampus and frontal regions of the brain (Canessa et al., 2011). The importance of early recognition and treatment of OSA to prevent cognitive loss is supported by these study findings including study replication with women.

Cancer. Another condition currently under investigation as potentially associated with OSA is cancer. Using mortality data from the Wisconsin Sleep Cohort Study (*N* = 1522, 44.9% women), Nieto and colleagues (2012) investigated the link between cancer deaths and OSA. They hypothesized that intermittent hypoxia contributes to tumor growth. After adjusting for age, sex, BMI, and smoking, study findings demonstrated an increase in the relative hazard ratio with the severity of SDB from mild to severe: mild SDB (*HR* 1.1, 95% CI [0.5, 2.7]); moderate SDB (*HR* 2.0, 95% CI [0.7, 5.5]), and severe SDB (4.8, 95% CI [1.7, 13.2]) (*P*-trend = 0.0052). As severity increased in the hypoxemia index, the HR climbed from 1.6 to 2.9 to 8.6, respectively (Nieto et al., 2012). These findings suggested SDB as a potential modifiable risk factor for cancer prevention (Redline & Quan, 2012).

In the first study to investigate the association between OSA and cancer incidence, Campos-Rodriguez and colleagues' (2013) retrospective, multicenter, longitudinal cohort study of patients with suspected OSA (*N* = 4910, *n* = 1634 women) measured the percent of nighttime spent with oxygen saturation below 90% ($TSat_{90}$) and AHI as surrogates for OSA severity. After adjusting for confounding variables the adjusted hazard rates of cancer incidence increased as the category of $TSat_{90}$ increased, $TSat_{90}$ 1.2-12% (*HR* 1.58, 95% CI [1.07, 2.34]) $TSat_{90}$ greater than 12%. (*HR* 2.33, 95% CI [1.57, 3.46]) (Campos-Rodriguez et al., 2013). Continuous $TSat_{90}$ (adjusted *HR* 1.07, 95% CI [1.02, 1.13] per 10-unit increase in $TSat_{90}$) was also associated with cancer incidence (Campos-Rodriguez et al., 2013). Campos-Rodriguez and colleagues found AHI was not associated with cancer incidence in the adjusted analyses, except for patients younger than 65 years (adjusted *HR* for AHI >43 vs. <18.7, 1.66, 95% CI [1.04, 2.64]). At the conclusion of the study, 261 patients (5.3%) had been diagnosed with cancers, colorectal (*n* = 43, 16.5%), prostate (*n* = 42, 16.1%), lung (*n* = 24, 9.2%) and breast (*n* = 20, 7.7%) (Campos-Rodriguez et al., 2013). Incidence of cancer had increased overall across AHI (log-rank test, *p* =

0.014) and most significantly in all categories of $TSat_{90}$ (log-rank test, $p < 0.0005$) (Campos-Rodriguez et al., 2013). The impact in this study was mostly on males (adjusted *HR* 1.11, 95% CI [1.04, 1.17] per 10-unit increase in $TSat_{90}$) under the age of 65 (adjusted *HR* 1.13, 95% CI [1.06, 1.21] per 10-unit increase in $TSat_{90}$), although the reason for lack of findings in women might be due to the authors' stated underrepresentation in this study (33.3%) (Campos-Rodriguez et al., 2013).

In a prospective cohort study ($N = 8783$, $n = 4860$ women) with subjects drawn from the Copenhagen City Heart Study, Christensen and colleagues (2013) found limited evidence of association of SDB symptoms (snoring, apnea, EDS) with cancer subtypes and total cancer incidence. This study did not replicate the findings of incident cancer from the Campos-Rodriguez study, only finding association between EDS and higher cancer incidence (*HR* 4.09, 95% CI [1.58, 10.55]) in persons younger than 50 years, alcohol-related cancers (*HR* 4.92, 95% CI [1.45, 16.76]), and virus/immune-related cancers (*HR* 2.73, 95% CI [1.27, 5.91]) (Christensen et al., 2013). There was higher risk of smoking-related cancers when the individual reported more cumulative SDB symptoms (*p trend* = 0.04) (Christensen et al., 2013). A Taiwanese nation-wide population-based cohort study by Chang and colleagues (2014) of women with newly diagnosed OSA ($n = 846$) each age-matched to five control women ($n = 4230$) and followed for five years, explored the effect of OSA on the development of breast cancer. Breast cancer occurred in twelve women with OSA (adjusted *HR* 2.09, 95% CI [1.06, 4.12]; $p < 0.05$) as opposed to only thirty-two women in the control group, suggesting an association between OSA and increased breast cancer risk in women (Chang et al., 2014).

Sexual Dysfunction. Women with OSA have reported sexual dysfunction associated with endothelial dysfunction, abnormal testosterone levels, low progesterone, mood alterations, and/or lower QOL (Steinke, 2013). Sexual functioning in women with OSA was studied in

eighty women with OSA aged 28 to 64 including sexual distress and life satisfaction in a study (N = 240) by Petersen and colleagues (2011). Women with OSA were found to be at higher risk for sexual difficulties and sexual dysfunction (n = 46; 71%; $p < 0.001$), experienced more sexual distress (n = 41; 51%; $p < 0.001$), and overall scored lower on life in general ($p < 0.001$) than women without OSA in the population sample (Petersen, Kristensen, Berg, Giraldi, & Midgren, 2011). Premenopausal (n = 43) and postmenopausal (n = 58) women with OSA were evaluated for sexual functioning in relation to hormonal status (Stavaras et al., 2012). Similar to the Petersen study, both pre- and postmenopausal women with severe OSA were found to have lower sexual function scores (16.5 $\pm$ 4.0 and 16.9 $\pm$ 4.7, respectively) when compared to women with moderate/mild OSA (23.4 $\pm$ 5.5, $p < 0.01$ and 21.8 $\pm$ 7.5, $p < 0.05$) and control subjects without OSA (27.0 $\pm$ 5.5, $p < 0.01$ and 24.0 $\pm$ 6.7, $p < 0.01$). Additionally, progesterone was found to be significantly lower in premenopausal women with severe OSA and was significantly correlated with the Female Sexual Function Index (FSFI) (r = 0.39, $p < 0.01$), indicating that progesterone may be involved in the association between sexual dysfunction and OSA in younger women (Stavaras et al., 2012).

Petersen and colleagues (2013) followed CPAP-compliant women (N = 44) for one year to determine if CPAP usage had any effect on women's sexuality. After one year, the Manifest Female Sexual Dysfunction (MFSD) scores for women with a regular partner (n = 32) were significantly lower, especially for women older than 45 years (p = 0.06) rather than younger women (p = 0.63). The Epworth Sleepiness Scale (ESS) also was significantly lower for both women older than 45 ($p < 0.001$) and younger women ($p > 0.004$) after one year of CPAP treatment. There were no significant improvements in Female Sexual Function Index (FSFI) (p = 0.89) or Female Sexual Distress Scale (FSDS) (p = 0.06), or in the chosen items of the Life Satisfaction 11 (Scale LiSat-11): life as a whole (p = 0.59), family life (p = 0.73), partner

relationship (p = 1.00), and sexual life (p = 0.92) (Petersen, Kristensen, Berg, & Midgren, 2013). Overall, although there was a significant decrease in MFSD, the authors could not be sure that it was directly related to CPAP therapy alone, but CPAP usage did not appear to affect partner relationships in this small study (Petersen et al., 2013).

Difference in presenting symptoms

Uncommon symptoms. When evaluating women, significant gender-related differences in how patients' symptoms of OSA present need to be considered. Besides snoring as the most common presenting symptom of OSA in both men and women (Kapsimalis & Kryger, 2009; Young et al., 1996), women do present with different symptoms than men. Women appeared to present with atypical symptoms such as morning headache (Quintana-Gallego et al., 2004; Resta et al., 2003; Walker, Durazo-Arvizu, Wachter, & Gopalsami, 2001), fatigue (Quintana-Gallego et al., 2004), insomnia (Cronlein et al., 2011; Glidewell, Roby, & Orr, 2012; Pavlova & Sheikh, 2011; Phillips et al., 2008; Quintana-Gallego et al., 2004; Shepertycky et al., 2005; Subramanian et al., 2011; Valipour et al., 2007), depression (Quintana-Gallego et al., 2004; Resta et al., 2003; Valipour et al., 2007), dissatisfaction with life (Walker et al., 2001), frequent awakenings (Resta et al., 2003), and restless legs (Kapsimalis & Kryger, 2009; Valipour et al., 2007) more frequently than do men.

The 2007 Sleep in America Poll evaluated the prevalence of common symptoms in women (Kapsimalis & Kryger, 2009) as habitual snoring (61%), body movements (60%), restless legs syndrome (RLS) (33%), onset insomnia (32%), daytime sleepiness (24%), sleep maintenance insomnia (19%), or observed apneas (7%). In 2007, Valipour prospectively assessed presenting symptoms in a sampling of 2739 men and 782 women with SDB at a tertiary pulmonary referral center in Vienna, Austria. Men scored significantly higher on items related to worsening SDB with use of alcohol ($p < 0.001$), smoking ($p < 0.01$), witnessed apneas ($p <$

0.001) and worsening of snoring when supine ($p < 0.05$). In contrast, women scored higher with a significance level ($p < 0.001$) on more atypical symptoms including insomnia, restless legs syndrome, depression, nightmares, night time palpitations, and hallucinations on the Periodic Limb Movement Syndrome (PLMS), Psychiatric Sleep Disorder (PSY), and Narcolepsy (NAR) scales (Valipour et al., 2007).

Additional symptoms useful in OSA identification in women included nocturia, insomnia and fatigue. Previously identified as a symptom in men (Resta et al., 2003), Lowenstein (2008) looked at nocturnal urine concentration as a predictor of OSA. Study findings indicated 81% of patients ($n = 17$) diagnosed with OSA had diluted urine and nocturia as potential useful clinical markers (Lowenstein et al., 2008). The Sleep Heart Health Study ($N = 6342$, 53% women) also found nocturia to be independently associated with SDB with AHI > 15/hour (*OR* 1.3, 95% CI [1.2, 1.5]) even after accounting for confounding factors (age, BMI, diuretic use, diabetes, and alpha-blocker use) (Parthasarathy et al., 2012). Raheem and colleagues (2014) retrospectively evaluated OSA patients without ($n = 100$, $n = 41$ women) and with nocturia ($n = 100$, $n = 40$ women). While AHI was not significantly correlated between the groups ($p = 0.071$), in multivariate analysis, age over 70 years ($p = 0.003$) and moderate AHI ($p = 0.03$) were statistically significant predictors of nocturia, suggesting that screening for nocturia may be a helpful diagnostic tool for OSA (Raheem, Orosco, Davidson, & Lakin, 2014)

Insomnia. Insomnia has been a frequent presenting symptom in women with OSA (Castillo et al., 2014; Cronlein et al., 2011; Kapsimalis & Kryger, 2009; M. H. Lee et al., 2014; Phillips et al., 2008; Quintana-Gallego et al., 2004; Shepertycky et al., 2005; Subramanian et al., 2011; Valipour et al., 2007). In one of the earliest studies to link insomnia and OSA, Shepertycky and colleagues (2005) matched 130 pairs of men with women and found that women were significantly more likely to report insomnia (17% vs. 5% for men) (Shepertycky et

al., 2005). Ye and colleagues (2009) noted fatigue and insomnia as symptoms in women with OSA including when fatigue was a presenting symptom, more impaired daytime functioning was noted (Ye et al., 2009). Stepnowsky and colleagues found significantly greater association between fatigue and depressive symptoms (15% of variance; $p < 0.001$) than fatigue and AHI or hypoxia. Self-reported sleep quality (11% of variance; $p < 0.001$) was found to be independently associated with fatigue in a study of fatigue and depressive symptoms (Stepnowsky, Palau, Zamora, Ancoli-Israel, & Loredo, 2011). A meta-analysis of 34 articles also detailed gender differences in insomnia with a female predisposition to insomnia (*RR* 1.41) for women vs. men (B. Zhang & Wing, 2006).

Clinical differentiation between insomnia and sleep apnea is difficult. When the usefulness of PSG to diagnose primary insomnia was evaluated by Crönlein (2011) ($n = 77$ women; $n = 16$ men); 34% of patients had a previously undiagnosed sleep apnea and/or concomitant PLMS identified. Citing the under-representation of women in sleep clinics, they suggested that women with insomnia may need evaluation for OSA (Cronlein et al., 2011). A model of BMI and daytime sleepiness may predict OSA status in women as noted by Glidewell and colleagues (2012). This study ($N = 100$) noted the inclusion of insomnia significantly improved the model's predictive ability ($p < 0.001$) for women with OSA (61%; $p = 0.007$) versus women without OSA (54%; $p = 0.033$) (Glidewell et al., 2012).

Insomnia and OSA can coincide in some patients based on reports of difficulty falling asleep, staying asleep, and inability to return to sleep after waking (M. H. Lee et al., 2014). Lee and colleagues (2014) evaluated the effect of co-morbid insomnia and OSA ($N = 655$) on depression, fatigue, and daytime sleepiness (M. H. Lee et al., 2014). The small number of women ($n = 86$) in this study reported higher depression, fatigue, and EDS and lower HR-QOL than men with linear regression adjusted by age, AHI, BMI, education, work and marital status

(all: $p < 0.05$). Although when looking at gender-by-insomnia interaction in this study, only men were negatively affected by insomnia symptoms for fatigue ($p = 0.005$) and QOL ($p = 0.015$) (M. H. Lee et al., 2014).

The influence of gender and ethnicity in the prevalence of insomnia in patients with OSA found white women had the highest percent of sleep maintenance insomnia (80%, $n = 40$) while Hispanic women reported the highest psychophysiologic insomnia (58%, $n = 29$) (Subramanian et al., 2011). Psychophysiologic insomnia has been learned or behavioral insomnia characterized by heightened state of arousal and bad sleep habits that become habitual (Kelso, C.M., 2011). Subramanian's (2011) study sampled 150 men and 150 women, equally divided between three racial groups (African American, Caucasian, and Hispanic), with findings that women were older, had higher BMI, and lower AHI scores. Insomnia was also noted as frequently associated with mental health disorders (Subramanian et al., 2011) where complaints of SDB may be dismissed or considered as psychiatric in nature.

Depression. Depression has often been associated with a diagnosis of OSA. In a large study ($N = 9714$; $n = 4767$ women) evaluating the association between SDB and depressive symptoms, Wheaton and colleagues (2012) interviewed subjects about snoring, snorting, gasping, or breathing stoppages during sleep and completed a 9-item depression scale (PHQ-9; score $\geq$ 10 indicates depression). OSA was associated with probable major depression (*OR* 2.4, 95% CI [1.5, 3.6] among men; *OR* 5.2, 95% CI [2.7, 9.9] among women) and snorting/stopping breathing $\geq$ 5 nights/week was strongly associated with probable major depression in men (*OR* 3.1, 95% CI [1.8, 5.2]) and women (*OR* 3.0, 95% CI [1.6, 5.4]) (Wheaton, Perry, Chapman, & Croft, 2012). In this study, women were as likely to experience/be at risk for major depression as men, despite reporting less diagnosed OSA and snorting/breathing stoppages.

Sociocultural threats to diagnosis

Sociocultural stigmas and coping associated with snoring have been perceived as barriers to OSA diagnosis in lifestyles where home employment or non-high risk occupations (including not driving a car) presume less risk for adverse outcomes from daytime sleepiness (Quintana-Gallego et al., 2004). Women were also hesitant to report (or under-reported) symptoms of OSA viewed as socially unacceptable or distasteful such as loud snoring, gasping, choking, and snorting during sleep (Redline et al., 1994; Shepertycky et al., 2005; Venn, 2007). A qualitative study of married heterosexual couples (N = 40) by Venn (2007) explored snoring in the context of the marriage where one or both partners snored. Women subjects viewed their snoring as unfeminine and felt stigmatized, while snoring by their male partners was expected and acceptable (Venn, 2007). Female bed partners of OSA patients were more attuned to the disturbed breathing patterns of the partner and more readily reported them, where male partners may be unaware of or downplay the seriousness of respiratory difficulties in the woman with OSA (Quintana-Gallego et al., 2004; Redline et al., 1994; Shepertycky et al., 2005; Venn, 2007).

Healthcare provider recognition, referral, and treatment

HCP recognition of differences in symptoms of OSA has been lacking, including atypical presentation, or women not forthcoming with information that could lead to a diagnosis of OSA (Baldwin et al., 2001; Camargo, Carvalho, Prado, & Prado, 2013; Hayes, Murray, Castriotta, Landrigan, & Malhotra, 2012; Qaseem et al., 2014; Quintana-Gallego et al., 2004; Redline et al., 1994; Valipour et al., 2007; Young et al., 1996). Lack of awareness of symptoms by women also contributes to under-diagnosis of OSA, HCPs have only been able to diagnose when information was presented to them. Camargo and colleagues (2012) retrospectively analyzed medical records (N = 208; 84 women) to determine patients' ability to accurately present health problems/symptoms to the HCP as compared to the final diagnosis. The correlation for women's

reported and actual snoring (34.5% vs. 46.4%; $p > 0.05$) was significantly different; OSA complaints and actual diagnosis were even more variable in women (9.5% vs. 28.6%; $p > 0.05$) (Camargo et al., 2013).

Lack of confidence and knowledge by generalists has prevented timely referral for diagnosis and treatment. Hayes and colleagues (2012) conducted a mixed method study to assess HCP comfort with sleep disorders. Generalists reported challenges in assessing and diagnosing sleep disorders, and lacked confidence in managing CPAP (66.5%) and monitoring OSA (57.7%). Furthermore, 66% of generalists and 68% of sleep specialists reported difficulty in collaboration and coordination of care (Hayes et al., 2012). The American College of Physicians has published a clinical practice guideline (CPG) (2014) to aid in the diagnosis of OSA in adults. Although the CPG recommended sleep studies for patients with unexplained EDS, it was a weak recommendation with low-quality evidence. Similarly, the recommendation for PSG in patients with suspected OSA was also a weak recommendation with moderate-quality evidence (Qaseem et al., 2014).

Gender-bias by referring physicians and gender-related differences in presenting symptoms (such as depression and insomnia) has been among the proposed reasons for the under diagnosis and treatment of women with OSA (Cronlein et al., 2011; Pavlova & Sheikh, 2011). OSA should be explored in women with unexplained complaints of extreme fatigue, tiredness, not feeling rested after sleep or insomnia (especially if the body habitus of obesity is suggestive of OSA), including women with a diagnosis of hypothyroidism, or depression (Phillips et al., 2008; Shepertycky et al., 2005).

When HCPs fail to correctly diagnose OSA in women, proper referral for treatment cannot occur. Factors involving women's symptoms not meeting the "standard" criteria for OSA diagnosis including under-reporting result in less frequent referral to a sleep clinic compared to

men (Cronlein et al., 2011; Larsson et al., 2003; Pelletier-Fleury et al., 2004; Quintana-Gallego et al., 2004; Redline et al., 1994; Young et al., 1997; Young et al., 1996). Larsson (2003) conducted the only sleep apnea study that analyzed women's referrals to sleep clinics over a ten year period. Despite a statistically significant male to female ratio of 1.25:1 (p = 0.012) and women who experienced more daytime sleepiness than men, less than 20% of the men and women complaining of snoring or witnessed apneas were referred (including women referred less frequently than men) (Larsson et al., 2003).

Differences in treatment of OSA were also apparent for women found to be undertreated due to lack of proper diagnosis. Women were found to respond well to treatment once the correct diagnosis was made including predicted success with OSA treatment (Marklund et al., 2004; Tomfohr et al., 2011; Tzischinsky, Shahrabani, & Peled, 2011; Woehrle et al., 2011; Ye et al., 2009). More women (56.5%) than men (40.7%) used CPAP in an Israelian study (N = 50; n = 23 women) (Tzischinsky et al., 2011). In a study of newly diagnosed French subjects (N = 34; 52.9% female), participants chose CPAP (60.2%) over oral appliances (OAs) (36.2%) based on concerns about how the chosen treatment would impact daily life and its effectiveness before they considered potential side effects and cost (Krucien, Gafni, Fleury, & Pelletier-Fleury, 2012). Women with mild OSA and non-supine dependent sleep apnea were more likely to be successfully treated with a mandibular advancement device than men in a study evaluating 619 subjects (*OR* 6.1) (Marklund et al., 2004). In a secondary analysis of data from a large multisite study (Ye et al., 2009), women with OSA who showed greater impairment in daytime functioning and symptoms than men, benefited from treatment with CPAP (38% vs. 23%, p = 0.040, effect size = 0.47). Woehrle (2011) found adherence to CPAP treatment to be high in a retrospective study of 4281 patients that included 18% female who used CPAP, with excellent efficacy in long-term users of CPAP. While adherence was both age- and gender- related, use

(5.8 ± 1.6 to 6.3 ± 1.2 days/week; 363 ± 88 to 395 ± 120 min) increased with age with males (377 ± 94 vs. 370 ± 96 min) more likely to use the device than females, but the differences were not clinically relevant (Woehrle et al., 2011). In another study (N = 59) that included 8 females, three weeks of CPAP treatment significantly reduced AHI and fatigue (both, $p < 0.05$), with increased reports of energy in patients with OSA; while significant levels of reduced daytime sleepiness ($p < 0.05$) were demonstrated only in patients with high levels of EDS prior to the study (Tomfohr et al., 2011). In a study of CPAP treatment and effects on CVD in the elderly patient with OSA (N = 130), women with moderate-to-severe OSA (n = 37) were less likely to receive CPAP (n = 9, 24.3%) as compared to 59.1% of males, even though women had a 4.2-fold increase in CVD events in multivariate analysis when compared to men (Nishihata et al., 2013).

Impact of delay in treatment

Delay in treatment has led to significant risk of co-morbidity and mortality for women with OSA, as well as reduction in quality of life. Sleep deprivation and OSA have been associated with many cardiovascular (CV) outcomes including HTN, especially drug-resistant HTN, coronary lesions, coronary artery disease (CAD), arrhythmias, stroke, CVD and mortality (Kartali et al., 2014; Levy et al., 2012; Nishihata et al., 2013; Pedrosa et al., 2014; Valenza et al., 2014), timing of myocardial infarction (MI) (Nakashima et al., 2013), and occurrence of and resistance to atrial fibrillation (Monahan & Redline, 2011; Pan et al., 2014). Research has been ongoing into the role of systemic inflammation, sympathetic activation and oxidative stress in the link between OSA and intermittent hypoxia (Levy et al., 2012; Monahan & Redline, 2011). C-reactive protein (CRP), a widely studied marker of low grade inflammation, has come to attention in a study (n = 436; n = 184 females) by Mermigkis and colleagues (2011). CRP has been linked to atherogenesis and associated with cardiovascular morbidity in patients with OSA.

In studying the impact of treatment with CPAP in the return of CRP levels to normal, women were found to need at least six months of effective CPAP treatment to allow statistically significant normalization of CRP levels from baseline (0.87 $\pm$ 0.79 mg/dl) to six months (0.34 $\pm$ 0.36 mg/dl, $p < 0.001$). In comparison, males showed a statistically significant decrease after three months of treatment with CPAP (Mermigkis et al., 2011).

Cardiovascular Disease and Hypertension. In a study of hypertensive (n = 120) and non-hypertensive (n = 120) young adults aged 18-40 years (32.5% female), OSA was found to be related to HTN (*OR* 2.7, 95% CI [1.2, 6.1]), with more pronounced association with severe OSA (*OR* 7.94; 95% CI [7.94, 15.33]) (Asha'ari et al., 2012). In a prospective cohort study (N = 1889) of individuals without HTN, (followed for a median of 12.2 years), participants who developed OSA had increased hazard ratios of developing incident HTN including persons untreated due to ineligibility for CPAP (*HR* 3.34, 95% CI [2.85, 3.82]), declining CPAP (*HR* 5.84, 95% CI [4.82, 6.86]), or non-adherent to CPAP (*HR* 5.12, 95% CI [3.76, 6.47]), The risk was modified in those subjects who underwent successful treatment with CPAP (*HR* 3.06, 95% CI [2.70, 3.41]) (Marin et al., 2012). Based on research findings, recommendations have been issued by the European Society of Hypertension and the European Respiratory Society to consider the presence of OSA in patients with HTN and CVD, and conversely, to be aware of the potential for HTN in the patient presenting with OSA (Monahan & Redline, 2011; Parati et al., 2012). Hypertension was significantly related to OSA (*OR* 2.42, 95% CI [1.91, 3.07]) in the Pan cross-sectional study (N = 39461; n = 38638 controls) of the association of alcohol and chronic diseases to OSA (n = 823, n = 357 women) (Pan et al., 2014).

Perimenopausal women (N = 277) without a known history of CVD or OSA underwent 24-hour blood pressure monitoring and arterial stiffness evaluation in a study by Pedrosa and colleagues (2014). Women with moderate to severe OSA (n = 31) in this study had a higher

prevalence of HTN, were prescribed more medications for HTN, had higher awake (systolic $p <$ 0.01 & diastolic $p < 0.07$) and nocturnal (systolic $p < 0.01$ & diastolic $p < 0.01$) B/P, and more arterial stiffness (pulse wave velocity (PWV), $p < .001$). Nocturnal oxygen desaturation index (ODI) was independently associated with 24-hour arterial B/P and arterial stiffness (per five-unit increase in ODI, $\beta = 1.30$, 95% CI [0.02, 2.54]; $p = .04$) in women with OSA (Pedrosa et al., 2014). This study drew from women not previously diagnosed with OSA, more than one-third were identified as having OSA during the study, leaving the authors to suggest a lack of awareness of OSA in this population. OSA is more common in women than known, and may lead to poor CV outcomes in perimenopausal women (Pedrosa et al., 2014).

Kartali and colleagues (2014) evaluated the effect of CPAP on hypertensive subjects with severe OSA and no other comorbidities ($n = 38$) against normotensive controls without OSA ($n = 15$). More than five hours of CPAP per night reduced SBP ($p = 0.007$), DBP ($p = 0.004$) and PWV after the first night of CPAP therapy ($p = 0.003$) and at 3 months ($p = 0.007$) in the first study to show reduction in B/P and improvement in arterial stiffness after one night of CPAP and sustained over three months, although total B/P control was not necessarily realized in all subjects (Kartali et al., 2014).

Mortality. Many OSA- associated CV studies have focused on mortality. The Multi Ethnic Atherosclerosis (MESA) cohort ($n = 5338$) assessed the relationship of snoring, physician-diagnosed OSA, incident CV events and all-cause mortality in adults free of CVD at baseline (Yeboah et al., 2011). The cohort of women snorers with OSA ($n = 71$; 34.2%) followed over 7.5 years were found to have higher CV incident rates (e.g. MI, stroke, angina, resuscitation from cardiac death, and both stroke and CV death) in both univariate and multivariable models (*HR* 1.89, 95% CI [1.22, 2.93], $p = 0.004$ and 1.91 [1.20, 3.04], $p = 0.007$, respectively) than the habitual snorers ($n = 610$; 42%), and control subjects ($n = 2016$; 54.8%)

(Yeboah et al., 2011). Women snorers with OSA had a higher overall death rate than normal participants in both univariate and multivariable models (*HR* 2.44, 95% CI [1.36, 4.3]; $p = 0.003$ and 2.71, 95% CI [1.45, 5.08]; $p = 0$ .002, respectively) (Yeboah et al., 2011). The Nishihata study (2013) of elderly patients ($N = 130$) with CVD and moderate-severe OSA, who chose/maintained CPAP treatment ($n = 64$) or remained untreated ($n = 66$) found during follow-up (32.9 $\pm$ 23.8 months), 28 patients (21.5%) died or were hospitalized with CVD events, with significantly lower CVD event-free survival in the untreated OSA group ($p < 0.005$) (Nishihata et al., 2013).

Two large studies that included women in their samples were conducted by Rich and colleagues (2012) ($N = > 77,000$; 27.9% female) and Hudgel and colleagues (2012) ($N = 1025$; 38% female) finding increasing OSA severity by desaturation index (ages 41-50 years; adjusted *HR* 1.217, 95% CI [1.014, 1.461]; $p = 0.035$), apnea index (ages 21-30 years; *HR* 1.632, 95% CI [1.053, 2.532]; $p = 0.028$), and AHI (ages 31-40 years; *HR* 1.222, 95% CI [1.010, 1.478]; $p = 0.039$). After adjusting for the confounding factors of age, gender and BMI (Rich, Raviv, Raviv, & Brietzke, 2012) including younger male subjects (Hudgel et al., 2012), these findings were independently associated with slightly increased all-cause mortality in patients under the age of 50. For those over age 50, OSA did not increase the chance of mortality, instead co-morbidities in the presence of the OSA may have more impact on survival (Marrone et al., 2012).

Lamberts and colleagues (2014) followed 4.5 million Danish citizens over an 11-year period until subjects developed OSA ($n = 33274$, 21% female) and maintained persistent treatment with CPAP (44%). Subjects with OSA in this study, relative to the general population, exhibited increased risk of MI (*IRR* 1.71, 95% CI [1.57, 1.86]) and ischemic stroke (*IRR* 1.50, 95% CI [1.35, 1.66]), in particular in subjects younger than 50 years (MI: *IRR* 2.12, 95% CI [1.64, 2.74] and ischemic stroke: *IRR* 2.34, 95% CI [1.77, 3.10]) (Lamberts et al., 2014).

In the Won and colleagues' retrospective cohort study (*N* = 281; 2% female) of patients with previous myocardial injury and with severe OSA (*n* = 130) or mild-moderate OSA (*n* = 151), OSA had a dose-dependent effect on mortality on those with ischemic heart disease or previous myocardial injury. During the four year study, significantly more deaths (*p* = 0.04) were found in the severe OSA sample (*n* = 53; 41%) than in the mild-moderate OSA sample (*n* = 44; 29%) (Won et al., 2012). A longitudinal study followed patients (*N* = 10701, 32% female) newly diagnosed with OSA and without history of CVD for a mean of 5.3 years to resuscitated or fatal sudden cardiac death (SCD) (*n* = 142, annual rate 0.27%) (Gami et al., 2013). OSA was shown to be independently and significantly associated with SCD in this study based on the severity of nocturnal hypoxemia (mean nocturnal O_2 sat < 93%) (*HR* 2.93), and lowest nocturnal O_2 sat < 78% (*HR* 2.60); all *p* < 0.0001), and AHI >20 (*HR* 1.60) (Gami et al., 2013). In a similar Canadian historical cohort study (*N* = 10149, 38% female) of risk of CV events and mortality, Kenderska and colleagues (2014) followed patients with OSA over a ten-year period. They found after controlling for traditional risk factors that OSA-related factors other than AHI, including time spent with oxygen saturation < 90% (9 vs. 0 minutes; *HR* 1.50, 95% CI [1.25, 1.79]), heart rate (70 vs. 56 bpm; *HR* 1.28, 95% CI [1.19, 1.37]), TST (4.9 vs. 6.4 hours; *HR* 1.20, 95% CI [1.12, 1.27]), daytime sleepiness (*HR* 1.13, 95% CI [1.01, 1.28]), awakenings (35 vs. 18; *HR* 1.06, 95% CI [1.02, 1.10]), and periodic leg movements (13 vs 0/hour; *HR* 1.05, 95% CI [1.03, 1.07]) were significant predictors of CV events (Kendzerska, Gershon, Hawker, Leung, & Tomlinson, 2014).

To the contrary, a study by Shah and colleagues (2012) found that the hypoxic effects of OSA may be beneficial in the recovery of patients (*N* = 136) suffering non-fatal myocardial infarctions (MI). The findings suggest that the nocturnal hypoxic episodes may precondition the myocardium to ischemia and have a cardio-protective role exhibited by less severe cardiac injury

at the time of MI (Shah et al., 2012). Buchner and colleagues (2013) compared patients with recent MI (N = 56) without (n = 27) and with SDB (n = 29) and found myocardial ischemia attributed to SDB hypoxemia resulted in significantly less salvaged myocardial tissue (myocardial salvage index 52% vs. 77%, $p < 0.001$), and smaller reduction in infarct size (0.3% vs. 6.5%, $p < 0.001$) within 3 months after acute MI. The SDB MI patients also had a larger final infarct size (23% vs. 12%, $p < 0.001$), and a lower final left ventricular ejection fraction (48% vs. 54%, $p = 0.023$) after three months (Buchner et al., 2014). OSA patients (n = 216, n = 48 females) were significantly more likely to have suffered morning MI (0600-1159 hours) (38 vs. 25%, $p = 0.039$), with higher odds for moderate-to-severe OSA (43 vs. 25%, $p = 0.014$) than control patients (n = 72) in a study of patients with recent initial MI and percutaneous coronary intervention (PCI) who underwent PSG to identify pre-existing OSA (Nakashima et al., 2013).

Health-related Quality of Life. Delay in or lack of treatment also impacts the individual's HR-QOL. How a woman views OSA, as a threat that she can modify and control or as a life-altering event will also affect her HR- QOL. A review of newly diagnosed Chinese patients with OSA (N = 108, 20% female) cited patients having hypersomnolence (n = 59), depression (n = 46), and anxiety (n = 21) while anxiety and sleepiness predicted 45.2% of the variance for overall quality of life ($p < 0.001$) (Ye, Liang, & Weaver, 2008). A larger 2010 study (N = 5237), affiliated with the Sleep Heart Health Study, evaluating the interaction of sleep disturbances, ethnicity and QOL found SDB to be associated with worse physical and mental HR-QOL, but incidentally, the mental HR-QOL scores were noted to be above the U.S. norm (Baldwin et al., 2010). The findings of the Baldwin study varied across ethnicities with African-Americans reporting significantly worse physical health ($p < 0.001$) and Hispanics reporting significantly worse mental health ($p < 0.001$) than Caucasians (Baldwin et al., 2010).

HR-QOL was found to be multifactorial in the 2008 Gulbay study (N = 135) composed of newly diagnosed OSA subjects (n = 69; n = 17 females) and habitual snorers (n = 66; n = 26 females). OSA could not be identified as the sole reason for reduced HR-QOL, but was attributed to a combination of factors such as the presence of co-morbidities, presence of nocturnal desaturations, symptoms related to SDB, and obesity (Gulbay et al., 2008). Perceived diminished HR-QOL related to physical functioning was associated with OSA in subjects (N = 502; n = 111 female) with moderate to severe OSA, however, an association was not found between AHI and HR-QOL (Asghari, Mohammadi, Kamrava, Jalessi, & Farhadi, 2012).

Cost of OSA. Delay in treatment can impact the health of the individual and HR-QOL. The costs of delay in treatment can be significant, both to the individual patient and to society as a whole. Fragmented sleep resulting from OSA, leading to EDS, is linked to higher accident rates and is a major safety concern (D. Hiestand & Phillips, 2011; Lindberg, Carter, Gislason, & Janson, 2001; Quera Salva et al., 2014; Rajaratnam et al., 2011; Sagaspe et al., 2010; Sassani et al., 2004; Torzsa et al., 2011; Ulfberg, Carter, & Edling, 2000). The frequency of accidents (p < 0.0001) was higher in snorers (24%) compared to nonsnorers (17%) in a Hungarian study (N = 12,643) (Torzsa et al., 2011).

A French study of long-distance drivers (N = 3051, n = 756 women) by Quera Salva and colleagues (2014) found drivers reporting near-miss sleepy accidents (NMSA) during the current road trip (n = 87, 2.9%), NMSA in the past year (8.5%), and sleepy-related accidents in the past year (2.3%). NMSA were not related to sleepiness from acute lack of sleep or accumulated sleep debt, instead in univariate and multivariate analysis SDB (snoring) (*OR* 1.9, 95% CI [1.2, 3.0] vs. *OR* 2.0, 95% CI [1.1, 3.7]) and non-restorative sleep (*OR* 3.4, 95% CI [2.1, 5.3] vs. *OR* 1.9, 95% CI [1.0, 3.6]) appeared to be more of a risk (Quera Salva et al., 2014).

Several studies including an Australian study of databases reported SDB-related costs of $7494 million (2004 figures) for both direct and indirect costs such as sleep disorders and associated conditions, accidents, and loss of revenue. The equivalent cost for the U.S. in 2004 was estimated to be $109 billion (Hillman, Murphy, & Pezzullo, 2006). Harvard Medical School (2010) presented data showing that estimated economic costs of SDB range from $65-165 billion (Harvard Medical School, 2010). It is difficult to put an exact number on the costs of SDB and OSA because of its far reaching consequences and implications for so many co-morbidities including cardiovascular diseases.

Costs associated with OSA can also include employment. Guglielmi and colleagues (2014) assessed job satisfaction, job stress, and burnout in patients with OSA (n = 182, n = 25 women) and healthy control subjects (n = 71, n = 24 women). Under burnout, OSA was significantly associated only with emotional exhaustion (p = 0.015) (Guglielmi, Jurado-Gamez, Gude, & Buela-Casal, 2014). With multivariate analysis, AHI was only correlated with perceived support at work (β = 0.142; p = 0.048). Associations were found between subjective sleep quality, perceived support from coworkers, and supervisors (β = 0.157; p = 0.025), psychological demands (β = 0.226; p = 0.001), emotional exhaustion (β = 0.405; p = 0.000), and cynicism (β = 0.224; p = 0.002) (Guglielmi et al., 2014). There were also associations between EDS and the burnout dimensions emotional exhaustion (β = 0.232; p = 0.000) and cynicism (β = 0.139; p = 0.048) (Guglielmi et al., 2014). Perceived sleep quality and EDS appeared to have more effect than did OSA diagnosis in this study.

Under-representation of women in OSA research

Research findings show women remain underrepresented in major OSA studies. Reasons for this disparity are gender-related differences in physical manifestations as women present with different OSA- associated symptoms than men (Bailes et al., 2011; Cronlein et al., 2011;

Glidewell et al., 2012; Kapsimalis & Kryger, 2009; Lowenstein et al., 2008; Nishihata et al., 2013; Parthasarathy et al., 2012; Pavlova & Sheikh, 2011; Phillips et al., 2008; Shepertycky et al., 2005; Stepnowsky et al., 2011; Subramanian et al., 2011; Valipour et al., 2007), leading many practitioners away from the diagnosis of OSA and proper treatment of women. Despite their significant findings of gender differences in a large study of OSA, the ratio of males to females in the Quintana-Gallego study was 4.9:1 (Quintana-Gallego et al., 2004). The percentage of women in the Pelletier-Fleury study who received immediate treatment for OSA was 19.5% and only 15.7% in the delayed treatment group (Pelletier-Fleury et al., 2004). Only nine women received CPAP treatment out of 37 enrolled in the Nishihata study despite the authors acknowledging OSA as a risk factor for CVD and treatment was beneficial in women as well as men (Nishihata et al., 2013). In a study on gender differences in presentation only 782 women were included opposed to 2739 men (Valipour et al., 2007). No women were included in the 2011 study on cognitive effects of OSA (Canessa et al., 2011). The North American study on OSA and police officers was weighted towards male participation (4079 men vs. 861 women) (Rajaratnam et al., 2011). In a number of HR-QOL studies women were under-represented (Asghari et al., 2012; Guglielmi et al., 2014; Gulbay et al., 2008) including several studies with greater than 80% male participation (Deng et al., 2014; Lacasse, Godbout, & Series, 2002; Ye et al., 2008).

Summary

Originally viewed as a man's disease, OSA is now known to affect women at a 2:1 ratio. Women present with snoring as a major symptom similar to men, but more frequently present with atypical symptoms such as morning headache, insomnia, fatigue, depression, and restless legs syndrome. This atypical presentation has often led to delay in or misdiagnosis and lack of effective OSA treatment. Women remained susceptible to the same risks associated with OSA

as men, including CVD, including arrhythmias that can lead to sudden death, HTN, stroke, cognitive impairment, and diminished QOL. Once diagnosed, women responded well to treatment, including adherence to therapy. Some delay can be attributed to sociocultural factors such as reluctance to acknowledge snoring, snorting/gasping during sleep, or lack of awareness of breathing difficulties on the part of the subject or her sleep partner. Women may be aware of difficulties but reluctant to start treatment with CPAP and thus delay diagnosis. Other factors may be related to HCP lack of knowledge of presenting symptoms in women or lack of awareness of the risk of OSA as experienced by women. Delays in diagnosis, referral and treatment are impacted by these factors.

Most studies have been done in men. There have been no studies using Leventhal's Self-regulatory theory in the study of OSA in women. Little is known about what the threat of OSA in women represents, including appraisal of the OSA and coping strategies. Key to effective diagnosis and treatment in women includes understanding what OSA represents to the woman, how she perceives it, as a threat or as a challenge, and cognitive perceptions and emotional responses as she adjusts to her symptoms. Understanding the illness representation, including the threat, and coping appraisal that women experience in self-regulation of OSA could improve diagnosis and treatment.

Chapter II

Leventhal's Self-Regulatory Theory

The organizing framework for this study is Leventhal's Self-Regulatory Theory (1983). The Self-Regulatory Theory was used to explore illness representation in women recently diagnosed with OSA, including coping and appraisal of the health threats including cognitive perceptions and the emotional response associated with the diagnosis of OSA.

Operational definitions

The operational definitions of illness representation were explored in the context of the meaning of OSA symptoms to the woman. For purposes of this study, illness representation was defined as what OSA meant to the recently diagnosed woman, specifically how she identified her symptoms, named them, and determined what they meant to her life. Coming to terms with OSA and forming an illness representation will allow her to join the abstract cognition as represented by any feelings of vulnerability to the concrete experiences of her symptom presentation, allowing for the experience of emotion and providing the opportunity to identify the illness threat (L. Cameron & Leventhal, 2003). Cognitive perceptions were the woman's interpretation of her condition, which may not be based in or be consistent with medical knowledge. The woman's emotional response was measured by how she reacted to her diagnosis and health condition: moodiness, distress, anxiety, or relief at having a diagnosis and resolution to move on with treatment. External environmental influence was defined as the input the woman received from her HCP, family, friends, colleagues, or social media. Internal environmental influence was how the woman described OSA and internalized her symptoms, perhaps based on past experiences or personal knowledge of OSA. Coping strategies were the methods the woman used to adapt to her diagnosis: educating herself, losing weight, improving sleep hygiene, or seeking and maintaining treatment.

The self-regulation model

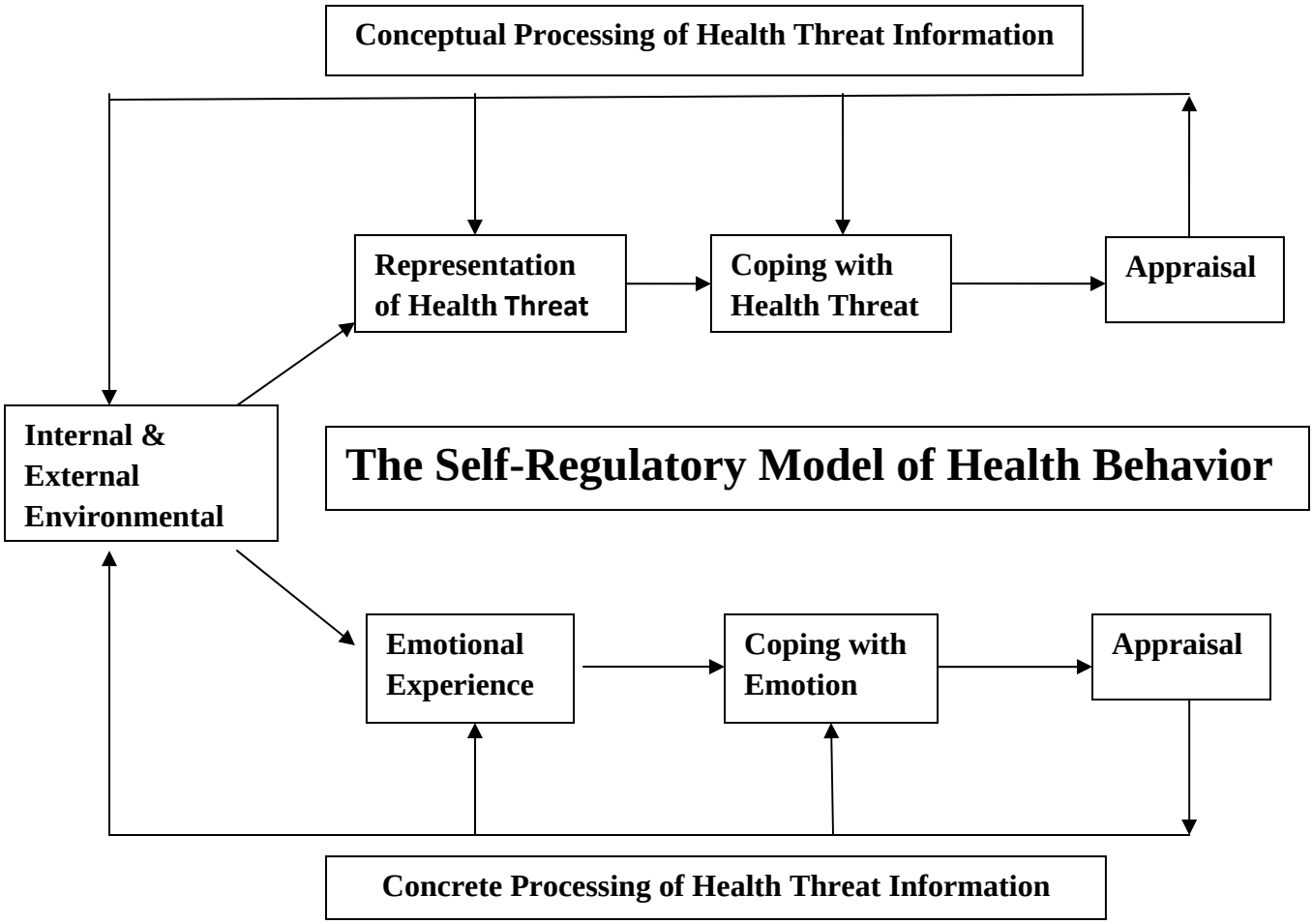
The self-regulation model views the individual as actively constructing a representation of the illness or stressor (Nerenz & Leventhal, 1983), in defining OSA as a threat and the self-regulation of coping behaviors. As self-regulation is defined by information-processing or illness-cognition (Nerenz & Leventhal, 1983), the woman with OSA would then regulate behaviors based on what OSA represented to her in coping with the diagnosis of OSA. Leventhal refers to his model as an adaptive system, adaption occurs in response to a system of mediators. It is the individual's coping skill combined with planning and execution in conjunction with the mediating factors that determines whether the adaptive efforts of the individual will succeed or fail (Nerenz & Leventhal, 1983). Mediating factors for OSA in women may be related to the ability to recognize presenting symptoms (including atypical), and includes diagnosis and treatment.

The model focuses on the conscious experience of health threats and response behavior, but primarily it seeks to identify the variables or factors that underlie the experience and resultant actions (Nerenz & Leventhal, 1983). The primary feature of the model is composed of a series of three stages that guide the adaptive response as identified by Nerenz and Leventhal (in Burish & Bradley, 2003). Representation is the first stage and is defined as the reception and interpretation of information that allows for the definition and identification of potential and actual health threats. The second stage is action planning or coping and it involves assembling, selection, sequencing, and performing of the response alternatives identified by the individual as worthy of consideration because of the perceived chance of success. The appraisal or monitoring stage requires the individual to set criteria for the purpose of evaluating responses and appraising coping efforts against the response (Nerenz & Leventhal, 1983).

The secondary feature of the self-regulatory model is parallel processing (Nerenz & Leventhal, 1983). The model assumes that at least two feedback loops are in play in most illness/stress situations (Nerenz & Leventhal, 1983). Danger-control regulates objectively perceived dangers or threats and the plans and reactions for modifying the impact of the threat on the individual (Nerenz & Leventhal, 1983). Emotion-control regulates the subjective feeling or emotional response to the danger or threat including the cognitions, plans and reactions for modifying that emotional response (Nerenz & Leventhal, 1983). The action or coping plans for emotional regulation usually differ from and may conflict with danger regulation, but can complement each other based on the specifics of the perceived danger (Nerenz & Leventhal, 1983).

The third feature is the hierarchical organization of the model, moving from the highly abstract to the more concrete material at the bottom (Nerenz & Leventhal, 1983). The concrete levels of representing danger and coping involve perceptual and attentional processes combining new information with perceptual memories of prior episodes of illness/stress to inform concrete current experiences (Nerenz & Leventhal, 1983). The abstract conceptual processing resembles cognitive processing/interpretation of situations close to consciousness as automatic or deliberate, controlled and volitional (Nerenz & Leventhal, 1983). In contrast, the concrete-perceptional processing is nearly always automatic (Nerenz & Leventhal, 1983). These two levels of processing can generate similar outcomes that are mutually supportive and interactive, or totally dissimilar and in conflict (Nerenz & Leventhal, 1983). (See Figure 1 below)

Figure 1 The Self-Regulatory Model of Health Behavior **(**L. D. Cameron & Leventhal, 1995)



Leventhal's early work explored how the use of fear-based messages would impose healthy behavior responses from individuals when faced with information regarding smoking and lung cancer (H. Leventhal & Niles, 1964; H. Leventhal & Watts, 1966), and tetanus (H. Leventhal, Singer, & Jones, 1965). The mixed results of these experiences led Leventhal (1970) to develop the Parallel Response Method (Berkowitz, 1970), a precursor to the Dual Process Model, and ultimately the Self-Regulatory Theory. Leventhal acknowledges that it is a complex model with many labels during its development; referred to as an information-processing model, a self-regulation model, a common sense model of illness representations, and a parallel – processing model (Nerenz & Leventhal, 1983). In Wooldridge, Schmitt, Skipper, and Leonard

(1983), Leventhal outlined the development of the Self-Regulatory Theory. Teaming with nurse researcher Jean Johnson to study the relationship between informational response by the sensory conduction system and the emotional distress response, a series of experiments led to the development of the Leventhal Self-Regulatory Theory (Howard Leventhal & Johnson, 1983).

Leventhal and Johnson came to the conclusion that any self-regulatory theory must include a clear representation of the environmental threat, adequate opening responses, and reasonable criteria for successful self-regulation (Howard Leventhal & Johnson, 1983). In addition, the individual's point of view must be respected as one's perception of and interpretation of the problem guides individual coping and evaluation of responses (Howard Leventhal & Johnson, 1983). An individual actively constructs a representation or definition of illness or the stress episode using information processing, illness cognition, or a common sense model. Once constructed, the individual would base or regulate behavior in terms of this representation as the coping or self-regulation aspect of the model (Nerenz & Leventhal, 1983).

By the 1980s, the research focus had changed from fear messages supplied to passive subjects to studying how participants could regulate health practices through parallel response to both an objective health threat and the subject's fear of the health threat (H. Leventhal, Safer, & Panagis, 1983). The original linear Dual Process Model focused on illness threat messages that provoked danger and fear, with parallel tracks of action plans and generated responses (H. Leventhal et al., 1983). Leventhal's Self-Regulatory Theory (1983) looks at the individual's perception or belief about an illness, or illness representation, as mediators between health threats and the individual's emotional reaction to the health threat (Howard Leventhal & Johnson, 1983).

Illness representations may be impacted by previous experience with illness, by cultural beliefs, or through input by family, friends, and media. Illness representation is not static, but

open to change over time as circumstances evolve (Baum, Taylor, & Singer, 1984; L. Cameron & Leventhal, 2003; H. Leventhal et al., 1997). Among the basic components or concepts: a) representation is defined as receiving and interpreting information to define a potential/actual health threat; b) action planning or coping assembles, selects, sequences, and performs response alternatives; and, c) appraisal or monitoring is defined as setting the criteria to evaluate one's responses and appraising the coping efforts to counter the responses (Nerenz & Leventhal, 1983). The Self-Regulatory Model uses parallel processing with the assumption that at least two feedback loops are active in the model, one for regulation of the danger or threat, and the second for the emotional control to regulate the emotional response to the threat (Nerenz & Leventhal, 1983). The danger or threat control reflects the objective representation of the perceived threat including the reaction to it and plans to modify its impact. The emotion control reflects the subjective feeling state, cognitions specific to it, reactions, and the plans to modify the emotional state (Nerenz & Leventhal, 1983).

The theory has five core dimensions: a) how the threat is identified, symptoms experienced, and how it is labeled; b) how it is caused; c) its timeline, or the perceived duration of the threat; d) the perceived consequences; and, e) how controllable the threat is, belief that it can it be prevented or cured (H. Leventhal et al., 1997). Individuals will respond to a similar threat in different ways, making the individual's perception and illness representation important in terms of prevention, treatment, and control of the threat (H. Leventhal et al., 1997). Throughout the process, Leventhal (Burish, 1983) reports delays may occur as the individual processes the situation. Appraisal delay occurs as the individual develops a representation of the illness; while illness delay may occur after the individual has recognized there is an illness until he/she seeks care. Illness delay may occur due to fear of the consequences of the illness or fear of treatment, but may be mediated by social input or social pressure to seek treatment. After the

decision to seek treatment occurs, utilization delay takes place until the individual actually receives treatment (Nerenz & Leventhal, 1983).

Leventhal's Self-Regulatory Theory has been used in research studies in genetic counseling (Shiloh, 2006), chronic fatigue syndrome (Deary, 2008), genetic testing for Paget's Disease (Langston et al., 2008), and dietary self-care in adolescents with type 1 diabetes (Nouwen, Urquhart Law, Hussain, McGovern, & Napier, 2009). More recent research has focused on breast cancer (Costanzo, Lutgendorf, & Roeder, 2011), presenting symptoms at health services (Farquharson, Johnston, & Bugge, 2011), oral hygiene (Godard, Dufour, & Jeanne, 2011), and postnatal depression (S. Patel, Wittkowski, Fox, & Wieck, 2012). Martin has explored cardiac health care seeking in conjunction with Suls' study of the adaptive process in cardiac health using self-regulation (L. Cameron & Leventhal, 2003). Representation of OSA can be considered very similar to the barriers and health threats women faced in respect to diagnosis and treatment of cardiac disease several decades ago. Cardiac disease was also viewed as a "man's disease", while women were under diagnosed and inappropriately treated leading to adverse outcomes. Self-regulation in OSA has been studied by Peach (Peach, 2006) using the self-regulation theory of Zimmerman, Bonner, Evans, and Mellins (Zimmerman, Bonner, Evans, & Mellins, 1999).

Naturalistic inquiry

This study was conducted using naturalistic inquiry as predicated on the five axioms of the naturalistic paradigm as defined by Lincoln and Guba (1985). These axioms speak to the a) nature of reality, b) the relationship of the knower to the known, c) generalization, d) causation, and, e) the role of values (Lincoln & Guba, 1985). Lincoln and Guba (1985) view reality as multiple, constructed and only able to be studied holistically. The knower and the known are inseparable, while the inquirer interacts with the subject under investigation and both will

influence the other (Lincoln & Guba, 1985). Lincoln and Guba (1985) believe that the aim of naturalistic inquiry is to develop a body of knowledge only possible in the form of working hypotheses that describe an individual case, that all entities are simultaneously being shaped, while it is not possible to identify cause and effects (Lincoln & Guba, 1985). Lastly, Lincoln and Guba (1985) believe all inquiry to be value-bound, according to their five corollaries. Inquiries are influenced by a) the values of the inquirer, b) the choice of the paradigm guiding the investigation, c) the choice of substantive theory guiding the study, d) the values inherent in the context, and lastly, e) inquiry must be value-resonant, defined as reinforcing or congruent, if meaningful results are to come of the inquiry (Lincoln & Guba, 1985).

Acknowledging that the five axioms were not enough, Lincoln and Guba (1985) identified fourteen characteristics of operational naturalistic inquiry that undergird the paradigm by their dependence on the axioms or because of their coherence and interdependence, the characteristics act to create synergy. The naturalistic inquirer conducts research in the natural setting, using one self as well as other humans as the instrument of data collection (Lincoln & Guba, 1985). Intuitive or tacit knowledge is legitimatized, in addition to the use of propositional knowledge that can be expressed in language form (Lincoln & Guba, 1985). Naturalistic inquiry uses qualitative methods as more conducive to working with multiple realities, purposive or theoretical sampling to increase the scope and range of data uncovered exposing the full range of multiple realities, and to assist in the development of grounded theories (Lincoln & Guba, 1985). Inductive data analysis was used as it is more likely to identify multiple realities, to make interactions recognizable, explicit, and accountable, and to make the findings transferrable (Lincoln & Guba, 1985). Naturalistic inquiry generally prefers a case study approach to presenting data as it can more easily describe multiple realities, and provides thick description that aids in transferability (Lincoln & Guba, 1985). The naturalistic inquirer is likely to set

focus-determined boundaries to the inquiry based on the emergent data, and allows the multiple realties to define the focus (Lincoln & Guba, 1985). Lastly, naturalistic inquiry uses special criteria for trustworthiness (Lincoln & Guba, 1985). I will discuss credibility, dependability, confirmability, and transferability (Lincoln & Guba, 1985) in more detail in Chapter 3.

Chapter III

Methods

This study used a qualitative descriptive design (Sandelowski, 2010) to describe the experiences of women recently diagnosed with OSA. The purpose of this study was to explore women's experiences with the diagnosis of OSA, specifically the illness representation of OSA and the use of self-regulation in coming to terms with the diagnosis.

The study was conducted using Leventhal's Self- Regulatory Theory (Howard Leventhal & Johnson, 1983) as the guiding framework. The specific aims were:

1. explore the illness representation of women with a recent diagnosis (within one year) of OSA
2. explore the cognitive perceptions and emotional response to diagnosis and treatment of OSA in this sample of women
3. explore the meaning of OSA and the coping strategies used by this sample of women.

Sample

Inclusion criteria for the proposed study were: 1) adult female participants diagnosed with OSA within one year; 2) prescribed OSA treatment; 3) agreeable to give informed consent; 4) able to understand, read, and write English; and, 5) physically and mentally able to answer questions and verbally interact during the interview process. Exclusion criteria included: 1) male gender; 2) non-English speaking; 3) OSA diagnosis > 1 year; and, 4) severe psychiatric disorders.

Setting

The study took place at the UMass Memorial Medical Center (UMMMC) with participants recruited from the Sleep Disorders Center, the Sleep Apnea Awareness Support Group, and snowball sampling. The Sleep Disorder Clinic is located at 85 Prescott Street and is

part of the UMass Memorial system. The center is accredited by the American Academy of Sleep Medicine and provides comprehensive diagnosis and management of more than 81 sleep disorders including adult and pediatric services, treatment for OSA, insomnia, and circadian rhythm disorders. Its sleep disorder services include access to specialists in pulmonology, neurology, psychiatry, and dentistry. The center treats a predominance of patients with OSA; over the past year 1,219 patients underwent overnight PSG testing and 394 did in-home OSA testing. Of the last 300 patients tested, 111 were women (37%). The Sleep Apnea Awareness Support Group Meetings are held on the first Wednesday of odd numbered months at the Sleep Disorders Center. It is geared towards patients with OSA, those who want to learn more about OSA, and offers free annual calibration of CPAP machines.

Procedures

The study used semi-structured face-to-face interviews (Appendix B) with an interview guide employing open-ended questions developed using the five core dimensions of the self-regulatory theory. Interviews elicited the subjective experience of illness representation of OSA. Self-perceived cognitive and emotional threats, coping mechanisms and appraisal strategies were explored with the participants (Nerenz & Leventhal, 1983). Information about how the threat was identified, causation, timeline, perceived consequences, and feelings of control were elicited (H. Leventhal et al., 1997). Discussion of appraisal, illness, and/or utilization delay and mediation by social input/pressure was encouraged (Nerenz & Leventhal, 1983).

Participants were asked to complete a demographic data sheet (Appendix C) to collect descriptive information on age, gender, ethnicity, education level, income, marital status, occupation, co-morbidities, and current medications. Information regarding the time line of the diagnosis of OSA (how long ago, method, currently under treatment, etc.) was elicited.

IRB approval and protection of human subjects

IRB approval was obtained through the UMass Medical School. There was minimal risk to participating in these interviews. The researcher reviewed the purpose of the study including the study procedure regarding interviews, study length of time, and permission to re-contact the participant for follow-up. Discussion of the use of digital recording occurred. Participants were told confidentiality would be maintained, their right to withdrawal from the study at any time, and that refusal to participate would in no way affect their care. Participants were informed that there are no direct benefits or costs to study participation and minimal risks were anticipated, such as the possibility of emotional distress. In the event of emotional distress that couldn't be handled by the P.I., the participant would be referred to their HCP or escorted to emergency mental health services.

Recruitment

Recruitment of participants took place from the UMMMC Sleep Disorders Center. Recruitment of participants using eligibility criteria occurred through initial meetings by the researcher with the UMMMC Sleep Disorders Center HCPs to inform them about the study and request their assistance in identifying eligible patients. I requested a fact sheet be provided to the patients containing information about the study including contact information while also asking the patients' permission for the researcher to contact them regarding the study. I contacted potential participants about participating in the study once permission to contact them was obtained from the individual. At the time of initial contact with the participant, I explained the purposes of the study and that participation in the study included an audio-recorded interview occurring over an anticipated 30-60 minutes. I then met in-person with the participant in a mutually acceptable location that included privacy or by phone to obtain informed consent and conduct the study interview. The participants interviewed by phone were notified that they were

on speaker phone, the interview was audio-recorded, and conducted from within a private secured room.

The UMMMC Sleep Apnea Awareness Support Group was not a source of referrals, after a visit, it was determined that most of their clients were male and/or had long-standing OSA. Snowball technique sampling was also used to recruit additional participants. Study referrals came from the staff of the Sleep Disorders Center, previously enrolled study participants, or colleagues who are aware of my study. A minimum of 20 participants were recruited and interviewed until redundancy of data occurred.

Data Collection (Measures)

Study participation included completion of a sociodemographic data form for each participant (10 minutes) (See Appendix C), one audio recorded interview lasting 30-60 minutes, and permission to re-contact the participant for the possibility of a follow-up member check for credibility and trustworthiness of findings. Field notes were recorded after each interview while audit trails documenting procedures involving recruitment and interviews were kept. Follow-up interview of some participants was necessary for further data collection when new information emerged during coding and theme development.

Data Management

Data was collected and stored by the researcher with the strict assurance that privacy would be maintained. Data was coded with a study identification number known only to the researcher. Demographic data collection forms were collected and checked for completeness by the researcher at the time of the interview. Demographic data was entered into a database using IBM PASW 21®. Verification occurred through double entry of data.

Qualitative interviews were transcribed verbatim by an experienced professional medical transcriptionist into Microsoft Word documents. Upon completion of transcription and review

by the PI comparing the original recording with the transcription, the transcripts were reviewed with NVivo 9© software. All interviews including field notes and audit trails were transcribed and kept confidential, shared only with dissertation committee members. They were stored in a locked file cabinet in the researcher's secured office. Research findings did not reference any participant identifiable data. All electronic data was secured on an encrypted password protected drive with the study identifier code known only by the researcher.

Data Analysis

Each audio taped interview was reviewed including field notes to determine if further probes were needed in subsequent interviews with participants for the study purposes. Interviews were transcribed into an MS Word document for analysis using NVivo 9© software and hand coding. Qualitative content analysis techniques were used to review all participants' responses through a stepwise process of identifying, coding, and categorizing emerging themes or patterns of responses by the researcher (Miles & Huberman, 1994). Miles and Huberman (1994) view qualitative analysis as three concurrent activity flows. Initially data reduction involves devising coding strategies while reviewing transcripts and field notes to select, focus on, simplify, abstract and transform the data (Miles & Huberman, 1994). Displaying data to organize and compress the gathered information in a manner that allows conclusions and actions to be drawn is the second activity flow; this can be accomplished by developing matrices, charts, maps (Miles & Huberman, 1994). The third flow of activity is conclusion drawing or deciding the meaning of the data. Miles and Huberman (1994) believe conclusions must also be verified by testing them for plausibility, sturdiness, and their confirmability or validity (Miles & Huberman, 1994). Data analysis involves data reduction, display, and conclusion drawing or verification interwoven before, during, and after data collection, occurring in a parallel process (Miles & Huberman, 1994). This process includes using the participants' own words first, then comparing and

contrasting findings for the number of times used (including within and across participant cases), that will guide identification of categories that ultimately derive study themes.

Trustworthiness

Trustworthiness was established by using the four criteria as described by Lincoln and Guba (Lincoln & Guba, 1985). The credibility or believability of the data was enhanced by prolonged engagement during the 30-60 minute qualitative interviews, allowing the participant the time needed to tell her story. For in-person interviews, keen observation of the participant occurred during the interview. Field notes consisted of observations of participants' behaviors during the interview provided rich descriptions of the process, and enhanced the credibility of the findings. Peer debriefing with the researcher's dissertation chair was used as needed to increase credibility, provide methodological guidance, and as a cathartic release (Lincoln & Guba, 1985). Member checks to test for factual and interpretative accuracy were used prior to the conclusion of the study (Lincoln & Guba, 1985). Selected participants were asked if the themes that emerged from the study were representative of their experience with diagnosis of OSA to determine the degree to which the findings were reflective of their voices and not researcher bias. Using the participant's own words through judicious use of quotes enhanced credibility; while the descriptions generated were recognizable to the participant as reflective of her experience. Dependability, the stability of the data over time, was enhanced by accurate record keeping, keeping logs of all events, recording field notes after every interview, and journaling.

All data collected including transcripts of participant interviews, field notes, research procedures, and analysis processes will be saved and secured for a total of five years after completion of the study to allow for a transparent audit trail. Initial and subsequent transcripts were reviewed by the dissertation committee chair for content, method and analysis of themes. Confirmability was enhanced by reflecting the voices of the participants' OSA experience with

diagnosis, including cognitive and emotional responses and the coping and appraisal strategies used. Transferability or the extent to which the findings can be generalized or transferred to other contexts was enhanced through the use of thick, rich description, analysis, and interpretation of the findings.

Reflexivity

As a professional nurse practicing in the perianesthesia specialty, I am aware of the problems associated with OSA in the context of administration of anesthesia and analgesia. Acknowledgement of any biases from my own personal and professional experiences in witnessing the untoward effects of OSA on the post anesthesia patients did occur. Reflexivity was required in separating my preconceived perceptions from that of study participants to allow their story to be told about the diagnosis and treatment of OSA. Reflexivity also included awareness of the difficulties faced by women in obtaining a diagnosis and treatment, (including a delay in diagnosis), that I probed further as part of the study aims.

Debriefing and reflexivity techniques occurred after each interview and throughout the study. Reflexive thinking occurred through journaling by the researcher and the presence of a clear audit trail enhanced confirmability. Reflexive journaling should occur as needed throughout a study to record information about the investigator's method (Lincoln & Guba, 1985). A reflexive journal provides insight into why and how methodological decisions are made (Lincoln & Guba, 1985). At the minimum, Lincoln and Guba (1985) believe a reflexive journal should include the logistics and daily schedule of the investigation, and a methodological log for recording methodological decisions and accompanying rationales. It can also serve as a personal diary and a source of catharsis, an opportunity to reflect upon one's values and interests, and to record speculation about growing insights into the research topic (Lincoln & Guba, 1985).

Chapter IV

Findings

Introduction

The methodology chosen for this study was a qualitative descriptive design as described by Sandelowski (Sandelowski, 2010). Leventhal's Self-Regulatory Theory was used as the guiding framework for analysis of data regarding women's experiences with diagnosis and initiation of treatment for obstructive sleep apnea. The specific aims were to: 1) describe the illness representation of women with a recent diagnosis (within one year) of OSA; 2) describe the cognitive perceptions and emotional response to diagnosis and treatment of OSA in this sample of women; and, 3) describe the meaning of OSA and the coping strategies used by this sample of women.

Participants in this study were first asked open-ended questions exploring what the diagnosis represented to them (illness representation) and for their cognitive perceptions and emotional responses to diagnosis and treatment (Appendix B). Participants were asked the following questions: "Tell me about your experience with being diagnosed with OSA?" and "What was it like when you were told you had OSA?" Many of the women responded with very detailed narratives of their experience leading up to diagnosis and initiation of treatment including response to treatment. Other participants were more taciturn and required the use of probes to elicit more information that described their personal experiences.

The study findings revealed the overarching theme, *A life-altering diagnosis*. Three subthemes that emerged from the data included *Making sense of it, Making it work,* and *Paying it forward*. *A life-altering diagnosis* reflected how participants described being diagnosed and initiating a challenging and potentially life-long treatment.

Sample

A total sample of twenty-one women participants were interviewed for this study. One participant was eliminated from analysis upon disclosure of being previously diagnosed several times prior while refusing treatment because of ongoing psychiatric concerns. A second woman who had been previously diagnosed with mild OSA who was told by her HCP "not to worry about it" was included in the final analysis as she was determined to be similar to others in the study who had prior negative sleep studies. The final study sample included twenty women interviewed. The setting for the study where recruitment of participants occurred included the Sleep Disorders Center and word-of-mouth snowball sampling. Of the study (N = 20) participants, 65% (n = 13) were referrals from the Sleep Disorders Center; 20% (n = 4) were patients at the Sleep Disorders Center, but were not referred by the center, instead were self-referred/snowball sampled to the study; 10% (n = 2) self-referred from another local sleep center; and 5% (n = 1) were from a sleep center outside of Worcester County. Many other women (n = 15) who expressed interest in the study through the Sleep Disorders Center were not interviewed as they failed to respond to phone calls, keep scheduled interview appointments, or declined or postponed interviews repeatedly. No participants were recruited from the Sleep Apnea Awareness Support Group where a majority in this group were men or had long-standing OSA.

Recruitment to the study opened in December 2013 with data collection occurring between January 2014 and July 2014. Due to scheduling conflicts and inclement weather, a majority or 70% (n = 14) of participants were interviewed over the phone while the remaining 30% (n = 6) were interviewed in-person (Table 1).

Demographics

Study findings of the demographic data for the sample (N = 20) are depicted in Table 2. The final sample included N = 20 women, from the Commonwealth of Massachusetts with a

mean age of 53.2 years (SD 12.992). A majority of the sample were married (60%, *n* = 12), while others were separated (15%, *n* = 3), single (10%, *n* = 2), divorced (10%, *n* = 2), or living with a partner (5%, *n* = 1). The majority of the women identified themselves as White/Caucasian (95%, *n* = 19) and one identified as Hispanic (5%, *n* = 1).

A majority of the participants completed two years of college (45%, *n* = 9), high school (30%, *n* = 6), four years of college 15% (*n* = 3), and one a master's program (5%, n=-1). Forty percent of the women were employed full-time (*n* = 8), retired (35%, *n* = 7), working part-time (15%, *n* = 3), a stay-at-home mom (5%, *n* = 1) or a student (5%, *n* = 1). Household income was provided by 90% of the participants, two participants (10%) deferred answering the question. Income reported by two thirds of the participants (*n* = 12, 60%) included $21,000-40,000 range (15%, *n* = 3), $41,000-60,000 range (15%, *n* = 3), or $61,000-80,000 range (15%, *n* = 3).

Mean weight for the sample averaged 188.5 pounds (SD 46.5) while the participants had a mean BMI calculated at the obesity level (> 30), at 32.37 (SD 7.89). Participants were noted at normal weight range (15%, *n* = 3), overweight range (25%, *n* = 5), obese (45%, *n* = 9), and super obese (15%, *n* = 3) with a BMI greater than 40. Mean height for the sample was 64 inches (SD 2.53).

In this study, the average age of menopause occurring was 46.89 years (SD 6.55), with 70% (*n* = 14) postmenopausal, 10% (*n* = 2) perimenopausal and 20% (*n* = 4) experiencing menstrual cycles. Most postmenopausal participants underwent a natural menopause (60%, *n* = 12) including use by 50% (*n* = 6) of HRT and 5% (*n* = 1) home remedies to treat menopausal symptoms (Table 3).

The co-morbidities experienced by these participants included depression (65%, *n* = 13), hypertension (60%, *n* = 12), resistant HTN (25%, *n* = 3), and insomnia (30%, *n* = 6). Heart-related issues included arrhythmias (15%, *n* = 3), high cholesterol (10%, *n* = 2), cardiac events

including rule-out MI (10%, *n* = 2), and stroke (5%, *n* = 1). Respiratory issues reported by these women included asthma (25%, *n* = 5), sinus problems/post-nasal drip (5%, *n* = 1), and deviated septum (5%, *n* = 1). Endocrine disorders reported included diabetes mellitus (DM) (5%, *n* = 1), "borderline" DM (25%, *n* = 5) treated with diet (*n* = 1) or under observation for DM (20%, *n* = 4); and thyroid disease (20%, *n* = 4). Two women (10%, *n* =2) were diagnosed with cancer (breast treated with surgery, chemotherapy and radiation; Stage 1 uterine cancer treated with surgery). Women in this study reported having a diagnosis of anxiety (40%, *n* = 8); irritability (30%, *n* = 6); and loss of libido/sexual dysfunction (30%, *n* = 6). This sample reported morning headaches (50%, *n* = 10), although they often attributed them to sinuses, or TMJ. Teeth grinding (45%, *n* = 9) and restless legs (40%, *n* = 8) were also reported. Other conditions noted are listed in Table 4.

The majority of the women in this study never smoked (45%, *n* = 9). Women who had smoked (40%, *n* = 8) started as teenagers and smoked a pack per day or less before quitting in their early twenties (30%, *n* = 6). Two smoked until their 50s when they gave it up for health reasons. The current smokers (15%, *n* = 3) noted multiple attempts to quit, and classified themselves as "social smokers" who only smoke intermittently, no more than a few cigarettes/day (Table 5).

As displayed in Table 6, the majority of the participants were diagnosed with severe OSA (40%, *n* = 8), 30% diagnosed with moderate OSA (*n* = 6), 10% (*n* = 2) mild OSA, and 20% (*n* = 4) not told the severity or did not recall. All participants (100%, *n* = 20) were initially prescribed for their CPAP treatment. One woman who failed CPAP was pursuing an oral appliance for OSA treatment. The women used their CPAP on average 6.3 hours per night (SD 2.54). Refer to Table 6 for details on CPAP use.

Most women in this study did report snoring (90%, *n* = 18) of varying degrees, half reported awareness of frequent and loud snoring (50%, *n* = 10), awareness of intermittent or mild/light snoring (30%, *n* = 6), 10% reported they were unaware of snoring but had been told they had occasional light snoring (*n* = 2), and two women reported no history of snoring. Although the majority reported themselves as poor sleepers with frequent arousals (55%, *n* = 11), only five (25%) reported waking up snorting, choking or other respiratory concerns. The remainder reported that they slept well and were oblivious to any problems with their sleep other than an occasional awakening for urination or hydration (45%, *n* = 9). These self-described good sleepers included 3 with moderate OSA, 3 with severe OSA, and 3 who did not know their degree of OSA. Only 35% of the women in this study were aware of witnessed apneas as reported by sleeping partners or other family members, this included comments such as "your breathing changes" and "you get really quiet". Only two women complained of excessive daytime sleepiness (EDS), a hallmark of OSA terminology, instead using words such as "tired", "extreme tiredness", and "fatigue". They hence did not see themselves as at risk for OSA (Table 6).

Table 1

Participant Recruitment and Interview

Category	Participant Response (N)	Percentage
Recruitment		
UMMMC Sleep Center	13	65
UMMMC Sleep Center – self-referred/ snowball sampling	4	20
Other local sleep center	2	10
Massachusetts sleep center outside Worcester County	1	5

Type of Interview			
	In-person interview	6	30
	Phone interview	14	70

Table 2

Participant Demographic Data

Age	Mean (Standard Deviation)	Median (Range)
	53.20 years (12.992)	57 years (19-71)

Category	Participant Response (N)	Percentage
Calculated BMI		
18.5-24.9 (normal)	3	15
25-29.9 (overweight)	5	25
30- 40 (obese)	9	45
> 40 (morbidly obese)	3	15
Marital Status		
Married	12	60
Widowed	1	5
Single	2	10
Separated	3	15
Divorced	2	10
Living with partner	1	5

* Percent exceeds 100% because one woman provided two answers: widowed and living with partner

Occupation		
Business	3	15
Educators	2	10
Health care workers	6	30
Secretary/clerical worker	3	15
Service	3	15
Stay at home mom	1	5
Student	1	5
Current Occupational Status		
Working full time	9	45
Working part time	4	20
Retired	7	35
Student	1	5

* Percent exceeds 100, full-time student was also employed part-time

Household Income		
$0-20,000	1	5
$21,000-40,000	3	15
$41,000-60,000	3	15
$61,000-80,000	3	15
$81,000-100,000	3	15
> $101,000	5	25
Deferred/preferred not to answer	2	10
Race/Ethnicity		
White/Caucasian	19	95
Hispanic/Latino	1	5
Last year of school completed		
12 (High School)	6	30
13	1	5
14 (Associate Degree)	9	45
16 (Baccalaureate Degree)	3	15
18 (Master's Degree)	1	5

Table 3

Current Menstrual/Menopause Status

Age at Menopause	Mean (SD) 46.86 (6.538)	Median (Range) 49 (29-54)

Category	Participant Response (N)	Percentage
Menstrual/Menopause Status		
Menstrual cycles	4	20
Perimenopausal	2	10
Postmenopausal	14	70
Age at Menopause		
29-44 years	5	35.6
46- 50 years	4	28.5
50.5 - 54 years	5	35.6
Type of Menopause		

Surgical menopause	2	14.3
Natural menopause	12	85.7
Hormone Replacement (HRT) Use		
Yes	6	37.5
No	10	62.5
Type of HRT		
Prescription	6	85.7
OTC/Natural remedies	1	14.3

Table 4

Participant Co-morbidities

Category	Participant Response (N)	Percentage
Heart disease		
None	7	35
HTN	12	60
Hypercholesterolemia	1	5
Respiratory disease		
None	13	65
Asthma	5	25
Other (Sinus problems/deviated septum)	2	10
Other Sleep problems		
None	14	70
Insomnia	6	30
Thyroid disease		
No	16	80
Yes	4	20
Diabetes		
No	14	70
Yes	1	5
Borderline, under observation	5	25
Cancer		
No	18	80
Yes	2	10
Type of Cancer		
Breast (Surgery/chemo/radiation)	1	5

Stage 1 Uterine (surgery)	1	5
Other co-morbidities		
None	7	35
Anxiety	1	5
Autoimmune disorder	1	5
Chronic fatigue	1	5
Depression		
Depression (diagnosed)	3	15
Depression (self-reported)	7	35
Depression/panic disorder/ fibromyalgia	1	5
Neuropathy r/t back injury/long-time depression/RA/psoriatic arthritis/ fibromyalgia/chronic fatigue	1	5
Bipolar	1	5
Morbid obesity	3	15
Polio/post-polio syndrome (self-diagnosed)	1	5
Ulcerative colitis	1	5

* Percent exceeds 100 as some women reported in more than one category

Table 5

Participant Smoking History

Category	Participant Response (N)	Percentage
Smoking history		
Never smoked	9	45
Smoked in the past	8	40
Age started		
16	2	25
17	1	12.5
18	5	62.5
PPD smoked		
< 1 ppd	5	62.5
1 ppd	3	37.5
Age quit		
18 - 20	3	37.5
22 - 23	3	37.5
52 - 59	2	25
Reason for quitting		
R/O MI scare	1	12.5
Fad	1	12.5

Health reasons/aging	1	12.5
Husband's request	1	12.5
No interest in continuing	1	12.5
Pregnancy	1	12.5
Started running	1	12.5
Taxes/price too high	1	12.5
Currently smoking	3	15
Age started		
14	1	33.3
18	1	33.3
20	1	33.3
PPD smoked		
< 1 PPD	3	100
Attempts to quit		
Yes	3	100

Table 6

Participant OSA Characteristics

Category	Participant Response (N)	Percentage
Degree of OSA		
Mild	2	10
Moderate	6	30
Severe	8	40
Don't know/Not told	4	20
Snoring characteristics		
Snoring, aware, loud	10	50
Snoring, aware, mild	6	30
Snoring, unaware, mild	2	10
No snoring	2	10
Sleep Characteristics		
Good sleeper	9	45
Poor sleeper, frequent arousals	11	55
Prescribed Treatment		
CPAP	20	100
Decision left to participant*	1	5
Pursuing Oral Appliance*	1	5

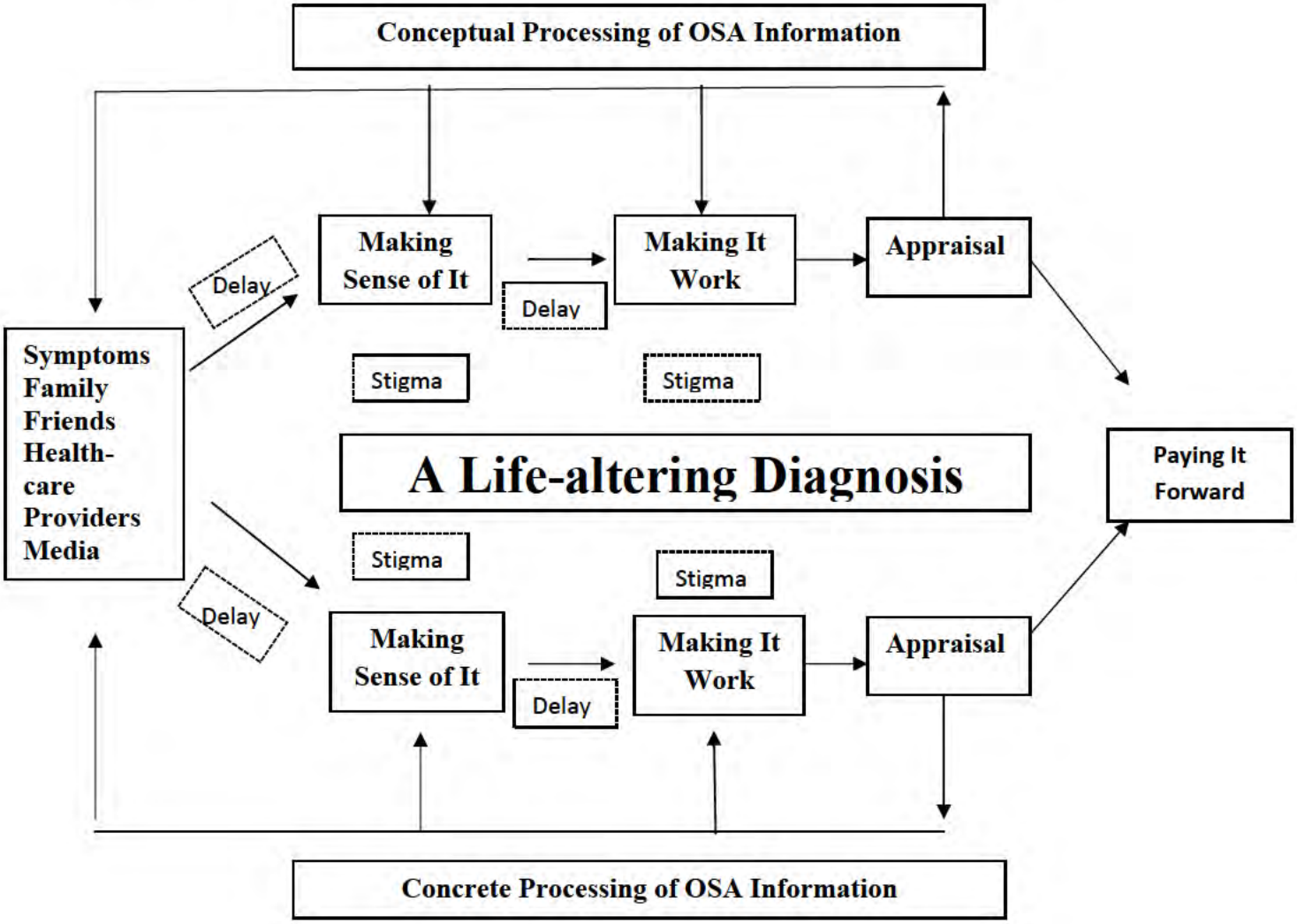
* Percent exceeds 100 as one applicant was left to decide if she wanted to pursue treatment and second failed with CPAP and was pursuing OA

Use of prescribed treatment		
Never	2	10
Few times a week (5-6 x/wk.)	2	10
Every night	13	65
Every night plus naps	3	15
Number of hours/night CPAP is used		
0 hours	2	10
3 hours	1	5
6 – 7 hours	8	40
7.5 – 8.5 hours	8	40
10 hours	1	5

Experience of Women with a Diagnosis of Obstructive Sleep Apnea (OSA)

The overarching theme from this study was *A life-altering diagnosis.* Three subthemes emerged from the data included *Making sense of it, Making it work,* and *Paying it forward*. *A life-altering diagnosis* reflected how participants described being diagnosed and initiating a challenging and potentially life-long treatment. *Making sense of it* describes how the participants came to terms with their symptoms and sought diagnosis. *Making it work* was the second subtheme and described how the women dealt with their treatment. The last subtheme was defined as *Paying it forward.* Many of the women in this study felt strongly about helping others and advocating for information about OSA to reach more women. The overarching theme, subthemes and categories are outlined in Figure 2.

Figure 2. A Life-altering Diagnosis



Woven throughout these subthemes were the topics of delay, family influences, lifestyle changes and the stigma of OSA. Delay described the participants' experience seeking diagnosis and treatment for their symptoms. Most of the participants experienced delay of varying lengths of time on their journey to diagnosis and treatment, both provider-related and participant-related. Anger and concern over experienced/perceived delays was expressed by several participants. Family was an important topic for the women in this study, both in terms of diagnosis and support of treatment, and included sleeping partner awareness, and family support. Stigma of

OSA reflected the women's views on being diagnosed and how others might respond to their diagnosis, in particular in intimate situations and included physical intimacy and embarrassment.

Additionally, the women in this study described making lifestyle changes upon struggling with extreme fatigue, lack of sleep, and cognitive issues prior to diagnosis. They reported sleeping, napping, or just "resting" during the day. Many avoided driving long distances. Some were faced with long commutes, and found they needed to pull off the road because of extreme fatigue/falling asleep at the wheel. They coped with their cognitive issues by making lists, writing things down or using a smartphone to set alarms or record reminders for themselves, "Yeah, I live on sticky notes. I have them everywhere. I don't know what I would do. I have sticky notes to remember my sticky notes. It's bad." They adapted their sleeping arrangements, one woman sleeping with a fan blowing on her and propped up on four pillows in an attempt to keep her airway open. Some self-medicated with caffeine in an effort to stay alert. This often had consequences of interfering with falling/staying asleep at night. Some women used OTC sleep aids, herbal teas, or herbs to try to improve their sleep. More concerning were the women who were prescribed medications for sleep, depression and/or anxiety, as these can worsen the effects of OSA. One HCP had prescribed attention deficit disorder (ADD) meds for his patient in a failed effort to improve her ability to focus/concentrate in the workplace.

Although many women sought treatment because of their personal health concerns, many described the impact on others: spouses, young children dependent upon them, foster children they cared for, and schoolchildren on the bus one participant drove. They were also concerned about other women who might not be aware they had OSA and how to get the message out to them. Many served as advocates to others to seek testing/treatment as they saw the symptoms they had experienced playing out in other women.

A variety of reactions were described by the women in this study. For some, the diagnosis was embraced and the benefits of treatment were immediately realized, others resented the diagnosis and treatment, but realized some benefits. Some participants stated they were in denial, did not describe any benefit from the treatment and were resistant to using CPAP as prescribed. One participant, unsuccessful with CPAP and seeking alternative treatment, described feelings of having been failed by her HCPs. Failure by healthcare providers to diagnose and treat women was frequently expressed by these women and went hand-in-hand with concern over the possible implications for their future health. These women related the need to be proactive in seeking treatment for their symptoms. What they did express was that this was a life-altering diagnosis for them with far-reaching effects on their lives.

A life-altering diagnosis

A life-altering diagnosis was the overarching theme derived from this group of women. The women referenced both positive and negative aspects equally. Among the positive effects was having a diagnosis and a treatment that could improve their quality of life. Negative reactions dealt with being diagnosed with a condition that many of them were unaware of, or unaware they had, and that had far-reaching health consequences (cognitive, cardiovascular, obesity). Some resented being saddled with a life-long, inconvenient, difficult to maintain treatment with potential impact on their life-style that at the time of interview seemed more trouble than it was beneficial. The participants described trying to reconcile the extreme tiredness they were experiencing with other things occurring in their life simultaneously, chronic disease, menopause, raising children, demands of work and home (subtheme: *Making sense of it*). *Making it work* brought discussions of the difficulty with adapting to and using CPAP. The women discussed taking control of the situation, making lifestyle changes, and how this was one more burden to bear in an already complicated life. Throughout the process, there was constant

appraisal, re-evaluation and adaption occurring as these women tried to make it work (subtheme: *Making it work*). The final subtheme dealt with *Paying it forward*. Many of these women felt an obligation to mentor and advocate for other women who might not recognize they had OSA and to support those women who were struggling with treatment. They described being open and sharing their knowledge of OSA and CPAP, especially if they had realized positive benefits from treatment: "I'm just one of those people who like wants to tell the world about the wonderfulness that I have found" (subtheme: *Paying it forward*).

Making sense of it. *Making sense of it* was the first subtheme and included coming to terms with symptoms and diagnosis. For this sample of women, both acceptance (acknowledging the diagnosis of OSA and embracing treatment), and denial (not convinced of diagnosis or need for treatment, seeking alternatives) were factors in how they made sense of the situation.

Symptoms. It has been acknowledged in the literature that women have different symptoms of OSA than men. Identifying symptoms related to OSA was a challenge for many of the participants. Although the women in this study did not have the classic triad of symptoms for OSA: snoring, witnessed apneas, and EDS; they did all report extreme tiredness or fatigue that was out of proportion to other events occurring in their lives. As they struggled to make sense of their symptoms, they made associations to life events, older women attributing their tiredness and other health issues to hormonal changes associated with menopause and/or aging. Younger women referred to raising children, work and everyday stresses.

These women did not discuss sleepiness as a symptom, but when queried, most of the women (70%, $n = 14$) would acknowledge falling asleep during the day if the opportunity presented itself. Most common was falling asleep while riding in a car (50%, $n = 10$) and sedentary activities such as reading or watching TV (50%, $n = 10$), sleeping in meetings (5%, $n =$

1), or sleeping at her desk (5%, *n* = 1). Six women (30%) reported having close calls while driving, although they reported no accidents as a result, most involved falling asleep at stoplights (20%, *n* = 4) and one found she frequently needed to pull off the road to rest.

A majority of women in this study reported being under treatment for depression (65%, *n* = 13). Most did not associate their depression with OSA, although many of them initiated treatment for depression at about the same time they began to exhibit symptoms of OSA. The association was made by one post-menopausal woman, "Yeah, I mean, I'm not terribly depressed; I'm depressed because I'm tired. I don't think I'm tired because I'm depressed."

The symptoms that caused the most concern among the women in this study were cognitive. A significant number complained of difficulty concentrating (75%, *n* = 15) and short-term memory loss (70%, *n* = 14), describing lack of focus (15%, *n* = 3) and being forgetful or absentminded (25%, *n* = 5). Among those who denied cognitive symptoms (25%, *n* = 5), they exhibited short-term memory loss, slow thinking and speaking patterns, and would ask other family members for corroboration or clarification of events during the interview.

Conceptual and concrete processing of OSA information: Seeking diagnosis. The reactions to their diagnosis of OSA varied significantly among these women. Many of them reported initial thoughts of being happy to have a diagnosis, OK with the diagnosis, "hoping to have a magic pill to feel better, like I did before", relieved to have an answer to the symptoms she had been experiencing. Others were angry, "pissed off", sad and depressed, frustrated (about length of time without a diagnosis and treatment), aggravated, and referred to it as "just something else I have to deal with". Some expressed disappointment in themselves, citing weight loss, or taking better care of themselves as something they could have done to prevent the occurrence of OSA. Many women in this study were surprised by the diagnosis, shocked, "never thought in a million years it would be something like that." Many expressed fear of the health

consequences of OSA from not being promptly diagnosed and treated. They reported being scared, vulnerable, worried about it (OSA), fear of using CPAP, "afraid of dying in my sleep", afraid of strain on the heart from hypertension related to untreated OSA, afraid of seizures, scared because of all the health dangers associated with untreated OSA, and loss of brain cells. One woman with loud snoring and moderate OSA who had believed she was sleeping well, denied short-term memory loss but was very concerned about her cognitive functioning and mentioned it repeatedly throughout the interview:

> I must not be breathing, which is probably affecting my brain cells, which is not funny, really. You do love your brain cells as you get older, especially. . . . . Let's just hope it's not too late. I hope that doesn't come later. You know. She had sleep apnea for ten years. That's why she has Alzheimer at fifty-seven. Oh, it's like kind of making a joke, but kind of serious, because really it is serious. You know what I'm saying. It's serious.

Others were scared, angry, and disillusioned by the diagnosis. One participant who prided herself on her physical fitness and active lifestyle was particularly upset, "I was somewhat depressed and sad because I felt very old — I was in denial and I didn't want to believe I had it and I — it makes you feel old." When asked to explain, she related that aging made her feel nervous and anxious, "your life is changing; you're not the same young person. It's just an old diagnosis . . . and I worked so hard to stay healthy and it just makes you mad, like why do I have this?"

Another women was sure that nothing would come of being tested for OSA because she didn't believe it to be her problem. She discussed coming to terms with her OSA diagnosis:

> I just didn't put that much stock into it. And then when they told me, I was scared at first because all of the new information. Like knowing that it is dangerous, it was very like, it was very shocking, I guess, to just hear that this is happening inside my own body and it took me thirty-three years to figure it out.

Another woman initially had very negative reactions to being diagnosed with OSA, admitting to her preconception about OSA to be "a bunch of hogwash. . . That it wasn't a real problem, that something else must be going on, and how could so many millions of people be suffering from sleep apnea. I kind of looked it at as the new medical trend." Once diagnosed, she admitted it "was unfair of me, I'm a medical person" and was determined to maintain treatment with her CPAP.

There were two small but overlapping subsets within this group of women. The first was participants who had significant co-morbidities (20%, $n = 4$) including autoimmune disorder of unknown etiology; post-polio syndrome; depression with panic disorder and fibromyalgia; and neuropathic pain following an injury with depression, fibromyalgia and chronic fatigue syndrome. The symptoms such as extreme fatigue and depression experienced with their underlying disease entities were often similar to symptoms women with OSA experienced. These women had difficulty distinguishing whether their symptoms were related to their chronic illness or to their OSA, and most did not experience the degree of relief of symptoms they anticipated with treatment for their OSA. These were the women who spoke of one more thing to deal with, or something else to suffer with above and beyond their chronic illness. The second subgroup were women (15%, $n = 3$) who did not believe they had OSA and thought they were misdiagnosed because of what they felt were less than optimal testing conditions and/or lack of desired result from treatment. For one woman who did not believe she had OSA for a variety of reasons including fear of not having an adequate home sleep study:

> I'm not totally convinced that I do indeed have sleep apnea because a) I don't know how they could have gotten the test results that they think they got from the test. I think that the test actually should have run a second time before the decision was made to go ahead with the machine.

Family influence. Family influence was an external environmental influence (see Figure 2) that factored into the participants seeking a diagnosis. These women were heavily influenced by family members, including sleep partner awareness of her breathing problems. It was often the family that was first aware of the problem and urged the woman to seek diagnosis for her disturbed sleep pattern. Family members did research on SDB and OSA for the woman. Single women with children spoke of needing to take care of themselves as to be there for their children. Many of these women were the sole support for their families and felt their children had no one else to be there for them. One foster care provider was so concerned about her EDS and fear of harming her foster children in an accident that it was the catalyst to seek diagnosis. She described her fear about keeping the children in her care safe:

> I'd be behind the wheel and I would be so sleepy I could not stay awake. I was fighting it so bad I was afraid that I would get into an accident, and I do foster care. I take care of kids from the state. They need a home and all that. A lot of times I will be driving them to an appointment and I catch myself falling asleep.

Sleep partner awareness. Sleep partner awareness was heard from a majority of women currently or previously with sleep partners (currently married, separated, divorced, living with partner; 90%, $n = 18$); their partners were aware of their sleep and breathing difficulties (60%, $n = 12$), including witnessed apneas (30%, $n = 6$). Sleeping partners of these women were very aware of their partner's respiratory distress, reporting snoring, changes in breathing, and witnessed apneas. This was especially true for men who were in treatment for OSA. They were

often the impetus for the woman seeking treatment. Several women referred to it as "payback" because they had originally been responsible for their husband being diagnosed with OSA. These men told their partners, "Your breathing changes", and "you get really quiet".

One older participant was very aware of snoring and had problems with sleep dating back 10-15 years but didn't seek treatment until she developed resistant hypertension. Her husband had mentioned breathing difficulties to her urging her to look into her sleeping because as he said, "sometimes you go so quiet that I have to actually look to see whether you're still breathing or not, you get too quiet." He was not alone in urging a woman to investigate her sleep disturbance; from another woman's sleeping partner, "I'm very concerned about your breathing in the middle of the night. I'm really scared. It worries me. I lay awake listening to you." This was the impetus for this woman to seek diagnosis. This was a new relationship for this participant whose former husband had been oblivious to the distress she was in. This woman was diagnosed with severe OSA with the persistence of her current partner. Another woman's partner, after his own diagnosis of OSA, had told the woman she was snoring and having apnea, she was "in denial" and put off testing until she suffered a stroke.

Some men who were bothered by their wife's snoring tried a variety of methods to stop the snoring or make the woman aware of the problem. One participant who felt she was sleeping very soundly, was unaware of any breathing problems. Her husband, previously diagnosed with OSA and successfully using CPAP, was trying to convince her to be tested. He was frequently nudging her during the night to stop her snoring. When that proved unsuccessful, he recorded his wife snoring, "my husband used to tell me I was really snoring. I used to tell him 'no', so he actually recorded it. Kind of mean. So I actually did snore."

Other husbands took more extreme measures to convince their wives to get treatment. One participant with multiple co-morbidities was a solid sleeper and unaware she was snoring or

having breathing difficulties. Her husband took some unusual means to curb his wife's snoring, "he was like pinching my nose so that I would stop breathing to wake me up, because apparently hitting me didn't always work." One husband became so frustrated with the participant's snoring and her failure to act on it for more than four years, it was causing marital discord, and "you know it got to a point where my husband actually moved out of the room, because I was keeping him up and (he) not being able to sleep." The woman reported being afraid to go to sleep "because I knew I wasn't going to sleep" and out of fear that if she did sleep she would disturb her husband.

Only two women (10%) with partners noted that their partners were not aware of their breathing difficulties or apneic episodes. They referred to their husbands as being "not observant" and "not the type of person to be aware of anything like that."

For women without partners, they often heard from children, grandchildren, friends, parents, or traveling companions that there was a problem with snoring or apnea. One woman was unaware of any airway problems until her mother made an overnight visit and commented on her snoring, "you stopped breathing in your sleep, and plus you're snoring." The woman was shocked to learn that she had "stopped breathing four or five times and I seemed to be gasping for air." One single parent sought treatment for the benefit of her family:

> And then all of a sudden, I was out on my own with a five-year-old in tow . . . I'm the only thing between my child and the streets, just flipped a switch. And I became very proactive with things. If things aren't good, then fix it. . . . I think that's what made me notice that my sleeping was not normal, and I wasn't going to settle for what it was.

Delay in diagnosis. As the women attempted to *make sense of it*, the majority of them (80%, $n = 18$) experienced delay in diagnosis and/or initiation of treatment for periods varying

from a few weeks to more than thirty years (See Table 2). Some of the delay was *provider-related*: refusing to refer to testing, telling the woman to lose weight, to exercise more, ignoring complaints of extreme fatigue, prescribing sleeping aids, treating for depression, giving a prescription for a “daily nap”, and/or telling the woman she didn’t look like she had OSA. Some women found they had to be proactive and pursue testing and treatment. One woman saw her dentist for teeth grinding and new onset of malocclusion. He suggested a sleep study, she felt the only reason she was tested was because as a healthcare worker she knew the pulmonologist. Even with that, she met resistance, told "you don't look like the typical sleep apnea person. You're not real overweight. I don't think you have this thing, yet." This same participant had been symptomatic for years and discussed it with her HCP. She, as almost half of the women in the study (45%, $n = 9$), were not initially tested for OSA, but misdiagnosed and medicated inappropriately with either antidepressants, anti-anxiety agents, or sleep aids:

> And you know what was weird when I — I would go to my primary doctor, you know, I'd go once a year and I'd say, "I don't sleep well. I can't — I wake up in the middle of the night. Sometimes, I can go back to sleep. Sometimes I can't. And then my mind will start racing and I can't go back to sleep." And he prescribed me like, Ativan. And I would take a pill here and there, you know if I couldn't go back to sleep and I think that was probably making it worse.

One participant in the study had symptoms for more than thirty years that had been ignored by her HCPs despite complaints of EDS so severe that she was sleeping at her desk and once fell asleep on the commuter train and missed her stop. Another woman had experienced a sleep center that closed before providing her study results, requiring multiple sleep studies before finally obtaining a diagnosis in a process that took more than a year. Participants described the delays experienced in diagnosis and treatment and referenced having to become proactive to

maintain their health, demanding testing and treatment, "I actually pushed for this. . . my brother-in-law is a big guy and he has none of these symptoms either and he has the worst form, and I drive a school bus. That was it. She put me in for the test."

Some of the participants in this study also contributed to their delay in diagnosis. Among the reasons women did not seek diagnosis (*participant-related delay*) were that they didn't want to know they had OSA, they didn't want to use CPAP, they were in "denial" and as one woman shared, she didn't fit the "stereotype":

> I mean it was, you know, it was surprising to me I guess because I just felt, you know, atypical, you know. I would say ninety-nine, maybe not that high, we'll go with eighty-five percent of the people that had sleep apnea that I've worked with were men with fat necks, you know. So I'm thinking, you know, well obviously I'm not a man and, secondly, I don't have a fat neck. . . . but I just didn't feel like I fit that stereotype, you know?

One woman had received information about OSA from her HCP in the past but reported lack of time to pursue a diagnosis. Her rationale was that she was always "trying to juggle a lot of things. I've had a high pressure, high travel job. I have two kids, trying to keep everything going" and she could always catch up on sleep later and take care of it by "trying to squeeze more in and just kind of battle through and figure out I guess, try to relax, try to exercise, do all the positive things to improve sleep."

Even family support was not enough to overcome participant-related delay in several cases. One participant talked about her sleeping partner's concern about her breathing and witnessed apneas and her failure to follow up and be tested, "Yeah I was a little bit, oh I just, I was very busy working, and I just procrastinated, and that happens to be part of my personality; I tend to procrastinate." Although another participant's husband had complained for four years

about her snoring impacting his ability to sleep, it took him moving out of the bedroom as the impetus for her to seek treatment.

Concern and anger over delayed diagnosis. Among the women who had experienced delay in diagnosis/initiation of treatment, more than a third of them (n = 7) expressed reactions ranging from concern to anger about the potential consequences of delay. Wishing they had known about their OSA much earlier was a recurrent statement. Many were disgruntled that they had never been asked about sleep problems, or had not been listened to when they brought the subject up with their HCP. They expressed a desire for more information about OSA to be provided to women and it should be part of yearly screenings like weight, blood pressure, diabetes, etc. Women in this study expressed concern about potential or realized health issues they believed were related to OSA, referencing fear of cognitive effects like loss of brain cells, developing dementia or Alzheimer's disease, having a stroke or developing cardiac disease as a result of not being diagnosed and treated early enough. One woman was aware of the potential cardiac effects, "well the fact that it puts so much strain on your heart when you aren't breathing really scared me." She was concerned that she might have suffered cardiac damage by not catching her OSA soon enough.

The women also expressed anger that their HCPs had not been proactive enough in screening them, in referring to treatment, or in listening to their reports of sleep problems. Several women spoke of circumventing the HCPs who they felt were not listening to their concerns and self-referring themselves for sleep studies. One participant was extremely concerned about the delay in diagnosis and potential health problems related to her OSA not being discovered and treated sooner, expressed criticism of doctors for not screening their patients for OSA:

> I didn't know it until I was seventy years old. Excuse me, seventy years old. So I don't know how you, I think you have to have doctors to ask questions, 'how are your sleep habits?' I just never knew it. Again, I don't think doctors pick up on this.

One woman who had been overweight her entire life expressed her frustration about a lifetime of dieting failures and steady weight increase. It was not until she sought consultation for bariatric surgery that she was told of the connection between OSA and obesity and underwent the required pre-surgical sleep study that showed she suffered from severe OSA. She felt a strong need to advocate for other women based on her experience, "I also kind of wish that more PCPs talked about it with their patients . . . I wish that it had been suggested to me earlier in my life. . . there was more awareness about it."

Some of the most poignant comments came from women who felt they were "blown off" because they had mental health diagnoses such as depression and/or anxiety. They felt their quality of life had suffered needlessly for years because every time they mentioned sleep problems it was attributed to mental health problems requiring medications for depression and/or anxiety. One participant summed up the thoughts of several:

> I think once you say anything about depression, anxiety, things like that, that's it. Everything is then categorized as that's your problem, unfortunately. And the sad thing's my experience, up until this point, is that well you have a history of anxiety. It's really frustrating, you know what I mean, I shouldn't just have all of my symptoms blown off because I have a history of anything. You know, like everything should be taken into account.

Stigma of OSA. Beyond the stigma associated with a concurrent mental health diagnosis, these women were aware of stigma and embarrassment associated with their diagnosis of OSA.

Although they may have initially denied any concerns, with probing, they shared more insight into issues they might harbor about having OSA. The most common concern was being physically intimate with a partner and this included women who were currently married or in a relationship. Another concern was the impact to body image, and embarrassment about having OSA.

The women in this study spoke to fatigue contributing to lack of sexual relations that they often attributed to menopause or aging. One husband complained about lack of sexual relations, "he used to get angry because I slept all the time; you know, he'd come upstairs and 'you'd be asleep.'" Other women spoke of loss of libido, "Yes, I thought it was age and you know, once you're past menopause, and I don't know, I kind of put it all together and just figured it was just natural." One woman had suffered from loss of libido for the last ten years, she had brought it to the attention of both her PCP and her gynecologist, "they don't want to hear it, you know. You know, they don't want to listen to it because it embarrasses them and you're embarrassed, too." She had given up on it, "thinking it was just menopause and old age and I kind of dismissed it and maybe it was that (OSA) the whole time."

In effort to reduce the impact on the sleeping partner, snoring led to behaviors that diminished intimacy like sleeping on the couch, "my last two years of marriage, I slept out of the bedroom", moving into the spare bedroom, or the husband moving out of the marital bedroom. Those women who were currently not in relationships expressed more concerns about having OSA and snoring. One recently divorced woman spoke about resuming dating, acknowledging that it was an issue, "I'd thought about trying to get back out and start dating, but the idea of snoring up a storm is not real appealing to think about somebody having to get to know me that well." For another woman who was a self-described loud snorer, an embarrassing experience on a date, "I actually, I chased a date out of the house, he says, 'I can't do this. I need sleep'" made

her seek diagnosis. She reported she was "embarrassed and horrified." She was looking to the future and concerned about "how is a relationship ever going to work?"

Although most women denied embarrassment, there were almost a third (n = 6) who were ashamed or expressed embarrassment about their diagnosis. The topic of snoring was a particular concern for the participants in this study. Some women avoided social situations such as traveling on trips away with friends or family because they were teased or embarrassed by their snoring. One woman's snoring was a family joke that she did not find particularly funny. Another woman, who was "in denial" about her snoring was very offended when her sister mentioned it. Others who were aware of loud snoring in others were horrified to find they snored as bad or worse. One woman's former husband used to say to her, "'I feel like I'm in bed with twenty guys,' that's how bad my snoring was. Isn't that sweet?" These women were audio-recorded snoring by spouses, video-recorded by a friend, and expressed fear of where this could end up in today's social networking world. Women avoided social situations involving late nights because of fatigue and fear they might fall asleep in public or in front of friends. Many preferred not to share the news of their diagnosis with others, not liking to "talk about health issues outside the family", or wanting to be comfortable and successful with the machine before telling others and hearing "scary stories" about other's failures with treatment. Comments from others often forced women to acknowledge there was a problem, "Yeah, I do snore. Oh well, probably a good ten years or so. Yeah, like the grandchildren will say 'we heard you'. "People tell me", and "Oh yeah, the whole neighborhood could hear me snore."

Some women were embarrassed because their job performance was impacted, either by being too tired to do their job, needing to take breaks to rest, falling asleep on the job, or falling asleep during meetings where others noticed. One woman was mortified when co-workers told her they had watched her sleeping throughout their meeting. One woman's reluctance to share

the information about her diagnosis was related not only to her desire for privacy, but also to her perception of what individuals with OSA were like based on her career in healthcare:

> It's like I said I am embarrassed . . . to me it's a diagnosis like you're unhealthy; you're not taking care of yourself. And I feel personally like I am just the opposite. I tried so hard and I guess it's not really that kind of diagnosis and you just — people aren't aware of that yet. Because what I see at work, the people that have it are obese, they smoke, they don't take care of themselves, they don't exercise. I don't think I have ever seen a person that's been in a normal weight range that has it.

For some women, the embarrassment was related to their association of snoring with men, "A little bit (embarrassing), yeah. Mm-hm. Kind of attributed heavy snoring to men. You know, you always think of men as snoring," and "It's OK for men to snore". Another participant put it this way:

> It's embarrassing. That's about it. You never want to sleep over anybody's house. You can't sleep over anybody's house. It hinders your life in that way. You want to be in your own little room so nobody can hear you. It's embarrassing just because it's a girl. Guys snore. That's a typical thing. Girls to be like that—no.

The combination of recognizing symptoms, seeking a diagnosis and coming to terms with the diagnosis with the support of family and others, and dealing with any stigma or embarrassment they might associate with OSA allowed the women to move forward with treatment. Once the women *"made sense of it"* and came to terms with their diagnosis, the next theme to emerge was the need to take control of their lives and their OSA by *"making it work"*.

Making it work. This subtheme dealt with the women's experiences with adapting to treatment. It addresses how they coped with treatment, both physically and emotionally,

including the appraisal, reconsideration and adjustments when they encountered difficulties and delays. Similar to "*making sense of it",* family support and the stigma of OSA and CPAP were also involved in how the women accepted and adapted to treatment. The most common initial thoughts expressed by the participants were that this was "something to deal with", and "just had to accept it". There were some who were glad to be diagnosed and begin treatment with CPAP. The early adapters were those who had the least difficulty with CPAP and experienced positive results rather quickly: "I love it. Not a process at all." One participant related her experience:

> And then once I got the machine, the first night I used it, I remember waking up and feeling like a completely different person. Oh, yeah, in a good way. It was weird to like sleep and not feel like a zombie. You know, I actually, I loved my CPAP machine from the second I got it because of how good it made me feel. I know a lot of people struggle getting used to it, but I actually really like using it because of how I would wake up and actually feel rested.

The majority of women viewed this as something they could fix, an issue they could handle by wearing their prescribed CPAP. They also referred to avoiding sleeping aids that would make OSA worse, losing weight, exercising, adapting a healthier lifestyle, and taking better care of themselves. Their comments included, "I'll lose twenty pounds and make it better", and "I absolutely plan on walking. Now I have the energy to walk."

Some of the women, while viewing this as something they could fix, also stated it was just another burden, something more to deal with, in their already complicated lives. Dealing with their OSA would require quite a bit of adaption and struggle. One participant was aware she had a negative attitude that needed to be addressed in order to be successful, "So I kind of discarded my negative attitude and said okay, we're going to do this, we're going to give it a try." Another was resigned that she needed to use her CPAP and stated she would make the best

of it. One woman resolved to achieve success with her CPAP out of fear of her husband's reaction if she did not curb her snoring.

Although they experienced varying degrees of difficulty in adapting to CPAP, women (45%, *n* = 9) expressed a variety of positive thoughts such as loving their CPAP, "I wouldn't even think about not using it, it's like my third arm", "now I can't sleep without my mask", having a good night's sleep to look forward to, and "I don't give it a second thought, I just use it". Several wondered how they had functioned before being treated with CPAP. One woman who experienced initial difficulty adapting stated:

> I wish I didn't have to use it, I wish there was an easier way to help with it, but it's just, you know, a little bit of an aggravation, you know, so oh I've got to clean this today and I have to you know. But, I mean, I know I need it to help me, so I do use it. Yeah, just decided why fight it, you know? That's my attitude is why fight it. Yeah. I think it helped definitely.

Using CPAP is not an easy adjustment for most individuals, and these women were no exception. For most women, it was a struggle requiring many adjustments to pressure settings, changing styles of masks, changing sleeping positions, describing this experience as, "I was a stomach sleeper", and getting equipment tangled while sleeping with a partner who also had OSA and wore CPAP. Others described their masks as "suffocating", not getting enough air, too tight, too loose, and slipping off. They also stated that air was escaping from the mask and keeping them awake, or waking up and throwing off the mask during the night. Most women experienced many return visits to the CPAP supplier as well as to their sleep doctor before they noticed some semblance of success. A few women without sleep disturbances prior to diagnosis felt their sleep was more disturbed and not sleeping as well with the CPAP. One woman described this experience as:

> Yeah, as I tried to use it (CPAP), and I was finding it, I was having a difficult time having any sleep with it at all. So I was going from maybe four hours, five hours sleep a night to two. And it was very annoying, I mean I was just sleep-deprived, upset.

In the efforts for *making it work*, the women reached out for information, researching online, viewing media reports, reading pamphlets, books, articles on OSA, and seeking information from other users of CPAP. Nearly half the women (40%, n = 8) sought support and information on adapting to CPAP from fellow users who were successful, "So, it's been good, to have somebody else that you kind of know around the same age that's on it and has the same problem", "There's a gentleman at work who he and his wife both use a CPAP, and she told me some of the things that she has done that's helped her", and "I've tried to reach out to some people who I know who have masks, have tried using them." One woman described preference for information from experienced individuals she knew versus strangers on the internet:

> Honestly, I've just been talking with other people who have had experience with it, and just, my brother-in-law has a CPAP, has had one for a long time. And just hearing him, how he said it really does make a difference. You know, because nine times out of ten, if somebody I know tells me something, I'm going to listen to it a lot more than if I read it off the Internet or something like that.

Others relied on their sleep medicine doctors, their CPAP suppliers, and pamphlets found in the Sleep Center. One early participant found a website (CPAPtalk.com) chronicling a journey of adapting to CPAP that she found to be particularly helpful and asked that I share with others in my study who might be having difficulty. While the Sleep Disorders Center has a support group, it was not well publicized. None of the participants in this study were aware of it, and a few expressed interest in attending meetings upon learning of its existence.

Some women found that they were receiving negative information about using CPAP from others with OSA, including from websites devoted to OSA. They felt it necessary to avoid these websites, and/or discussing their diagnosis with or tuning out those negative individuals. One woman who did discuss her diagnosis and treatment with a relative with OSA was concerned by his reaction:

> So I talk to him about it a lot, and he's really hated it, so it kind of made me a little nervous. I like to go into things with my own, you know what I mean, I like to go into things open-minded.

Conceptual and concrete processing of OSA treatment. Having a treatment for OSA represented many things to these women. To some (40%, $n = 8$), it was a relief, something to explain the symptoms they had experienced, they were happy to have a treatment to improve their quality of life. A middle-aged postmenopausal participant had concerns about using CPAP. She had some initial trouble with her CPAP, "at first, it was hard getting used to, I'm not going say (it wasn't)" but has since experienced significant improvement in her life, "since I've had the machine, I put that on. … but now I'm so used to it that and the benefits from being on the machine. My God, I wake up and I'm rested, I'm ready for the day." Another woman noted, "the positive benefits of using one kick in really fast. I mean it's amazing what just a couple days in a row of, and you're asleep, it made a huge difference." This was great motivation to continue and maintain treatment, "it was so noticeable that it was like, oh my God, like I don't care how hard this is, I have to stick with it." For one woman whose husband moved out of the bedroom, it was the catalyst she needed to seek treatment for her severe OSA and the motivation to consistently use her CPAP. With effective treatment, her husband moved back into the bedroom and their relationship has improved.

Women in this study also expressed dismay about the "cookie cutter" approach to treatment, based on what works for men, with CPAP as the only option, with no consideration for the woman's individuality and needs:

> So the CPAP machine was the automatic choice. So a machine if you're a guy that just crawls into bed, closes his eyes, falls asleep and the machine just takes you through the night, it's great. But when you're a woman that does not sleep well to start with, to just throw a machine that makes noise and is more inconvenient may not be the right first step in the process.

Delay in treatment. These women also experienced delay in treatment. One woman underwent a "traumatic" sleep study due to physical discomfort. She then experienced significant delays (months) in obtaining her CPAP, resolving issues with CPAP problems including taking away her CPAP and leaving her without treatment because of miscommunication between her providers. Women diagnosed with severe OSA with impacted daily functioning in this study often went weeks to months before receiving their CPAP machines.

Lifestyle changes. Upon initiation of treatment with CPAP, all of the women found they were required to make further lifestyle changes. Some found the changes to be minimal and adapted well. Others had more concerns, especially about traveling with their machine. Traveling with the machine was the major concern of most of the women and included flying with the machine (going through security), traveling to foreign countries, on cruise ships, and using it while traveling/visiting with others. These women verbalized the arrangements they needed to make to travel safely and to be sure they would be able to use their CPAP at their destination, including calling ahead to hotels/cruise ships to be sure there would be a supply of distilled water available, and extension cords could be obtained. Others discussed packing

voltage adaptors for travel to foreign countries. One woman considered leaving her CPAP behind on a trip to Europe because she didn't want to have to deal with it. Another woman was concerned about a woodland camping trip where she could not take her CPAP. A business woman who traveled light and often was annoyed with the added burden of transporting her CPAP. Some women expressed misgivings about traveling/rooming with friends for fear that the CPAP would disturb her companions, but one woman had received a request from her traveling companions that she never leave the CPAP behind again as they were so disturbed by her loud snoring.

Some women disliked the necessary daily maintenance of the CPAP machine, finding it to be time-consuming. One woman's husband made adjustments to their travel motor home, building special shelving in a closet behind their bed and putting the hoses through the wall, to decrease the noise from the machine and safely secure them during travel.

Although several of these women were retired and no longer in the workforce, others had sought treatment because of their employment, as a school bus driver, foster care provider, or nanny. One woman who was employed by her husband felt she was so impaired from her lack of sleep that it seriously impaired her job performance. Although she stated it was not a difficult job, it was very difficult for her and she felt that she would not be employable if she worked for anyone other than her husband. Regardless of the impact on their life and profession, most women relied on the support of their family and friends to adapt to the lifestyle changes forced on them by their diagnosis of OSA.

Family influences. Family support also played a role in *"making it work"* in assisting the woman to successfully adapt to CPAP treatment. Support took many forms, it was a spouse or child accompanying the woman to appointments and meetings to be sure the woman didn't miss important information or instructions because of cognitive impairment. Others reminded

the woman to wear her CPAP, or encouraged her when she was having difficulty adjusting to the machine. Troubleshooting problems with the CPAP was another support especially if the supporter used CPAP. Women with partners often referred to working as a team with their spouses, "We set our team up and we help each other", and their biggest source of support, "Mostly is like my husband." For many of the women, it was the sheer existence of family members and the woman's need to be there and be healthy for her partner and/or her children that drove them and made them persevere when difficulties arose:

> You know—I'm raising my daughters. My husband left when my daughters were two and seven. My job was—I'm going to raise my children . . . . My kids are still young. They're still little. I want to be around here for them. That's why I would never not use my machine. Ever.

Family members did not always provide positive support. One participant who was struggling with mild OSA but severe sleep disturbance did not receive positive support from her husband who did not comprehend her struggles with CPAP when he was successful with his own CPAP. Although she felt strongly about continuing to use and adjust to the CPAP, he was actively dissuading her from using it, "you should just stop because this is not going to work for you."

Stigma of OSA treatment (CPAP). As women dealt with their perceived stigma of OSA, CPAP added another dimension. More than half of the women (n = 13) in this study had concerns about physical intimacy, including handling sexual intimacy and/or dating, attractiveness to her partner, loss of libido, and hesitation to use CPAP in intimate settings. A woman had recently resumed dating and shared her thoughts about her hesitancy for a partner to see her wearing her CPAP, "I'm not embarrassed about what it does for me, it's just the attempt at vanity of having a machine attached to my face. Yeah. It's not going to catch the boys' eye."

For some women, using CPAP was a concern, with two women offering to move out of the bedroom to avoid disturbing her partner with the machine noise.

Several women verbalized reservations about using CPAP during initial sexual encounters, not wearing it on a "honeymoon date", or not bring it with her if she anticipated things getting serious, out of fear that it might "ruin the moment." Other women who were planning to date and become intimately involved with a partner described positively how they would use CPAP when the opportunity arose. They stated they would not compromise their health, described using humor to get over rough patches, and having fortitude to advocate for themselves in intimate situations. They spoke of being "hesitant, not unwilling" to introduce CPAP to the relationship, and discussed postponing intimacy until they felt they knew the person well enough for the CPAP to be accepted. They spoke about not being in a rush to introduce CPAP, that it might be "complicated" and could take some of the glamour out of dating and intimate encounters.

Women in this study expressed conviction that they would be able to handle the situation, and for two women, handling it with humor, "look at this stupid machine I've got to use. So I can use this so I don't snore and keep you awake or something" and "I'd be more embarrassed you hearing me snore than seeing me wear a machine." Another planned to be very forthright and state, "hey, it's night, you're in it for me, it sticks with me. And just deal with it. You know, until we put the mask on; and then the lights are out." One woman thought she had found the perfect solution, "I dated a gentleman, and he had one too. So we both looked like idiots."

Who they would be with also impacted how women felt about sharing their diagnosis and using CPAP. For one woman, using CPAP was preferable to the embarrassment she felt from others being aware of her loud snoring. She didn't take her CPAP with her on a trip and regretted it as she was afraid to fall asleep and snore:

> I went away for a weekend with my brother and his friend. I would have been comfortable with my brother but not his friend so I didn't take it. So it is a little bit embarrassing. It bothers me. It's embarrassing. I keep trying, before I go to sleep, please don't let me go into a deep sleep and snore. You know. I don't want to snore. I try to like, before I went to sleep, I was trying to bite on the pillow or something or bite on something so that I could breathe through my nose.

Paying it forward. The final subtheme in this study is one of paying it forward by offering information and support to others who have not yet been diagnosed, or are struggling with diagnosis and treatment. Many of these women were staunch advocates for other women to be tested, for HCPs to be more aware, to be more attuned to women's sleep history, and to refer women for treatment. They were also concerned about spouses, sleep partners, children, parents, siblings, friends and work colleagues. A surprising number referred to their concern for mere acquaintances in their housing complexes/neighborhoods/social groups who they identified as someone who needed treatment. Several participants expressed gratitude that this study was being done to help other women to prevent suffering needlessly as they had done. One woman was surprised to learn that she would be compensated for her participation in the study and said she gladly would have done it for nothing just to get the word out.

These women fought for referrals for testing for their children whom they believed to be suffering from OSA. One younger participant had to fight her children's PCP as well as insurance companies for coverage for sleep studies and treatment for her teenage sons. Another woman was concerned about her husband and her son, "No, he should be, and my son (tested for OSA). Definitely. Maybe after I get a good handle on it (CPAP), I'll stick it on his nose. He does stop breathing."

Many of them were responsible for significant others seeking treatment, including former spouses/fathers of their children, whom they encouraged testing and treatment out of concern for the children of the marriage. One participant included her ex-husband in the members of her family she encouraged to be treated:

> I have my ex-husband, my daughter's father, I have been on him all the time. Go and ask for a sleep test, go fast and push for a sleep test. Because I know he has it, because I have heard him stop breathing. And my little brother went through this when we were little, and so I keep pushing him to like, and that's why my sister got it done. And one of my best friends pushed to get it done, and what do you know, they all have it.

Another woman convinced a co-worker to seek diagnosis and treatment:

> I said, "Why don't you go and ask your doctor, can you have a sleep study for this thing because if you can't sleep all night how are you going to function during the day?" She finally went and I guess they gave her the machine. . . she's said she seem to be a little bit better, that she was sleeping three or four hours better than what she was sleeping before.

Another participant was concerned about her niece's lack of sleep and advocated for treatment, "I told her, me I'm having problems staying awake during the day. You stay awake all night. I don't see how you can function."

Others were concerned about family members who were having difficulty adjusting to CPAP and expressed fear that they would give up before realizing the benefits of treatment and protecting their health. They served as support personnel and advocates for these struggling individuals. They appreciated the support they had obtained from family, friends and colleagues and wanted

to serve in the same capacity for others who they felt to be in need of assistance. Three of the women in the study spoke to why they felt the need to pay it forward:

> Oh yeah, I have people say yeah, I know I have a case of it, but I don't like that feeling of having a CPAP machine on me. Or I've had another woman say yeah, my husband and my son are on it. And she apparently went for it too, after I told her I had it. So I guess it kind of encouraged her to go get tested. I have, yeah, I'm kind of an open book; I don't hold things in, you know? Sure. I mean when I learn something in life, I try to share it with people. That's the way I am. That's the way I'm made.
>
> I don't mind telling people, I really don't. . . .I think a lot of other people are starting to think they might have it, too. Just from the way I am talking and they are going, "Oh, yeah."
>
> Yeah, and it's one of those things that, I'm one of those people when I find something, I like I don't care how silly it is, if it's like Tupperware, or a TV show or whatever, I'm the one that like wants to tell the world about the wonderful-ness that I have found.

In addition to concern for others, these women spoke of taking better care of themselves, becoming more proactive about their health. The onset of OSA symptoms including extreme fatigue/tiredness had coincided with decreased activity and weight gain that was enough to move several of the women into the overweight or obese category. With decreased fatigue and increased energy, some of the participants felt motivated to prepare healthier food choices, lose weight and to exercise. These plans often involved children, spouses, and friends and other family members, as they chose a healthier family lifestyle. One women was joining Weight Watchers with her overweight daughter and planned nightly walks for them. The women in this

study had repeatedly commented on how they felt they could have done more to prevent developing OSA (losing weight, exercising, living a more healthy lifestyle, paying more attention to what their body was trying to tell them), the diagnosis and successful treatment gave them the impetus to improve their life and that of their families. From one woman, who had talked about the need to lose weight and get healthy:

> I go walking. When I walk every day, like I was walking for eight weeks when my husband was out of work in October, so October, November we were walking together. I felt great. We were doing two to four miles a day. Then we'd have lunch and come to work. Great blood oxygen flowing, a lot of feeling good, and I think that's also a very big part, is exercise.

Overall, the majority of women in this study (n = 11) were optimistic about their success in treating their OSA and had experienced improved quality of life to some degree, either improved health, more rested, less fatigued, improved sleep or fewer apneic episodes. As one participant noted when discussing how successful she was at managing her OSA, "I mean it's my sleep apnea, so I own it." Another woman put things into perspective, "It's just another pain and I'd rather have sleep apnea than cancer. Let's say you get diagnosed with something. Okay yeah, it's a pain, but deal with it."

Summary

The overarching theme of this study was that this was a life-altering diagnosis that required the participants to process the health threatening information in both a conceptual and concrete process, dealing with what OSA represented to them physically and emotionally. The first two subthemes that emerged were *Making sense of it,* and *Making it work* as the women came to terms with their symptoms, diagnosis, and adapted to their treatment. This was a fluid iterative process as the women appraised their situation and often moved back and forth between

acceptance, denial, seeking alternatives, struggling with treatment and moving forward. The third theme that emerged was *Paying it forward* as many of these women felt the obligation to help themselves by adapting a healthier lifestyle, their families and others impacted by OSA.

Chapter V

Discussion

Introduction

The purpose of this qualitative description (QD) study was to describe the experience of women seeking diagnosis and treatment for OSA guided by the methodological approach of Leventhal's self-regulatory theory. Qualitative interviews explored women participants' reactions to their diagnosis, perceptions of OSA and what it represented to them. The study also explored how they coped with the physical and emotional aspects of diagnosis and treatment.

One overarching theme emerged from the data, *A life-altering diagnosis* with subthemes *Making Sense of It, Making it Work, and Paying It Forward. Making sense of it* required women first to recognize symptoms, often unusual, that might be related to OSA and to seek a diagnosis. Diagnosis with OSA then required the women to *make it work* by embracing and adjusting to treatment while dealing with the psychosocial, physical and emotional aspects of a chronic illness with many co-morbidities. Participants found that *Making it work* often required support from sleep partners, families, HCPs, friends, co-workers, the media, and social networking. *Paying it forward* emerged as an additional finding that went beyond the initial model. Leventhal's theory used as the guiding framework for this study was found to be a good fit for this research study (see Figure 2).

A life-altering diagnosis

A life-altering diagnosis aptly described what happened in these women's lives in the struggle with symptoms they couldn't make sense of or understand. Women struggled with lack of knowledge about OSA, unawareness that it also affected them, or dismissed OSA as a possibility after comparing their symptoms to those of the men in their lives. Although Rodgers

(2014) made reference to OSA as a life-altering experience, women's experiences have not been described in this manner in previous literature.

Delay. Participants also struggled to *Make sense of it,* and often felt neglected by HCPs about their concerns in needing to address an OSA diagnosis for problems with sleep and fatigue, while experiencing lack of follow-up care. Instead HCPs prescribed panaceas like "exercise more" or prescriptions for sleep aids. Many studies report similar reasons for delay in OSA diagnosis due to lack of knowledge of presenting features and/or making other inappropriate diagnoses (Camargo et al., 2013; Castillo et al., 2014; Rodgers, 2014; Ye et al., 2009).

As reported in previous studies (Henry & Rosenthal, 2012; Redline et al., 1994; Rodgers, 2014; Ye et al., 2009; Young, 1993), women often go undiagnosed and experience delays in diagnosis and initiation of treatment. The delays in this study were both provider and participant related, ranging from lack of proper diagnosis to delay in initiating treatment, and were often impacted by the woman's reluctance to seek treatment out of ignorance or fear of consequences. Additionally, many of the women in this study were totally unaware of the possibility their symptoms might be related to OSA.

Some participants did have providers who listened, but many still experienced delays in diagnosis and treatment as subpar or home sleep studies failed to initially confirm a diagnosis. Once participants were diagnosed and referred for treatment, it often took weeks to months to obtain their CPAP and begin treatment. Participants particularly referenced concerns about the effects on their cardiovascular and cognitive health, especially with severe OSA or serious co-morbidities which is similar to other study findings (Elfstrom et al., 2012; Jennum, Ibsen, & Kjellberg, 2014; Rodgers, 2014; Stalkrantz, Brostrom, Wiberg, Svanborg, & Malm, 2012).

Unusual symptoms. The classical signs of OSA as defined by studies using male subjects included snoring, witnessed periods of apnea and EDS. Snoring has been a universal

sign occurring in both genders (Kapsimalis & Kryger, 2009; Young et al., 1996) as most women in this study experienced some degree of snoring, although several were unaware of the symptom. A particularly interesting finding in this study was the number of women who had experienced jaw clenching, teeth grinding or SB (n = 9, 45%) that was similar to OSA study findings (Caprioglio et al., 1999; Carvalho et al., 2014; Guilleminault & Quo, 2001; Hosoya et al., 2014; Ohayon et al., 2001). Much of the research into SB including association with OSA has been done in children, while this study suggests that SB might be a valuable diagnostic indicator of OSA in women.

This study did uphold findings that women may exhibit very different symptoms than men (Quintana-Gallego et al., 2004; Shepertycky et al., 2005; Ye et al., 2009). As previously documented in the literature, women in this study reported depression (Quintana-Gallego et al., 2004; Resta et al., 2003; Valipour et al., 2007; Wheaton et al., 2012), frequent nocturnal awakenings (Resta et al., 2003), morning headaches (Quintana-Gallego et al., 2004; Resta et al., 2003), restless legs (Valipour et al., 2007), anxiety (Ye et al., 2008), and loss of libido/sexual dysfunction (Petersen et al., 2011; Petersen et al., 2013; Stavaras et al., 2012; Steinke, 2013). OSA diagnosis has often coincided with the onset of menopause as women's symptoms were attributed to menopause and aging in previous studies (Bixler et al., 2001; Hachul et al., 2014; Hall et al., 2012). Six women with OSA in this study also had experienced insomnia symptoms and either assumed they had or were formally diagnosed with insomnia. Previous research has indicated that insomnia has been frequently associated with OSA in patients (Castillo et al., 2014; Cronlein et al., 2011; Kapsimalis & Kryger, 2009; M. H. Lee et al., 2014; Phillips et al., 2008; Quintana-Gallego et al., 2004; Shepertycky et al., 2005; Subramanian et al., 2011; Valipour et al., 2007). These symptoms are not unique to women, men also may exhibit some of the same symptoms. Ye and colleagues (2014) used cluster analysis to identify the heterogeneity

of OSA presentation in a large Icelandic study (N = 822), three distinct clusters based on symptom experience and co-morbidities emerged: disturbed sleep; minimally symptomatic; and excessive daytime sleepiness group. Although subjects were predominately middle-aged obese men (n = 666, 81%), with severe OSA, no statistical differences were found in gender symptom presentation and co-morbidities (p = 0.336) (Ye, Pien, et al., 2014). Identification of OSA subgroups and acknowledgement that presentation may vary can lead to increased diagnosis for those with atypical symptoms and more individualized treatment for OSA (Ye, Pien, et al., 2014). These findings may reshape the current view of what the stereotypical OSA patient looks like and result in more women being appropriately diagnosed and treated.

OSA Treatment. Once treatment was initiated, most of the women in this study were unprepared for the process of *Making it work,* adapting successfully to CPAP (or any treatment). Participants required multiple visits to the CPAP distributor or sleep center for tweaks to masks, pressure settings, and adjustments to machines to increase comfort and tolerability. Similar studies also revealed the need for support with CPAP including from sleep partners or family members (Elfstrom et al., 2012; Jennum et al., 2014; Rodgers, 2014).

Although most of the women in the study were aware of internet sources, many participants avoided the internet out of fear of unreliability or misinformation. Some participants with health care backgrounds were able to discern beneficial websites that did provide helpful information. One participant referred to success stories and a step-by-step journal of the experience of adapting to CPAP providing hope that treatment would be successful (CPAPTalk.com, 2015). Rodgers's study (2014) recruited from an Internet discussion group where participants found the Internet to be a mixed source of support with some participants displaying little knowledge about OSA and CPAP (Rodgers, 2014).

The women participants often expected an immediate relief of symptoms with CPAP as a total cure. As they struggled to adapt, some participants failed to see the small gains being made. Other participants readily adapted to using CPAP with minor adjustments and found immediate and profound relief. They became among the biggest advocates for diagnosis and treatment. Participants adapted a strategy of *Paying it forward*, in hopes of helping others to be diagnosed and treated. Rodgers qualitative study (2014) found only a small number of participants (n = 5) dedicated to share information about their condition with others.

A life-altering diagnosis for the women included failure to adapt to CPAP (and abandoning it) or to seek out other treatment for OSA. This knowledge created anxiety and despair at the inability to successfully treat OSA including concerns about co-morbidities, in particular heart disease and cognitive function. Studies reflect similar findings in patients with untreated OSA including spouses (Stalkrantz et al., 2012) and patients who mourned lost opportunities and feared the consequences of untreated OSA (Rodgers, 2014).

Lack of awareness by women participants. The majority of women (n = 11) in this study were unaware they had OSA with reactions of surprise, shock, and disbelief, including two women who were unaware of any sleep disturbances. Being unaware, while not a new finding (Pedrosa et al., 2014; Ye et al., 2009; Young et al., 1997), was noteworthy because of the number of women in this study completed in 2014, who were unaware of having OSA and went considerable periods of time without diagnosis and treatment. It is concerning that some of the women were totally unaware of any symptoms or did not associate their snoring with the possibility that OSA might be a consideration. The depth of unawareness in women was also reflected by findings reported in perianesthesia research that as many as 93% of women present for surgery as undiagnosed with OSA (American Society of PeriAnesthesia Nurses (ASPAN), 2014; Gali, Whalen, Schroeder, Gay, & Plevak, 2009). As noted by Pan (2014), given this degree

of unawareness in women, current estimations of ratios of OSA in men and women may be more substantial than the currently reported 2:1 ratio.

Sleep partner awareness. New findings in this study included a more prominent role by sleep partners in raising awareness of OSA than previously reported, including awareness of respiratory distress, sleep disturbances, and sometimes, apneic episodes. The sleep partners were proactive in encouraging women to seek help for their SDB. This finding is contrary to previous literature that found men to be unaware of female sleeping partner's distress, especially if they were in treatment for OSA themselves (Quintana-Gallego et al., 2004; Redline et al., 1994; Shepertycky et al., 2005; Venn, 2007). In Henry and Rosenthal's study (2012) of twelve OSA patients and their spouses, all of the female spouses were instrumental in the husband seeking treatment. Of the female patients (n = 5), 40% sought treatment on their own. The male spouse often felt limited in his ability to help as discussion of sleep disturbances with one's female partners has been previously viewed as socially unacceptable to do (Henry & Rosenthal, 2012). Rodgers (2014) (N = 82; women, n = 29, 35%) reported considerable support from sleep partners and family members, but did not report out gender and sleep partner awareness prior to diagnosis (Rodgers, 2014). In this study, male sleep partners were generally reported to be attuned to the women in their lives, being aware of breathing difficulties, often encouraging or demanding they seek treatment.

Co-morbidities. Cognitive function was a frequent concern described by the women in this study as prior studies have suggested as a co-morbidity finding in persons with OSA (Chang et al., 2013; Spira et al., 2014; Yaffe et al., 2011). Participants spoke of forgetfulness, cloudy thinking, and fear of developing dementia and Alzheimer's disease as a result of undiagnosed and untreated OSA. Cardiovascular co-morbidities were more common amongst the women of this study. Similar to reports in the literature (Asha'ari et al., 2012; Marin et al., 2012; Monahan

& Redline, 2011; Pan et al., 2014; Parati et al., 2012), a majority of participants (60%) were under treated for HTN, with three diagnosed with resistant HTN prior to OSA diagnosis. A study by Marin (2012) found women with no cardiac co-morbidities expressed concern about the association of OSA and potential cardiac effects including being undiagnosed and untreated for considerable periods of time.

OSA has been researched in association with cancer diagnoses (Campos-Rodriguez et al., 2013; Christensen et al., 2013; Kendzerska, Leung, Hawker, Tomlinson, & Gershon, 2014; Nieto et al., 2012; Redline & Quan, 2012). Two women in this study had been treated for cancer prior to their diagnosis with OSA, one with breast cancer. A Taiwanese study by Chang and colleagues (2014) proposed a relationship between OSA and breast cancer (Chang et al., 2014).

The stigma of OSA has been referenced to frequently in the literature, as a "man's disease", with symptoms of snoring, gasping, choking (not being lady-like) and concerns about personal appearance (physical intimacy) when using CPAP (Petersen et al., 2011; Petersen et al., 2013; Quintana-Gallego et al., 2004; Redline et al., 1994; Resta et al., 2003; Rodgers, 2014; Shepertycky et al., 2005; Venn, 2007). Most partners of women were found to be helpful and supportive with treatment, especially if the sleep partner also had OSA and/or used CPAP. As in the Rodgers (2014) study, participants noted intimate relationships often improved with successful treatment of OSA. Women participants in the study without partners who planned on dating spoke about introducing CPAP into a new relationship by using humor, making it clear that it was a necessary part of them and provided benefits to the partner (as opposed to snoring). Although they often sounded confident of their ability to introduce CPAP into an intimate relationship, participants did express reservations about not using it initially at the start of a new relationship.

Comparison and Contrast to Leventhal's Self-Regulatory Theory

Leventhal's Self-Regulatory Theory aptly described the experience of the women diagnosed with OSA as study participants were influenced by both internal and external environments. Internally, the women were affected by their symptoms, the need for an answer to what was occurring, by self-awareness of having OSA, and seeking official diagnosis and treatment. Externally, input from family members, sleep partners, and/or friends included awareness of snoring, sleep disturbances, and in some cases, witnessed apneas that often triggered women to seek help. Sleep partner awareness and encouragement to seek treatment was of special importance for those women who had no awareness of sleep disturbances or apneas. Websites and literature devoted to OSA, information from their HCPs and the experts at their sleep centers, and media reports were other influential sources of external information that the women sought both before and after diagnosis.

Leventhal's Self-Regulatory Model uses parallel processing with the assumption that at least two feedback loops were active in the model, one for regulation of the danger or threat (objective representation, reaction, and modification plans) and the second for the emotional control to regulate the emotional response to the threat (subjective feeling state, cognitions, reactions, and modification plans) (Nerenz & Leventhal, 1983). The findings of this study reflected parallel processing as the women identified the health threat, what it represented and how they coped with it. The participants also described the emotional aspect of diagnosis and appraisal including coming to terms in coping with the diagnosis and moving forward. Some of the women in this study added an additional step, not in the original model, that of *paying it forward* (see Figure 2). This step was not exclusive to the women who were successful in treatment, but also included women who were still struggling but concerned about health consequences and wanted to share their story with others who might benefit.

Implications for Practice

Lack of knowledge of and confidence in diagnosing and treating OSA by HCPs has been established. Practice implications include need for more education and collaboration with sleep specialists as a means to improve identification and care of the OSA patient (Hayes et al., 2012). Familiarity with the 2014 American College of Physicians Clinical Practice Guideline on OSA (Qaseem et al., 2014), recommendations from the European Society of Hypertension and the European Respiratory Society (Parati et al., 2012), and other professional standards and guidelines may prove beneficial in increasing awareness of the many health issues and co-morbidities associated with OSA. Although it was clear from this study that snoring was a viable assessment for diagnosis of both women and men, the female patient may need more in-depth risk assessment to identify those women who are unaware of having OSA (Camargo et al., 2013; Castillo et al., 2014).

Similar to men, resistant HTN should be evaluated for association with OSA in any woman who experiences HTN that remains difficult to control with diet and medication (Parati et al., 2012). Women presenting with cardiac complaints and/or CVD should undergo a sleep study to rule out OSA (Campos-Rodriguez et al., 2014; Chao et al., 2014; Gunnarsson et al., 2014).

Symptoms such as depression and morning headaches (Quintana-Gallego et al., 2004; Resta et al., 2003; Valipour et al., 2007; Wheaton et al., 2012), and sleep bruxism (Hesselbacher et al., 2014; Hosoya et al., 2014; Ohayon et al., 2001) require further exploration. References to insomnia or other sleep disturbances need further assessment (Castillo et al., 2014; Cronlein et al., 2011; Glidewell et al., 2012; M. H. Lee et al., 2014) as they may be masking an undiagnosed OSA. A topic that may not be broached because of embarrassment or discomfort, sexual dysfunction, should trigger a discussion about sleep patterns given the association with OSA (Petersen et al., 2011; Petersen et al., 2013; Stavaras et al., 2012; Steinke, 2013).

HCPs (and women) need to be attuned to the reports of sleep partners. Unlike previous studies that found male sleep partners to be unaware of the female partner's respiratory distress (Quintana-Gallego et al., 2004; Redline et al., 1994; Shepertycky et al., 2005; Venn, 2007), men in this study were very much aware of their sleep partner's snoring and apneas. Similar to the reported role in the literature of women in driving men to seek diagnosis and treatment (Henry & Rosenthal, 2013; Venn, 2007), men in this study served in the same capacity, convincing the women to seek help. The importance of the statement, "yeah, my husband says I snore and stop breathing sometimes, but I don't think I do" cannot be undervalued. Many of these women had severe OSA with significant co-morbidities and HR-QOL consequences. Asking about the partner's perception of the woman's sleep cannot be overlooked in any assessment of OSA. Research has been done on the involvement of sleep partners and treatment of OSA. Elfström and colleagues (2012) interviewed patients and sleep partners using critical incident technique to analyze initial treatment with CPAP by identifying the importance of the sleep partner's support for successful treatment (Elfstrom et al., 2012). Ye and colleagues (2014) have called for a dyadic approach to studying CPAP adherence by including sleep partners in developing successful interventions (Ye et al., 2014).

Identifying the woman with OSA has far-reaching implications for not only future health (cardiovascular, cognitive, weight-control) but more immediate implications in current treatment. Many of the women in this study were treated with prescription sleep aids that could worsen the hypopnea/apnea of OSA (Epstein et al., 2009). For individuals undergoing anesthesia, sedation or opioid-related pain control, the outcome can be devastating in the undiagnosed OSA population. Identification of these women requiring sedation would be critical as they present with unusual symptoms and may be unaware of the presence of OSA. Anesthesia professional associations have been proactive in identifying individuals with OSA and creation of guidelines

to ensure safety for the patient undergoing anesthesia-requiring procedures (American Society of Anesthesiologists (ASA), 2014; American Society of PeriAnesthesia Nurses (ASPAN), 2014; Joshi, Ankichetty, Gan, & Chung, 2012). Among the recommendations, care providers should institute use of CPAP postoperatively, prescribe non-opioids or regional blocks as pain relievers, anticipate extended observation postoperatively in the PACU, and consider overnight monitored admission for patient considered at risk of respiratory events (American Society of Anesthesiologists (ASA), 2014; American Society of PeriAnesthesia Nurses (ASPAN), 2014; Joshi et al., 2012). Screening for OSA preoperatively has resulted in alterations in the plan of care to avoid use of anesthetic, sedation and opioid agents that can impact respiratory function with life-threatening consequences (American Society of Anesthesiologists (ASA), 2014; American Society of PeriAnesthesia Nurses (ASPAN), 2014; Joshi et al., 2012).

Women in this study experienced inconclusive or non-diagnostic at-home studies and required an overnight sleep center study to confirm OSA diagnosis. As insurance companies decline to pay for sleep center studies, the trend has been increased home sleep studies, making sleep centers less profitable, leading to closure of centers. An additional practice implication would involve the lack of access to sleep centers and concern about who will provide care for the patient with OSA (Ioachimescu, et al., 2014).

All of the women in this study were originally prescribed CPAP, despite having oral appliances as an option (Tegelberg, Nohlert, Bergman, & Andren, 2012). The participants expressed a desire for other more female-friendly options while dismissing the idea of surgery or implantable devices. The American Sleep Apnea Association (ASAA) has provided multiple option alternatives including acupuncture, surgical procedures and Inspire® Upper Airway Stimulation (UAS) Therapy, a 2014 FDA approved implantable system that monitors respiratory

status and delivers mild stimulation to maintain airway patency during sleep (American Sleep Apnea Association (ASAA), 2015).

Implications for Research

Although some recent studies have included more women (Campos-Rodriguez et al., 2013; Chao et al., 2014; Christensen et al., 2013; Cizza et al., 2013; Gunnarsson et al., 2014; Hesselbacher et al., 2014; Kendzerska, Leung, et al., 2014; Raheem et al., 2014; Rich et al., 2012; Rodgers, 2014), it would seem clear that women be included in research studies on OSA, as a vastly underrepresented minority in the majority of current studies (Bailes et al., 2011; Cronlein et al., 2011; Deng et al., 2014; Glidewell et al., 2012; Guglielmi et al., 2014; M. H. Lee et al., 2014; Nishihata et al., 2013; Won et al., 2012). Inclusion of appropriate numbers of women in all applicable OSA studies must become a priority for researchers (Rodgers, 2014; Ye et al., 2014; Ye et al., 2009). With the inclusion of more women, the current ratio of men to women might change, as many women were unaware of OSA until included in studies (Pedrosa et al., 2014). Uncertainty has existed about why more recent studies have not emphasized the inclusion of women despite awareness of at least a 2:1 ratio of men to women (Peppard et al., 2013; Young et al., 1996). Acknowledgement by researchers needs to include women and other underrepresented minorities in OSA research (Nishihata et al., 2013; Rodgers, 2014).

Because women frequently present with non-classic symptoms of OSA, instrument development of female-specific screening tools will need to be researched to identify the more subtle symptoms displayed by women. Currently many screening tools include male gender as a criteria (American Society of PeriAnesthesia Nurses (ASPAN), 2014; Chung et al., 2012). More research on designing alternative OSA treatment options for women may prove more beneficial and more palatable than CPAP use. Women also desire individualized treatment considerations

as opposed to the same "cookie cutter" approach treatment offered to others including men with OSA.

Future studies need to look more in-depth about modifiable risk factors for OSA and individualized treatment of women with OSA. Further research on how women cope with OSA during diagnosis and initial treatment would also be useful. Interventional studies will need to be designed that test gender-based strategies to manage OSA treatment. Sleep partners must be included in future studies for valuable input on women's symptomatology for earlier diagnosis, and greater impact on successful treatment of OSA (Ye et al., 2014).

Implications for Health Policy

In general, the public needs to be more aware of the lack of knowledge about the consequences of OSA, especially amongst women. More awareness by insurance companies of OSA in women must also involve universal coverage for diagnosis and treatment. Insurance companies need to revamp their criteria for coverage for sleep studies with the understanding that woman's experience with OSA may not be the same as men. Women have been denied testing by insurance companies because they did not express awareness of the classic symptoms of OSA. There has been an uptick in media reports about OSA, and more coverage about prominent personalities, especially sports figures (M. Hiestand, Milhoces, G., 2004; The Associated Press, 2004), who have succumbed to OSA. Strategically placed public service announcements (PSA) during prime-time programs, especially those of interest to women including other social media tools may increase awareness. The importance of raising public awareness of women's risk for OSA includes that it is not just a diagnosis found in men, the obese, the elderly and the unhealthy. OSA deserves the same sort of coverage in the media for women including co-morbid conditions such as heart disease, cancer, diabetes, and depression.

Limitations

This study was conducted at one sleep disorder center affiliated with one medical center with referrals from one sleep medicine specialist that limits transferability of findings. However participants were also recruited via word-of-mouth snowball sampling. The final cohort included self-referrals from the Sleep Disorders Center (under the care of other sleep specialists), another local sleep center, and a sleep center outside of Worcester County. This recruitment strategy provided diversity in location where subjects were diagnosed and treated, which impacted their experience.

Another limitation of the study was lack of racial diversity. The final sample was predominately Caucasian with the exception of one woman who identified as Hispanic. This is not reflective of the racial makeup of Worcester county which in the most recent 2013 census was predominately Caucasian (88%) but has a significant Hispanic (10.1%), African-American (5.1%), and Asian (4.5%) population (United States Census Bureau, 2015). Such sample homogeneity on race/ethnicity limits the transferability of findings to other populations in seeking a diagnosis and maintaining treatment. Future studies should be conducted recruiting from multiple centers with more racial/ethnic inclusion or diversity.

A final limitation was that the majority of the interviews were done by phone. Although the initial plan was to do in-person interviews, it quickly became apparent that strategy was ineffective. Most participants requested a phone interview, as some women stated they could only do a phone interview. Despite the obvious shortcoming of not being able to observe the physical appearance and demeanor of the participant, most participants were extremely forthcoming in describing their weight and physical description, including body habitus.

Conclusions

This qualitative study which explored the experiences of women with OSA supported the ongoing issues of delay in diagnosis and appropriate treatment. Women described this experience as a life-altering diagnosis with significant co-morbidities, unusual symptoms at presentation, struggles with treatment, while most responded with some improvement in their overall health. These women had support from sleep partners and family members during diagnosis and acceptance of treatment. A new finding included women's descriptions of paying it forward and wanting to help others with issues surrounding stigma and coping strategies for OSA. OSA detection has significant implications for women's health including enhancing awareness by HCPs and targeting strategies for OSA prompt diagnosis and treatment in this population. Advocacy of prompt OSA recognition in women includes further study of interventions that focus on prevention of untoward co-morbidities and enhancement of coping strategies for overall well-being.

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UNIVERSITY OF MASSACHUSETTS MEDICAL SCHOOL
COMMITTEE FOR THE PROTECTION OF HUMAN SUBJECTS IN RESEARCH

STUDY FLYER

You are invited to participate in a research study called
Women's Experience with a Diagnosis of
Obstructive Sleep Apnea (OSA)

The purpose of this study is to interview you about your experience with being diagnosed with Obstructed Sleep Apnea, also known as OSA. Your experience may help us to better understand how women become aware that they have OSA and may lead to earlier diagnosis and treatment for women. Participation is voluntary and confidentiality of responses will be protected.

We are asking you to participate in one to two visits to interview you about your experiences.

As part of this study, you will be required to complete a background information form and interviews taking approximately 30-60 minutes of your time. The interviews will be audiotaped. You will also be compensated $10.00 per interview for travel and parking expenses and in appreciation of your time

The risks of being in this study include breach of confidentiality from a loss of your personal information and emotional distress. Loss of information is very unlikely to happen, and we will do everything to make sure that your information is protected. The risk for emotional distress is minimal while the nurse interviewing you is aware of this and will provide assistance should this happen.

Participation is voluntary. You do not have to be in this study, and if you do participate, you are free to leave at any time. In either case there are no penalties and you do not lose any benefits to which you are otherwise entitled. The care you receive at UMass Memorial Health Care will not be affected if you decide to not be in the study or to quit after joining.

Efforts will be made to limit access to your personal information to people who have a need to review this information. We cannot promise complete secrecy. The UMMS Institutional Review Board and other representatives of UMMS may inspect your information.

If you have any questions, concerns, or complaints, or think that the research has hurt you, you can talk to the research team:
Kathleen J. Menard, MS RN at 508-450-1217,
Jean Boucher, PhD RN, at 508-856-5755,
University Of Massachusetts Worcester
Graduate School of Nursing

This research has been reviewed and approved by an Institutional Review Board. You can reach them at (508) 856-4261 or irb@umassmed.edu if you would prefer to speak with someone not associated with the study or have questions about your rights as a research subject.
Approved UMass Medical School IRB

Template 2/13/13

APPENDIX B INTERVIEW GUIDE

Aims Participant Interview	*Questions*	*Probes*
1. Explore the illness representation of OSA for the newly diagnosed woman, including cognitive perceptions and emotional response to diagnosis and treatment	1.1 Tell me about your experience with being diagnosed with OSA?	How did you know? When and how did you recognize it? Did you notice it? Did someone else?
	1.2 What was it like when you were told you had OSA?	How and when was it diagnosed?
	1.3 What did you have for signs or symptoms?	Any new symptoms? Energy level? Fatigue?
	1.4 What does the diagnosis of OSA represent to you and your health?	Was your diagnosis of OSA related to any other health issues you may have? HTN? Heart attack? Heart disease or failure? Weight changes?
2. Explore the cognitive perceptions and emotional response to diagnosis and treatment of OSA in this sample of women.	2.1 Tell me more about OSA and what it means to you. Physical concerns?	
	2.2 Tell me is you have ever noticed any difficulty concentrating? Any changes in your job performance?	
	Have you noticed any problems staying awake?	Falling asleep during the day? Falling asleep while driving? Any accidents?
	2.3 Tell me about your partner? Does your partner notice any changes in your sleeping habits?	Snoring? Breathing changes? Concerns about sexual performance?

	2.4 Did you feel scared or anxious? Can you tell me about that?	
	Have you experienced any psychological changes?	Depression? Mood swings? Irritability?
	What has been the impact on your lifestyle?	Social isolation or stigma concerns?
	What social concerns do you have?	
3. Explore the meaning of OSA and the coping strategies used by this sample of women.	3.1 Tell me about what it means to you in terms of any changes or adjustments you have had to make after being diagnosed with OSA?	Were services easily accessible to you in your area?
	3.2 Tell me how you are coping with having OSA? What strategies have you used? What resources were offered?	Difficulty with getting access? Any delays?
	3.3 What are you doing for treatment?	CPAP? Sleeping devices? Lifestyle changes?
	3.4 Have you had any difficulties with treatment?	
	3.5 At this time can you tell me about how successful or unsuccessful you feel you are with managing your OSA?	
	Anything else you would like to share about you experience with OSA?	

APPENDIX C DEMOGRAPHIC DATA SHEET

Subject #_____

Date: _____

Instructions: Please complete all sections to the best of your ability:

1. **Age at last birthday_____**
2. **Height _____**
3. **Weight _____**
4. **Marital Status:**

   a. Married _____ b. Widowed _____ c. Single_____

   d. Separated_____ e. Divorced _____ f. Living with partner_____

   g. Other_____

5. **Occupation:** _____

   a. Working full time _____ b. Working part time_____

   c. On leave from work_____ d. On disability _____

   e. Retired _____ f. Student _____

6. **Household Income:**

   Gross annual family income: _____

7. **Education:** Circle last year of school completed:

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Elementary / Junior/ Senior H.S. College Graduate School

8. **Race/ethnicity**

   a. White/Caucasian: _____
   b. Hispanic/Latino: _____
   c. Black/African American: _____
   d. Asian: _____
   e. Native Hawaiian or Pacific Islander _____
   f. American Indian/Native American _____

9. **How long have you had symptoms of OSA** _____

10. **Age at diagnosis of OSA** _____

11. Degree of OSA (if known)

a. Mild _____

b. Moderate _____

c. Severe _____

d. Don't know/not told _____

12. Prescribed treatment

a. None _____

b. Oral appliance _____

c. CPAP _____

d. Surgery _____

i. What surgery has been recommended? _____

e. Other_____

13. Prescribed treatment use for <u>oral appliances</u> or <u>CPAP</u>:

a. Never _____

b. Once a Month _____

c. Few times a month _____

d. Once a week _____

e. Few times a week _____

f. Every night _____

14. How many hours per night do you use oral appliances or CPAP treatment: _____Hours

15. Menstruation:

a. Last menstruation cycle: _____

b. Perimenopausal Yes ____ No _____

c. Postmenopausal Yes ____ No _____

d. Age at menopause _____years

Surgical menopause _____

Natural menopause _____

e. Do you use hormone-replacement treatments: Yes _____ No _____

If yes: Prescription: _____

Other treatments: _____

16. Other health conditions:

a. Heart disease _____

i. High blood pressure_____

ii. Heart failure_____

iii. Heart attack_____

iv. Heart arrhythmias_____

v. Other_____

b. Breathing problems_____

i. COPD_____

ii. Asthma_____

iii. Other_____

c. Other sleep problems_____

i. Insomnia_____

ii. Other_____

d. Thyroid disease_____

e. Diabetes_____

f. Cancer_____

i. Type_____

ii. Treatment_____

g. Other_____

17. Smoking history:

a. Never smoked: _____

b. Smoked in the past:

i. Started smoking at age: _____

ii. how many packs per day: _____

iii. quit at age: _____

iv. reason for quitting: _____

c. Current smoker:

i. Started smoking at age: _____

ii. how many packs per day: _____

iii. any attempts to quit: _____

18. **Medications (please list any medications you take on a regular basis):**

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Appendix D

OSA-associated Health Problems

Cardiovascular	CVD	Buchner, S., Satzl, A., Debl, K., Hetzenecker, A., Luchner, A., Husser, O., . . . Arzt, M. (2014). Impact of sleep-disordered breathing on myocardial salvage and infarct size in patients with acute myocardial infarction. *European Heart Journal, 35*, 192-199. doi: 10.1093/eurheartj/eht450
		Campos-Rodriguez, F., Martinez-Garcia, M. A., Reyes-Nunez, N., Caballero-Martinez, I., Catalan-Serra, P., & Almeida-Gonzalez, C. V. (2014). Role of sleep apnea and continuous positive airway pressure therapy in the incidence of stroke or coronary heart disease in women. *American Journal of Respiratory and Critical Care Medicine, 189*, 1544-1550. doi: 10.1164/rccm.201311-2012OC
		Gunnarsson, S. I., Peppard, P. E., Korcarz, C. E., Barnet, J. H., Aeschlimann, S. E., Hagen, E. W., . . . Stein, J. H. (2014). Obstructive sleep apnea is associated with future subclinical carotid artery disease: thirteen-year follow-up from the Wisconsin sleep cohort. *Arteriosclerosis, Thrombosis, and Vascular Biology, 34*, 2338-2342. doi: 10.1161/ATVBAHA.114.303965
		Lamberts, M., Nielsen, O. W., Lip, G. Y., Ruwald, M. H., Christiansen, C. B., Kristensen, S. L., . . . Gislason, G. H. (2014). Cardiovascular risk in patients with sleep apnoea with or without continuous positive airway pressure therapy: follow-up of 4.5 million Danish adults. *Journal of Internal Medicine, 276*, 659-666. doi: 10.1111/joim.12302
		Lee, E. T., Welty, T. K., Fabsitz, R., Cowan, L. D., Le, N. A., Oopik, A. J., . . . Howard, B. V. (1990). The Strong Heart Study. A study of cardiovascular disease in American Indians: design and methods. *American Journal of Epidemiology, 132*, 1141-1155.
		Levy, P., Tamisier, R., Arnaud, C., Monneret, D., Baguet, J. P., Stanke-Labesque, F., . . . Pepin, J. L. (2012). Sleep deprivation, sleep apnea and cardiovascular diseases. *Frontiers in Bioscience (Elite*

		Ed), 4, 2007-2021. Retrieved from http://europepmc.org/abstract/med/22202016.
		Monahan, K., & Redline, S. (2011). Role of obstructive sleep apnea in cardiovascular disease. *Current Opinion in Cardiology, 26*, 541-547. doi: 10.1097/HCO.0b013e32834b806a
		Nakashima, H., Henmi, T., Minami, K., Uchida, Y., Shiraishi, Y., Nunohiro, T., & Maemura, K. (2013). Obstructive sleep apnoea increases the incidence of morning peak of onset in acute myocardial infarction. *European Heart Journal: Acute Cardiovascular Care, 2*, 153-158. doi: 10.1177/2048872613478557
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		Parthasarathy, S., Fitzgerald, M., Goodwin, J. L., Unruh, M., Guerra, S., & Quan, S. F. (2012). Nocturia, sleep-disordered breathing, and cardiovascular morbidity in a community-based cohort. *PLoS One, 7*, e30969. doi: 10.1371/journal.pone.0030969
		Redline, S., & Quan, S. F. (2012). Sleep apnea: a common mechanism for the deadly triad--cardiovascular disease, diabetes, and cancer? *American Journal of Respiratory and Critical Care Medicine, 186*, 123-124. doi: 10.1164/rccm.201204-0657ED
		Shah, N., Redline, S., Yaggi, H. K., Wu, R., Zhao, C. G., Ostfeld, R., . . . Kaplan, R. C. (2012). Obstructive sleep apnea and acute myocardial infarction severity: ischemic preconditioning? *Sleep and Breathing*. doi: 10.1007/s11325-012-0770-7
		Yeboah, J., Redline, S., Johnson, C., Tracy, R., Ouyang, P., Blumenthal, R. S., . . . Herrington, D. M. (2011). Association between sleep apnea, snoring, incident cardiovascular events and all-cause mortality in an adult population: MESA. *Atherosclerosis, 219*, 963-968. doi: 10.1016/j.atherosclerosis.2011.08.021

	Atrial Fibrillation	Chao, T. F., Liu, C. J., Chen, S. J., Wang, K. L., Lin, Y. J., Chang, S. L., . . . Chen, S. A. (2014). Incidence and risk of atrial fibrillation in sleep-disordered breathing without coexistent systemic disease. *Circulation Journal, 78*, 2182-2187. http://dx.doi.org/10.1253/circj.CJ-14-0222.
		Valenza, M. C., Baranchuk, A., Valenza-Demet, G., Munoz-Casaubon, T., Martin-Navajas, J. A., & Healey, J. (2014). Prevalence of risk factors for atrial fibrillation and stroke among 1210 patients with sleep disordered breathing. *International Journal of Cardiology, 174*, 73-76. doi: 10.1016/j.ijcard.2014.03.156
	Hypertension	Asha'ari, Z. A., Hasmoni, M. H., Ab Rahman, J., Yusof, R. A., & Lope Ahmad, R. A. (2012). The association between sleep apnea and young adults with hypertension. *The Laryngoscope, 122*, 2337-2342. doi: 10.1002/lary.23379
		James, G. D., Toledano, T., Datz, G., & Pickering, T. G. (1995). Factors influencing the awake-sleep difference in ambulatory blood pressure: main effects and sex differences. *Journal of Human Hypertension, 9*, 821-826. Retrieved from http://europepmc.org/abstract/med/8576898.
		Kartali, N., Daskalopoulou, E., Geleris, P., Chatzipantazi, S., Tziomalos, K., Vlachogiannis, E., & Karagiannis, A. (2014). The effect of continuous positive airway pressure therapy on blood pressure and arterial stiffness in hypertensive patients with obstructive sleep apnea. *Sleep and Breathing, 18*, 635-640. doi: 10.1007/s11325-013-0926-0
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