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Exploring Long-haul Truck Drivers' CPAP Use when Working Over the Road

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EXPLORING LONG-HAUL TRUCK DRIVERS' CPAP USE WHEN WORKING OVER THE ROAD

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WHEN WORKING OVER THE ROAD

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ABSTRACT

Obstructive sleep apnea (OSA) is a chronic health condition affecting an estimated 13-26% of U.S. adults. The condition is characterized by partial or total airway collapse. It has been associated with increased cardiovascular disease, hypertension, and diabetes mellitus morbidity. Risk factors include middle-age, obesity, male gender, narrowed airway, and smoking. Continuous positive airway pressure (CPAP) is the recommended treatment for OSA. Though it is an effective treatment modality, uptake and adherence to CPAP remains low.

With concern for public safety, OSA has received a great amount of attention in the trucking industry. When working over the road, long-haul truck drivers diagnosed with OSA use CPAP while sleeping in the sleeping berth in their trucks. Research in this group has focused on OSA diagnosis, screening, and the relationship to motor vehicle crashes. However, there has been limited research in the area of truck drivers' health behaviors, such as CPAP management.

The purpose of this dissertation was to conduct: a) an analysis examining mandatory OSA screening policy options; b) a comprehensive review of literature on CPAP use from the client's perspective; and c) an exploratory descriptive study examining long-haul truck drivers' CPAP use when working over the road.

The results of this three-article dissertation demonstrate the influences of policy on CPAP use in the trucking industry and provide insight on the experience of CPAP use from the long-haul driver's viewpoint. Despite a variety of barriers, long-haul truck drivers are able to successfully use CPAP when working over the road. Some of the challenges they face in managing CPAP are similar to those of individuals in the general population; however, many are unique to their work environment. Findings of the exploratory study highlight opportunities for tailored education and support that have the potential to enhance the long-haul truck driver's CPAP use and thereby increase CPAP adherence and safety.

Keywords: obstructive sleep apnea, continuous positive airway pressure, long-haul truck drivers, policy analysis, client experience

DEDICATION

To

Mrs. Louise Penn, RN, my maternal grandmother, the first nurse in our family. You were my inspiration to enter the nursing profession.

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LIST OF ABBREVIATIONS

AHI	Apnea hypopnea index
APU	Auxiliary power unit
BMI	Body mass index
CMVDs	Commercial motor vehicle drivers
CPAP	Continuous positive airway pressure
CVD	Cardiovascular disease
DC	Direct current
AC	Alternating current
DM	Diabetes mellitus
DOT	Department of Transportation
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
HIPAA	Health Insurance and Accountability Act
HTN	Hypertension
IBM-WASH	The integrated behavioral model for water, sanitation and hygiene
INC-I	The informational needs of CPAP-inventory
LHTDs	Long-haul truck drivers
MVCs	Motor vehicle crashes
NRCME	National Registry of Certified Medical Examiners
OA	Oral appliances
OSA	Obstructive sleep apnea
OTR	Over the road
PTSD	Post-traumatic stress disorder

QOL	Quality of life
SEC-I	Side-effects of CPAP inventory
TIAs	Transient ischemic attacks
USE-PAP	The usability of sleep apnea equipment-positive airway pressure questionnaire

INTRODUCTION

The purpose of chapter one is to describe the research focus of the dissertation, the background, and significance and to provide an overview of the three manuscripts included in the dissertation. The manuscripts advance nursing knowledge of obstructive sleep apnea (OSA) and continuous positive airway pressure (CPAP) from a social ecological perspective.

Obstructive sleep apnea is a growing public health and safety problem. As a major health condition, OSA has been associated with hypertension (HTN), cardiac arrest, arrhythmia, stroke, diabetes mellitus (DM), cognitive impairment, and increased risk of motor vehicle crashes (MVCs) (Kendzerska, Gershon, Hawker, Tomlinson, & Leung, 2014; Sanchez-de-la-Torre, Campos-Rodriguez, & Barbe, 2013; Tregear, Reston, Schoelles, & Phillips, 2009).

In the transportation industry, given the negative health consequences of OSA and the potential impact on public safety, attention has been directed toward OSA screening policies, OSA diagnosis, and CPAP treatment guidelines. Such efforts seek to ensure transportation employees in critical safety positions receive prompt OSA diagnosis and treatment thereby, increasing public safety and increasing employees' quality of life (QOL).

Commercial motor vehicle drivers (CMVDs) are a population within the transportation sector that has been under intense scrutiny regarding OSA diagnosis.

Commercial motor vehicle drivers transport people and property in both interstate and intrastate commerce (National Highway Traffic Safety Administration, n.d.). Long-haul truck drivers (LHTDs) are a specific group of CMVDs who drive interstate routes that cover long distances. Due to their lifestyles, heavily influenced by the characteristics of their jobs, LHTDs are at increased risk for obesity, a major OSA risk factor (Kales & Straubel, 2014). Strategies are needed that support LHTDs who are diagnosed with OSA and use CPAP.

Background and Significance

Obstructive sleep apnea is the most common form of sleep-disordered breathing diagnosed in the world (Lam, Sharma, & Lam, 2010). In the early 1990's OSA prevalence in the United States was estimated between 2-4% (Young et al., 1993), but has increased to approximately 13-26% among U.S. adults (Peppard et al., 2013). Among U.S. CMVDs, OSA prevalence is estimated between 13 and 28% (Federal Motor Carrier Safety Administration [FMCSA], 2002; Talmage, Hudson, Hegmann, & Thiese, 2008). In the transportation industry OSA has been cited as a significant sleep disorder (Zhang, Berger, Malhotra, & Kales, 2012). It is a chronic condition that involves collapse of upper airway soft tissues and obstruction of the airway that causes episodes of apnea and hypopnea during sleep (Sanchez-de-la-Torre et al., 2013; Stone, Taylor, McCrae, Kalsekar, & Lichstein, 2008). These episodes are associated with frequent arousals and fragmented, non-restorative sleep (Stone et al., 2008). Individuals with OSA frequently experience residual sleepiness that may be related to such factors as hypoxia (Feng, Wu, Zhang, & Chen, 2012), primary sleep insufficiency (Al Lawati, Patel, & Avas, 2009; Risso et al., 2013), and inadequate treatment (Mulgrew et al., 2010).

Negative effects on cognition have been noted in patients with OSA. Cognitive effects associated with OSA include declines in attention, vigilance, and visual-spatial declines (Bucks, Olaithe, & Eastwood, 2013; Ferini-Strambi, Marelli, Galbiati, & Castronovo, 2013), all of which may affect driving safety. Although OSA is treatable, it is often undetected because many of the signs and symptoms are only present during sleep (Sanchez-de-la-Torre et al., 2013), and daytime symptoms such as sleepiness and cognitive performance declines may not be acknowledged or may be associated with other conditions or circumstances. Unfortunately, OSA is often undiagnosed and untreated in the general population, as well as, among LHTDs (Kales & Straubel, 2014; Punjabi, 2008). An estimated 85% of individuals are undiagnosed (Kapur et al., 2002). In both commercial and non-commercial drivers, untreated OSA or ineffective treatment is also associated with increased risk of motor vehicle crashes (MVCs) (Tregear et al., 2009). Drivers with OSA are at a two to seven-fold increased risk of MVCs (Howard et al., 2004; Mulgrew et al., 2008; Shiomi et al., 2002). Along with increasing MVC risk, undiagnosed and untreated OSA and ineffective treatment can negatively impact other facets of health.

Cardiovascular Consequences of OSA

OSA has been associated with a variety of cardiovascular conditions: HTN (Calhoun, 2010; Guralnick, 2013), arrhythmias (Somers et al., 2008), stroke (Arzt, Young, Finn, Skatrud, & Bradley, 2005; Lyons & Ryan, 2015), atherosclerosis (Levy et al., 2009), and endothelial dysfunction (Atkeson, Yeh, Malhotra, & Jelic, 2009). It has been identified as an independent risk factor for systemic HTN (Konecny, Kura, & Somers, 2014) and is prevalent among patients diagnosed with resistant HTN (Pimenta,

Calhoun, & Oparil, 2009). Arrhythmias were noted to be more frequent in patients diagnosed with OSA and the number of arrhythmias increased with increasing apneic events (Somers et al., 2008). Individuals who had an Apnea Hypopnea Index (AHI) ≥ 20 episodes per hour had a three-fold increased risk of stroke (Arzt et al., 2005). Atherosclerosis has been diagnosed in OSA patients who do not have any other significant cardiovascular or atherosclerosis risk factors (Levy et al., 2009). Research has shown a statistically significant positive correlation between AHI and coronary plaque volume (Levy et al., 2009). Endothelial dysfunction is an early indicator of CVD (Atkeson et al., 2009). Abnormal endothelial function and OSA may have a synergistic effect and further increase CVD risk (Atkeson et al., 2009).

With each of these conditions, research has demonstrated that CPAP can have a positive impact on patient outcomes. Findings are mixed on whether CPAP lowers blood pressure in hypertensive individuals. However, rigorous randomized controlled trials have demonstrated that CPAP has a modest yet significant impact on blood pressure (Calhoun, 2010). Research suggests that individuals with more severe OSA, and those who are more adherent to CPAP therapy are more likely to benefit from treatment (Calhoun, 2010). In a sample of women, an increased risk of stroke and coronary heart disease were associated with untreated OSA (Campos-Rodriguez et al., 2014). CPAP adherence of greater than 4 hours per night appeared to reduce the CVD risk in this same group (Campos-Rodriguez et al., 2014). There is evidence that CPAP treatment reverses early signs of atherosclerosis (Drager, Bortolotto, Figueiredo, Krieger, & Lorenzi-Filho, 2007). Positive effects on endothelial function have been noted with CPAP therapy as endothelial vasomotor tone improves and inflammation decreases (Atkeson et al., 2009).

Quality of Life and OSA

The quality of an individual's life is an important attribute that impacts activities of daily living and one's work life. Researchers and health care providers are cognizant of the impact that illness can have on people's lives, thus, QOL has been the focus of many studies. "Quality of life can be defined as the overall state of well-being that individuals experience as assessed by subjective and objectives measures of functioning, health, and satisfaction with the important dimensions of their lives" (Reimer & Flemons, 1999, p. 139). Persons diagnosed with OSA have decreased QOL and impaired social functioning (Avlonitou et al., 2012; Engleman & Douglas, 2004). Social and interpersonal dysfunction was noted in both work life and family life (Engleman & Douglas, 2004). OSA has been shown to impact overall health, mental health, and vitality (Karkoulias et al., 2013). Research has shown that CPAP therapy reduces OSA symptoms and improves QOL (Avlonitou et al., 2012; Diamanti et al., 2013; Pichel et al., 2004). However, some consequences of OSA may not be fully reversible (Antic et al., 2011; Harris et al., 2009; Valkulin et al., 2011). Therefore, prompt diagnosis and treatment is imperative, and CPAP adherence is an important component of the treatment regimen.

Continuous Positive Airway Pressure (CPAP)

CPAP is the recommended treatment for OSA; however, empirical evidence has shown adherence to CPAP treatment is poor (Amfilochiou et al., 2009; Hui et al., 2006). For the transportation industry, this is a critical issue because CPAP use among individuals with OSA has been shown to be effective in reducing MVC risk (Tregear, Reston, Schoelles, & Phillips, 2010). Reductions in daytime sleepiness with as little as

one night of CPAP treatment were noted in a systematic review of the literature (Tregear et al., 2010). In addition, effective treatment with CPAP has been shown to improve CVD morbidity and mortality and QOL. Despite evidence that CPAP is a highly effective treatment for OSA, self-reports of adherence are overestimated when compared to objective measures (Amfilochiou et al., 2009; Hui et al., 2006; Salepci et al., 2013). Though a variety of factors have been found to influence CPAP use, definitive predictors of CPAP adherence have not been identified (Amfilochiou et al., 2009; Salepci et al., 2013; Weaver & Grunstein, 2008; Ye et al., 2012). Additionally, there is limited research that examines CPAP use from the user's perspective (Ward, Hoare, & Gott, 2014).

Information from actual CPAP users offers first-hand accounts of the nuances of CPAP therapy and factors that promote or impede its use. Users' perspectives may offer critical insight on CPAP use, which cannot be gained from assessment tools designed from a medical or healthcare provider perspective. Such knowledge is especially important with regards to LHTDs, given their non-traditional work environment. When using CPAP on the road, LHTDs are faced with many circumstances that are not encountered when CPAP is used in a home or home-like environment, such as a hotel. Some of the unique situations include: identifying appropriate electrical sources to power the CPAP machine, using the machine in the small sleeper berth space, arranging work schedules to allow sleep time that meets CPAP use regulations, and identifying facilities to clean equipment. Given the estimated rates of OSA among CMVDs and evidence that adherence to CPAP therapy decreases MVC risk, research surrounding CPAP use among LHTDs is important. Knowledge gained from such research has the potential to inform occupational sleep management programs, industry regulations, policies, and the

development of interventions that promote CPAP adherence among LHTDs. Improvement of CPAP adherence through each of these channels has the capacity to improve highway safety.

Commercial Motor Vehicle Drivers

As of December 2016, the Federal Motor Carrier Safety Administration (FMCSA) estimated that there were 3 million active CMVDs drivers in the United States (FMCSA, 2017a). Commercial motor vehicle drivers, who drive long distance interstate routes, are commonly referred to as long-haul drivers, over-the-road drivers, or tractor-trailer drivers. Long-haul truck drivers can drive with a partner (team driver) or alone (Triplett, 2012). Additional long-haul driver classifications include owner operators, company drivers, and owner operators leased to a motor carrier (Apostolopoulos, Lemke, & Sonmez, 2014). Owner operators leased to a motor carrier are truck owners who lease their trucks to trucking companies to transport freight (Social Security Administration, 2012). Drivers are considered company employees when they meet specific criteria, such as, being paid per hourly wages, having the inability to reject freight assignments, and receiving company fringe benefits (Social Security Administration, 2012).

As noted, OSA has been identified as a significant health issue within the transportation industry. Risk factors commonly associated with OSA, obesity, middle-age, and male gender are characteristics seen among a large percentage of LHTDs (Sieber et al., 2014b; Stoohs, Bingham, Itoi, Guilleminault, & Dement, 1995; Tregear et al., 2009). A systematic review and meta-analysis of OSA-related MVC risk in commercial drivers indicated that commercial drivers with OSA had MVC risks ranging from 21 – 489% higher than commercial drivers without the OSA diagnosis (Tregear et al., 2009).

The conservative estimate of 13% OSA prevalence among CMVDs suggests that approximately 400,000 CMVDs may have OSA. The structure of the trucking industry and nature of LHTDs' work may contribute to OSA risk and may impede effective diagnosis, treatment, and treatment adherence. Thus, policies that support drivers' CPAP use within the challenging trucking work environment are vitally important.

Working as a professional truck driver is arduous work which is regulated by both state and federal laws. Long-haul truck drivers must adhere to medical certification of fitness for duty (FMCSA, 2015). The fitness for duty requirement does not imply that LHTDs who pass the fitness exam are healthy and fit to drive; it mainly represents a minimal health standard. The drivers' work environment is not conducive to a healthy lifestyle. Delivery and pick up schedules may be affected by traffic and weather conditions which makes the job time sensitive and stressful. Pay is usually based on the number of miles driven versus number of hours worked (Saltzman & Belzer, 2007). In relation to federal hours of service regulations, truckers earn approximately $7.00 per hour if they drive the legal limit of hours specified in the regulations. If they drive beyond the limit they earn effectively $6.20 per hour (Saltzman & Belzer, 2007). Long-haul truck drivers are subject to irregular work schedules and may be away from their homes for several days or weeks at a time (Shattell, Apostolopoulos, Sonmez, & Griffen, 2010), which in turn impacts their access to health care, medical treatment, and supplies. When at home, truckers are challenged with juggling multiple duties, such as spending time with family, tending to family business, and catching up on rest and sleep (Renner, 1998). Unfortunately, this leaves little time to address personal health issues or seek preventative healthcare. It is unknown what impact such demands have on CPAP use.

For LHTDs diagnosed with OSA, balancing work life and personal responsibilities may impact CPAP use, access to CPAP follow-up medical visits, and acquisition and maintenance of CPAP equipment and supplies. The trucking industry work structure may hinder access to OSA diagnosis and treatment for drivers who have risk factors but have not been formally diagnosed with OSA.

Studies have shown that truckers experience significant rates of CVD, HTN, DM, musculoskeletal problems, mental disorders, and sleep disturbances (Apostolopoulos, Sonmez, Shattell, & Belzer, 2010; Shattell et al., 2010; Sieber et al., 2014b; Solomon, Doucette, Garland, & McGinn, 2004). This makes consistent medical treatment and preventative health care very important for the health and well-being of LHTDs. When on the road carrying out their job duties, LHTDs are subjected to few nutritious food options, limited access to health care when needed, social networks that promote isolation and risky behaviors, and less than optimal sleep environments (Apostolopoulos et al., 2010; Apostolopoulos, Sonmez, & Massengale, 2013). Given the workplace structure and risk for multiple co-morbidities, this occupational group is very vulnerable from a health standpoint (Apostolopoulos et al., 2010; Renner, 1998; Solomon et al., 2004).

For LHTDs diagnosed with OSA, the workplace environment further compounds their vulnerability and creates a challenging environment for proper CPAP use. An example of the barriers encountered while on the road is the problem faced when attempting to obtain replacement supplies or a replacement CPAP machine due to machine failure. In these situations, securing replacements may not be possible or may require deviations from scheduled routes. Thus, a driver may be in jeopardy of CPAP non-adherence if unable to get replacement supplies or equipment in a timely manner (B.

Stanton, personal communication, September 5, 2014). Other challenges include arranging the driving schedule to meet hours of service regulations and identifying a location to park the truck to get the required hours of sleep using CPAP.

These barriers exemplify the uniqueness of the long-haul trucking work environment, which is atypical when compared to that of the general working population and other transportation industry professionals. Individuals in the general working population who are prescribed CPAP use their machines in the convenience of their homes and bedrooms. This is not the case for LHTDs who, when on the road, use CPAP while sleeping in the sleeper berths of their trucks. Located behind the driver and passenger seats, the sleeper berth is the sleeping quarters in a tractor-trailer truck (see Figure 1). The FMCSA provides regulatory guidance on the construction and dimensions of the sleeper. A sleeper berth is rectangular in shaped and must be equipped for sleeping with suitable linens and a mattress (Sleeper berths, 2011). Despite regulations mandating berths be appropriate for human habitation, a sleeper berth is an unusual sleep setting. The sleeper berth of a truck is exceptionally small when compared to the sleep environment in a person's home. This creates unique challenges for LHTDs. For example, feelings of claustrophobia and discomfort with the CPAP face mask are two major complaints expressed by CPAP users (Almeida et al., 2013; Bachour, Vitikainen, Virkkula, & Maasilta, 2013; Chai-Coetzer et al., 2013; Wallace, Vargas, Schwartz, Aloia, & Shafazand, 2013) and are often cited as reasons for CPAP non-adherence (Chai-Coetzer et al., 2013; Hussain et al., 2014). Face mask discomfort is one of the main reasons for CPAP non-adherence early in CPAP use. The small sleeper berth area and limited space to place CPAP equipment may heighten feelings of claustrophobia and

compound face mask discomfort. These conditions may serve as barriers to effective CPAP use and possibly non-adherence for LHTDs.

Figure 1: Sleeper Berth

Compared to other employees within the transportation industry, the LHTD's sleep situation is atypical. Aviation and railroad are two transportation sectors in which vehicle operators (i.e. pilots and locomotive freight engineers) are in safety-sensitive positions similar to LHTDs. However, the sleep arrangements for pilots and locomotive freight engineers are different than those experienced by LHTDs. Neither pilots nor freight engineers sleep in their work vehicles. When their work shifts are complete, pilots and freight engineers usually sleep in hotels (Trejos, 2014). Thus, their sleep environments are more similar to a home sleep environment. This is in direct contrast to the sleeper berth where LHTDs sleep.

The LHTDs' work is time sensitive with limitations on the number of hours they can drive per day and strict delivery deadlines. Such time constraints may impact when LHTDs can sleep and the amount of time they are able to sleep. For the long-haul truck driver with OSA, this is a significant issue. Regulations stipulate that CMVDs diagnosed with OSA must use CPAP four hours nightly for 70% of nights (Ancoli-Israel, Czeisler, George, Guilleminault, & Pack, 2008). Thus, for LHTDs who use CPAP it is imperative that they adjust their work schedules to allow sufficient time for sleep with the CPAP machine. To use the CPAP machine there must be electrical power which can be provided by idling the truck engine, using auxiliary power units (APU), and having inverters. However, anti-idling laws may prevent truck idling and/or a lack of an APU or inverter may challenge drivers in powering their CPAP machines (Environmental Protection Agency [EPA], 2006; Hinton, n.d.a; Hinton, n.d.b; Perrot et al., 2004).

Undiagnosed, untreated, or under treated OSA threatens the health and well-being of truckers and presents a public safety hazard (Kales & Straubel, 2014). Obstructive sleep apnea increases the potential for negative health consequences and exacerbates trucker vulnerability (Gurubhagavatula, 2010). Vulnerability increases for LHTDs who use CPAP. Reasons for increased vulnerability include but are not limited to the following: 1) management of a complex medical condition in a complex work environment where the vehicle is the bedroom; 2) the nature of long-haul work (e.g. the driver may not have immediate social support in help overcome barriers); 3) increased risk of non-adherence if CPAP education is not thorough thus jeopardizing the trucker's livelihood; and 4) delayed or impaired CPAP self-efficacy due to trial and error in learning to manage CPAP use. In light of this, research is needed to better understand

how the work environment and LHTDs' knowledge of OSA and CPAP impact their use of CPAP when they are on the road.

The majority of research among professional truck drivers has not focused on individual health behaviors (Krueger, Brewster, Dick, Inderbitzen, & Staplin, 2007). Of particular concern are LHTDs diagnosed with OSA and the potential impact that their work has on CPAP use. The manner in which the work environment impacts CPAP use among LHTDs is not clearly known.

National Survey of Long-Haul Truck Driver Health and Injury

Recently more attention has been directed toward the health of LHTDs through the National Survey of Long-Haul Truck Driver Health and Injury (NSLHTD). The survey was conducted to garner a nationally representative sample of LHTDs from which estimates of injuries, health conditions, and health behaviors within the long-haul trucking context could be drawn (Sieber et al., 2014b). Three articles (addressing health behaviors, injury and safety, and obesity and risk factors) have been published from the data set (Birdsey et al., 2015; Chen et al., 2015; Sieber et al., 2014b). Surprisingly, respiratory conditions, such as asthma and OSA, were not addressed in the NSLHTD. Neither the obesity publication nor the health behavior publication included reports of OSA or any respiratory health conditions (Birdsey et al., 2015; & Sieber et al., 2014b). It is doubtful that future publications will address respiratory conditions among LHTDs as no questions related to the respiratory system were mentioned in the NSLHTD overview (Sieber et al., 2014b). Also, despite fairly comprehensive recommendations for future research and health promotion activities among LHTDs, neither OSA nor CPAP

adherence were addressed as recommended areas of future research or program planning (Sieber, 2014a).

In reviewing the health and environmental research devoted to LHTDs, no studies were found that examined CPAP use, adherence, or CPAP behavior modification among LHTDs. Despite the lack of CPAP focused research among LHTDs, studies have shown that LHTDs are concerned about their health and desire accessible health education and health promotion activities (Olson, Anger, Elliot, Wipfli, & Gray, 2009; Smith & Phillips, 2011; Stasko & Neale, 2007; Whitfield Jacobson, Prawitz, & Lukaszuk, 2007). It is possible that, given the opportunity, LHTDs would embrace interventions and initiatives that support their use of CPAP and thereby improve their health. Long-haul truck drivers who use CPAP appropriately despite the challenges presented by the work environment demonstrate that LHTDs have the desire, discipline, and ability to manage their health within the complex trucking industry work environment. It is important that industry and governmental stakeholders hear from LHTDs in their own voices about the reality of using CPAP on the road. Given that CPAP use is essentially absent from the literature regarding LHTDs, the dissertation study will address a substantial gap in the literature.

Conceptual Model

The Integrated Behavioral Model for Water, Sanitation and Hygiene (IBM-WASH) will be the conceptual model that frames the study. Designed to guide exploration of water, sanitation, and hygiene practices, the IBM-WASH model is a social ecological framework derived from behavioral models, comprehensive review of the literature, and formative and pilot research (Dreibelbis et al., 2013). The model is comprised of three

dimensions (contextual, psychosocial and technology factors) and five levels (societal/structural, community, interpersonal/household, individual, and habitual) (Dreibelbis et al., 2013) (see Table 1). This social ecological model is unique because in addition to traditional ecological levels (i.e. societal, community, interpersonal and individual), it also includes a habitual level and technological factors. Such concepts are generally not represented in ecological frameworks.

When applied to LHTDs' use of CPAP, the IBM-WASH model is unusually comprehensive because the three dimensions (i.e. contextual, psychosocial, and technology), when correlated to the five levels, encompass broad factors that influence CPAP use such as transportation policies and regulations to very intimate factors such as employment classification and personal habits. Salient elements not often seen in ecological models are technology factors. As CPAP is a highly technology dependent treatment modality, the model provides an avenue to capture technology factors at high levels such as the structural level (e.g. production of CPAP machines with features useful to LHTDs) to lower levels, such as, the individual and habitual levels that may be more amenable to interventions. For example, at the individual level convenience of using CPAP in a sleeper berth may be an important predictor of consistent CPAP use with the habitual level capturing a driver's ease or difficulty in establishing a CPAP routine.

When considering CPAP use among LHTDs, a benefit of using the IBM-WASH model is that the three dimensions of IBM-WASH mirror the reciprocal determinism concept of the Social Cognitive Theory, in which there is interaction between the individual, the behavior of interest, and the environment (Bandura, 1999). Many CPAP adherence studies employ the Social Cognitive Theory to examine self-efficacy and

outcome expectancies (Sawyer et al., 2011; Sawyer, Deatrick, Kuna, & Weaver, 2010; Stepnowsky, Marler, &Ancoli-Israel, 2001). Both concepts are important in CPAP use and are captured among psychosocial factors of the IBM-WASH model. Table 2 depicts concepts relevant to LHTDs' use of CPAP as framed within the IBM-WASH model.

Within the long-haul truck driver population, the IBM-WASH model will provide a platform to examine behavioral, psychosocial, environmental and technological influences on CPAP use among drivers diagnosed with OSA. The model combines traditional social ecological levels with contextual, psychosocial and technological factors. This makes the model an excellent framework in which to capture the unique essence of long haul trucking, the technical elements of CPAP therapy "on the road", and the social/community and personal influences of adherence.

Table 1

The Integrated Behavioral Model for Water, Sanitation, and Hygiene (IBM-WASH)

Levels	Contextual factors	Psychosocial factors	Technology factors
Societal/Structural	Policy and regulations, climate and Geography	Leadership/advocacy, cultural identity	Manufacturing, financing, and distribution of the product; current and past national policies and promotion of products
Community	Access to markets, access to resources, built and physical environment	Shared values, collective efficacy, social integration, stigma	Location, access, availability, individual vs. collective ownership/access, and maintenance of the product

(Table 1 Continues)

(Table 1 Continued)

Levels	Contextual factors	Psychosocial factors	Technology factors
Interpersonal/Household	Roles and responsibilities, household structure, division of labor, available space	Injunctive norms, descriptive norms, aspirations, shame, nurture	Sharing of access to product, modeling/ demonstration of use of product
Individual	Wealth, age, education, gender, livelihoods/employment	Self-efficacy, knowledge, disgust, perceived threat	Perceived cost, value, convenience, and other strengths and weaknesses of the product
Habitual	Favorable environment for habit formation, opportunity for and barriers to repetition of behavior	Existing water and sanitation habits, outcome expectations	Ease/Effectiveness of routine use of product

Table 2

The IBM-WASH Model applied to CPAP use among Long-haul Truck Drivers

Levels	Contextual factors	Psychosocial factors	Technology factors
Societal/Structural	OSA Screening policy, CPAP treatment guidelines	Leadership/ advocacy for OSA diagnosis and use of CPAP, professional truck driver cultural identity	Manufacturing of CPAP machines, supplies & equipment; distribution of CPAP machines, supplies and equipment; different types of PAP machines
Community	Availability/access to sleep testing and OSA diagnosis; access to resources to equip truck for CPAP machine	Shared values among LHTDs regarding OSA & CPAP; support in CPAP use; stigma of OSA diagnosis and CPAP use	Availability/access to CPAP supplies and equipment when on the road; availability/access to appropriate electrical sources Availability of trucks with appropriate equipment & electrical sources

(Table 2 Continues)

(Table 2 Continued)

Levels	Contextual factors	Psychosocial factors	Technology factors
Interpersonal/Household	Spousal/partner support in CPAP use Peer support in CPAP use; household responsibilities when at home Availability of appropriate space & set up in sleeper berth	Injunctive norms and descriptive norms associated with CPAP use on the road; shame/pride associated with CPAP use	Modeling use of CPAP Access to appropriate electrical sources
Individual	Age, education, gender, socioeconomic status, driver classifications	Self-efficacy in using CPAP and maintaining equipment when on the road, knowledge of OSA and CPAP; attitude toward CPAP; perceived threat to livelihood	Perceived cost, value, convenience of CPAP; strengths and weaknesses of CPAP machine and equipment
Habitual	Favorable environment for habit formation in using CPAP; facilitators of CPAP use; barriers to habitual CPAP use	Electrical source, supplies, equipment; expected CPAP outcomes	Ease/Effectiveness of routine CPAP use and maintenance when on the road

Overview of the Three Manuscripts

Manuscript One—A Policy Analysis of Mandatory Obstructive Sleep Apnea Screening in the Trucking Industry

The purpose of the first manuscript was to analyze mandatory OSA screening policy options in the trucking industry. The analysis is guided by Bardach's eightfold path to policy analysis which provides a systematic method to evaluate policy options (Bardach, 2012). Because LHTDs' work and lifestyles are heavily influenced by federal and state regulations, development of strategies or laws related to OSA and CPAP adherence must consider the impact on truck drivers. Therefore, a manuscript dedicated

to OSA policies is intrinsically relevant to the examination of CPAP use among LHTDs. Possible policy options explored in the manuscript included: 1) mandating that trucking companies offer sleep management programs for all employees, 2) revising the medical examination report form to capture OSA risk factors, 3) using a multi-level approach that involves revisions to existing federal statutes, and 4) maintaining the status quo. Based upon the analysis, the recommendation was that mandatory OSA screening within the trucking sector be pursued through the federal rulemaking process because this process affords all stakeholders input in the creation of regulations. Through the analysis, it was apparent that for professional truck drivers it was important that they participate in the conversations and development of laws and policies that affect their livelihoods. With the rulemaking process, all stakeholders from transportation officials to drivers have an opportunity to provide feedback and shape future OSA testing regulations.

Manuscript Two—CPAP Use Through the Eyes of the Client: A Review of Literature

The purpose of the second manuscript was to synthesize the evidence related to the CPAP experience among individuals diagnosed with OSA with focus on users' perspectives. Much of the research on CPAP focuses on adherence which is the amount of time that CPAP is worn. However, definitive predictors of CPAP adherence have not been identified. Knowledge of CPAP users' experiences, feelings, and attitudes associated with CPAP may provide insight to strategies or interventions that have the potential to increase CPAP adherence among those diagnosed with OSA. A recent review recommended more CPAP research that focuses on the user's perspective (Ward et al., 2014).

Findings from the review demonstrated that using a CPAP machine is a multidimensional, multifactorial process. There was a universality with regards to barriers and facilitators that CPAP users encountered when incorporating CPAP into their lives. Despite the type of healthcare system or country where users were located, financial burdens, psychosocial attributes, knowledge deficits, desire for more information about OSA and CPAP, and interactions with the healthcare team were areas that significantly influenced CPAP uptake and continued use. Though seldom discussed in the literature, many users grappled with body image concerns when using CPAP. This phenomenon was seen among males and females.

No studies were found that examined CPAP use among occupational groups. Exploring LHTDs' use of CPAP is important because a better understanding of LHTDs' engagement with CPAP while working over the road may lead to the development of strategies with potential to increase CPAP adherence among this population. Increased CPAP uptake and adherence could thereby reduce MVCs, improve public safety on U.S. roads, decrease comorbid medical conditions among LHTDs, and improve their QOL.

Manuscript Three—Exploration of CPAP Use in Long-haul Truck Drivers

The third manuscript describes the exploratory, descriptive study conducted as the final requirement of this dissertation. Descriptive inquiry was used to explore LHTDs' use of CPAP when they were working over the road. Qualitative descriptive research uses low-inference interpretation to describe a phenomenon and presents the experience in everyday language (Sandelowski, 2000). This method is particularly useful when little is known about a particular phenomenon and a description of the event is desired (Sandelowski, 2000). Since little is known about CPAP use by LHTDs, descriptive

inquiry was well suited to answer the research questions posed in the study. The specific research aims and research questions guiding the study were:

Research Aims

To explore the:

a. CPAP experiences of long-haul truck drivers who are diagnosed with OSA and using CPAP therapy "on the road"
b. Knowledge of OSA and CPAP treatment among long haul truck drivers who are diagnosed with OSA.

Research Questions

1. How do long haul truck drivers use CPAP on the road?
2. What are the barriers and facilitators to CPAP use faced by long haul truck drivers on the road?
3. What do long haul truckers diagnosed with OSA know about OSA and CPAP treatment; and how does that influence their CPAP use "on the road"?

Long-haul truck drivers who were diagnosed with OSA and currently using CPAP were recruited to participate in the study. Fourteen LHTDs who met inclusion criteria were enrolled in the study. Recruitment stopped when data saturation was achieved (i.e. no new information was obtained). Telephone interviews were conducted with participants at times convenient to their schedules. Each participant was asked open-ended questions regarding their experiences with OSA and CPAP, their knowledge of OSA and CPAP, and barriers and facilitators to CPAP use on the road. All interviews were audio recorded and transcribed.

Thematic analysis was used to analyze the body of data. The data revealed that becoming accustomed to CPAP was a complex, self-care management process that involved cognitive and behavioral engagement. From the analysis five themes emerged: 1) It takes time to adapt to CPAP; 2) No different than home; 3) Being prepared to hit the road with CPAP; 4) Caring, coercion, or just feeling better; and 5) A constant source of aggravation to use CPAP on the road.

Each theme provided insight on different aspects of LHTDs' experiences with CPAP. The distinctiveness of their work and the truck environment where they slept with their CPAP machines presented unique challenges to CPAP use. However, most barriers were overcome in efforts to maintain health or the required CPAP adherence.

Implications for advancing nursing knowledge, nursing practice, and policy were identified through the study and discussed in the manuscript. No studies were found that addressed CPAP use among LHTDs, thus, the dissertation study informs our understanding of CPAP among this population. Additionally, this study adds to the limited body of knowledge regarding the user's perspective of CPAP and CPAP use in occupational settings.

Conclusion

Obstructive sleep apnea has been identified as a significant health issue that impacts the general working population, the LHTD occupational group, and public safety. Continuous positive airway pressure is an effective treatment for OSA, though adherence rates are traditionally low among individuals diagnosed with OSA. Despite high prevalence rates of OSA among LHTDs and the increased attention devoted to long-

haul truck driver health, no studies were identified that explored CPAP use among LHTDs. This dissertation stands to fill a significant gap in the literature.

CPAP use by LHTDs is a complex health behavior that is influenced by the multi-layers of the trucking industry's unique work environment. Using the IBM-WASH social ecological model as the conceptual framework enabled the investigator to capture factors that impacted LHTDs' CPAP use from the macrolevel (e.g. societal) to the microlevel (e.g. habitual). The three manuscripts included in this dissertation mirror the social ecological framework that undergirds the study. The first manuscript analyzed potential OSA screening policies that were congruent with the societal/structural level of the IBM-WASH model. The second manuscript was a comprehensive review of current knowledge of the users' perspective on CPAP therapy that correlates to the community, interpersonal, individual, and habitual levels of the IBM-WASH model. Lastly, the third manuscript presents findings from the investigator's dissertation study which provided insight on all levels of the IBM-WASH model in relation to CPAP use by LHTDs. For both clinicians and researchers, greater awareness of the personal experiences surrounding CPAP use has the potential to clarify important predictors of CPAP adherence. Identification of such predictors is particularly important among vulnerable populations and those working in nontraditional occupational environments, such as long-haul trucking.

A POLICY ANALYSIS OF MANDATORY OBSTRUCTIVE SLEEP APNEA SCREENING IN THE TRUCKING INDUSTRY

by

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MANUSCRIPT 1

A POLICY ANALYSIS OF MANDATORY OBSTRUCTIVE SLEEP APNEA SCREENING IN THE TRUCKING INDUSTRY

Abstract

Obstructive sleep apnea (OSA) is a chronic condition characterized by occlusion of the upper airway during sleep resulting in daytime sleepiness. Drivers with OSA are at a two- to seven-fold increase in risk of motor vehicle crashes (MVCs). Approximately, 13% to 28% of commercial motor vehicle drivers (CMVDs) are thought to have OSA. Obstructive sleep apnea is a significant issue in the transportation industry. Currently, The Federal Motor Carrier Safety Administration (FMCSA) does not mandate OSA screening. Federal regulations only specify that CMVDs be free of "respiratory dysfunction" that would impair driving. Untreated OSA is a public safety concern. The purpose of this paper is to use Bardach's eightfold policy analysis approach to examine policy options related to OSA screening in the trucking industry.

Keywords: Obstructive sleep apnea, policy analysis, public safety, commercial motor vehicle driver, mandated testing, motor vehicle crashes

Obstructive sleep apnea (OSA), safety, and mandatory OSA screening in the trucking industry have garnered much discussion. After several years of contentious debate among regulatory, advocacy, and key stakeholders, in October 2013, President Obama signed into law a bill requiring that any federal standards and federally mandated screening, testing, and treatment of OSA among commercial truck drivers (CMVDs) be set forth through formal rulemaking, rather than a guidance process (Public Law 113-45, 2013). The regulatory process, through formal rulemaking, began on March 10, 2016 with the Federal Motor Carrier Safety Administration (FMCSA) and Federal Railroad Administration (FRA) issuing an Advanced Notice of Proposed Rulemaking regarding moderate and severe OSA among individuals in safety-sensitive positions in highway and railroad transportation (Darling & Feinberg, 2016; Minor & Lauby, 2016). In an unexpected turn of events, the FMCSA and FRA announced that the OSA proposed rule was rescinded as of August 2017 (FMCSA, 2017a). Although the FMCSA is not seeking to establish federal regulations regarding OSA screening and treatment, OSA remains an important issue in the trucking sector. The purpose of this paper is to use Bardach's (2012) eightfold policy analysis to analyze mandatory OSA screening policy options in the trucking industry.

Bardach's Eightfold Policy Analysis Path

Bardach's (2012) eightfold path to policy analysis (Figure 1) is a straightforward, concrete method of analyzing public policy. The process involves eight steps that guide the analysis from delineating the problem to sharing the policy narrative. The critical first step is to define the problem because the identified problem supports the need for conducting the analysis and provides direction for gathering supporting data. After

defining the problem, the next step is assembling evidence that is related to the problem. Three main purposes guide data collection: (a) assessing the extent and nature of the problem, (b) assessing the current policy climate, and (c) examining policies from other locales that are similar to the problem under study.

The next step is to identify or construct alternative strategies, policy options, or interventions. Work within this step should start with a broad approach and then concentrates on two to three main alternatives. The fourth step is primarily focused on evaluation. Through this step, values and philosophy are applied to judgments about the projected outcomes. The most important evaluation measure examines whether the proposed outcomes will adequately solve the problem.

Often identified as the hardest step in the process, Step 5 involves projecting realistic future outcomes. After projected outcomes are identified, the sixth step is to consider strengths and limitations. In some cases, one outcome is obviously best, but generally this is not the case and trade-offs between outcomes must be explicated. In Step 7, after all the evidence, alternatives, evaluation measures, outcomes, and trade-offs have been appraised, the best approach for addressing the problem must be chosen. The eighth and final step is sharing the analysis with interested audiences and stakeholders. The analysis should be presented so that both lay and professional audiences can understand the implications. This policy analysis is presented using the organizing frame of the Bardach eightfold path.

Step 1: Define the Problem

Obstructive sleep apnea is a condition characterized by collapse of upper airway soft tissues and obstruction, resulting in episodes of apnea and hypopnea during sleep

(Sanchez-de-la-Torre, Campos-Rodriguez, & Barbe, 2013). These episodes are associated with frequent arousals and subsequent fragmented, non-restorative sleep (Stone, Taylor, McCrae, Kalsekar, & Lichstein, 2008). Drivers with OSA frequently experience residual sleepiness that may be related to such factors as hypoxia (Feng, Wu, Zhang, & Chen, 2012), primary sleep insufficiency (Al Lawati, Patel, & Ayas, 2009), inadequate treatment (Mulgrew et al., 2010), comorbid conditions, such as depression (Wheaton, Perry, Chapman, & Croft, 2012), and periodic leg movement and restless leg syndrome (Roux, 2013). Along with residual sleepiness, negative effects on cognition have been noted in individuals with OSA and respond to some extent to continuous positive airway pressure (CPAP) treatment. Among the noteworthy cognitive effects associated with OSA are attention, vigilance, and visual-spatial declines (Ferini-Strambi, Marelli, Galbiati, & Castronovo, 2013), all of which may affect driving safety. The condition often goes undetected because many signs and symptoms are evident only during sleep (Sanchez-de-la-Torre et. al, 2013), and daytime symptoms such as sleepiness and cognitive performance declines may not be readily recognized or may be associated with other conditions or circumstances. Drivers with OSA are at increased risk of motor vehicle crashes (MVCs) (Mulgrew et al., 2008; Shiomi et al., 2002). A systematic review and meta-analysis of OSA-related MVC risk in commercial drivers indicated that commercial drivers with OSA had a 2-fold higher MVC rate per mile than commercial drivers without the OSA diagnoses (Tregear, Reston, Schoelles, & Phillips, 2009). Obstructive sleep apnea prevalence among CMVDs is estimated to range from 13 to 28% (Berger et al., 2012; Gurubhagavatula, Maislin, Nkwuo, & Pack 2004; Talmage, Hudson,

Hegmann, & Thiese, 2008). OSA has been cited as a significant issue among commercial motor vehicle drivers (Kales & Straubel, 2014).

Step 2: Assemble Evidence

Concern regarding CMV crashes and public safety raises the issue of whether OSA screening among CMVDs should be mandatory. Motor vehicle crashes involving CMVDs are costly in terms of human capital, property loss, and litigation. In 2015, 116,000 people were injured in crashes involving large trucks (gross vehicle weight rating greater than 10,000 pounds) in the United States (National Highway Traffic Safety Administration [NHTSA], 2017). This statistic represented a 4% increase from 2014 crash reports. Of the 116,000 injured 73% were occupants of other vehicles, 24% were occupants of the large trucks, and 4% were nonoccupants. In the same year, 4,067 people were killed in large truck crashes; 74% of those killed were occupants of other vehicles, 16% were occupants of the large trucks, and 10% were nonoccupants (NHTSA, 2017). Of the large truck crashes that occurred in 2015, occupants of the large trucks accounted for 24% of the individuals who sustained injuries and 16% of the fatalities (NHTSA, 2017). Although these numbers represent the human toll, the economic costs are also staggering. For 2015 alone, large truck and bus crashes that resulted in property–damage-only cost an estimated US$28 billion (based on 2015 dollars) and fatalities and injuries caused due to large truck crashes cost an estimated US$90 billion combined (FMCSA, 2017b).

Although these statistics are startling, they do not necessarily link OSA to crash risk. Findings of a systematic review of MVC risk among individuals diagnosed with OSA indicated that studies that included noncommercial drivers found a positive

correlation between MVC and OSA (Ellen et al., 2006). For studies involving CMVDs the association between MVC and OSA was weaker than the association noted among noncommercial drivers (Ellen et al., 2006). The University of Pennsylvania Sleep Apnea Study found that there was no statistical evidence that supported the belief that OSA significantly increased the risk of crashes by CMVDs (Steinberg, 2002). However, a recent study by Burks et al. (2016) found a link between OSA treatment nonadherence and increased crash risk among CMV drivers; truck drivers who were non-adherent to OSA treatment had a fivefold increased risk of preventable MVCs.

Precedence in linking OSA to a crash involving a CMVD was set in a notable case in which the Celadon trucking company settled with the family of John Lindsay for US$3.25 million after what was determined to be a likely OSA-related crash (Platenburg, 2011). Mr. Lindsay was killed when a 40-ton truck rear-ended Lindsay's car while stopped in traffic. In an industry first, Celadon acknowledged that the crash was most likely related to the truck driver's untreated sleep apnea (Platenburg, 2011).

Currently, FMCSA, the regulatory agency of the trucking industry, does not mandate OSA screening among CMVDs. Current regulations are broad and specify only that CMVDs cannot be medically certified to drive if they have a "respiratory dysfunction" that would interfere with their ability to drive safely (Subpart E—Physical Qualifications & Examinations, 1970). Over the years, various health-related experts, professional health-related organizations, and an expert panel have made recommendations regarding OSA screening for transportation industry workers; the FMCSA has not implemented any of the recommendations as federal regulations (Czeisler, 2011).

Untreated OSA has been associated with multiple health problems such as cognitive deficits (Engleman & Douglas, 2004), hypertension (Calhoun, 2010; Konecny, Kara, & Somers, 2014), cardiovascular disease (Sanchez-de-la-Torre et al., 2013), diabetes (Kendzerska, Gershon, Hawker, Tomlinson, & Leung, 2014), and decreased quality of life (Isidoro et al., 2015). Treatment of OSA with CPAP for as few as 2-7 days is associated with improved performance on a driving simulator (Tregear, Reston, Schoelles, & Phillips, 2010). Cognitive improvement post-CPAP therapy has been found to be inconsistent, and more research in this area is recommended (Aloia, Arnedt, Davis, Riggs, & Byrd, 2004; Kylstra, Aaronson, Hofman, & Schmand, 2013). Furthermore, mandatory OSA policies have garnered support both from inside and outside the trucking industry. Schneider National Inc., a major U.S. trucking company, implemented a fleetwide OSA screening and treatment program for their drivers (Garber, 2008). Professional organizations such as the Joint Task Force of the American College of Chest Physicians, American College of Occupational and Environmental Medicine, and the National Sleep Foundation (Hartenbaum et al., 2006) and the FMCSA Medical Expert Panel have recommended mandatory OSA screening and treatment for CMVDs (Ancoli-Israel, Czeisler, George, Guilleminault, & Pack, 2008).

Step 3: Construct Alternatives

Several policy options to address the problem of undiagnosed OSA among CMVDs were identified. One bold option would be to mandate trucking companies implement sleep programs for all employees and contractors who drive for their companies. Sleep apnea programs generally include screening, diagnosis, education, treatment, and monitoring (Benefit Design Group, Inc., n.d.; SleepSafe Drivers, Inc.,

n.d.). Schneider National serves as an exemplar of a trucking company's commitment to the safety of their drivers and the public (Mabry, Baker, Hickman, & Hanowski, 2012). In 2007, Schneider won the National Sleep Foundation Healthy Sleep Community Award for their sleep apnea program (Lazar, 2007). Through their program, the company has reported savings of US$538 to US$780 in health care costs per driver each month, a 30% reduction in crash frequency and a 65% increase in retention among drivers who were being treated for OSA (Garber, 2008). J. B. Hunt explored the utility of a sleep program. The company participated in a clinical trial focusing on treatment of sleep apnea in their fleet of CMVDs, with positive results for both the company and drivers (Heavy Duty Trucking, 2009; Mabry et al., 2012). The company later contracted with SleepSafe Drivers, a national provider of sleep apnea management programs, to deliver OSA testing and treatment to the JB Hunt driving fleet (Heavy Duty Trucking, 2011). This option may be possible for large companies; however, small independent trucking companies would not likely have the human or financial resources to implement mandatory sleep management programs for their employees.

A second policy option would involve revisions to the current medical examination report form to include areas specific to OSA recognition, which increase identification of CMVDs at risk for OSA and hold them accountable. Two task forces consisting of experts in sleep, respiratory, and occupational medicine (Epstein et al., 2009; Hartenbaum et al., 2006) have recommended that measurement of body mass index (BMI) and neck circumference be included in assessments of individuals at risk for OSA because BMI greater than or equal to 30 and neck circumference greater than or equal to 17 for males and greater than or equal to 16 for females may suggest OSA. The current

medical examination report form does not include any questions or measurements that are specific indicators of OSA risk (FMCSA, 2015). Questions addressing BMI, neck circumference, and history of OSA could be easily added to the form. Currently, height and weight are obtained during medical examinations, but BMI and neck measurements are not documented. If neck measurements and BMI were readily available, they could be used in conjunction with OSA history to identify drivers who may be at risk for OSA. The examiner could then recommend further testing or allow conditional certification.

As noted, FMCSA regulations do not require OSA screening during fitness-for-duty examinations of CMVDs. A third policy option would be to mandate OSA screening in all medical certification examinations and require ongoing compliance with treatment regimens as a condition of medical certification with required annual recertification. The goal of the mandate would be to identify drivers with undiagnosed or untreated OSA and require treatment. Theoretically, with comprehensive screening more drivers would be referred for formal diagnosis and begin treatment if diagnosed with OSA. This option alone could decrease daytime sleepiness and fatigue among drivers, and thereby increase safety on U.S. roadways (Lazar, 2007). In a study examining the impact of CPAP treatment on health plan and disability costs, treatment of OSA was associated with lower health care and disability costs (Hoffman, Wingenbach, Kagey, Schaneman, & Kasper, 2010). Estimates suggest that mandatory OSA screening would cost the trucking industry US$1 billion dollars and more than US$100 million to the private bus industry (U.S. House of Representatives, 2011). Given such costs, cost-benefit analyses should be conducted to determine the benefits of such mandates. Cost-benefit analyses are most

useful for analyzing policies to determine whether their benefit to society exceeds its costs (Cellini & Kee, 2010).

Per public law, the third policy option, mandatory OSA screening, and treatment among CMVDs would have to be pursued through the formal rulemaking process (Public Law 113-45, 2013). On March 10, 2016, the FMCSA and FRA initiated the formal rulemaking process by publishing an Advance Notice of Proposed Rulemaking and sought public comment on a proposed rule regarding the impact of OSA screening, evaluation, and treatment of safety-sensitive personnel (Darling & Feinberg, 2016; Minor & Lauby, 2016). A federal OSA rule would have specified treatment protocols and indicate which conditions would require a diagnostic laboratory sleep study. Under the current system, medical examiners use their judgment and training to determine who is referred for diagnostic sleep studies. In a surprising development, FMCSA and FRA announced on August 4, 2017 that the Advanced Notice of Proposed Rulemaking regarding OSA among rail workers and CMVDs was withdrawn (FMCSA, 2017a). The agencies believe that currently established safety programs and the FRA's regulations that address fatigue are appropriate methods to manage OSA (FMCSA, 2017b). Although this policy option was begun in 2016 and subsequently abandoned, it remains a potential path to implementing mandatory OSA screening in the trucking industry should the effort be revisited.

Maintaining the status quo is always a possibility and constitutes a fourth policy option. Recently FMCSA's status quo sustained a significant change which was the establishment of the National Registry of Certified Medical Examiners (NRCME) (Hartenbaum, 2012).

The NRCME regulation stipulates that health care providers who conduct medical certification examinations for CMVDs must be trained about specific physical qualifications that affect drivers' ability to safely drive vehicles (Subpart D-National Registry of Certified Medical Examiners, 2012). As of May 2014, all certified medical examiners must have completed the required training and be listed on the registry and drivers must schedule medical examinations with certified examiners who are listed on the registry (Subpart D-National Registry of Certified Medical Examiners, 2012). According to the FMCSA, establishment of the NRCME is part of the organization's commitment to prevent crashes, injuries, and fatalities associated with commercial motor vehicles (NRCME Plus, n.d.). Training of certified medical examiners will be standardized and, therefore ensures examiners identify and properly address disqualifying conditions. The addition of the NRCME is an important step toward addressing OSA in the transportation industry.

Step 4: Select the Criteria

Criteria commonly used in the Bardach (2012) approach to policy analysis include such labels as efficiency, freedom, equity, fairness, justice, and legality. Given the potential impact of OSA screening and treatment regulations, efficiency is of the utmost importance. Policy outcomes that can be achieved in the most efficient manner for all stakeholders are the goal. Outcomes such as increased public safety, decreased liability, and improved health status are quasi-tangible results that may take months or years to realize, yet given time, these results will prove to be efficient outcomes. However, some stakeholders may incur initial costs that will be recouped through future

savings and indirect benefits (e.g., longer, more productive work lives and decreased liability; Hoffman et al., 2010; Nguyen, 2006).

A revised medical examination report form may be the least efficient option given the time and effort required to convene expert panels and to elicit recommendations from professional groups concerning form revisions; this approach may not be an efficient use of financial and human resources. Despite the lack of efficiency associated with medical examination form revision, this approach may be a most equitable way of applying OSA screening standards across all CMVDs who must have a medical examination at least before their driving careers commence and every 2 years afterwards.

All policy alternatives are unlikely to be perceived as satisfactory and fair for all parties involved. For example, with the implementation of mandatory OSA screening, some CMVDs may be deemed unfit for service or given conditional driving certifications that require time off from work. These outcomes may not be deemed fair, particularly in the light of the potential for referrals of drivers who ultimately are not diagnosed with OSA. Truck drivers may question the fairness of proposed OSA regulations that they perceive as potential actions that will cause them to lose their livelihoods (Nguyen, 2006). The fairness of mandating employers to offer sleep programs could also be questioned. Will such regulations create fair outcomes for small businesses that may not be able to absorb the costs of employer-sponsored sleep programs? Schneider National acknowledges that they are able to offer free OSA diagnosis and treatment to their drivers because of their size (Nguyen, 2006). Treatment of sleep apnea not only has the potential to increase safety on U.S. roads, but it also improves quality of life and decreases disability rates among drivers who are treated for OSA (Mabry et al., 2012; Nguyen,

2006). Fairness and justice may also be viewed through utilitarian lenses. That is, although more stringent screening, diagnosis, and treatment of OSA among commercial drivers may be inconvenient, perceived as unfair, and costly to the drivers, the potential benefit to the much larger driving public outweighs these concerns. However, increased public safety may be diluted when only CMVDs, and not the general public, undergo mandatory screening for OSA.

Regardless of the policy alternative chosen, realistically, years may be required before a federal rule mandates OSA screening and treatment, if such regulations are proposed again. The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005) mandated development and implementation of the NRCME. Nine years passed between the mandate and full enactment of the NRCME. The time required to change federal legislation, coupled with the potential economic burden that new OSA regulations could place on stakeholders, may impede implementation of stringent OSA rules (Dills, 2012).

All stakeholders must be given an opportunity to voice their opinions about and recommend proposed changes to policies so that outcomes reflect the interests of all affected parties. Due process is automatically built into the federal regulation revision mechanism. Any proposed changes to federal regulations include a required public comment period. This approach creates the potential for federal OSA screening, evaluation, and treatment outcomes to be crafted by all stakeholders.

Step 5: Project Outcomes

For the policy alternatives under review, stakeholders include CMVDs, the Department of Transportation, the FMCSA, trucking companies, the general public, the

public safety community, medical examiners, sleep professionals, companies that produce sleep apnea treatment appliances, and advocacy groups. Desired outcomes of OSA policies would include the following: (a) more CMVDs treated for OSA; (b) improved quality of life for CMVDs; (c) decreased disability among CMVDs treated for OSA; (d) disqualification of medically unfit CMVDs; (e) decreased MVCs related to OSA; (f) increased safety of U.S. roads; (g) decreased loss of life, productivity, and property damage due to OSA-related crashes; and (h) less liability for CMVDs and trucking companies when drivers are involved in MVCs. Projected negative outcomes are also associated with the policy alternatives. Implementation of federal OSA screening and treatment regulations would be challenging. Although a large number of CMVDs are estimated to have OSA; coordinating and financing the testing of drivers would be difficult (Czeisler, 2011; Papp, 2012). Referrals for OSA testing based on objective measures such as BMI would inevitably result in referrals of individuals who do not have OSA and failure to refer those who do have OSA but do not meet the BMI referral criterion (Czeisler, 2011). The average cost of a sleep study test is US$1,800 to US$2,000 (Dills, 2012; Gold, 2012) and these figures do not include loss of wages due to overnight testing in a sleep lab, nor do they include treatment and maintenance costs. The costs of OSA testing can negatively impact CMVDs. Furthermore, some truck drivers, particularly those who are uninsured, may not be able to afford a positive airway pressure mask and machine which are often the recommended treatment for OSA (Stanton, 2012). According to an Agency for Healthcare Research and Quality consumer summary, the costs of CPAP machines (before insurance adjustments) ranges from US$300 to US$2,000 plus supplies (e.g., masks, tubing, and filters) which can cost

US$300 to US$800 annually (John M. Eisenberg Center for Clinical Decisions and Communications Science, 2011). Such economic burdens create an environment in which truckers are reluctant to seek diagnosis or treatment for OSA (Smith & Phillips, 2011). The loss of commercial drivers related to the policy implementation may add tremendous burden to an already short-staffed trucking workforce (Walsh, 2013). In light of these realities consideration must be given to acceptable accommodations.

Step 6: Confront Tradeoffs

Mandating trucking companies to offer sleep programs as part of their benefit packages is also unlikely to be a popular solution among stakeholders because of the costs associated with such programs. Thus, mandating company sleep programs is not a realistic option.

In 2000, the FMCSA medical examination form was revised for the first time since 1970, and use of the new form has been required since November 2001 (Blumenthal et al., 2002). Thus, changing the medical examination form took approximately 30 years. In 2015, FMCSA implemented changes to the medical examination form that aligned the form with new certified medical examiner procedures and processes (Darling, 2015). Given the recently revised form, the likelihood of further revisions based on OSA-related biometric measures and family history is low, especially because none of the advisory committees made recommendations to revise the medical form. In addition, changes to the medical examination form that include documentation of OSA risk factors (e.g. BMI, neck circumference, and family history) could be interpreted as an indirect method of OSA screening. Any strategy that appears to circumvent the regulatory process will not be well received by CMVDs or motor carriers.

Considering the possible costs of examination form revisions, the interests of public safety may be better served by pursuing other policy options.

More in-depth examinations of cost-effective screening, testing, and treatment options are needed before regulations that mandate OSA screening and treatment can be implemented. Given the high costs of screening, more affordable treatment options are needed before the industry will support comprehensive OSA screening, testing, and treatment (Dills, 2012). Moreover, implementation of mandatory OSA screening and treatment through formal rulemaking will require extensive research, cost-benefit analyses, and an open comment period. Many CMVDs are fearful that OSA screening and treatment regulations will cause drivers to lose their jobs if they are diagnosed with OSA (Nguyen, 2006). Changing drivers' attitudes and perceptions will take time.

Implementation of the NRCME is expected to bring some standardization to the fitness for duty medical certification process and reduce the number of CMV drivers who are medically unfit to drive (Lester, 2012). The NRCME went into full effect on May 21, 2014.

Regardless of which course of action is taken, the economic impact on motor carriers and CMVDs must be considered. Some truck drivers, both insured and uninsured, cannot afford testing and treatment options or the lost work time due to testing and treatment (Stanton, 2012). In addition, treatment plans must incorporate strategies that address work environment challenges such as allowing idle time and fitting trucks to power CPAP mask safely (Stanton, 2012). The critical question is how the transportation industry balances the needs of drivers and the concerns of employers with public safety. In whatever manner the industry approaches OSA, the process that leads to reform will

be lengthy; however, this process is a trade-off for embracing change that is acceptable to most stakeholders.

Steps 7 & 8: Decide and Tell Your Story

Bardach's (2012) final steps are to decide upon a policy alternative and engage stakeholders to change current policy. Despite challenges to implementation and the time required to change attitudes, perceptions and federal regulations, the best policy alternative for the transportation industry is pursuing mandatory OSA screening and treatment guidance through the formal rulemaking making process. This option is the fairest and most just policy for all stakeholders. To be fair to all parties, research on the efficacy of portable OSA testing and cost-effective treatment options must be conducted. Efforts must be made to increase driver awareness of OSA, their knowledge regarding the importance of treatment and their understanding and belief that an OSA diagnosis does not inevitably result in loss of vocation. In addition, the FMCSA and motor carriers must earnestly support drivers by ensuring their livelihoods are not jeopardized by OSA diagnosis.

Regulations mandating screening and treatment have the potential to not only increase public safety, but also improve the health of CMVDs, extend their work years, and decrease cases of disability. Although the FMCSA has chosen not to pursue OSA screening and treatment through the formal rulemaking process, of the available policy alternatives, formal rulemaking is the approach most likely to produce results that allow due process and are equitable for all stakeholders.

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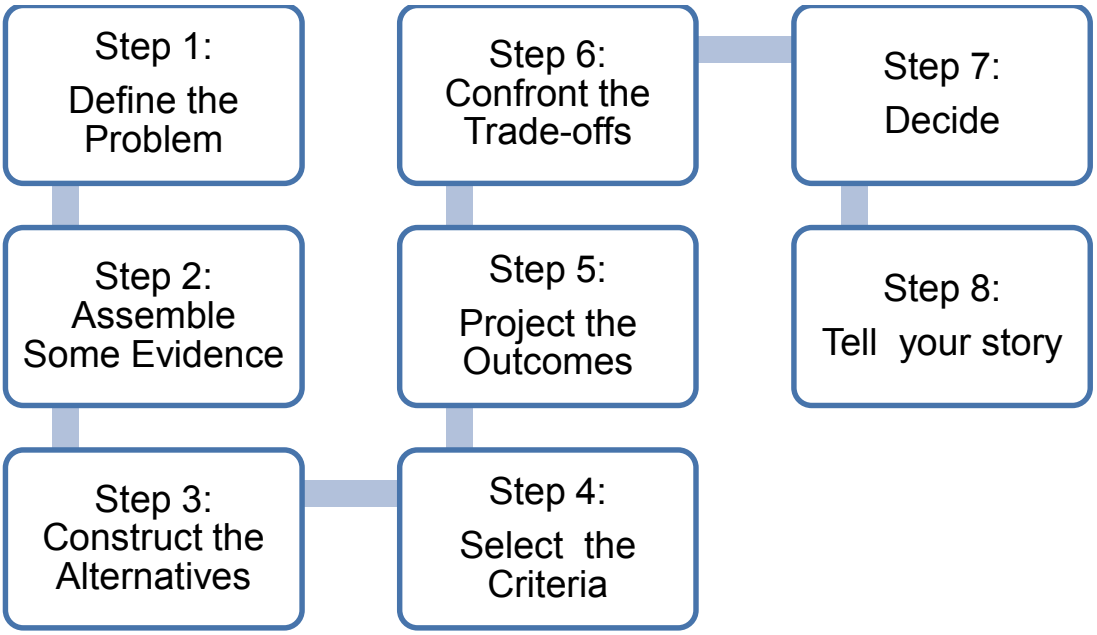

Figure 1. Bardach's eightfold path to policy analysis. *Source*. Adapted from Bardach (2012). Copyright 2012 by CQ Press.

CPAP USE THROUGH THE EYES OF THE CLIENT: A REVIEW OF LITERATURE

by

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MANUSCRIPT 2

CPAP USE THROUGH THE EYES OF THE CLIENT: A REVIEW OF LITERATURE

Abstract

Background and Purpose: Obstructive sleep apnea (OSA) is a growing public health issue. Continuous Positive Airway Pressure (CPAP) is the recommended treatment for OSA; however, adherence is low. Insight from CPAP users can potentially increase healthcare professionals' understanding of CPAP from the user's perspective. This review examines CPAP use through the eyes of CPAP clients.

Methods: A literature search of CINAHL, PubMed, Scopus, and PsychINFO was conducted for years 2006-2016. Thirty-three articles were included.

Conclusions: CPAP use is a complex health management behavior that some individuals successfully master. Issues surrounding CPAP use frequently discussed in the literature include mask related side effects such as claustrophobia and discomfort. Aspects of the experience, such as body image, intimacy, financial impacts, and individualized/culturally appropriate education are CPAP characteristics that have received little attention.

Implications for Practice: It is important that OSA and CPAP information is tailored to an individual's needs. Key timepoints to assess beliefs, attitudes, and needs are: the time leading to a formal OSA diagnosis, during and after the sleep study, and the first week and months after CPAP treatment is begun. Nurse practitioners can meet client needs by conducting thorough assessments and delivering tailored education that includes all aspects of the CPAP experience.

Keywords: obstructive sleep apnea, continuous positive airway pressure, patient satisfaction, review, sleep disorders

CPAP Use Through the Eyes of the Client: A Review of Literature

Obstructive sleep apnea (OSA) is a growing public health and safety problem and the most common form of sleep disordered breathing (Lam, Sharma, & Lam, 2010). It is a chronic condition characterized by closure of upper airway soft tissues and obstruction that cause recurrent episodes of apnea and hypopnea during sleep (Sanchez-de-la-Torre, Campos-Rodriguez, & Barbe, 2013; Stone, Taylor, McCrae, Kalsekar, & Lichstein, 2008). Frequent arousals and fragmented, non-restorative sleep are associated with the recurrent episodes of obstruction (Stone et al., 2008). Individuals who have OSA often experience residual sleepiness related to issues such as hypoxia (Feng, Wu, Zhang, & Chen, 2012), primary sleep insufficiency (Al Lawati, Patel, & Avas, 2009; Risso et al., 2013), and inadequate treatment (Mulgrew et al., 2010). Obstructive sleep apnea has been associated with hypertension (HTN), cardiac arrest, arrhythmia, stroke, diabetes mellitus, cognitive impairment, and an increased risk of motor vehicle crashes (MVCs) (Kendzerska, Gershon, Hawker, Tomlinson, & Leung, 2014; Sanchez-de-la-Torre et al., 2013; Tregear, Reston, Schoelles, & Phillips, 2009). Because signs and symptoms of OSA are only evident during sleep, the condition is often undiagnosed. In fact, OSA is often undiagnosed and untreated (Punjabi, 2008) with an estimated 85% of individuals undiagnosed (Kapur et al., 2002). Resultant symptoms such as daytime sleepiness and declines in cognitive performance may not be recognized or may be attributed to other circumstances or health conditions. An increased risk of MVCs has been associated with untreated OSA and ineffective treatment in both commercial and non-commercial drivers (Tregear et al., 2009). Motor vehicle drivers diagnosed with OSA are at a two to seven-

fold increased risk of MVCs (Howard et al., 2004; Mulgrew et al., 2008; Shiomi et al., 2002).

Obstructive sleep apnea is a treatable condition and continuous positive airway pressure (CPAP) is the recommended treatment modality. Continuous positive airway pressure provides a continuous flow of air via an interface such as a facial mask or nasal pillow; the air flow keeps the airway open and eliminates apneic events (Ryden, Bando, & Aysola, 2014). Continuous positive airway pressure has been shown to be effective in treating OSA with clear benefits including MVC risk reduction (Tregear, Reston, Schoelles, & Phillips, 2010). Improvements in daytime sleepiness have also been noted with as little as one night of CPAP treatment (Tregear et al., 2010). Despite evidence that CPAP is effective in treating OSA, adherence to CPAP treatment is low, and subjective reports of adherence often overestimate adherence rates, compared to objective measures of adherence (Amfilochiou et al., 2009; Hui et al., 2006; Salepci et al., 2013). In the general population, research has shown that adherence to CPAP treatment ranges from 30% to 60% (Weaver & Sawyer, 2010).

There is little evidence regarding specific determinants of CPAP adherence (Amfilochiou et al., 2009; Salepci et al., 2013; Weaver & Grunstein, 2008; Ye et al., 2012). A significant number of barriers and facilitators have been found to impact CPAP adherence; however, a majority of the research is from a healthcare or clinical perspective (Ward, Hoare, & Gott, 2014). Ward et al., (2014) recommend more research exploring CPAP from the users' perspectives and in their own words. For both clinicians and researchers, greater awareness of the personal experiences surrounding CPAP adherence has the potential to clarify important predictors of CPAP use. Identification of such

predictors is particularly important among vulnerable populations and in nontraditional occupational environments. The purpose of this review of literature is to synthesize the evidence surrounding the CPAP experience of persons diagnosed with OSA with particular focus on the user's experience associated with CPAP use.

METHODS

Literature Search

To provide direction and ensure that the goal of the review was achieved, a guiding question was formulated based on previous literature: What are the experiences of CPAP use among individuals diagnosed with OSA?

PubMed, CINAHL Plus, Scopus and PsycINFO were searched to identify relevant studies on personal CPAP experiences. Search terms included obstructive sleep apnea, continuous positive airway pressure, positive airway pressure, experiences, and perceptions. To identify additional articles, the terms workers and employees were used to identify studies among worker populations.

Inclusion and Exclusion Criteria

Articles included were those: 1) written in the English language, 2) published between 2006 and 2016, and included 3) only adults aged 18 years and older, 4) included CPAP as the treatment modality for OSA, 5) an examination of users' experiences with CPAP, and 6) individuals who used CPAP for 2 weeks or longer. Studies were excluded for the following reasons: 1) CPAP was used for conditions other than OSA, 2) Bi-level positive airway pressure was used as the treatment modality, and 3) the study did not examine any aspect of the user's experience with CPAP. Bi-level devices are not typically used in the initial treatment of OSA, but are generally reserved for treatment of

central apnea, more complicated sleep disordered breathing, or with people who failed CPAP. Dissertations, books, magazines, and conference proceedings were also excluded.

Review Method and Outcome

Database queries yielded 606 articles. Titles and abstracts were examined to identify studies with the greatest relevance to users' CPAP experience. From title and abstract reviews, 217 articles were eliminated because the studies did not address CPAP use; 353 duplicate articles were removed. Thirty-six relevant articles were identified for full text review. Upon further review, an additional six articles were rejected because they did not meet inclusion criteria. Three relevant articles were identified from an integrative review (Ward et al., 2014). A total of 33 articles were included in the final review (see Figure 1). Of the 33 articles, 13 described a quantitative design, 18 used qualitative designs, and two employed mixed method studies.

FINDINGS

Although limited in providing users' perspectives, results of quantitative studies often address specific information about side effects of CPAP use and CPAP adherence. Participants in quantitative studies experienced a variety of side effects such as mask discomfort and mask related side effects (El-Solh, Ayyar, Akinnusi, Relia, & Akinnusi, 2010; Fox et al., 2012; Kasai et al., 2008). Mask related issues were frequently cited as CPAP problems that impacted uptake of treatment and adherence (Aloia, Arnedt, Stanchina, Millman, 2007; Holmdahl, Schollin, Alton, & Nilsson, 2009; Kasai et al., 2008). Among veterans diagnosed with post-traumatic stress disorder (PTSD), mask discomfort was the most common reason for CPAP non-adherence in those with PTSD

and the control group (El-Solh et al., 2010). Other side effects included high pressure, air hunger, and claustrophobia (El-Solh et al., 2010).

CPAP treatment is a lifelong therapy, thus studies addressing long term adherence are important. Among a group of patients diagnosed with OSA and cardiovascular disease who were CPAP naïve, Chai-Coetzer et al. (2013) examined predictors of CPAP use over a one-year period of time. Particular focus was given to early indicators of adherence. With adherence defined as a mean ≥ 4 hours/night of CPAP use, findings revealed adherence progressively decreased over time. Side effects of treatment that reduced adherence were categorized into seven areas: Mouth dryness, nasal symptoms, eye problems, claustrophobia, noise problems, facial soreness or skin irritation caused by mask, and mask fit/leak problems. The most commonly found side effects at one month were dry mouth, nasal symptoms, and mask fit or mask leak problems. An increasing side effect score at one month was independently associated with lower CPAP adherence at 12 months. Further findings revealed that mean daily CPAP use and side effects score at one month were independent predictors of 12-month CPAP adherence (Chai-Coetzer et al., 2013). These findings suggest that early CPAP use may directly influence long term adherence.

In most of the studies, standardized checklists or single item questions were used to assess problems with CPAP use. Such approaches generally do not allow space for CPAP users to provide in-depth information about their CPAP experiences; nevertheless, relevant information was gained from these approaches. A study that compared perceived informational needs and side-effects between CPAP patients and health care providers used the Side-effects of CPAP Inventory (SEC-I) and the Informational Needs

of CPAP-Inventory (INC-I) (Brostrom et al., 2009). These instruments were specifically designed to survey CPAP related information needs and CPAP side effects. Content validity for both instruments was established with themes from in-depth interviews conducted with patients diagnosed with OSA and healthcare personnel (Brostrom et al., 2009; Brostrom et al., 2010a).

Fung et al. (2015b) developed the Usability of Sleep Apnea Equipment-Positive Airway Pressure questionnaire (USE-PAP) to examine patients' experiences using the CPAP machine and related equipment. It was designed to assess users' practices with assembling, operating, cleaning, and maintaining the machine and implements. Development included interviews with CPAP patients, an expert advisory panel, cognitive interviews, and field tests. Internal consistency of the instrument scales was high with a Cronbach' coefficient alpha of ≥ 0.84.

These instruments are important because they are designed specifically to assess CPAP users' information needs, their skills handling CPAP equipment, their experiences with side effects and were developed from a users' perspective versus solely from a medical paradigm or a health care provider perspective. The instruments by Fung and Brostrom provide quantifiable methods to assess CPAP users' needs and experiences.

In the review of studies that provided in-depth exploration of users' perspective using qualitative methodology, five groups of barriers and facilitators emerged. While some of these were similar as previously described, such as device/mask related issues, others differed such as human factors, interactions with the healthcare team, financial costs, and psychosocial factors.

Device/mask

Side effects of CPAP therapy are frequently experienced among CPAP users and a wide range of adverse effects have been identified (Bachour, Vitikainen, Virkkula, & Maasilta, 2013; Brostrom et al., 2010a; Pepin et al., 1995). However, device and mask side effects are frequent complaints among CPAP users (Bachour et al., 2013; Brostrom et al., 2010b; Sawyer, Deatrick, Kuna, & Weaver, 2010).

An examination of patients' experiences with CPAP identified device related barriers to CPAP included "practical problems" such as pressure from the mask, air leakage, mask adjustment, changing positions during sleep, and troubling noise (Brostrom et al., 2010b, p. 128). In a comparison of CPAP to oral appliances (OA) (a treatment device for OSA similar to a mouth guard used in sports), Almeida et al. (2013) found the five most frequently mentioned complaints regarding CPAP were related to 1) discomfort, 2) machine noise that disturbed sleep, 3) poor mask fit, 4) claustrophobia, and 5) cleaning the device. A range of side effects were attributed to discomfort namely the machine caused users to feel hot, left mask marks on face, air leakage that blew into the eyes, and limited mobility and sleeping positions. All OA users had been prescribed and used CPAP prior to using OA. The researchers did not explore OA users' reasons for switching from CPAP; however, CPAP side effects experienced by some individuals may lead them to seek other treatment options. Examination of such changes in OSA treatment could provide insight on the nuances of treatment that may cause individuals to abandon CPAP. Despite the side effects, overall, participants using CPAP were satisfied with their treatment choice (Almeida et al., 2013).

In a unique study that specifically examined different CPAP interfaces (i.e. face masks, nasal pillows), a sample of 730 participants completed questionnaires regarding satisfaction with their specific CPAP mask or nasal pillow, frequency of side effects, and other disconcerting elements related to treatment (Bachour et al., 2013). Fifteen different types of CPAP interfaces were represented in the study, and a variety of side effects were noted. Disturbing interface leaks, a frequent side effect of CPAP therapy, were experienced by 65% of participants. Another frequent complaint, skin marks caused by the interface and straps, was experienced by approximately half of the sample with 20% of the sample also reporting minor skin lesions. Approximately one-third (30%) of users found their interface uncomfortable. Poor fit, strap discomfort and noise were the main causes of annoyance. In addition, adjustments to sleep habits and sleep position were experienced by 23-26% of the sample (Bachour et al., 2013). These types of interface/device related complaints are commonly expressed by CPAP users (Dickerson & Akhu-Zaheya, 2007; Hu, Yu, Lee, & Tsao, 2013).

The ability to adjust or overcome side effects and CPAP issues is often seen among CPAP users (Brostrom et al., 2008; Matthias et al., 2014; Sawyer et al., 2010; Willman, Igelstrom, Martin, & Asenlof, 2012). Patients who experienced transient ischemic attacks (TIAs) and strokes described making "mid-course adjustments" that included identifying modifications that helped them sleep with the mask and just dealing with discomforts because the CPAP treatment was needed (Matthias et al., 2014, p. 151). In a study that explored how CPAP users problem solved to overcome CPAP side effects, those who adjusted to CPAP set goals centered on adapting to CPAP and finding solutions to challenges they experienced when using their machines (Sawyer et al., 2010).

For example, one participant described using self-talk to overcome feelings of claustrophobia. In contrast users who did not adapt well to CPAP, did not discuss setting goals related to CPAP or describe ways in which they overcame problems using CPAP (Sawyer et al., 2010). Others have simply persevered with CPAP because they felt the benefits of treatment outweighed the challenges (Dickerson & Kennedy, 2006; Willman et al., 2012).

To examine CPAP use among individuals with moderate or severe OSA (AHI > 15) and obesity (BMI > 30), Willman et al. (2012) conducted in-depth interviews focused on the personal experience of using CPAP. Common barriers to CPAP, such as mask discomfort, air leakage, dry nasal passages, nose bleeds, machine noise, difficulty handling the device, and adjusting to CPAP pressure were associated with the theme, "Coming to terms with wearing CPAP" (Willman et al., 2012, p. 168). As seen with the CPAP interface study (Bachour et al., 2013), participants continued with treatment despite experiencing side effects (Willman et al., 2012).

Though some CPAP users are able to overcome negative side effects and persevere in using their CPAP devices, this is not the case for all. For some, the problems encountered with using the CPAP machine, wearing the mask, and managing the device are too great, and many stop treatment (Matthias et al., 2014; O'Donoghue & McKay, 2012; Tyrrell, Poulet, Pe'pin, & Veale, 2006; Wang, Gao, Sun, & Chen, 2012). The differences in abilities to overcome problems encountered using CPAP highlight the individualized nature of the CPAP experience.

Human Factors

As has been noted some of the common physical complaints about CPAP include sleep disturbance, nasal symptoms, and facial markings from the mask. These complaints are related to the CPAP device as a whole; however, little research has focused solely on human factors related to CPAP use. Human factors are defined as "…a body of knowledge about human abilities, human limitations, and human characteristics that are relevant to design" ("Definitions," n.d.). Using semi-structured interviews, Fung et al. (2015a) explored how the design of CPAP devices support or hinder CPAP use among individuals with physical or sensory impairment. Types of physical and sensory impairments represented were tremor, weakness, impaired vision, loss of digits, numbness, and limited range of motion. Using a list of 24 common CPAP related problems, study participants were asked to address common problems associated with CPAP and to identify other problems that were not listed. Difficulty in setting up and using the machine increased the amount of time and effort required to use the device, as well as, the amount of frustration toward treatment. Problems were encountered with applying the mask and manipulating machine controls and device components (e.g. filter, water chamber, tubing). Participants expressed desires for redesigned masks that were easier to put on and CPAP machines that required less effort to operate (Fung et al., 2015a). Among CPAP users who were not identified as having physical/sensory impairments, similar suggestions for mask and machine redesign have been expressed (Bachour et al., 2013; Henry & Rosenthal, 2013).

Fung et al. (2015a) recommended that presentation of CPAP information should include a variety of modalities. Multi-modal presentations are in alignment with research

findings that suggest delivery of CPAP and OSA education is inadequate for many individuals (Hu et al., 2013; Shoukry, Wong, Bartlett, & Saini, 2011; & Wang et al., 2012). CPAP information may be better received with the incorporation of strategies that target various learning styles. Attention to human factors related to the CPAP mask and device use are worthy of more attention as both equipment design and delivery of related information impact CPAP use among users with and without physical/sensory impairments.

Interactions with the Healthcare Team

The healthcare team is an integral part of the OSA diagnosis and treatment process. An individual's interactions with the team and the healthcare system influence the CPAP experience (Bakker, O'Keeffe, Neill, & Campbell, 2014; Brostrom et al., 2010b; Hu et al., 2013; Shoukry et al., 2011). Interactions can serve as either barriers or facilitators to CPAP adherence. Common issues related to healthcare/system issues encountered with CPAP diagnosis and treatment are: 1) too much information, 2) inadequate information, 3) inadequate engagement, 4) desire for personalized information, and 5) systematic processes related to OSA diagnosis and CPAP therapy.

A study by Brostrom et al. (2010b) identified inadequate support from the healthcare team as a barrier to CPAP use; barriers were described as insufficient information about the CPAP machine and insufficient help with side effects and device problems. Many CPAP users reported they felt overwhelmed and that too much information was provided when their diagnoses were finalized and recommendations for treatment were made (Bakker et al., 2014; Shoukry et al., 2011). Hu et al. (2013) found inadequate health care team support was a similar barrier among a sample of Taiwanese

patients prescribed CPAP. However, CPAP users felt that not enough information was shared during the diagnosis/treatment process (Hu et al., 2013). As described in a study among individuals purchasing CPAP equipment from local pharmacies, users stated that educational information was too generic, not tailored to the individual, or descriptive of what it's like to live with CPAP (Shoukry et al., 2011). Similar desires have been expressed for more personalized information as well as exposure to people who have succeeded in using CPAP (Bakker et al., 2014). An alternative way CPAP users gain information is from CPAP users who have become expert in adapting CPAP into their lives. These "experts" often serve as encouragers and information sources for individuals who are new CPAP users (Bakker et al., 2014; Dickerson & Kennedy, 2006)

While perceived shortcomings in healthcare encounters have been cited as hindrances to CPAP use, interactions with the healthcare team also have been facilitators to CPAP use. Brostrom et al. (2010b) found trust in healthcare personnel to be a facilitator to CPAP adherence. Trust as described by study participants was based on a good relationship with the provider and a thorough introduction to CPAP (Brostrom et al., 2010b). Delivery of OSA and CPAP information by healthcare professionals in a culturally appropriate manner was also seen as a facilitator to CPAP use (Bakker et al., 2014). Among patients who received their CPAP devices from a local pharmacy, patients expressed satisfaction with service, delivery of information by pharmacists, the personalization of information and service as well as having a consistent provider (Shoukry et al., 2011).

A variety of systemic problems within healthcare systems which negatively influenced users' experiences with CPAP were noted. For CPAP users in the United

States, the inability to get information about CPAP machines from insurance companies and home care agencies was troubling (Dickerson & Akhu-Zaheya, 2007). Individuals felt that the agencies were more concerned with selling equipment rather than helping patients or being concerned about patients' health. Another source of frustration occurred when insurance companies refused to cover the cost of the CPAP machine or additional equipment (Dickerson & Akhu-Zaheya, 2007). Users in Taiwan experienced similar challenges with agencies that sell CPAP equipment such as inadequate information and spending a great deal of time to facilitate repair of equipment (Hu et al., 2013).

In the New Zealand healthcare system, CPAP patients expressed confusion regarding the processes for diagnostic referral and treatment (Bakker et al., 2014). When patients were seen by multiple providers, for many it was unclear which provider was responsible for the various aspects of care. Further, patients were unaware of the services and care protocol under the government sponsored healthcare and private pay entities (Bakker et al., 2014). The types of systemic problems are varied, and the relationship of these problems to CPAP use are not well known.

Financial Costs

Due to the lifelong nature of CPAP therapy, users have expressed concern regarding financial factors associated with equipment maintenance and replacement (Bakker et al., 2014). For some individuals, the cost of CPAP treatment was a barrier to acceptance (Bakker et al., 2014; Shoukry et al., 2011; Wang et al., 2012). In contrast, others expressed that the need for treatment outweighed the expenses; thus, they were willing to bear the financial costs (Almeida et al., 2013). Yet for participants in two

studies conducted in Israel, low socioeconomic status was found to be a risk factor for CPAP non-acceptance regardless of the negative or positive experiences with CPAP (Simon-Tuval et al., 2009; Tarasiuk, Reznor, Greenberg-Dotan, & Reuveni, 2012). According to Israel's National Health Law, patients are required to pay a mandatory copayment to initiate CPAP treatment (Simon-Tuval et al., 2009). The copayment ranges from 25-50% of the cost of the CPAP device (Turaski et al., 2012). Among studies conducted in the United States, the CPAP experience was impacted by financial concerns. Frequently, individuals had to advocate for themselves with insurance companies that would not cover the costs of needed equipment or determined the patient did not need the CPAP machine (Dickerson & Akhu-Zaheya, 2007; Rodgers, 2014). Despite concern that they may have a treatable breathing condition and a desire for testing, some who lacked insurance were unable to pay for diagnostic sleep study tests and possible initiation of treatment (Rodgers, 2014).

Cost effectiveness analyses regarding OSA diagnosis and CPAP can be found in the literature (Deutsch, Simmons, & Wallace, 2006; Guest, Helter, Morga, & Stradling, 2008). However, the financial aspect of OSA diagnosis and CPAP treatment are not frequently addressed within the context of users' experiences. The findings revealed through these studies, highlight financial cost of treatment as an important aspect of the CPAP experience or in some cases the reason CPAP treatment is never started. Financial implications and the relationship to CPAP adherence is an area in need of further examination.

Psychosocial

Self-management of CPAP is a complex behavior that involves physical, psychological and social elements. Psychosocial factors, such as, knowledge, outcome expectations, social support, self-efficacy, body image, and intimacy have been found to facilitate or hinder CPAP adherence.

Sawyer et al. (2010) found that knowledge of OSA and CPAP was a key aspect to diagnosis and accepting treatment. For adherent individuals, knowledge of OSA risks and CPAP benefits served as facilitators to treatment. Adherent participants were able to relate their knowledge to expected outcomes of treatment. Attainment of the outcomes further supported their use of CPAP. Knowledge of OSA and CPAP at diagnosis was similar among adherent and non-adherent individuals; however, among some who were non-adherent, their knowledge of OSA and CPAP were barriers and delayed their pursuit of a diagnosis for sleep symptoms. As time progressed, those who were adherent to therapy focused on the positive responses to CPAP experienced during their sleep studies and during the first week of treatment.

The positive influence of knowledge and outcomes were also seen among individuals diagnosed with OSA and obesity (Willman et al., 2012). For study participants who understood the risks associated with OSA their knowledge served as a facilitator to CPAP use despite challenges with therapy. Additionally, expectations that physical symptoms would improve served as a facilitator to treatment (Willman et al., 2012). This phenomenon has been reported in other studies (Hu et al., 2013). In contrast, Sawyer et al., (2010) found that non-adherent users' attitudes toward CPAP focused more on the negative experiences and lack of response with CPAP during the

sleep study. Initial exposure to CPAP may play a significant role in adherence as CPAP during sleep studies and peoples' attitudes may influence treatment acceptance and usage.

Social support has shown promise in helping CPAP users troubleshoot and overcome treatment problems and concerns. Family, friends, and support groups have been found to be facilitators to CPAP use (Willman et al., 2012). Spouses and bed partners were instrumental in helping with setting up and using the machine and providing support from diagnosis through treatment (Luyster et al., 2014; Rodgers, 2014; Sawyer et al., 2010). Family, friends, and social networks have been sources of help and information particularly when adequate information was not gained from healthcare providers or CPAP equipment suppliers (Bakker et al., 2014, Dickerson & Kennedy, 2006; Henry & Rosenthal, 2013).

Improved relationships with friends and spouses further enhanced the CPAP experience and served as a motivator to continue with treatment. Users reported better relationships with spouses and full engagement in social activities (Brostrom et al., 2008; Sawyer et al., 2010; Willman et al., 2012); however, negative social aspects (i.e. traveling with the machine and disturbances in interactions with bed partners) were also a part of the CPAP experience (Ayow, Paquet, Dallaire, Purden, & Champagne, 2009; Willman et al., 2012). Despite negative aspects of treatment, self-report of CPAP adherence was high among some users suggesting that individuals were able to overcome the negative aspects and continue CPAP therapy (Willman et al., 2012). Though social support has been found to be a facilitator of CPAP use, studies have found lack of support from family/friends (Brostrom et al., 2010b; Fung et al., 2015a), spousal pressure (Baron et al.,

2011) and negative reactions by spouses, family, friends, and associates (Bakker et al., 2014 Ayow et al., 2009) to be associated with lack of CPAP adherence.

Self-efficacy of CPAP use was a dominant theme among both adherent and non-adherent participants (Sawyer et al., 2010). Perceived self-efficacy is defined as the belief that a person can control his/her health habits (Bandura, 2004), in this case CPAP use. Given the complex nature of CPAP therapy, perceived self-efficacy of CPAP use is a factor that is thought to influence CPAP management. Adherent participants verbalized a belief that they could successfully use CPAP in the long-term. This is in sharp contrast to non-adherent participants who had negative experiences with CPAP and were not successful in troubleshooting CPAP difficulties (Sawyer et al., 2010).

A phenomenon similar to self-efficacy was noted in several studies conducted among CPAP users. The phenomenon, accommodating CPAP into one's lifestyle, involved the back and forth of trial, error, and success; the give and take in an effort to persist with CPAP (Dickerson & Kennedy, 2006). This determination to persist with CPAP was seen among CPAP users within the general population (Brostrom et al., 2008; Luyster et al., 2014), as well as specific populations such as persons who experienced TIAs and strokes (Matthias et al., 2014), and patients with OSA and obesity (Willman et al., 2012). Perceived self-efficacy is an important factor in adherence and warrants close examination among various populations who are prescribed CPAP.

Body image and intimacy are two areas that are impacted by CPAP yet receive very little attention. CPAP users have described feeling stigmatized by coworkers and friends because of the user's inability to stay awake or their use of CPAP (Ayow et al., 2009; Brostrom et al., 2008), while others stated they initially felt ashamed because they

had to use CPAP (Luyster et al., 2014). For some the perceived stigma was so great that they abandoned treatment (Ayow et al., 2009).

In addition to stigma, CPAP users have expressed feelings of negative body image due to the CPAP apparatus (Ayow et al., 2009; Henry & Rosenthal, 2013; Luyster et al., 2014) and feeling uncomfortable wearing the mask in the presence of others (Brostrom et al., 2007). A woman commented, "You feel like a monster…You don't like to see yourself with this contraption on your face" (Ayow et al., 2009, p. 233). Others have verbalized feeling less sexually attractive and concerned about their partners' reactions and receptivity of them wearing the CPAP mask (Henry & Rosenthal, 2013; Rodgers, 2014). Some female users described specific bedtime regimens that they followed so their husbands would not see them wearing the face mask (Ayow et al., 2009; Henry & Rosenthal, 2013). Concerns about intimacy are not unique to female CPAP users. Male CPAP users have expressed concerns about lost love and affection because of having to wear the CPAP device (Henry & Rosenthal, 2013; Luyster et al., 2014). These concerns felt by both males and female CPAP users have led some individuals to delay diagnosis (Rodgers, 2014). For partners of CPAP users, anticipated interference with intimacy may also be a concern (Brostrom et al., 2008). Yet, bed partners were overwhelmingly found to be supportive and did not reject their partners due to CPAP use (Brostrom et al., 2008; Henry & Rosenthal, 2013; Luyster et al., 2014; Rodgers, 2014).

Experience with CPAP treatment has universal qualities despite geographic location or the type of health system in which the treatment modality has been prescribed. The experiences described above transcend geography, race, and ethnicity.

Practice Recommendations

Individuals diagnosed with OSA desire and welcome information on OSA and CPAP, particularly from the healthcare team. Timing of information delivery and the amount of information shared is important. Providing individuals with information during the time leading up to formal OSA diagnosis and polysomnography is very important. Sharing accurate information about OSA and CPAP during this time may help to alleviate concerns, fears, and misconceptions that people may have about OSA and CPAP treatment. The information shared and the rapport established with the healthcare team may influence CPAP uptake. Nurses are in a prime position to meet these educational needs by tailoring information and interventions based on client needs. Family and significant others should be involved in education and interventions offered to CPAP users. By assessing and seeking to fill knowledge deficits with patients, family members, and significant others, nurses can identify challenges that are experienced by clients and help clients to problem solve, overcome the challenges, and accommodate CPAP into their lifestyles. Such efforts have the potential to positively impact CPAP use, increase adherence, and improve work life and overall QOL for individuals diagnosed with OSA.

Researchers have found that the first week of CPAP use is a critical time when CPAP users often decide to accept or abandon the treatment modality. Studies have shown that the first week of CPAP therapy is crucial to uptake and long-term adherence (Chai-Coetzer et al., 2013; Weaver & Sawyer, 2010). Other studies have shown that the experience with CPAP during the diagnostic sleep study can negatively impact an individual's perception of and ability to acclimate to CPAP (Sawyer et al., 2010). Hence,

first exposure to CPAP during sleep studies and initial use in the home environment are critical timepoints that influence users' attitude toward CPAP. After the sleep study and, at a minimum, throughout the first week of therapy it may be beneficial to discuss with individuals their feelings about CPAP and ways to overcome any self-identified challenges.

In examining the user's experience with CPAP it appears that it may take several months for some to adjust to using the machine, becoming comfortable with the device, overcoming challenges, and learning to handle side effects (Brostrom et al., 2008). Therefore, CPAP education and treatment should include close follow-up for several months to assist individuals in identifying ways to incorporate CPAP into their lives. Education and follow-up should be tailored to the individual, include culturally appropriate terminology, and examples that users understand and can apply to their daily lives. Connecting CPAP users with others who have been successful adapting to and using CPAP may be an effective strategy as well as providing reputable online sources of information.

Research Implications

More research is needed that examines CPAP use from users' perspectives (Ward et al., 2014). Research focused on users' perspective has the ability to capture the nuanced experiences and insights that can only be gained from first-hand accounts of CPAP use. Instruments such as the INC-1 (Brostrom et al., 2010a), the SEC-1 (Brostrom et al., 2010a), and the USE-PAP (Fung et al., 2015b) provide methods to capture CPAP users' perspectives on the experience of using CPAP versus a medical or the healthcare providers' viewpoint. Having reliable and valid instruments to capture the CPAP users'

perspectives will facilitate researchers' ability to examine the user perspective in statistical approaches to determine the contribution of the user perspective in CPAP adherence in relation to other factors. Examining CPAP use from the users' perspective in occupations where extensive driving is required may help in finding ways to increase adherence within these groups and reduce MVCs. Research that specifically examines CPAP use among new users is also needed.

Continuous positive airway pressure technology has changed relatively rapidly over the years with machines that blow less air that may disrupt a sleep partner, have more comfortable interfaces, are quieter, and give the user daily feedback about whether the CPAP user received adequate pressure during the night. Studies with users using these improved machines are needed to determine if these device changes improve adherence. Additionally, more research is needed that explores the impact of CPAP use on body image and sexuality and the financial issues that surround CPAP use. Mixed methods studies may be needed to fully examine these issues.

Conclusion

Continuous positive airway pressure treatment is a complex health management process. The studies in this review highlight some of the important aspects of CPAP treatment that are critical from the user's perspective. Some topics, such as body image, intimacy, financial influences, and the need for individualized/culturally sensitive education have received limited attention in the literature. Other aspects such as device/machine challenges, interface discomfort, claustrophobia, and sleep disturbances are well known and have been acknowledged in the literature and addressed through technology innovation. For example, there are a variety of face masks and pillows to

address interface discomfort, and technological advances have led to quieter, smaller, more sophisticated machines.

Though it was not the focus of this review, in addition to revealing the CPAP experience some articles addressed the impact that OSA has on individuals' engagement at work as well as participation in their family and social lives. From these studies, it is apparent that the experience of having OSA symptoms, receiving an OSA diagnosis, and being prescribed CPAP cannot be separated from the experience of using CPAP. When interacting with potential CPAP users, exploring the impact of OSA on their work and social relationships may help individuals better understand how the condition impacts their lives and increase CPAP acceptance.

This review illuminates the uniqueness of the CPAP user's experience with complex disease management and the need for continued research and education strategies to enhance the user's experience. Improved education, more substantial interactions with the healthcare team, and tailored intervention strategies may enrich users' CPAP experience and possibly increase adherence. Better adherence has the potential to improve safety in personal and job related activities as persons with inadequately treated OSA experience sleepiness and fatigue that can affect performance. Increased adherence has the potential to increase QOL of both CPAP users and their significant others. Continuous positive airway pressure use is a multidimensional, multi-factorial process and hearing from the people who use the treatment modality provides a rich and insightful perspective regarding CPAP users' needs, as well as, opportunities for practice and future research.

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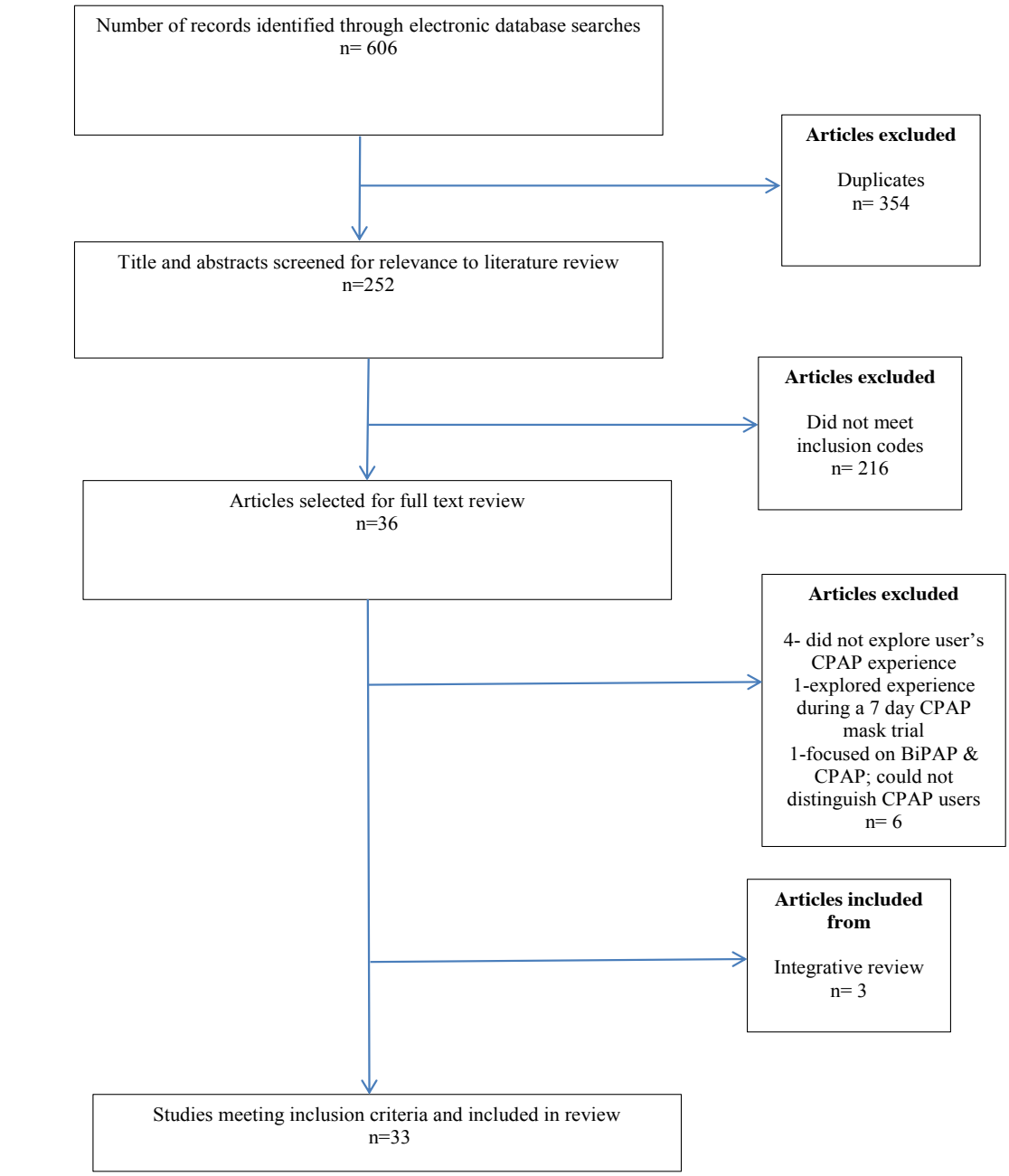

Figure 1. Search Results

EXPLORATION OF CPAP USE IN LONG-HAUL TRUCK DRIVERS

by

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MANUSCRIPT 3

EXPLORATION OF CPAP USE IN LONG-HAUL TRUCK DRIVERS

Abstract

The estimated prevalence of obstructive sleep apnea (OSA) among commercial motor vehicle drivers is 13-28%. Federal regulations require continuous positive airway pressure (CPAP) treatment for truck drivers diagnosed with OSA. The aim of this study was to explore CPAP use among long-haul truck drivers while they were working over the road. Fourteen long-haul truck drivers were interviewed individually about their experiences with CPAP. Five themes emerged from the data: (a) It takes time to adapt to CPAP; (b) No different than home; (c) Being prepared to hit the road with CPAP; (d) Caring, coercion, or just feeling better, and (e) A constant source of aggravation to use CPAP on the road. The findings demonstrate that long-haul truck drivers can successfully use CPAP when working over the road despite barriers encountered at multiple levels. This study reveals the need for multi-level strategies to support CPAP use in the trucking industry.

Introduction

Obstructive sleep apnea (OSA) is a growing public health and safety problem. In the general population, OSA prevalence has increased since the early 1990's to an estimated 13-26% among U.S. adults (Peppard et al., 2013; Young et al., 1993). As a major health condition, OSA has been associated with hypertension (HTN), cardiovascular disease (CVD), stroke, diabetes mellitus (DM), cognitive impairment, and increased risk of motor vehicle crashes (MVCs) (Kendzerska, Gershon, Hawker, Tomlinson, & Leung, 2014; Sanchez-de-la-Torre, Campos-Rodriguez, & Barbe, 2013; Tregear, Reston, Schoelles, & Phillips, 2009). OSA is treatable with continuous positive airway pressure (CPAP) as the primary recommended treatment modality. Although CPAP is effective in treating OSA and reducing MVC risk (Tregear, Reston, Schoelles, & Phillips, 2010), adherence and uptake of CPAP is low among those diagnosed with OSA (Kales & Straubel, 2014).

Commercial motor vehicle drivers (CMVDs) transport people and property in both interstate and intrastate commerce (National Highway Traffic Safety Administration, n.d.). As of December 2016, the Federal Motor Carrier Safety Administration (FMCSA) estimated that there were 3 million active CMVDs in the United States (FMCSA, 2017). A specific group of CMVDs are commonly referred to as long-haul truck drivers (LHTDs) or over-the-road drivers. These LHTDs drive long distance interstate routes and either drive alone or with a driving partner (team driver) (Triplett, 2012).

Among CMVDs, OSA prevalence is estimated between 13 and 28% (Berger et al., 2012; Gurubhagavatula, Maislin, Nkwuo, & Pack 2004; Talmage, Hudson, Hegmann,

& Thiese, 2008). In the transportation industry, OSA has been cited as a significant sleep disorder (Kales & Straubel, 2014). A systematic review and meta-analysis of OSA-related MVC risk in commercial drivers indicated that commercial drivers diagnosed with OSA had a 2-fold higher MVC rate per mile than commercial drivers without the OSA diagnoses (Tregear et al., 2009). LHTDs diagnosed with OSA must submit yearly reports documenting that they are compliant with the Department of Transportation (DOT) regulations, which require CPAP use four hours nightly for 70% of nights (Ancoli-Israel, Czeisler, George, Guilleminault, & Pack, 2008). Any driver out of compliance with the regulations could lose driving privileges, receive medical clearance to drive for only three months versus a year, or lose employment.

The structure of the trucking industry and nature of LHTDs work may contribute to OSA risk and may impede effective diagnosis, treatment, and treatment adherence. Working as a LHTD is arduous work regulated by both state and federal laws. Long-haul truck drivers are subject to irregular work schedules and may be away from their homes for several days or weeks at a time (Apostolopoulos, Sonmez, Shattell, Gonzales, & Fehrenbacher, 2013), which in turn impacts their access to health care, medical treatment, and supplies. Studies have shown that truckers experience significant rates of sleep disturbances and comorbidities including CVD, HTN, DM, and obesity (Apostolopoulos, Sonmez, Shattell, & Belzer, 2010; Sieber et al., 2014). For the LHTD diagnosed with OSA, the workplace environment creates a challenging environment for proper CPAP use. People in the general population who are prescribed CPAP typically use CPAP machines in the convenience of their homes. This is not the case for LHTDs who, when on the road, use CPAP while sleeping in a truck sleeper berth. Located behind the driver

and passenger seats, the sleeper berth is the living/sleeping quarters in a tractor-trailer truck. Of the health related and environmental research devoted to LHTDs no studies were found that examined CPAP use among LHTDs. The purpose of this study was to explore LHTDs' use of CPAP when they are working over the road (OTR).

Study Design

The Integrated Behavioral Model for Water, Sanitation and Hygiene (IBM-WASH), a social ecological model, was used to guide this qualitative descriptive study. Qualitative descriptive research is particularly useful when little is known about a particular phenomenon and a description of the event is desired (Sandelowski, 2000). Further, it affords a way to capture a rich description of an experience from the participants' perspective with minimal interpretation by the researcher (Neergaard, Olesen, Andersen, & Sondegaard, 2009).

The IBM-WASH model is comprised of three dimensions (contextual, psychosocial and technology factors) and five levels (societal/structural, community, interpersonal/household, individual, and habitual) (Dreibelbis, et al., 2013) (see Table 1). Social ecological models purport that: 1) individuals are situated within social systems; 2) individuals interact with entities within the social systems; and 3) these interactions have influence upon health behaviors and health outcomes (McLeroy, 1988; Stokols, 1992). LHTDs diagnosed with OSA and use CPAP are governed by federal regulations that stipulate that CPAP must be used four hours per night for 70% of the time (Hartenbaum et al., 2008). Given the nature of LHTDs' work, they must manage CPAP both in their homes and when working on the road. Thus, a model was needed that captured not only personal factors that influence CPAP use, but also policy and societal factors.

The IBM-WASH conceptual framework and review of the literature were used to foster development of the interview guide and prompt questions. The interview guide was structured to capture contextual, psychosocial, and technology factors within the context of LHTDs' use of CPAP while on the road. As CPAP is a highly technology dependent treatment modality, the IBM-WASH model provides an avenue to also capture technology factors that may influence use of CPAP.

Recruitment and Sample

Eligible participants were truck drivers who held commercial motor vehicle licenses, were diagnosed with OSA, used CPAP at least two nights a week in their truck cabs, and spoke English. Purposive sampling was used to recruit participants who met study inclusion criteria. Flyers with study information and the principal investigator's (PI, first author) contact information were distributed to individuals in the community and by email. Interested parties contacted the PI, the study was explained, and any questions about the study were answered. Fifteen LHTDs were invited to participate in the study. One potential participant did not answer the telephone at the scheduled time for the interview or follow up calls. Therefore, fourteen participants (N=14) were enrolled and completed the study. Each participant received a $50 gift card for participation. The University of Alabama at Birmingham Institutional Review Board approval was obtained prior to data collection.

Data Collection

Informed consent was obtained from potential participants before they were enrolled in the study. Study interviews were offered by telephone or face-to-face depending upon a participant's preference. Telephone interviews were the preferred

method by all participants (N=14). Participants' work routes were spread geographically throughout the United States; therefore, scheduling face-to-face interviews was not feasible. All interviews were conducted by the PI. Thirteen of the participants were located either at their homes or in their trucks during the interviews, while one participant was in a private room at a shipper's location. Interviews lasted 40 to 150 minutes. All interviews were audio recorded with participants' permission. Self-reported demographic data were collected including age, race, year of OSA diagnosis, year CPAP treatment onset, bed partner status, number of years as a professional truck driver, number of years as a long-haul truck driver, and category of driver.

Interview times were often difficult to schedule because of the LHTD's unpredictable schedule and required frequent calls and rescheduling. Securing second interviews was not guaranteed given participants' work schedules and availability. Therefore, participants were asked to orally confirm key points and clarify information prior to the conclusion of the interviews. These comments were recorded as well. Recruitment and interviews continued until no new knowledge was obtained and reoccurring responses were received (data saturation). Field notes were made about the interviews immediately at the conclusion of the interviews. Aspects such as pauses, voice tone, and participants' demeanor were noted and added to interview transcripts. Inclusion of nuances in speech and disposition were used to identify participants' feelings and attitudes toward topics.

Data Analysis

Interviews were transcribed verbatim by an outside HIPAA compliant vendor. Transcripts were reviewed for accuracy against the digital audio recordings by the PI. During the accuracy checks, contextual details such as voice tone, voice inflection, pauses in speech, and laughter were added to transcripts. Identifying information such as names, company names, and geographical regions, were removed from transcripts before being uploaded to Nvivo QRS 11 data management software. Data were analyzed using the thematic analysis approach described by Braun and Clark (2006). The PI served as the single coder of all interview transcripts. Initial codes were created deductively from interview guide questions. As coding proceeded, additional codes were identified inductively from the data. After all coding was complete, data were compiled into categories from which initial themes were derived. To ensure congruity, codes and themes were discussed with a researcher (second author) with expertise in qualitative methods. Participant quotes were used to exemplify themes.

RESULTS

Participant Characteristics

Participants included 14 LHTDs who were diagnosed with OSA and used CPAP at least two nights a week in their truck cabs. Thirteen were male. With regards to race, 12 self-identified as Caucasian and two as African-American. Ages ranged from 40 to 62 years. Of the 14 participants, there were seven company drivers, four owner operators leased to a motor carrier, and three owner operators. Thirteen were solo drivers, while one participant worked as a team driver. Each participant reported being formally diagnosed with OSA by in-lab polysomnography or a home sleep study. Years of CPAP

use ranged from eight months to 35 years with an average of 8.2 years. All reported starting CPAP within a days or weeks of OSA diagnosis.

Themes

Five themes emerged from analysis of the transcribed interviews: 1) It takes time to adapt to CPAP; 2) No different than home; 3) Being prepared to hit the road with CPAP; 4) Caring, coercion, or just feeling better; and 5) A constant source of aggravation to use CPAP on the road.

It takes time to adapt to CPAP

The truck drivers' descriptions of becoming accustomed to using CPAP indicated that it took time to get familiar with using the device. There appeared to be a process to becoming comfortable with CPAP, though the process evolved over time and was not a predetermined, conscious set of steps. The process involved both cognitive and behavioral aspects and was captured in four subthemes: 1) Getting used to CPAP; 2) Learning through trial and error; 3) You've got to make up your mind to use it; and 4) CPAP becoming second nature.

Getting used to CPAP

The work environment for LHTDs is non-traditional in that their work vehicles are their homes when they are working OTR. The drivers expressed that it took time getting accustomed to using the CPAP machine and wearing the mask. The amount of time varied among the drivers. For one LHTD it only took one week; another LHTD stated that it took him two months, while another stated it took him three years.

James had been using CPAP for approximately eight months and described his experience of adjusting to CPAP. "I'm getting used to it, so that's a good thing 'cause for

a long time, I had trouble sleeping because getting used to that thing on my face. Just something different and it takes time."

Richards's experience demonstrates that for some it may take years to become accustomed to CPAP.

> The first couple years I used it, I would wake up, and the mask would be thrown across the cab of the truck, or the bedroom of the house, and I would throw it so hard, that the machine would be knocked off whatever pedestal it was on, and then, the floor, and I was not aware of ripping it off in my sleep. I'm gonna say it took me in the neighborhood of three years, 36 months, to get accustomed to using the mask.

Not all of the LHTDs became comfortable using CPAP. Two truck drivers stated that they had never adapted to CPAP. Although CPAP was not something they enjoyed using, the drivers made sure they used their CPAP machines to stay in compliance with DOT regulations.

Learning Through Trial and Error

Only one driver described receiving comprehensive CPAP education when he was diagnosed with OSA. His primary care physician offered education that included CPAP monitoring and follow-up. Some LHTDs had limited knowledge about CPAP and OSA prior to starting CPAP therapy, but this knowledge did not help in using CPAP. Most of the drivers described learning through trial and error about CPAP and what worked best for them and their lifestyles. The life of LHTDs involves living both out of their trucks for several days or weeks at a time and living at home (their place of residence).

Neither health care providers nor sleep management companies provided education on how to efficiently use CPAP at home or in the cab of a truck.

Evan described how he discovered the power source in his truck that would power his CPAP without draining the truck's battery. Until he discovered that power source, he tried using different power points in the truck. There were times that the CPAP machine was shut off by the failsafe mechanism that preserves the truck's battery.

It took Evan time and multiple attempts to run the machine continuously throughout his sleep period. He used different power sources on different trucks, but it wasn't until he eventually found the power source that would not drain the battery that he was able to run the CPAP all night without interruption.

> There's one particular power point on the front dash you can use and it will not drain down the battery you can use it all night long [to run the CPAP]. And so that's one thing. I discovered that by accident actually.

Others described learning the importance of using CPAP through trial and error. For some LHTDs there may be times that they are at a destination for minutes or hours. Ryan said during these times he would occasionally wear his CPAP machine when he took naps or laid down to rest, but there were times when he would not. Then he attempted to use CPAP every time he took a nap or rested in the truck, but he was not consistent. Only through this back and forth process of trying to use his CPAP and not using it for short rest periods that he realized he needed to use his CPAP machine for short rest breaks as he did when he retired for the night, because he felt better when he used the CPAP machine whenever he rested. He shared, "…by trial and error, I figured

out that it doesn't matter whether I think I'm going to be there [intended destination] ten minutes or for ten hours. Every time I go to sleep now, I put my machine on."

You've Got to Make up Your Mind to Use It

The drivers spoke of family members and other drivers who could not adjust to using CPAP on a regular basis. When asked, what helped them become acclimated to CPAP, many of the drivers could not articulate specific things that helped. For the majority of drivers, using CPAP was based on anticipated outcomes such as staying healthy, feeling rested, and being allowed to continue driving as a LHTD. The reasons underlying the decisions to use CPAP were individualized, but were essentially illustrated by the sentiments shared by the following drivers.

James had been using CPAP for a short time and did not like it; however, compliance to the DOT regulations would allow him to continue driving and earn a living. He stated, "I don't have a choice but to do it ... use it, if I want to keep... driving trucks."

For Lloyd the health benefits of CPAP treatment undergirded his use of CPAP. He shared, "It won't do any good in the bag in the back because you don't like the mask…just use it and take care of your health."

Two drivers specifically stated that they made a decision to use CPAP. Sam struggled with adapting to CPAP for three years. When asked what helped him in using CPAP, he affirmed that it came down to deciding to use it. He shared:

> Truthfully, nothing really got me used to it at all until finally I just decided, okay I'm going to live with this thing, and I may as well use it. If I've got to spend the money to have it, I may as well use it.

CPAP Use Becoming Second Nature

Once a conscious decision was made to use CPAP, the drivers described establishing consistent routines or habits which led to CPAP becoming second nature. Having a regular routine was a key factor to using CPAP while on the road and at home. This was a sentiment expressed by most of the drivers. For Shane consistency was important.

> I mean, it's, like I said, it all comes down to being consistent. I mean, the work environment is just the driving, and the monotony of that. Once you get out, you're going to go take a shower, and then you're going to eat dinner, and then you're going to come back to the truck, start watching TV. You just have to get into a routine, and be consistent. I've made myself now, you know, a habit of when my head hits that pillow, that mask is on my head.

For drivers who saw physical benefit from using CPAP the differences that they experienced in their physical well-being, such as better cognition, feeling rested after sleeping, no longer feeling fatigued during the day, led them to form habits around when they used it. Richard noticed a difference in how he felt which led to using CPAP whenever he rested.

> I have grown so accustomed to it, that it is just a natural part of my daily, nightly routine. I do not so much as lay down for a 30-minute nap without putting my mask on, and turning the machine on. And it's just very much a natural part of my ritual.

Through consistency and routine actions in setting up and using the CPAP machine, a habit is formed and CPAP use appears to become second nature. Lloyd's observation captures the sentiment:

> it's second nature, you know it's just, it's like getting dressed you know. You get up, you take a shower you get dressed, you get ready to go you know, and it's just part of the whole regiment that you do every day.

No Different than Home

The use of CPAP is a complex health behavior. It involves setting up the machine and equipment, placing the machine on a level surface, connecting to an electrical source, attaching the mask to face, and turning the machine on. When asked how using CPAP on the road differed from using CPAP at home the majority of drivers, stated there was no difference. The consensus was that they used CPAP in the truck like they did at home. Lloyd felt the CPAP set up and process at home and in the truck were the same. He described placing the machine in a secure place and connecting to an electrical source. These were seen as the key elements.

> Well my, you know it's not much different than done at home. I have a shelf that it sits on when I'm using it [in the truck] and it's right there by the head of the bed and I have an inverter in the truck so, just plug it in and go to bed. …very, very simple…it's not that big of a deal. …An inverter basically changes DC current to AC. So…[describing the truck set-up] there's a socket, I have an extension cord that runs up there and I just plug it in and just like an outlet at home.

Daniel saw no difference.

> "Really none at all. Um, yeah, honestly it's pretty much all the same. Honestly, the only thing that's different sleeping inside the house with my CPAP machine and sleeping inside my truck is the environment and that's it."

He went on to explain that the environment at his home is peaceful and "country quiet." This contrasted with sleeping in his truck where there were always sounds from passing traffic such as cars, trucks, and ambulances with sirens blaring.

Though the majority of drivers felt there were no differences in using CPAP in their trucks and homes, there were some drivers who had different experiences. James and Gavin described differences in the sensation of air delivery and climate. James felt the pressure at which air was delivered by the CPAP on the road was less forceful than when using CPAP at his home. Gavin felt that the climate inside a truck and one's home were different and could contribute to differences with the machine. There may be a need for humidification and adjustments in air pressure. He shared, "Because you're living in two different environments. What may work at home in your bed, may not always work in the truck in your bed."

Cheryl was the only driver who described CPAP as an extension of work. For LHTDs the regulations encompass CPAP use when working OTR and when at home. Cheryl felt using CPAP at home was like work reaching into her home and personal life. She stated, "Even when I had time off, it was still like I was working. That modem [on the CPAP machine] was still recording." She also stated that when she used CPAP at home she did not have to worry about getting a ticket for idling her truck to power the

CPAP. Some states have laws that prohibit truck idling and LHTDs are subject to citations if they are caught idling their trucks.

Although most drivers said using CPAP on the road was the same as at home, through the interviews, themes were identified where clearly there are some differences in being able to use CPAP at home and on the road, such as access to power sources, anti-idling laws, and flat surfaces. For the LHTD it may seem there are no differences when CPAP use becomes second nature to them and is integrated into their routine.

Being Prepared to Hit the Road with CPAP

Having all needed CPAP equipment and extra supplies on hand before starting out on the road was a sentiment expressed by all of the LHTDs. The work routes for LHTDs require that they be away from home consecutively for several nights, several weeks, or months at a time. Having CPAP supplies and equipment before departing OTR is important because access to supplies while on the road is not guaranteed and the limited supplies available at truck stops may not be what the driver needs. Though medical supply stores are located across the United States, LHTDs may be challenged in gaining entry due to lack of parking space at the stores, having to make an appointment ahead of time, or being required to present a prescription for certain CPAP supplies.

For Ryan his dependence on CPAP influenced how he prepared.

> It's your whole lifestyle. Once you start using your, your CPAP machine and you start depending on it, then you, I mean, you really take care of it and make sure you've got your supplies. So, you make sure you have all of that stuff before you go out on the road.

When LHTDs are working on the road, the trucks are their homes. For some their experience in this type of living/working environment helps them manage their CPAP supplies. Chad felt strongly about having enough supplies on hand:

> I know living in a truck... I buy in bulk. I've got an extra head piece in there. The only thing I don't have that I wish I had right now is a mask. Whenever I get out of the truck here next Thanksgiving... That will be the first thing I do is go buy me another mask, more filters and stuff. I still got filters now, but I'll just go ahead and get some more.

For some drivers being prepared involved having two CPAP machines. Experiences such as malfunctioning machines led some drivers to secure multiple CPAP machines as a way of being prepared. Daniel endured a week without his CPAP machine because it malfunctioned and had to be sent in for repairs. A replacement was not provided. He eventually purchased a second machine, but also kept the first repaired machine. He explained:

> Of course, I keep my other machine right here in my bunk and it works. I made sure I didn’t lose my other machine. Cause if this one broke I have to have something to sleep. So there’s my back up.

Several of the LHTDs had two machines. Some kept both CPAP machines on the truck and others had one machine at home and the other on the truck. Sam had three CPAP machines. He kept two on the truck and one at home.

Second machines were primarily obtained as replacements. However, Stan convinced his insurance company that he needed a second machine due to the wear and tear caused by transferring the machine between his truck and home. He shared the following:

> I have a CPAP machine at the home and I have one on the truck. I was able to explain to them about my living in the truck just about and living at home that it was an inconvenience carrying the machine back and forth and possibility of me damaging it so it would be best to leave one in the truck and leave one at home. They were in agreeance with it.

Another drawback to having only one machine is forgetting to take the machine when a driver is heading out OTR. This was the experience described by Ryan.

> There's been a couple of times I've actually left it home. …the last time, I got to [U.S. state] and realized I didn't have it, so I stayed at the [U.S. state] state line the night before and slept. And then the next day, I woke up and came back home and got it.

In addition to the increased possibility of forgetting the machine Gavin described the hassle of having to constantly break apart and set up the machine when transferring between work and home. He has two machines; one is kept on the truck and the other at home.

> [Referring to transferring the machine] That is a first-class pain in the, you can fill in all the adjectives. you gotta tear it apart, put it in a bag, then when you get home, you gotta take it out of the bag, put it on the nightstand. And then when

> you get ready to go back to work you gotta tear it back apart, take the hose off, take the mask off, put it all in a bag. Take it back to the truck, put it back on the nightstand, put it all back together.

Caring, Coercion, or Just Feeling Better - Motivators for CPAP Use

When questioned about what helped in using CPAP, the LHTDs did not articulate a specific entity, person or group that helped with their CPAP use. The drivers appeared to have learned to navigate and incorporate CPAP use into their lives by their own will and determination. However, there were commonalities that had a positive effect on CPAP use. As noted earlier, having extra supplies on the truck supported CPAP use. Significant others, DOT regulations, and perceived health benefits also facilitated CPAP use when the drivers were OTR.

When asked directly if employers, coworkers, or friends had any role in their CPAP use, the answer was overwhelmingly no except one driver whose employer was seen as helpful. The sentiment was that it was the drivers' responsibility to manage their CPAP; as they managed the day to day operations of their work, they managed using their CPAP. However, many of the truck drivers made clear statements about their significant others caring about whether they used CPAP, often reminded them to use their machines, and for some assisted in managing CPAP.

Due to the latest technology, CPAP machines have modems that record usage. Records of CPAP use are downloaded or transmitted to health care providers to substantiate CPAP adherence. James who had recently begun using CPAP at the time of the interview stated his wife helped him set up the machine, she kept track of his paperwork and appointments, and submitted his compliance records, "Well, she, uh, she

pays attention a lot... reads a lot, help me set it up, help me get going with it....she downloads it [compliance data] and sends it in."

Richard is OTR Monday through Friday and is home on the weekends. He described how his wife handled the arrival of supplies in his city of residence, "Yes, ma'am, and just like, you know, my wife is able to go by the local store, and sometimes, pick up my supplies for me. I can pick it up whenever I come home on the weekends." His wife's assistance makes it convenient to get supplies and enables him to have extra supplies when needed.

Wives and girlfriends indirectly played supportive roles for many. Support involved encouragement and reminders to use the CPAP. Ryan said his wife's input was mainly encouragement. He shared, "Um, other than telling me to make sure I use it. She'll call me. I mean, I'll call her at the end of the day or whatever and she'll tell me, 'Put on your machine, lock the doors.'"

Yet, for others the DOT CPAP adherence regulation was the motivating factor in using their CPAP machines. Although using CPAP because of work regulations may be an external motivator, for some drivers this was an effective facilitator of CPAP use. James stated, "I ain't in favor of it and I don't like it but DOT is making me do it…, so I don't have a choice but to do it ... use it." A similar sentiment was shared by Jason, "I wear it because, like I said, DOT says I got to wear it to be in compliance because they're monitoring me."

Not all drivers felt a difference using CPAP versus not using it. However, for those who identified physical benefits when using CPAP, the perceived benefits were motivators for continued use. Several drivers described notable differences in how they felt when they used CPAP and when they did not. Ryan explained the differences he felt.

> I can tell you it's, it's a world of difference. It's like night and day. If I fall asleep without the machine, my day is totally ruined. I might get up and I can totally tell that I, I've slept without it. You're fatigued. You're tired. You're grumpy. Things get on your nerves really fast…. you're just a totally different person. I mean, when you've slept with it, you feel good….I mean, your day is a whole lot better. It's just your mind's clear."

Besides noting the clear differences in using and not using CPAP, some drivers spoke of health being important. When asked what helped him in using CPAP, Daniel explained that being healthy was important to him and that was a key factor in using CPAP, "I guess more than anything making sure I am staying healthy. Um you know, I can't really say anything that has helped me …just a desire to stay healthy and try to live a better life…"

A Constant Source of Aggravation to use CPAP on the Road

The truck drivers discussed some of the barriers they faced in using CPAP while driving their routes. These barriers were primarily related to the environment of the truck cab where they sleep, laws that make using CPAP on the road challenging, accessing supplies on the road, and challenges faced by team drivers. One additional barrier, the

cost of using CPAP, although not specifically related to being a trucker emerged as a barrier.

Having a place with a flat surface to set up the CPAP machine is often a challenge in the sleeper berth. Not all trucks have the ideal area to place the machine. Shane described the reason machine position is important:

> …because in the sleepers, you are really pushed for space in a truck…so you've got to keep the machine close to your head. So, and above you, so that you don't have the hose stretched out, and you do have a little bit of free movement when you're sleeping. And that's a challenge sometimes, you know. I've talked to several drivers on the road who don't have a flat space right by their head. they have to either buy some kind of a little table to set up and take down to set it on…"

Sometimes drivers are assigned trucks and have no input regarding the truck features. Evan spoke of his boss not really knowing what was needed in a truck for someone who uses CPAP. The following quote refers to his truck's lack of a flat surface or tray to place the CPAP machine.

> Um when my boss got me that truck I don't think he was considering…I think all he was considering was did it have a power point that was it. And you know…He doesn't have to use a CPAP he doesn't understand them. This truck I got right now doesn't work for me.

To use a CPAP machine in a truck, there must also be an available electrical source to power the machine. Drivers described the impact of having problems with obtaining a consistent electrical source. For Richard, it was an ongoing problem. He shared his experience in securing electrical power.

> In the past, I had a lot of issues, a lot of aggravation with the ability of readily available power for the machine. Prior trucks before this one, I had to constantly carry a portable inverter with me. I had issues finding a machine that was adaptable to 12-volt power supply, I had a lot of issues with the 12-volt power supplies, once I was able to start receiving them. Seemed like a cigarette lighter outlet would not stay plugged in, and I'd wake up, the machine would be inoperable. I'd have to reinstall the plug in, and just the inconvenience of converting the power over for the system. It was a consistent inconvenience in life.

If drivers are not able to show that the CPAP machine was used four hours for 70% of the monitored time period, they are at risk of not receiving a DOT medical card which gives them clearance to drive their trucks. Jason described the problems he had with powering his CPAP and how it impacted him.

> There for almost a week I had issues with my inverter in the truck and I couldn't run my CPAP. Well, I ended up going borderline on being in compliance so they could only give me a three-month DOT card [medical card] because I went a week without using my CPAP due to not being able to have electric actually running.

For the truck drivers, challenges were also encountered in powering their CPAP machines due to the anti-idling laws in some states which prohibit drivers from leaving the truck engine idling. Idling is one way that drivers obtain power to run things in the truck. When Cheryl had to park and sleep in states that had anti-idling laws she worried a lot which disrupted her sleep. She explained, "In Chicago, I always worried about getting a ticket [for idling]. Worrying didn't help with my sleep. It wasn't' a full, good night's sleep."

Some drivers expressed that being knowledgeable of the state laws and their routes helped them handle using CPAP in states with anti-idling laws. Richard described his approach,

> Now, I'm very fortunate that I know my routes and my runs. I know where I can park without any harassment from local law enforcement enforcing the no-idling laws. But yes, that can be a very major issue with us in this occupation.

There are other ways to power the CPAP, such as generators; however, those options are not feasible for all drivers. Daniel explained his situation considering the anti-idling laws.

> Yes, in some states they have a no idling law. You can't idle your truck for more than 5 minutes okay. But yet if you have a dog, or a cat, a fish, a snake, an iguana uh, you can idle that truck 24/7 as long as you want. I have to take the chance of [running my CPAP machine], you know, when I'm out in those states, I have to take the chance to get a ticket because I don't have what they call an idle free feature on my truck.

Accessing CPAP supplies while on the road is a challenge which includes locating needed supplies, finding parking space for the truck, and identifying a medical supply store that will allow the purchase of supplies. Limited CPAP supplies can be purchased at truck stops; however, truck stops are not the ideal supply source. Lloyd shared an analogy of what it is like to purchase CPAP supplies at a truck stop.

> I got an extra hose in the truck, I got an extra mask in the truck, and you know, I try to keep ahead on supplies. I can get some of these things, I can get a hose on the road but they're twice as expensive on the road as they are if I get them, you know, from another supplier. Truck stops is like, have you ever tried to go grocery shopping at a 7-11. You're going to pay three times the amount of money for whatever you buy so truck stops are the 7-11's.

CPAP machines and supplies can be purchased at medical supply stores, but buying supplies or equipment at a medical supply store can be a challenge due to limited parking space. Daniel described the challenge of parking.

> Most of these medical supply stores, one of the two…they are either by a hospital which is really hard for a big truck to get close to or into…or they are in a little downtown area that doesn't allow trucks to park there. Parking is an issue. Trying to find somewhere you can get to and be able to go into the store.

Drivers also had problems gaining permission to visit medical supply stores and described their experiences with CPAP vendors and staff at medical supply stores.

Daniel went on to describe an experience he had in trying to buy a mask at a medical supply store outside of his home state.

> Some of these stores want you to call and schedule an appointment to come in…just to buy something. I told them, "Look man, I'm a truck driver. I don't live here. All I want to do is come in and look at your mask and see what you have." 'Well sir, you have to schedule an appointment. I'm sorry.' "Alright, have a nice day. You just lost $100." You know, 150, 160, my gosh some of these new masks cost $230.

Having to make appointments was only one challenge posed by medical supply store policies. Federal regulations stipulate that CPAP masks and machines require a medical prescription. Richard explained how purchase policies were a deterrent to him trying to buy supplies from a medical supply store.

> For example, my current hose has got a hole in it. And, I don't know nowhere to pick one up, while I'm on the road. And even if I did, the way the vendors work and the supply companies work, you've got to have a doctor's order to be able to pick up these supplies, and it's just a long drawn out process to get such a simple item. …It's not like it's drug paraphernalia that you need to do illegal drugs, or whatnot. This is just simple, mechanical equipment to help us to be able to live.

Solo drivers drive alone while, team drivers share driving responsibilities with a partner. Given the unique driving arrangement, team drivers are faced with challenges

with CPAP that solo drivers may not encounter. These challenges were described by Jason who team drives with his wife.

> here's something else you may want to look at. The difference between a solo driver and a team driver because a solo driver, the truck is parked and he's resting. Team driver, that truck is basically rolling 24/7. Road conditions, a hard brake, if you're not really resting well with the CPAP to start with and you add these other factors into play with it, too, that's that much less rest you're really getting.

When asked what it was like using CPAP on the road, he also described the challenges of driving coast to coast with the changes in the physical landscape.

> For me, I am coast-to-coast. It's very hard, I'm going to say very hard to use for the simple reasons I've got the humidifier, but if I've got the humidifier set for the conditions of where my home is at and then I drive out West where it's drier…..If I turn the moisture up there and I don't turn it back down by the time I get home and I get back to a little bit wetter climate, then I've got water actually coming out of a tube coming to me because I've got so much moisture in the air. You're constantly fighting with the dehumidifier if you really want comfort. Anyway, I said the heck with it. I won't even use the humidifier because it's such a hassle when you're changing climates daily.

Financial Cost of Therapy

Though the financial aspects of CPAP therapy were not specifically identified as problems or barriers, several drivers spoke of the cost of treatment being prohibitive.

Daniel described the cost of getting started on CPAP treatment with a company that conducted his home sleep study.

> They charged me way too much for the machine. I didn't have the insurance….still don't. Ah, so you know, I am paying out of pocket costs for the machine and everything like that. Gosh, it ended up running me you know out of pocket about 1200 dollars.

When asked what would be one thing that helped with using CPAP on the road, Daniel responded:

> Um, it would be nice if the cost wasn't so expensive. A mask costs you 100 plus dollars. Even a replacement mask is….I'm just talking about the gel part that you kind of just clip into your mask…your frame. That's 40-50 bucks there, um it's about the same price on the internet.

Having insurance did not guarantee cost savings. Despite the high costs, for some the health benefits outweighed the cost of the machine and supplies. Lloyd has owned two CPAP machines. Though he had medical insurance, with each machine he had to personally pay the costs of the machines. However, he felt strongly that his health was worth the cost of CPAP therapy. He shared:

> …my first CPAP machine cost me almost $1,500 this one here cost me $650. My insurance didn't cover any of it. Or the second and so, you know, I forked it out of my pocket, but I was glad to fork it, my health is worth more than $650 okay.

Discussion

Findings from this qualitative descriptive study detail some of the facilitators, barriers and education needs of LHTDs who use CPAP over the road. The five themes revealed that despite multiple challenges LHTDs are able to successfully use CPAP when over the road but ongoing support is needed. This is critical, understanding that research has shown CPAP uptake and continuation rates in the general population are low (Weaver & Grunstein, 2008). For LHTDs continued, consistent use of CPAP is required to maintain their jobs, despite the additional work-related challenges. To our knowledge this is the first study of its kind to explore CPAP use in a worker population.

Management of CPAP is a complex health behavior that requires time to adjust and incorporate into one's life. In a case study of a young male diagnosed with OSA and prescribed CPAP, Brostrom et al. (2008) found that adaptation to CPAP occurred over a period of months. The time factor related to CPAP adjustment was also noted in a grounded theory process model of CPAP use (Ward, Gott, & Hoare, 2017b). Our study supports these findings as the LHTDs shared that it took time for them to adjust to CPAP. There was no set time period for adjustment; it was an individual experience that was different for each participant. For some the adjustment occurred over a few weeks, while for others it took years. The LHTDs did not volunteer that health care providers provided comprehensive information on CPAP or information on adapting to CPAP in a truck sleeper berth. There is an abundance of online education information for general CPAP users (American Academy of Sleep Medicine, 2015). Though information is available, CPAP clients are often left to find the information on their own or from their social networks (Bakker, O'Keeffe, Neill, & Campbell, 2014; Dickerson & Kennedy, 2006). In

contrast, education specific to the unique needs of LHTDs who use CPAP is limited. Drivers learned to manage CPAP through experience, trial, and error. More help is needed to assist LHTDs in adapting to CPAP in both the home and work environment. Specific written materials or short video clips with information such as ways to set up CPAP in truck sleeper berths, power sources in trucks for CPAP, lists of states with anti-idling laws, and maintaining back up equipment and supplies could be helpful to new users.

Additional educational information and strategies for health care provider support can be derived from the trial and error learning described by participants. Continuous positive airway pressure treatment is a complex self-care behavior that involves cognitive engagement and dexterity to manage the machine and equipment. Users must identify a routine that works for their situation, lifestyle, and preferences. In the current study, the process of adjustment appeared to take place through a period of trial and error in which participants tried various efforts to become comfortable with CPAP, find equipment that met their needs, and use it consistently during sleep periods. These findings are similar to Dickerson and Akhu-Zaheya (2007) and Ward et al. (2017b) who found that the trial and error process involved perseverance in overcoming CPAP challenges. For LHTDs the trial and error process may place them in jeopardy of non-adherence if the errors encountered in their attempts to use CPAP interfere with the required DOT adherence regulations. Therefore, health care team members should be available to help clients through the trial and error process by discussing the benefits of developing a CPAP use routine and possible needs when using CPAP in their trucks. In addition, they can provide guidance and help clients problem solve. For example, discussions about

machine set up can help LHTDs consider how CPAP will be used in their trucks and if they have the necessary flat surface for the machine. By providing this information and support, health care providers may be able to expedite and enhance the adjustment period to get CPAP use to become second nature for LHTDs.

Participants described a variety of facilitators and/or motivators to CPAP use – social support, preparation, CPAP adherence regulations, physical benefits, and establishing a routine. Social support has been found to be both a facilitator and barrier to CPAP adherence (Baron, Gunn, Czajkowski, Smith, & Jones, 2012; Brostrom et al., 2010). While Ward and colleagues (2017a) found that being a team was an important component in the CPAP process, LHTDs initially did not identify social support of any kind as a contributor to their CPAP use. Upon further discussion, it became apparent that wives and girlfriends provided support and encouragement for some LHTDs. One possible explanation for their initial lack of recognition of support from significant others may be that LHTDs are independent in the management of their routes and work planning and this leads them to view themselves as self-sufficient in their CPAP management. Another possible explanation is the study participants may have high levels of self-efficacy that may have enabled them to manage CPAP successfully. Studies examining CPAP adherence profiles have shown that individuals who adhere to CPAP treatment had higher levels of self-efficacy than individuals who were non-adherent to therapy (Sawyer, Deatrick, Kuna, & Weaver, 2010; Wohlgemuth, Chirinos, Domingo, & Wallace, 2015). Future studies among LHTDs should examine self-efficacy and its role in their management of CPAP. In addition, spouses, partners or other

supportive family members or friends should be included in education about CPAP management over the road.

The findings of this study reveal that a major facilitator to regular CPAP use was being prepared with extra supplies and equipment stocked in their trucks. The concept of being prepared was found in the literature, but the concept primarily centered on patients' information needs as a form of preparation (Hanna, Sambrook, Armfield, & Brennan, 2017; Hu, Bell, Kravitz, & Orrange, 2012; Knobf, 2013). Knobf (2013) found that information preparation supported self-care management among patients diagnosed with cancer. In the current study, the LHTDs revealed that they received limited OSA and CPAP information from healthcare providers, and there was no mention of information related to CPAP use when working OTR. With continued use and experience, the truckers became more knowledgeable about CPAP self-management. The experience of living with CPAP in the sleeper berth led participants to accumulate extra supplies in the truck. Occupational health nurses and employees of sleep management companies are in a unique position where they can provide information about preparation such as having backup supplies and equipment. This type of information is especially important for LHTDs who are new CPAP users.

For LHTDs the DOT CPAP adherence regulation serves as a strong external motivator for continued use, which may lead to habit formation. However, for some LHTDs the physical improvement in health alone was a strong motivator that led to continued use, surmounting challenges, and ultimately establishing a CPAP habit. In the current study behaviors such as consistent set-up of the machine and always putting the mask on when in bed led to an established CPAP routine. Sawyer and colleagues (2014)

found that patients whose bedtime varied by 75 minutes or more had greater odds of CPAP non-adherence. Together these findings suggest that consistency in behaviors is important to consistent, routine CPAP use. Further studies are needed that examine habit formation among CPAP users to explore antecedents to CPAP habit formation. Even with the strong external influence of DOT adherence regulation, the variability of the LHTD's sleeping routine makes CPAP use difficult.

Discomfort from the mask and trouble sleeping with CPAP are common complaints that impede CPAP use (Henry & Rosenthal, 2013; Luyster et al., 2014). Though LHTDs reported similar discomforts, they also experienced barriers that were unique to the trucking work environment. For example, there are states that have anti-idling laws which prohibit idling to power CPAP. For some, being in a state with anti-idling laws disrupted their sleep. Others stated they would fight for their rights if they received tickets, and one driver made a point to know where he could and could not idle his truck. Such efforts are not required for CPAP users who sleep at home or a home environment such as a hotel. Other trucking sector unique barriers include accessing supplies on the road, having a flat surface for machine set-up in the truck sleeper berth, and securing an appropriate electrical source. These are critical areas to compliance with DOT CPAP regulations. Research has shown that inability to overcome barriers can lead to abandonment of CPAP (Dickerson & Akhu-Zaheya, 2007). The consequences of abandonment of CPAP for LHTDs would mean they could not continue in their work.

No literature was identified regarding CPAP use among any occupational groups, particularly those who use CPAP in non-traditional settings such as LHTDs and mariners who sleep in their work vehicles or vessels. Research is needed to examine CPAP use

from a user's perspective to better understand occupational characteristics that support or hinder CPAP use. In the trucking and maritime sectors, the inability to adapt to CPAP within the work environment has safety implications. There have been incidents in both sectors in which OSA has been attributed as a causative or exacerbating factor in collisions which have resulted in property damage, environmental harm, and loss of human and marine life (National Transportation Safety Board [NTSB], 2009; Platenburg, 2011).

The breadth of the IBM-WASH model was a good fit for this study. The model addresses contextual, psychosocial, and technology factors at five ecological levels. This was critical because LHTDs' CPAP use is impacted by dynamics at macrolevels (i.e. societal and community), as well as microlevels (i.e. interpersonal, individual and habitual). Factors influencing CPAP use at all levels were captured in the interviews. LHTDs described individual factors such as the perceived value of CPAP and how their knowledge influenced preparation and use when they were working OTR. On the habitual level, the drivers described CPAP becoming second nature and a routine part of their lives. Though very self-sufficient in managing CPAP, with regards to interpersonal relationships, some LHTDs described wives and significant others as providing support and encouragement regarding CPAP. Long-haul truck drivers do not have control of anti-idling laws or the availability CPAP supplies in community, yet both were mentioned as societal and community level entities that influenced LHTDs' management of CPAP.

Limitations

This study did have limitations. Interviews were conducted with LHTDs who were currently using CPAP, yet there were questions in which participants had to recall events, knowledge, and feelings. Though using CPAP is a life-long, life changing experience, memory recall of details may wane over time. Additionally, given the attention surrounding OSA and CPAP in the trucking industry, participants may have been reluctant to share certain aspects of their CPAP experiences. All participants were currently using CPAP and had successfully integrated CPAP into their daily lives. It is possible they were more open to discussing CPAP use because of their success with treatment. Drivers who were unable to accommodate CPAP into their lives, encountered many challenges, or may have lost their jobs by not adhering to CPAP are not represented in the sample. Regarding gender diversity, only one female participant was enrolled. Future studies should seek to recruit more female drivers to gain knowledge of whether the CPAP experience differs from the female perspective. Future research should include the experiences of team drivers because there may be differences in CPAP use and CPAP needs between solo and team drivers.

This descriptive study identified salient aspects of the experience of CPAP use in this specific occupational group. Overall findings from this study contribute to the limited knowledge surrounding CPAP use in an occupational setting where there are governmental regulations as oversight for adherence. While some of the issues for LHTDs were similar to other groups' use of CPAP such as cost, others were unique to this working group. Findings highlight the importance of addressing CPAP self-management and adherence in an occupational setting that affects the individual's safety

and potentially public safety. Being alert when driving is essential for LHTDs. This has significant implications for nursing practice. Occupational health nurses who care for this occupational group can provide tailored, individualized CPAP education. Each client encounter should be an opportunity to assess CPAP adjustment, barriers, facilitators, and problem-solving strategies. Based on the study findings, the information provided by the health care team has the potential to facilitate CPAP adaptation, habit formation, and successful self-management among LHTDs.

Additionally, policy changes are needed that support LHTDs in using CPAP rather than hindering CPAP use. LHTDs encounter many challenges when trying to secure CPAP supplies on the road, such as a replacement mask. Research is needed that examines the impact of CPAP purchase regulations on CPAP use among LHTDs and the general population. Currently there are laws that allow exceptions to anti-idling laws for pets that are housed in motor vehicles. Possibly such exemptions can be made to include LHTDs who use CPAP. Supporting LHTDs in consistent CPAP use through policy change and targeted education has the potential to increase CPAP adherence and improve drivers' health which in turn positively impacts public safety.

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Table 1

The IBM-WASH Model applied to CPAP use among Long-haul Truck Drivers

	Contextual factors	**Psychosocial factors**	**Technology factors**
Levels			
Societal/Structural	OSA Screening policy, CPAP treatment guidelines	Leadership/ advocacy for OSA diagnosis and use of CPAP, professional truck driver cultural identity	Manufacturing of CPAP machines, supplies & equipment; distribution of CPAP machines, supplies and equipment; different types of PAP machines
Community	Availability/access to sleep testing and OSA diagnosis; access to resources to equip truck for CPAP machine	Shared values among LHT drivers regarding OSA & CPAP; support in CPAP use; stigma of OSA diagnosis and CPAP use	Availability/access to CPAP supplies and equipment when on the road; availability/access to appropriate electrical sources; Availability of trucks with appropriate equipment & electrical sources
Interpersonal/Household	Spousal/partner support in CPAP use Peer support in CPAP use; responsibilities when at home Availability of appropriate space & set up in sleeper berth	Injunctive norms and descriptive norms associated with CPAP use on the road; shame/pride/anger associated with CPAP use	Modeling use of CPAP Access to appropriate electrical sources
Individual	Age, education, gender, socioeconomic status, driver classifications	Self-efficacy in using CPAP and maintaining equipment when on the road, knowledge of OSA and CPAP; attitude toward CPAP; perceived threat to livelihood	Perceived cost, value, convenience of CPAP; strengths and weaknesses of CPAP machine and equipment
Habitual	Favorable environment for habit formation in using CPAP; facilitators of CPAP use; barriers to habitual CPAP use	Expected CPAP outcomes	Electrical source, supplies, equipment Ease/Effectiveness of routine CPAP use and maintenance when on the road

CONCLUSIONS

Obstructive sleep apnea (OSA) is a growing public health concern. In the early 1990's OSA prevalence in the general population estimates were 2-4%; however, current evidence suggests OSA prevalence has increased to approximately 13-26% among U.S. adults (Peppard et al., 2013; Young et al., 1993). Within the trucking industry OSA has been cited as a significant issue with prevalence rates between 13 and 28% (Berger et al., 2012; Gurubhagavatula, Maslin, Nkwuo, & Pack, 2004; Talmage, et al., 2008). Given prevalence rates in the trucking industry and the nature of the job requirements, OSA has received much attention surrounding appropriate diagnosis and public safety. Continuous Positive Airway Pressure is the first line treatment of OSA. To date no information regarding LHTDs experiences with CPAP were found. The purpose of this dissertation was to examine OSA and CPAP use among LHTDs within the context of the U.S. trucking industry. To achieve this goal the following three manuscripts were completed: a) a policy analysis of OSA screening and treatment regulations in the trucking industry; b) a literature review of CPAP use from the user's perspective; and c) a qualitative, descriptive study of long-haul truck drivers' CPAP use. This chapter presents the following: a) a brief overview of the findings of each manuscript, b) manuscript synthesis of the findings, c) study limitations, d) strengths of the dissertation research, e) and implications for policy, research, and nursing practice.

Overview of the Three Manuscripts

Manuscript 1: A Policy Analysis of Mandatory Obstructive Sleep Apnea Screening in the Trucking Industry

A concern for public safety has led to considerable research and discussion within the trucking industry focused on OSA diagnosis and the relationship between OSA, crash risk, and MVCs. There has been debate whether OSA diagnosis and treatment should be mandatory for CMVDs which include LHTDs. Federal law requires that regulations related to OSA diagnosis or treatment must be established through the federal formal rulemaking process. The rulemaking process culminates in federal law. Using Bardach's eightfold path to policy analysis as a framework, a policy analysis of mandatory OSA screening in the trucking industry was conducted to explore different policy options. The analysis revealed that some policy options could not be realistically implemented by all trucking companies. For example, small trucking companies would not be able to sponsor sleep management programs for their drivers; whereas, large trucking companies have the capacity to offer such programs. Policy options that did not appear to treat all stakeholders fairly or were perceived to bypass federal laws were not considered suitable options. Recently, the FMCSA decided not to pursue mandatory OSA screening and treatment through the rulemaking process (FMCSA, 2017b). The organization felt that the current fatigue management program was sufficient in addressing OSA within the trucking industry (FMCSA, 2017b). Therefore, federal law mandating OSA screening, diagnosis and treatment is unlikely. However, through application of the Bardach method, establishing mandatory OSA screening through the formal rulemaking process was deemed the most equitable and thus the recommended policy option. Should federal

regulations on mandatory OSA screening in the trucking industry be pursued, the formal rulemaking process is the best avenue to pursue such regulations.

Manuscript 2: CPAP Use Through the Eyes of the Client: A Review of Literature

Much of the literature on CPAP examines adherence to the treatment modality. Little research has explored the use of CPAP from the user's perspective. The purpose of the second manuscript was to synthesize literature that explored the CPAP experience from the user's perspective. The review of the literature included 33 articles published in English between 2006 and 2016 and retrieved from PubMed, CINAHL Plus, Scopus and PsycINFO databases. As expected, device and mask issues were found to be a frequent complaint of CPAP users. Quantitative studies generally focused on CPAP adherence, but some assessed side effects most often through checklists. Though the checklists used were usually designed from a medical or provider perspective to assess the most frequently occurring side effects, the Usability of Sleep Apnea Equipment-Positive Airway Pressure (USE-PAP) questionnaire is an instrument developed to evaluate patients' practices with assembling, operating, and maintaining the CPAP machine and related equipment (Fung et al., 2015). The USE-PAP has the potential to increase knowledge surrounding human factors related to using CPAP machines and equipment as the human factors associated with CPAP machines have rarely been examined. Other aspects of the CPAP experience that have received little attention, but have the potential to impact CPAP use include: financial costs of diagnosis and treatment, body image, interferences with intimacy, and perceived stigma associated with CPAP use. Most studies were not focused on a sample that had CPAP use as an essential part of their employment requirements.

More research is needed that focuses on these areas as well as the CPAP patient's perspective on CPAP. An interesting finding was that the CPAP experience had universal aspects that were faced by users regardless of the type of health care system or country of origin, such as New Zealand and the United States of America. Consistent with the finding of a systematic review of CPAP literature by Ward et al. (2014), the findings from the review of literature (second manuscript) included a recommendation for more research that examines CPAP use from the user's perspective.

Manuscript 3: Exploration of CPAP Use in Long-haul Truck Drivers

The third manuscript describes the methodology and findings of the qualitative, descriptive study conducted to examine LHTDs' experiences using CPAP while working over the road. The IBM-WASH, a social ecological model, was used to guide the study because societal level factors, such as federal regulations influence LHTDs' CPAP use as does individual factors, such as drivers' attitudes and beliefs. Therefore, the IBM-WASH model was well suited to explore CPAP experiences within the trucking industry because the model is comprised of five ecological levels, societal, community, interpersonal, individual, and habitual, that have the potential to impact CPAP use. Semi-structured interviews were conducted with 14 long-haul truck drivers who were diagnosed with OSA and used CPAP at least two nights a week in the sleeper berth of their trucks. Thematic analysis was used to analyze the data. The following five themes and subthemes emerged: 1) It takes time to adapt to CPAP; 2) No different than home; 3) Being prepared to hit the road with CPAP; 4) Caring, coercion, or just feeling better; and 5) A constant source of aggravation to use CPAP on the road.

Findings from the study revealed that LHTDs who are diagnosed with OSA and use CPAP while working over the road experience barriers directly related to the occupational environment as well as similar challenges experienced by CPAP users outside trucking industry. Many LHTDs adjust to CPAP over time and find ways to meet the challenges encountered when on the road.

Synthesis of the Body of Work

The purpose of this dissertation was to examine long-haul truck drivers' experiences with CPAP treatment when working over the road. To fully explore this phenomenon, it was important to understand the significance of OSA within the trucking industry and to identify what was known about CPAP patients' experiences with the treatment modality. To gain insight about the regulations and the significance of OSA in the trucking industry, a policy analysis on mandatory OSA screening was conducted. To gain insight on the state of the science about CPAP from the user perspective, a review of the literature was conducted. Lastly, an exploratory study of CPAP use from the perspective of LHTDs diagnosed with OSA, who were required to demonstrate CPAP adherence to maintain employment, was conducted to add to our understanding of the challenges faced with using CPAP when working over the road.

Within the occupational health discipline, a great deal of OSA research has addressed the association between OSA diagnosis and safety in the trucking sector. Mandatory OSA screening and treatment within the trucking industry has been debated for several decades. Recommendations and guidelines have been set forth; however, there are no federal regulations that require mandatory OSA screening for professional truck drivers which includes LHTDs. There are regulations regarding adherence to

CPAP once a trucker has been diagnosed. Thus, successful adaptation and adherence to CPAP is essential for truck drivers.

The first manuscript, a policy analysis, assessed potential policy options centered on mandatory OSA screening in the trucking industry. The policy analysis exposed the interconnections between policy and the lives of professional truck drivers. A significant result of the analysis is the understanding of the importance of stakeholder involvement in OSA policy creation and implementation because of the distrust and suspicion that exists among truck drivers regarding OSA policies. Drivers feel that OSA policies are designed to penalize them and place their livelihoods at risk. The analysis uncovers the sensitive nature of OSA and CPAP within the trucking industry. Though the debate regarding mandatory OSA screening and treatment has been settled to a degree due to the FMCSA's decision not to implement federal OSA regulations and to continue to use the fatigue management protocol to address OSA, the first manuscript highlights the significance of policy surrounding OSA and CPAP in the trucking industry and aided in understanding the context when developing the qualitative study. Thus, the first manuscript illustrates the value of using a social ecological conceptual framework to address the different perspectives regarding the need for regulations and the potential effects of policy changes related to LHTDs use of CPAP.

As noted much of the CPAP research has focused on adherence. Limited research has been conducted on the CPAP user's perceptions of CPAP therapy. The review of literature, the second manuscript, provided insight on the barriers and facilitators to CPAP solely from the user's perspective and informed interpretation of the qualitative study. Areas of the CPAP experience that are not generally discussed in CPAP

adherence studies, such as body image, stigma, financial burdens, and human factors, were identified. Knowledge of OSA and CPAP or lack thereof were also a part of the CPAP experience. Findings from the review of literature provided a picture of the CPAP experience outside of occupational settings that was contrasted to unique experiences with LHTDs' CPAP experiences in the workplace. For example, CPAP users in the home environment do not have to constantly move their CPAP machines between home and work, and the CPAP machine is not subjected to truck vibrations as with LHTDs. Further, the review of the literature findings and the IBM-WASH social ecological model were used to create the semi-structured interview guide used in the qualitative study.

The policy analysis revealed the importance of LHTDs having a voice in the policies and guidelines that impact their lives and work. From the review of literature there were no studies found that focused on CPAP use within occupational settings or from an occupational perspective. More importantly, there was no research found that examined LHTDs' use of CPAP. These discoveries led to the development of the dissertation study that examined LHTDs' CPAP use while working over the road. A qualitative approach was selected because of the lack of information about LHTDs' use of CPAP either at home or while working on the road. Thus, a descriptive, qualitative study afforded the opportunity to obtain a rich description of LHTDs' CPAP experiences that included macrolevel influences such as federal laws, to microlevel influences such as personal feelings toward CPAP. The qualitative study also gave LHTDs a platform to share their thoughts and experiences regarding CPAP treatment in the trucking sector.

Limitations

This study did have limitations. Interviews were conducted with LHTDs who were currently using CPAP, yet there were several questions in which participants had to recall events, knowledge, or feelings. Though using CPAP is a life-long, life changing experience, memory recall of details may wane over time. Thus, participants may have recalled details inaccurately. Among study participants, CPAP use ranged from eight months to 35 years. Additionally, given the attention surrounding OSA and CPAP in the trucking industry, participants may have been reluctant to share certain aspects of their CPAP experiences.

Participants volunteered, and it is possible they were more open to discussing CPAP use because they had successfully integrated CPAP into their daily lives. Drivers who were unable to accommodate CPAP into their lives, encountered many challenges, or may have lost their jobs by not adhering to CPAP are not represented in the sample. Further, LHTDs who were non-compliant with DOT CPAP regulations may have been less likely to volunteer to participate in the study.

Regarding gender diversity, only one female participant was enrolled. Future studies should seek to recruit more female drivers to gain knowledge about the CPAP experience from the female perspective. There may or may not be differences in CPAP experiences related to gender. Future research should include the experiences of team drivers because more can be learned about any differences in CPAP use and CPAP needs between solo and team drivers.

Strengths

There were several strengths of the study including diversity of the sample, study rigor and consistent interview and data analysis procedures. The study sample was diverse in its occupational and racial composition. The sample included four owner-operators, three owner-operators leased to a motor carrier, seven company drivers, one team driver and 13 solo drivers. With regards to race, two of the 14 participants were African-American and the remaining were Caucasian.

Participant interviews and data analysis were conducted in a uniform manner. A semi-structured interview guide and prompts were used in all interviews. Interview questions were open-ended and allowed other relevant questions to emerge. Generally, interviews lasted 40 to 90 minutes with one interview lasting 2.5 hours, and all were audio recorded. To maintain study rigor, memos were created for each interview. Additional notes and edits were made to memos during data analysis and when listening to the audio recordings. Notations of voice tone, inflections, and pauses were noted in the audio transcripts and memos for consideration during analysis.

Initial codes were derived from the conceptual framework and additional codes were borne of the data with multiple quotes identified to support each code. Quotes were read and re-read to capture participants' feelings, emotions, and thoughts that permeated the quotes within individual interviews and across the data set. The researcher kept a journal to document methodological decisions, study logistics, and acknowledge personal thoughts, values, beliefs, biases, and ideas about the data.

Implications for Advancing Nursing Knowledge

The implications of this body of work contributes to an initial understanding of the complex issues with OSA and CPAP treatment in LHTDs. The policy paper highlights the complexity of balancing the cost of routine screening and public safety. Nurses need to be aware of policies that affect screening, diagnoses, and treatment related to patients' occupations. This is especially true for patients who work in the trucking industry. The review of the literature demonstrates the importance of gaining the user perspective and the qualitative study provides insight on LHTDs' perspective on CPAP and the challenges they face when using CPAP on the road. Federal regulations may influence employers and sleep management companies to institute policies aimed at ensuring CPAP adherence; however, attention must be given to CPAP users' experiences and adjustment to CPAP within the occupational setting.

Clearly, the review of the literature and the qualitative study provide evidence of why it is important to understand the user perspective. For example, even when LHTDs want to comply with CPAP treatment, not having the appropriate electrical connection or a flat, elevated surface for the machine makes it difficult to adhere to using CPAP on the road. Additional studies that include machine set up and different types of electrical sources, such as APUs and inverters, are needed. Such topics need to be incorporated into quantitative studies and qualitative studies of LHTDs. Findings from such studies may lead to interventions to help LHTDs adjust to CPAP use on the road more quickly and without non-adherence violations.

While there is a substantial amount of research about screening and diagnosis of OSA in the trucking industry, little research has focused on LHTDs' health behaviors and

self-management of health conditions. In the review of the literature, no studies were conducted in an occupational setting or among any occupational groups. The review of literature and the findings of the qualitative study highlight the importance of, and need for, additional studies that examine CPAP use from the users' perspective among drivers in different work environments to better understand the challenges they face. Studies are also needed that explore the impact of job category (i.e. owner operators, company drivers, owner-operators leased to a company) on CPAP use, as well as the influences of health insurance and the lack of health insurance.

The qualitative study findings indicated there was limited to no knowledge about OSA and CPAP among participants prior to starting CPAP therapy and that feelings toward CPAP were mixed. These findings are consistent with those of the review of the literature in which CPAP users desired information about OSA and CPAP (Bakker, O'Keeffe, Neill, & Campbell, 2014; (Hu, Yu, Lee, & Tsao, 2013). Additionally, studies are needed that explore patients' attitudes toward CPAP use. In the qualitative study, participants' feelings and motivations regarding CPAP were varied. Participants who experienced physical health improvements had positive attitudes toward CPAP. Others complied mainly because of the DOT regulations requiring CPAP use to maintain their jobs. There are structured instruments such as the attitudes to CPAP treatment inventory (ACT-I) (Brostrom, Ulander, Nilsen, Svanborg, & Arestedt, 2011), Informational Needs of CPAP Inventory (INC-I) (Brostrom et al., 2009), the Apnea Knowledge Test (AKT), and the Apnea Beliefs Scale (ABS) (Smith, Lang, Sullivan, & Warren, 2004), available to explore knowledge, attitudes, beliefs, and informational needs more in depth. Studies that address CPAP and OSA knowledge and attitudes among LHTDs have the potential

to identify informational needs and important cognitive and emotional factors that may impact CPAP uptake, use, and adjustment. Findings from such studies could inform development of industry tailored educational and supportive interventions that could be delivered by occupational health nurses and through sleep management companies.

From the qualitative study results, it is apparent that it took time for participants to learn the nuances of CPAP therapy, incorporate treatment into their lives, and adapt the living space in their trucks. These findings are consistent with the accommodation phenomenon observed by Dickerson & Akhu-Zaheya, (2007) in which it took time for some patients to become accustomed to CPAP; however, by persevering through challenges, they were ultimately able to successfully accommodate CPAP in their lives. Time and perseverance have been found to be characteristics of adapting to CPAP (Ward, Gott, & Hoare, 2017). Tailored education targeting LHTDs who are new CPAP users is needed. Effective tailored interventions can only be developed with more research. Acquisition of CPAP supplies, such as masks and filters were difficult to obtain from medical equipment companies when LHTDs were working over the road. Participants encountered different policies and procedures at companies. Policies were not consistent regarding procedures for selling CPAP supplies to potential customers. Studies are needed that further assess the process of acquiring CPAP supplies from medical equipment companies and the resulting impact on patients. Findings from these studies could lead to the creation of education material on supply acquisition, as well as, policy changes that improve LHTDs' ability to access CPAP supplies when on the road.

Implications for Advancing Nursing Practice

The qualitative study and the review of the literature highlight many areas in which nurses can have a positive impact on LHTDs' CPAP use. The study participants reported receiving limited CPAP education when diagnosed with OSA and throughout their use of CPAP. The participants mainly learned about CPAP and OSA through trial and error as they used their CPAP machines. As noted, CPAP users desire OSA and CPAP information (Bakker et al., 2014; Brostrom et al., 2010) and value is placed on information from health care providers (Hu et al., 2013). Nurses, especially occupational health nurses, could be helpful in providing adequate CPAP education during initial OSA diagnosis and when CPAP is prescribed; however, this is not always possible. Thus, nurses can assess knowledge deficits when conducting DOT physicals and whenever they interact with clients whether during an illness visit or an annual checkup. In addition to the customary client information that is obtained during health care visits, information should be gathered about clients' occupations, their sleep habits, and integration of CPAP into both personal and work life. This information can then be used to identify problems with CPAP use and help clients with problem solving and addressing the challenges they may encounter. This is not necessarily new knowledge; however, the qualitative study highlights the need for and the importance of guidance and educational interventions.

With regards specifically to LHTDs, occupational health nurses can help new CPAP users consider some of the occupational challenges they may encounter using CPAP over the road. Nurses can provide anticipatory guidance around supply acquisition, powering CPAP in the truck cab, and preparation with extra supplies. Helping drivers identify sources of supplies when working over the road such as making

a list of medical supply companies and their requirements for purchasing supplies would be helpful if supplies were needed urgently while away from home. Discussing power options for CPAP may help drivers consider possible challenges they could encounter when using CPAP in the truck, such as using the CPAP machine in a state with anti-idling laws. Other important areas for discussion include the potential financial challenges in machine replacement and acquiring supplies over time as CPAP is a lifelong treatment. These efforts can help LHTDs who are new CPAP users avoid episodes of non-adherence which may negatively impact their ability to get full, non-conditional medical certification or place their jobs in jeopardy.

Implications for Policy

Findings from all three manuscripts suggest that there are significant opportunities for policy changes that can benefit LHTDs when using CPAP while working over the road. The lives of LHTDs are greatly impacted by federal and state regulations which govern various aspects of their lives, from their ability to obtain medical clearance to drive a commercial motor vehicle to the ability to power their CPAP machines. Policy changes are needed that support LHTDs in using CPAP rather than hindering CPAP use. LHTDs encounter many challenges when trying to secure CPAP supplies on the road, such as a replacement mask. Currently, federal law requires a prescription to purchase a CPAP machine, mask, or humidifier. Research and policy analyses are needed that examine regulations on purchases of CPAP machines and the impact on CPAP use among LHTDs and the general population. Perhaps exceptions to the purchasing laws can be amended to allow LHTDs to purchase masks or humidifiers without a

prescription. From the CPAP user's perspective, research in this area is especially needed.

Although policy change regarding mandatory OSA screening in the trucking industry is not likely, there may be opportunities for change to anti-idling laws. Currently there are laws that allow exceptions to anti-idling laws for pets that are housed in motor vehicles. Possibly such exemptions can be made to include LHTDs who use CPAP.

Conclusion

This body of work highlights the need for attention to CPAP use and LHTDs to improve their health and promote driving safety. Obstructive sleep apnea is a chronic condition that results in symptoms that may contribute to crash incidents for LHTDs, as well as the development of comorbid conditions and decreased quality of life; however, CPAP is an effective treatment for OSA. Transportation administrators, policy makers, and health care providers need to prioritize ways to effectively support LHTDs' use of CPAP over the road as this is their livelihood and important for the safety of truck drivers and the public. In considering policy and CPAP adherence for LHTDs, the user perspective is critical to inform future interventions to support LHTDs' adaptation to CPAP on the road.

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APPENDIX A

IRB Approval Form

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

Institutional Review Board for Human Use

Form 4: IRB Approval Form
Identification and Certification of Research
Projects Involving Human Subjects

UAB's Institutional Review Boards for Human Use (IRBs) have an approved Federalwide Assurance with the Office for Human Research Protections (OHRP). The Assurance number is FWA00005960 and it expires on January 24, 2017. The UAB IRBs are also in compliance with 21 CFR Parts 50 and 56.

Principal Investigator:	KIRKENDOLL, KENYA D
Co-Investigator(s):	CHILDS, GWENDOLYN DENICE HEATON, KAREN L
Protocol Number:	**X160429004**
Protocol Title:	*CPAP Use Among Long-Hail Truck Drivers*

The IRB reviewed and approved the above named project on 6/15/16 The review was conducted in accordance with UAB's Assurance of Compliance approved by the Department of Health and Human Services. This Project will be subject to Annual continuing review as provided in that Assurance.

This project received EXPEDITED review.

IRB Approval Date: 6/15/16

Date IRB Approval Issued: 6.15.16

IRB Approval No Longer Valid On: 6.15.17

Partial HIPAA Waiver Approved?: Yes

Expedited Reviewer
Member - Institutional Review Board
for Human Use (IRB)

Investigators please note:

The IRB approved consent form used in the study must contain the IRB approval date and expiration date.

IRB approval is given for one year unless otherwise noted. For projects subject to annual review research activities may not continue past the one year anniversary of the IRB approval date.

Any modifications in the study methodology, protocol and/or consent form must be submitted for review and approval to the IRB prior to implementation.

Adverse Events and/or unanticipated risks to subjects or others at UAB or other participating institutions must be reported promptly to the IRB.

470 Administration Building
701 20th Street South
205.934.3789
Fax 205.934.1301
irb@uab.edu

The University of
Alabama at Birmingham
Mailing Address
AB 470
1720 2ND AVE S
BIRMINGHAM AL 35294-0104

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

Institutional Review Board for Human Use

PI: KIRKENDOLL, KENYA D
Protocol # X160429004

UAB IRB Approval of
Partial Waiver of HIPAA Authorization
to Use PHI in Screening for Research

☑ **Patient Authorization: Approval of Partial HIPAA Waiver to Use PHI in Screening for Research.** The IRB reviewed the proposed research and granted the request for a "partial HIPAA waiver," to allow the proposed use of protected health information (PHI) in screening for research, based on the following findings:

1. The use/disclosure of PHI to screen candidates for research involves no more than minimal risk to the privacy of individuals
   a. There is an adequate plan to protect the identifiers from improper use and disclosure.
   b. There is an adequate plan to destroy the identifiers at the earliest opportunity consistent with conduct of the research, unless there is a health or research justification for retaining the identifiers or such retention is otherwise required by law.
   c. The PHI will not be reused or disclosed to any other person or entity, except as required by law, for authorized oversight of the research study, or for other research for which the use or disclosure of PHI would be permitted.
2. The screening cannot practicably be conducted without the waiver or alteration.
3. The screening cannot practicably be conducted without access to and use of the PHI.

—OR—

☐ **Full Review**
The IRB reviewed the proposed research at a **convened meeting** at which a majority of the IRB was present, including one member who is not affiliated with any entity conducting or sponsoring the research, and not related to any person who is affiliated with any of such entities. The partial waiver of authorization for screening was approved by the majority of the IRB members present at the meeting.

Date of Meeting

Signature of Chair, Vice-Chair or Designee

Date

☑ **Expedited Review**
The IRB used an **expedited review procedure** because the research involves no more than minimal risk to the privacy of the individuals who are the subject of the PHI for which use or disclosure is being sought. The review and approval of the partial waiver of authorization for screening was carried out by the Chair of the IRB, or by one of the Vice-Chairs of the IRB as designated by the Chair of the IRB.

6/15/16
Date of Expedited Review

Signature of Chair, Vice-Chair or Designee

6/15/16
Date

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The University of
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Mailing Address:
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BIRMINGHAM AL 35294-0104

Informed Consent Document

TITLE OF RESEARCH: CPAP Use among Long-Haul Truck Drivers

IRB PROTOCOL NO.: X160429004

INVESTIGATOR: Kenya D. Kirkendoll, MSN, MPH, RN; Karen Heaton, PhD

Purpose of the Research

We are asking you to take part in a research study about CPAP use by long-haul truck drivers. The purpose of the study is to learn more about how long-haul truck drivers use CPAP when they are on the road. It is hoped that the information gained from this study will help us understand how to support truck drivers in using their CPAP machines when they are on the road.

Explanation of Procedures

If you enter this study, you will be asked to participate in an interview about your use of CPAP when you are on the road. You will be asked questions about how you use your CPAP machine, what helps with using CPAP, and what makes it hard to use the machine. The interview should take about 30 to 60 minutes to complete. The interview will be audio recorded. After completing the interview you will receive some educational materials about health and wellness. You may receive a follow up phone call from the investigator to clarify information from the interview.

Risks and Discomforts

In this study, you will not have any more risks than you would in a normal day of life. You may experience anxiety or distress during the interview; however, you may stop the interview at any time or not answer questions that you do not feel comfortable answering. There is a potential risk of loss of confidentiality of the information obtained about you, but we believe this risk is small, and we will do everything we can to prevent your loss of confidentiality.

Benefits

You may not benefit directly from taking part in this study. However, this study may help us better understand how CPAP is used by long-haul truck drivers in the future.

Alternatives

The only alternative to participating in the study is to not participate in the study.

Confidentiality

Information obtained about you for this study will be kept confidential to the extent allowed by law. However, research information that identifies you may be shared with the UAB Institutional Review Board (IRB) and others who are responsible for ensuring compliance with laws and regulations related to research, including people on behalf of UAB School of Nursing and the Office for Human Research Protections (OHRP). The information from the research may be published for scientific purposes; however, your identity will not be given out.

UAB IRB
Date of Approval 6.15.16
Not Valid On 6.15.17

Voluntary Participation and Withdrawal

Whether or not you take part in this study is your choice. There will be no penalty if you decide not to be in the study. If you decide to enter the study and change your mind, you have the right to stop at any time. You may be removed from the study without your consent if you are not following the study rules.

Cost of Participation

There will be no cost to you for taking part in this study.

Payment for Participation in Research

You will receive a $50 gift card and general health and wellness information at the end of your interview.

Questions

If you have any questions, concerns, or complaints about the research please contact Kenya D. Kirkendoll, MSN, MPH, RN. She will be glad to answer any of your questions. Ms. Kirkendoll's number is 678-699-6019 and her email address is kkirken@uab.edu. You may also contact her faculty mentor, Dr. Karen Heaton. Her telephone number is 205-996-9467, and her email address is kharnp@uab.edu

If you have questions about your rights as a research participant, or concerns or complaints about the research, you may contact the UAB Office of the IRB (OIRB) at (205) 934-3789 or toll free at 1-855-860-3789. Regular hours for the OIRB are 8:00 a.m. to 5:00 p.m. CT, Monday through Friday. You may also call this number in the event the research staff cannot be reached or you wish to talk to someone else.

Legal Rights

You are not waiving any of your legal rights by signing this informed consent document.

Signatures

Signature of Participant Date

Signature of Principal Investigator Date

Signature of Witness Date

University of Alabama at Birmingham

AUTHORIZATION FOR USE/DISCLOSURE OF PROTECTED HEALTH INFORMATION (PHI) FOR RESEARCH

Participant Name: _____
Research Protocol: ***CPAP Use among Long-Haul Truck Drivers***

UAB IRB Protocol Number: X160429004
Principal Investigator: Kenya D. Kirkendoll
Sponsor: The University of Alabama at Birmingham School of Nursing

What is the purpose of this form? You are being asked to sign this form so that UAB may use and release your protected health information for research. Participation in research is voluntary. If you choose to participate in the research, you must sign this form so that your protected health information may be used for the research.

Why do the researchers want my protected health information? The researchers want to use your protected health information as part of the research protocol listed above and as described to you in the informed consent.

What protected health information do the researchers want to use? All medical information, including but not limited to information and/or records of any diagnosis or treatment of disease or condition, which may include sexually transmitted diseases (e.g., HIV, etc.) or communicable diseases, drug/alcohol dependency, etc.; all personal identifiers, including but not limited to your name, social security number, medical record number, date of birth, dates of service, etc.; any past, present, and future history, examinations, laboratory results, imaging studies and reports and treatments of whatever kind, including but not limited to drug/alcohol treatment, psychiatric/psychological treatment; financial/billing information, including but not limited to copies of your medical bills, and any other information related to or collected for use in the research protocol, regardless of whether the information was collected for research or non-research (e.g., treatment) purposes.

Who will disclose, use and/or receive my protected health information? All individuals/entities listed in the informed consent documents, including but not limited to, the physicians, nurses and staff and others performing services related to the research (whether at UAB or elsewhere); other operating units of UAB, HSF, UAB Highlands, Children's of Alabama, Eye Foundation Hospital, and the Jefferson County Department of Health, as necessary for their operations; the IRB and its staff; the sponsor of the research and its employees and agents, including any CRO; and any outside regulatory agencies, such as the Food and Drug Administration, providing oversight or performing other legal and/or regulatory functions for which access to participant information is required.

How will my protected health information be protected once it is given to others? Your protected health information that is given to the study sponsor will remain private to the extent possible, even though the study sponsor is not required to follow the federal privacy laws. However, once your information is given to other organizations that are not required to follow federal privacy laws, we cannot assure that the information will remain protected.

How long will this Authorization last? Your authorization for the uses and disclosures described in this Authorization does not have an expiration date.

Can I cancel this Authorization? You may cancel this Authorization at any time by notifying the Principal Investigator, in writing, referencing the research protocol and IRB Protocol Number. If you cancel this Authorization, the study doctor and staff will not use any new health information for research. However, researchers may continue to use the protected health information that was provided before you cancelled your authorization.

Can I see my protected health information? You have a right to request to see your protected health information. However, to ensure the scientific integrity of the research, you will not be able to review the research information until after the research protocol has been completed.

Signature of participant: _____ Date: _____

or participant's legally authorized representative: _____ Date: _____

Printed Name of participant's representative: _____

Relationship to the participant: _____

APPENDIX B

INTERVIEW GUIDE

Interview Guide

Long-Haul Truck Driver CPAP Study

Topic: CPAP use by long-haul truck drivers while on the road

The Interview: Semi-structured

1. Tell me the story of your diagnosis with sleep apnea.

2. What did you know about OSA before you were diagnosed with OSA?

3. What did you know about CPAP before the doctor said you needed CPAP?

   PROBE: Do you think your knowledge of OSA helped you with using CPAP?
   PROBE: What about your knowledge of CPAP, did that help you in using CPAP?

4. Tell me what it is like to use CPAP when you are on the road.

5. What problems have you have had with using CPAP when you are on the road?

6. What has helped in using CPAP when you are the road?

7. How are you able to access CPAP supplies, resources, or information when on the road?

   PROBE: Tell mewhat it was like getting assistance or support in using your CPAP on the road.

8. What roles do friends, family, co-workers, your employer play in your use of CPAP on the road?
9. How does the work environment impact your ability to use CPAP when on the road?
10. Tell me how using CPAP on the road differs from how you use it at home.
11. How do policies affect you and using CPAP?
    a. What about state policies?

    b. What about environmental policies?

Concluding questions:

12. What's the worst thing about using CPAP on the road?

13. What's the best thing about using CPAP on the road?

Evaluation questions:

14. What was this interview like for you?

15. Would this interview have worked for you if we had talked on the telephone?

OR

Would this interview have worked for you if we had talked on the telephone?

APPENDIX C

DEMOGRAPHIC DATA

Demographic data

Long-Haul Truck Driver CPAP Study

1. What is your gender?
    - Male _____
    - Female _____

2. How old are you? _____

3. How many years have you been driving professionally? _____

4. How many years have you been driving as a long-haul driver? _____

5. What category of driver best describes you?
    - Company driver _____
    - Owner Operator _____
    - Owner operator leased to a motor carrier _____

6. What type of driver best describes you?
    - Solo _____
    - Team _____

7. When were you diagnosed with obstructive sleep apnea? _____

8. When did you start using CPAP? _____

9. In your home sleep environment, do you have a bed partner? _____

    In the truck cab sleep environment, do you have a bed partner? _____

APPENDIX D

SCRIPT TO INTRODUCE THE TELEPHONE INTERVIEW

Script to introduce the telephone interview:
This script will be read prior to scheduled interviews when there are several days between initial contact with potential participant and scheduled telephone interview.

Hello Mr./Mrs./Ms. This is Kenya Kirkendoll calling about the long-haul truck driver research study.

We spoke _____ about being a part of the study on long-haul truck drivers CPAP use when on the road.

Are you still willing to participate in the study? The interview should take between 30 minutes and 1 hour of your time and will be audio recorded.

Would you like me to remind you about the types of questions that I am going to ask?

If yes……

The questions will be about your use of CPAP when you are on the road and sleeping in your truck cab. For example the questions will be like: how you use your machine, what helps using the machine, what makes it hard to use the machine.

If no…. Ask if this is a bad time? Could I call you back at another time?

If yes, read below—

As I mentioned the other day, you are not required to answer any questions that you do not want to answer.

You can skip any questions or you can end the interview at any time if you choose.

Do you have any questions before we begin?

Answer patient questions.

Then begin the interview.

APPENDIX E

SCREENING SURVEY

Screening Survey

Long-Haul Truck Driver CPAP Study

Screening Questions:

1. Are you currently working as a long-haul truck driver? _____ Yes
   _____ No
2. Do you have a commercial driver's license? _____ Yes _____ No
3. Have you been diagnosed with OSA? _____ Yes _____ No
4. Are you currently using CPAP for the OSA? _____ Yes _____ No
5. Is the truck equipped with a sleeper berth? _____ Yes _____ No

An answer of No to questions 1-5 is a disqualifier for participation in the study.

6. How many nights per week do you sleep in your cab and use CPAP?-
   _____

An answer of 1 disqualifies the person for study participation.

Eligibility and Study Interest:

Is this person eligible? _____ Yes _____ No

Is the person interested in study participation? _____ Yes _____No

Study information provided _____ Yes _____ No

Interview scheduled _____Yes _____ No _____Call back to schedule interview

_____

_____

Name: First initial- _____ Last name- _____

Phone number: _____

Best time to call: _____

APPENDIX F

STUDY FLYER

LONG-HAUL TRUCK DRIVERS NEEDED FOR A STUDY

Do you or a trucker you know use CPAP on the road?
We would like to talk with you to hear about your story.
The purpose of this research study is to explore long-haul truck drivers' use of CPAP when they are on the road and to understand the benefits and difficulties.

The study involves one interview either in-person or by telephone.
You will receive a $50 gift card for taking part in the interview.

Participants should be:

- 21 years-old or older
- Hold a current CMV license
- Work as a long-haul truck driver
- Use CPAP in the truck cab at least 2 nights per week when on the road

If you want to learn more about the study, contact Kenya, doctoral nursing student at 678-699-6019 or kkirken@uab.edu

APPENDIX G

VERBAL INFORMED CONSENT DOCUMENT

Verbal Informed Consent Document

Study Title: CPAP Use among Long-Haul Truck Drivers

Principal Investigator: Kenya D. Kirkendoll, MSN, MPH, RN; Karen Heaton, PhD

Hello, my name is Kenya Kirkendoll, a student at the University of Alabama at Birmingham. I am asking you to volunteer to take part in a telephone interview as part of a research study about long-haul truck drivers use of CPAP when they are on the road. I am interested in learning what it is like for long-haul truck drivers when they use their CPAP machines while sleeping in their truck cabs. Your participation in this study is completely voluntary. This means you do not have to participate if you don't want to. If you agree to participate, you have the right to only answer the questions you choose to answer. You have the right to stop participation at any point during the interview if you so choose.

This phone interview is being conducted to learn more about what it is like for long-haul truck drivers to use CPAP when they are working on the road. You will be asked questions about how you use your CPAP machine, what helps with using CPAP, and what makes it hard to use the machine. The interview should take about 30 to 60 minutes to complete and will be audio recorded. After completing the interview you will receive some educational materials about health and wellness and a $50 gift card for your time. I may call you for follow up to clarify information from the interview.

The potential risks of this research are minimal and confidentiality of the information you share will be maintained at the highest levels. Information obtained about you for this study will be kept confidential to the extent allowed by law. However, research information that identifies you may be shared with the UAB Institutional Review Board (IRB) and others who are responsible for ensuring compliance with laws and regulations related to research, including people on behalf of UAB School of Nursing and the Office for Human Research Protections (OHRP). These groups ensure that your rights are not being violated during the research study. If you choose to participate in the study you will be assigned an identification number. Your name will not be associated with the interview questions or answers. The information from the research may be published for scientific purposes; however, your identity will not be given out.

If you have any questions, concerns, or complaints about the research please feel free to contact me; my number is 678-699-6019 and my email address is kkirken@uab.edu. I will be glad to answer any of your questions. You may also contact my faculty mentor, Dr. Karen Heaton. Her telephone number is 205-996-9467, and her email address is kharnp@uab.edu.

If you have questions about your rights as a research participant, or concerns or complaints about the research, you may contact the UAB Office of the IRB (OIRB) at (205) 934-3789 or toll free at 1-855-860-3789. You may also call this number in the event the research staff cannot be reached or you wish to talk to someone else.

Do you have any questions?

Do you agree to voluntarily participate in this research study?

____ Yes If Yes….. Continue

____ No If No….. Thank you for your time and good-bye.

APPENDIX H

UNIVERSITY OF ALABAMA
INSTITUTIONAL REVIEW BOARD APPROVAL LETTER

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM
Office of the Institutional Review Board for Human Use

470 Administration Building
701 20th Street South
Birmingham, AL 35294-0104
205.934.3789 | Fax 205.934.1301 | irb@uab.edu

APPROVAL LETTER

TO: Kirkendoll, Kenya D

FROM: University of Alabama at Birmingham Institutional Review Board
Federalwide Assurance Number FWA00005960

DATE: 12-Jul-2017

RE: IRB-160429004
CPAP Use Among Long-Hall Truck Drivers

The IRB reviewed and approved the Continuing Review submitted on 11-Jul-2017 for the above referenced project. The review was conducted in accordance with UAB's Assurance of Compliance approved by the Department of Health and Human Services.

Type of Review: Expedited (Category 7)
Determination: Approved
Approval Date: 12-Jul-2017
Approval Period: One Year
Expiration Date: 11-Jul-2018

The following apply to this project related to informed consent and/or assent:

- Waiver (Partial) of HIPAA