

A PRELIMINARY EFFICACY AND FEASIBILITY OF AN OBSTRUCTIVE SLEEP APNEA
EDUCATIONAL INTERVENTION IN OMAN

by

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Dedication

This work is dedicated to my wife, three sons, and daughter for their love, patience and support; to the rest of my family for their continuous support and encouragement; to my late parents, who would have been very proud of what I have achieved; and to my supervisors for giving me the chance to fulfill my dream.

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Abstract

A PRELIMINARY EFFICACY AND FEASIBILITY OF AN OBSTRUCTIVE SLEEP APNEA EDUCATIONAL INTERVENTION IN OMAN

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George Mason University, 2017

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Background: Obstructive sleep apnea (OSA) is chronic disorder that contributes to multiple physiological and psychological conditions. Obstructive sleep apnea contributes to high rates of morbidity and mortality and has substantial impacts on both health care costs and the quality of life for affected individuals and their families. Healthcare providers – particularly primary health care nurses – are ideally situated to interrupt the cascading consequences of OSA if they are equipped with evidence-based knowledge about the disease process and appropriate methods for screening, education, and preventive interventions.

Purpose: The purpose of the study was to test the preliminary efficacy and feasibility of an online health educational intervention on the knowledge and attitudes of OSA among primary health care nurses in Oman.

Methods: This study was designed to assess the preliminary efficacy and feasibility of an online educational program on OSA by randomly assigning subjects to either a treatment (OSA content) or attention control (diabetes content) group. At baseline, the OSA knowledge and attitudes of both groups were assessed by the Obstructive Sleep Apnea

Knowledge and Attitudes (OSAKA) questionnaire; both groups also completed the Diabetes Basic Knowledge Test (DBKT) to use for control comparisons. Following randomization, the intervention group viewed a 15-minute narrated video on "*Brief Introduction to OSA for Omani Nurses*" and the control group viewed a similarly formatted 15-minute narrated video on diabetes. The intent was for the subjects in both groups to complete a posttest that included both the OSAKA and DBKT instruments; however, due to a programming error, the software did not present the DBKT to the intervention subjects and did not present the OSAKA instrument to the control subjects as intended. Therefore, the results describe the findings from a one-group, pretest-posttest intervention study to assess the preliminary efficacy and feasibility of the educational intervention. Feasibility data were also collected with face-to face interviews with a convenience sample of nurse administrators who oversee primary health care nurses in health centers in the Al-Batinah governorate in Oman.

Results: Overall, the baseline OSA knowledge scores for the entire sample (N=156) were very low (M=8.87, SD=2.91; median=9, range 0-15 out of possible 18 points). There were no significant relationships between OSA knowledge and any of the demographic variables. There was no significant difference in the mean OSA knowledge scores ($p=0.80$, $t=0.26$) between the intervention group (M=8.90, SD=2.68, n=73) and the control group (M=8.84, SD=3.12, n=83) at baseline. Primary health care nurses in the intervention group (n = 73) had a significant improvement in posttest knowledge scores on the OSAKA as compared to pretest scores ($p = .037$, $t= -2.1$).

After the online OSA educational intervention, 91.8% (n=67) of participants (n=73) indicated they were “likely” or “very likely” to recommend the online video to other health professionals. Although posttest attitudes were higher than baseline for the intervention group, the difference did not reach statistical significance.

Implications for Practice: The low levels of OSA knowledge in this sample of primary health care nurses may indicate that their ability to identify patients at risk for OSA, assess at-risk patients appropriately, or refer as needed to physicians is limited. Nursing educators may consider integrating content about sleep disorders – and OSA – into the baccalaureate nursing curricula. Continuing education programs might offer focused programs on sleep disorders and OSA to raise awareness among practicing nurses.

Conclusion: Primary health care nurses in Oman are expected to assess patients, identify health risks, and refer as necessary to physicians or other practitioners. In this sample of primary health care nurses, knowledge about OSA was limited; low knowledge of risk factors, symptoms, and treatment options may undermine the nurses’ ability to assure that patients who may have OSA are referred appropriately. Implications for basic nursing curricula and continuing education are offered.

Chapter One: Introduction

Background and Significance

Obstructive Sleep Apnea (OSA) and its consequences have received considerable attention in research and clinical practice in the past few years. Studies have focused particularly on the burden that OSA brings to the health of populations as well as the health of each individual (AlGhanim, Comondore, Fleetham, Marram, & Ayas, 2008; Luo, Feng, & Li, 2013). OSA is a common sleep disorder among American adults. Researchers have estimated that roughly one in every five adults has a mild form of OSA and one in every fifteen adults has a moderate or more severe type of OSA (Young, Skatrud, & Peppard, 2004). The prevalence of sleep-disordered breathing without related daytime sleepiness was present in 24% of men and 9% of women, which is Apnea/Hypopnea Index (AHI) ≥ 5 events per hour (Young et al., 1993). In primary health care settings, one-third of primary health care patients report symptoms that indicate having OSA (Netzer et al., 2003).

According to the American Sleep Apnea Association (ASAA, 2012), it has been estimated that 22 million Americans suffer from the disorder of OSA and up to 26% of adults are at high risk for OSA (Carlucci, Smith, & Corbridge, 2013). In other Western countries, the overall prevalence of mild and moderate OSA is estimated at 20% and 7%, respectively (Mahboub et al., 2013). In New Delhi, a community-based study reported a prevalence of 14% for OSA in middle-aged men. In the Middle East, one study conducted in Jordan revealed that the high risk of OSA was present in 106/554 (19.1%) of men and in 96/651 (14.7%) of women ($p = 0.042$) (Mahboub et al., 2013).

There are no statistics about the prevalence of OSA in Oman, but risk factors and comorbid conditions exist in the country, including high rates of obesity, hypertension, heart diseases, and diabetes. For example, the prevalence of diabetes in Oman was 7.79% out of the total population of 2.5 million in 2012 and was expected to be 12.21% in 2030 rising from 145,600 cases in 2012 to 326,400 cases in 2030 (Bhattacharjee, 2013). The World Health Organization estimates a 190% increase in the number of people living with diabetes in Oman over the next 20 years (Al-Riyami, 2010).

Although risk factors and comorbid conditions suggesting a risk of OSA in the general population, researchers concluded that OSA was still underdiagnosed and unrecognized in the general population (Bahammam, 2011; Heffner, Rozenfeld, Kai, Stephens, & Brown, 2012; Valerio & Heaton, 2014). With healthcare technology advancing at a rapid rate, the basics of screening still need to be addressed. An estimated 80% of all cases of OSA are unrecognized by primary health care providers (Bahammam, 2011; Valerio & Heaton, 2014). Eighty-two percent of men and 92% of women with moderate to severe cases of OSA remain undiagnosed (Chung et al., 2012); Tasali, Mokhesi, & Van Cauter, 2008). From those undiagnosed with OSA, there are about 17 million untreated individuals around the globe who may account for as much as \$22 billion in healthcare costs annually (Al-Abri, et al., 2011).

The reason for these undiagnosed cases around the world is because no single questionnaire or physical exam can predict patients with OSA (Heffner et al., 2012; Valerio & Heaton, 2014). Another reason for patients being unrecognized for OSA is the limited information about sleep particularly OSA that primary health care providers

received in their educational programs (Bahammam, 2011; Heffner et al., 2012; Valerio & Heaton, 2014). In addition, primary health care providers do not systematically screen patients for OSA and may fail to identify comorbidities in high-risk patients (Bahammam, 2011; Heffner et al., 2012). Moreover, there is a lack of data on the awareness of primary health care providers from developing countries about sleep-related breathing disorders such as OSA (Bahammam, 2011; Ojeda, Jeffe, Guerrero, Mantilla, Santoro, Gabino, & Cherrez, 2013). Current evidence also suggests that in primary health care settings, patients are not being referred for further investigation and treatment. One-third of primary health care patients report symptoms that indicate having OSA (Netzer et al., 2003).

It is not just comorbid conditions and prevalence of OSA are in the rise, but mortality rate due to OSA is in the rise as well. In a prospective cohort study of men and women ($N = 6441$), Punjabi et al. (2009) found that subjects without OSA had a mortality rate of 16.8 deaths per 1000 persons/year as compared with mortality rates of those with severe OSA at 32.2, moderate OSA at 28.3, and 21.7 for mild OSA.

There were different studies conducted on the prevalence of OSA. For instance, Young and colleagues (1993) examined the prevalence of OSA in USA using overnight polysomnography. In this Wisconsin Sleep Cohort Study, a cohort of middle-aged men and women ($N = 602$), ranging from 30 to 60 years of age were examined. It was determined that 4% of men and 2% of women suffer from OSA. That is an apnea/hypopnea index (AHI) ≥ 5 events per hour with an accompanying daytime symptoms.

In a more recent study conducted in Nigeria, Viswanath and colleagues found a prevalence of 24% in men and 9% of women, which is almost three times higher in men than in women. It was stated that the reasons for the gender differences in the prevalence and severity of sleep apnea are multifactorial. It is mainly related to a difference in fat distribution in areas such as the neck and also due to structural differences in upper airway dimensions (Viswanath, Ramamurthy, Dinesh, & Srinivas, 2015). Some of the reasons for the gender differences discussed by Roca and colleagues, in men severe OSA was associated with older age, higher body mass index (BMI), and hypertension, whereas in women, in addition to the previously mentioned associations in men, more serious OSA was related to an increase in the prevalence of diabetes mellitus and current smoking (Roca et al., 2015).

Treating patients with OSA is financially burdensome for any society and country. According to Bahammam, the per capita polysomnography rate in Saudi Arabia was 7.1 per year per 100,000 people, compared with 18.3 in developed countries (2011). However, most of the people are either being underdiagnosed, misdiagnosed or untreated for OSA. That impacts a larger portion of the population especially in the primary health care settings. According to Al-Abri et al. (2011), it is estimated that the annual average of untreated OSA patient's healthcare costs in the USA were \$1,336 more than an individual without OSA (Al-Abri, Al-Hashmi, Jaju, Al-Rawas, Al-Riyami, & Hassan, 2011).

Although morbidity and mortality of OSA are in the rise, researchers suggested various rationales of having lack of awareness of OSA. One suggestion of lack of awareness is due to medical and nursing schools not offering enough educational

materials for medical and nursing students about OSA (Almohaya et al., 2013; Bahammam, 2011; Fernandez, Ojeda, Calderon, Murillo, Sanchez, Vilema, & Cherrez, 2014; Luo et al., 2013; Valerio & Heaton, 2014; Williams, Nunes, Zizi, Okuyemi, Airhihenbuwa, Ogedegbe, & Jean-Louis, 2015). In addition, primary health care providers lack knowledge and attitudes in identifying at-risk OSA patients (Bahammam, 2011; Luo et al., 2013; Valerio & Heaton, 2014; Williams et al., 2015).

Therefore, a gap exists in the knowledge of primary health care providers on how to identify patients with OSA (Bahammam, 2011; Ojeda et al., 2013). Bahammam demonstrated that increased OSA knowledge among primary health care providers was significantly associated with increased diagnosis and treatment. Thus, more awareness among primary health care providers in primary health care settings requires enhancing their attitudes and knowledge on diagnosing OSA patients for better diagnosis and treatment (Bahammam, 2011).

There may be a need to increase knowledge and improve attitudes of the primary health care providers in Oman. Increased knowledge and improved attitudes may improve health-related quality of life for the individual and safety of the community. Research has shown that OSA outcomes are determined by early intervention, detection, and treatment (Antic et al., 2009; Bahammam, 2011; Ojeda et al., 2013). It is imperative that primary health care providers have the skills necessary to detect those undiagnosed patients with OSA so that they may be referred for further tests and treatment as needed. For the purpose of this study, the primary health care providers will be nurses working in primary health care settings. The main reason primary health care nurses are the target

population for this study is their role in the first level of prevention in the health centers. Usually patients go first to the primary health care centers for diagnosis and treatment in Oman. This is considered the first line of contact before secondary and tertiary preventions. They can be screened for OSA by primary health care nurses using the various methods appropriate for the primary health care center setting. Also, those nurses may adopt the other screening methods that are being used elsewhere in the world.

Focusing on increasing the knowledge and attitudes of the primary health care nurses about OSA, may provide a clear societal benefit. This benefit will be in reducing automobile and occupation-related accidents, which directly impact the use of medical resources and subsequent medical cost expenditures (AlGhanim et al., 2008; Luo et al., 2013). Further identification of lack of knowledge and attitudes about OSA among primary health care nurses in Oman may open up more opportunities for research developments and investigation in this area. Improvement in the health care delivery system may also be expected as primary health care nurses gain knowledge and improve attitudes. They will be better informed in assessing whether or not their Omani patients show characteristics and risk factors of OSA. As screening methods are developed and implemented, more undiagnosed OSA patients may be identified.

The importance of this study is that OSA impacts not only societal health and economic issues, but the overall quality of life of individuals and their families. This study intends to fill a gap; there is no data on the primary health care nurses' knowledge and attitudes about OSA in Oman. Furthermore, Thus, better prevention and management of this disorder could be attained through better understanding and awareness.

Purpose of the Study

The purpose of the study was to test the preliminary efficacy and feasibility of an online health educational intervention on the knowledge and attitudes of Obstructive Sleep Apnea among primary health care nurses in Oman.

Research Questions

In this study of knowledge and attitudes related to OSA among primary health care nurses in Oman, the research questions were:

Question 1:

What is the *preliminary efficacy* of a brief educational intervention to increase the levels of knowledge and attitudes for primary health care nurses in Oman?

The intended specific aim for question 1 was to determine if there are significant differences in the mean scores on the Obstructive Sleep Apnea Knowledge and Attitudes (OSAKA) instrument between the intervention and control groups following the online educational intervention. However, as the control group did not have the opportunity to complete the OSAKA instrument in the posttest data collection, the specific aim has changed.

The specific aim for research question 1 is to determine if there is a significant difference between the baseline and posttest OSAKA knowledge scores for the group that received the OSA educational intervention.

Question 2:

What is the *feasibility* of providing a brief educational intervention on the levels of knowledge and attitudes of primary health care nurses?

The specific aims for question 2 are:

1. To test the feasibility of the educational intervention by obtaining subjects' perceptions of the usability, acceptability, and relevance of the “*Brief Introduction to OSA for Omani Nurses.*”
 - a) to assess the perceived usability by primary health care nurses by testing it for accessibility, navigation, and organization;
 - b) to assess the acceptability of the intervention by primary health care nurses in the Omani context;
 - c) to assess the relevance of the intervention to the subjects' nursing practice; and
 - d) to obtain administrators' perceptions on the practicality and relevance of the intervention.

Conceptual Frameworks

Importance of Theory to Guide Intervention Research

Theory-based research is essential in managing nursing practice as it describes the relationships between the variables and improves nursing knowledge and understanding of the process by which interventions are effective (Melnyk & Morrison-Beedy, 2012). According to Peek and Melnyk (2014), theory acts to guide nursing research by helping in detecting the problem of interest, and developing, designing, and implementing the intervention. In addition, theory acts to analyze the study; to explain the findings and identify specific associations between the intervention and the outcomes. Finally, theory acts to provide a framework that shows how to evaluate the intervention.

Knowledge, Attitudes, and Practice Triad Conceptual Model

Various researchers have suggested different theoretical models of the knowledge–attitude–practice (KAP) relationship. The most frequently useful ordering of the KAP variables is the cognitive model (Valente, Parades, & Poppe, 1998) (Figure 1). Valente et al. stated that this theoretical model asserts that individuals first learn by practice. Then they develop a positive attitude toward that practice. After passing through these stages, then they are more likely to engage in the behavior.

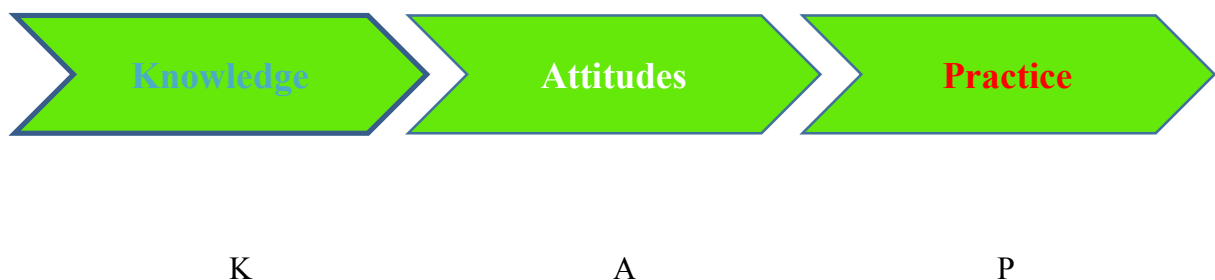


Figure 1. Conceptual Framework by Valente, Parades, & Poppe, 1998

Researchers have included the KAP model in their studies as the main conceptual model, such as Rogers who developed the Diffusion of Innovations (DOI) theory in 1962 (Hubbard & Hayashi, 2003). They said that the theory described the process that new ideas, or new methods, spread over time. The theory consisted of concepts such as, that the spreading of ideas occurred because of the passing of time, and that most people would experience the usage, but not the adoption, of an innovation. Scholars recently have been conducting research on DOI theory, and have incorporated the innovation

adoptions into three stages, which were classified as knowledge, attitude, and practice (Hubbard & Hayashi, 2003).

There are other research studies that used KAP as the conceptual framework in various fields of education and practice from health to science. For example, Dai, Chen, Yuan, and Yen (2012) used KAP as their conceptual framework to explore the differences in students' knowledge, attitude, and practice after participating in experimental teaching that incorporates the concept of nanotechnology into the curriculum of electronics courses in vocational high schools. On the other hand, Lothian and colleagues used the KAP model in the hygiene education field in teaching patients how to correct their health behavior in practice. The cognitive learning concentrated on the knowledge and the ability of comprehension, while the affective learning concentrated on changing subjects' intention, attitude, or norms to adjust themselves through hygiene education. The third part of the KAP triad focused on psychomotor learning or skills, which was stimulating learners' health behavior (Lothian, Ferrence, & Kaiserman, 1996).

Bano et al. used the KAP model developed by Schwartz in 1976 as a cognitive–affective–behavior theory in the area of social psychology. The aim was to understand the nutrition knowledge, attitude, and practices of female college students ($N = 100$) of the Hail University in Saudi Arabia. The sample was randomly selected from the classrooms based on nutrition background and divided into two groups of nutrition ($n = 50$) and non-nutrition students ($n = 50$). They suggested that an individual's diet and physical activity habits were influenced by their knowledge of and attitudes toward these behaviors.

Investigating these variables would shed light onto the factors that might be mediators of motivation to change behavior. Their result showed significant differences in nutritional knowledge, attitude, practice, breakfast-eating habits, and the concept of a balanced diet among the two groups of students (Bano, Al-Shammari, Fatima, & Al-Shammari, 2013).

Alzghoul and Abdullah (2015) used KAP to collect data from registered nurses ($N = 266$) in the management of patients' pain in Jordanian public hospitals. They said, based on reviewing previous studies of the KAP model, it was hypothesized that the main elements of the KAP model (attitudes and knowledge) significantly predicted the differences in the practices of nurses regarding pain management. The two constructs, attitude and knowledge, which are the main determinants of the KAP model were found independently to predict nurses' practices of managing patients' pain. Knowledge of pain management was found to be the strongest predictor.

Therefore, primary health care nurses' knowledge and attitudes related to OSA was based on the conceptual model of the knowledge, attitude, and practice by Valente et al. (1998) (Figure 1). It is worth noting that the researcher measured only the knowledge and attitudes parts of the model in this study. The next step in this program of research may be to expand the study to include the practice component of the model.

The first of the components is knowledge. Knowledge may be defined as the capacity to acquire, retain, and use information. Health system factors such as the training and continuous education of health care nurses on OSA can influence health care nurses' knowledge, attitude, and practice (Fernandez et al., 2014; Jha et al., 2013; Ojeda et al., 2013). Another influence for primary health care nurses is the availability of an

organizational support system. The health care nurses' knowledge of various aspects of OSA, in turn, affects the level of provision of OSA assessment and treatment.

The second component of the model is attitudes. Attitudes refer to preferences to react in a certain way to certain situations. In this study, the attitudes of primary health care nurses toward various aspects of OSA diagnosis and treatment were measured. The nurses' role in supporting diagnosis and treatment involves screening, assessment, and appropriate referral (Meredith et al., 2005; Passey et al., 2012). In this study, the model would suggest that the more primary health care nurses are familiar with patients experiencing OSA, the better will be their attitudes towards OSA patients and the need for appropriate diagnosis and treatment.

It is expected that primary health care nurses' familiarity and experience with patients diagnosed with OSA may make them more motivated and accepting, having the appropriate awareness of risk factors for OSA. There could also be external factors affecting the knowledge and attitudes, such as the environment surrounding the nurses or the type of organization in which they are working (Fernandez et al., 2014; Jha et al., 2013; Ojeda et al., 2013).

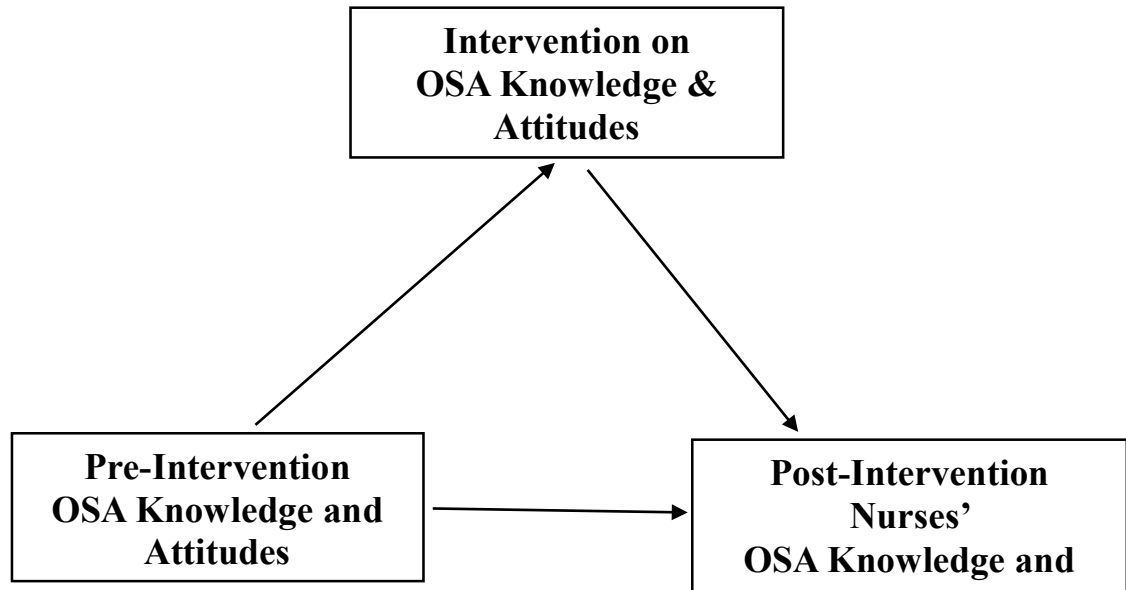


Figure 2. Variables Related to the Conceptual Framework

Conceptual Definitions for Study Variables:

Independent Variable (IV):

1. Independent variable: group assignment to the intervention

Dependent Variables (DVs):

1. Dependent variable: knowledge on OSA among primary health care nurses
2. Dependent variable: attitudes on OSA among primary health care nurses

Definitions of Terms

Independent variable (IV): assignment to intervention or not

Operational definition: Random assignment to the group receiving the OSA educational intervention.

Conceptual definition of OSA knowledge: Primary health care nurses' knowledge about OSA is based on five domains: (1) epidemiology, (2) pathophysiology, (3) symptoms, (4) diagnosis, and (5) treatments.

Operational definition of OSA knowledge: Primary health care nurses' knowledge about OSA will be measured by the knowledge subscale of the Obstructive Sleep Apnea Knowledge and Attitudes (OSAKA) questionnaire; the instrument is composed of 18 true/false/don't know questions, each of which can be categorized into one of the five knowledge domains (Schotland & Jeffe, 2003).

Conceptual definition of OSA attitudes: The primary health care nurses' attitudes toward OSA are the nurses' perceptions of the importance of OSA condition and their confidence in detecting and treating those patients with an OSA diagnosis.

Operational definition of OSA attitudes: Primary health care nurses' attitudes about OSA will be measured by the attitudes subscale (five questions) of the OSAKA questionnaire.

Conceptual definition of the OSA educational intervention: the educational intervention includes content about OSA knowledge and attitudes that are aligned with five underlying central domains of the OSAKA instrument. This educational intervention was designed to be culturally appropriate to the Omani context.

Operational definition of the OSA intervention: The educational intervention was a video entitled "*Brief Introduction to OSA for Omani Nurses.*" It was composed of a 15-minute narrated video presentation on OSA that incorporated some true/false review questions. The intervention was online and asynchronous to give leniency to the

participants to login depending on their time and place. The intervention was designed to be short because primary health care nurses at work may be busy. The online format was used to make the study available to as many participants as possible in the primary health care settings across Oman.

Note: The educational program for the [intended] control group condition had a parallel construction and format; nearly all aspects of the 15-minute video were aligned except that the content focused on diabetes knowledge for nurses and contained no information about obstructive sleep apnea.

Conceptual definition for feasibility: the perceptions of the OSA video's usability, acceptability, and relevance to the nurse's workplace.

Operational definition for feasibility: the perceptions of nurses were collected by 9 items obtaining feedback on aspects of the OSA video; the questions were developed by the researcher for this study. The administrators engaged in a face-to-face session to view the "*Brief Introduction to Diabetes for Omani Nurses*" video and provided their perspectives on its feasibility for use with PHC nurses with parallel 9 items to those items answered by the nurses. The [intended] control group completed a similar evaluation of the diabetes educational video.

Innovation

The innovative nature of this study is that it is the first of its kind in Oman. The study will be the baseline for future studies on the knowledge and attitudes of primary health care nurses on OSA. The innovation part of this study also is that it is an online educational intervention. It will be asynchronous, allowing primary health care nurses to

access it at their pace. A wider scale study could be implemented with a larger sample size after completion of this feasibility and preliminary efficacy study. Also, this work may be a model for other countries where OSA may be prevalent but under diagnosed.

Summary

This chapter covers the background and significance of the research, aims, and objectives, the purpose of the study, and the conceptual framework. Because this study is the first of its kind in Oman, it is anticipated that many advantages will arise from its implementation. One advantage of this study is the replication of it in larger scale or in a country where OSA may be prevalent but under diagnosed.

Because the researcher was testing the preliminary efficacy and feasibility of the online OSA educational intervention, it was appropriate to use a conceptual framework that is relevant to the specified purpose. So in this study, the KAP (knowledge, attitudes, and practices) triad conceptual framework was used. The model specifies each of the three factors and how they are interrelated to the outcomes of a study. Although the three factors are discussed, the practice component of the triad was not measured in this study..

Chapter Two Literature Review

Literature Search Strategy

This systematic review of the literature researches articles on knowledge and attitudes of obstructive sleep apnea (OSA) among primary health-care nurses.

Key terms used to find relevant literature for this study included: *sleep apnea*, *obstructive sleep apnea*, *obstructive sleep apnea/hypopnea syndrome*, *risk factors*, *diagnosis and treatment*, and finally *primary health-care nurses' knowledge and attitudes about OSA*, and *physicians' and/or nurses' knowledge and attitudes about OSA*. Search strategies to find published articles involved computerized database searches covering mainly the last five years, though some classic articles were included. The search used the Cumulative Index to Nursing and Allied Health Literature (CINAHL) and Medline with Full Text. Cochrane Library, ProQuest Nursing and Allied Health Services Research Library, and Google Scholar were used as well. Individual publisher databases were also explored, including ProQuest Digital Dissertations. Multiple databases were combined during searches of key terms when possible and duplicate articles were removed. A second strategy was examining the reference lists of articles to identify relevant source materials that had not come up in the database searches.

The highest yielding terms were obstructive sleep apnea (18,398) in Medline. Most of the articles used in this study were published between the years 2010 and 2015. This list of articles was further limited by special key terms and Boolean operators. The inclusion criteria for an article to be incorporated in this literature review were based on their relevance to the study concepts. However, there was minimal literature found on

nurses' knowledge and attitudes about obstructive sleep apnea. If the title of the article and abstract were irrelevant to the study, the article was excluded, and the next one was screened. After assessing for relevant titles and abstracts, 43 articles were retained for in-depth evaluation. In the end, 17 articles directly related to knowledge and attitudes on OSA among primary health-care professionals were selected. Going through the purpose and concepts of the study further reduced the number of articles to six that have relevance to knowledge and attitudes of OSA among primary health care nurses though indirectly. From the literature review, there seemed to be a lack of studies involving nurses' knowledge and attitudes on OSA. This conclusion applied to develop and developing countries in the world as most of the studies about the topic were related to physicians, cardiologists, and dentists (please see table). There was no evidence of any article or study anywhere that focused attention on nurses' knowledge and attitudes regarding OSA.

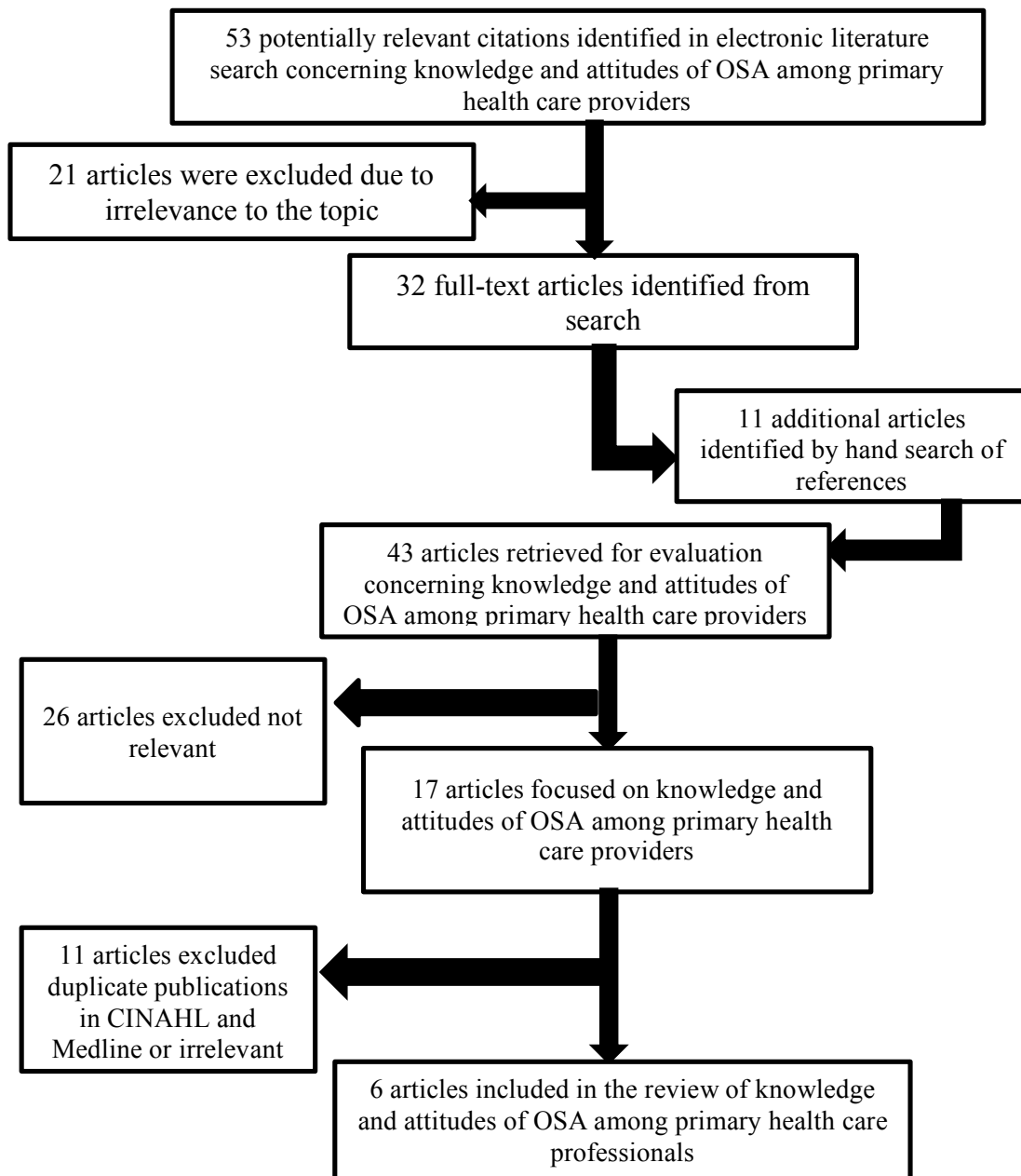


Figure 3. Literature Search and Study Selection Process

Review of the Literature

Obstructive Sleep Apnea

OSA is defined by the National Heart, Lung, and Blood Institute (NHLBI) as a common disorder that often goes undiagnosed or is misdiagnosed (United States Health and Human Services (HHS), NHLBI, 2012). The Centers for Disease Control (CDC, 2013) has identified insufficient sleep as a public health epidemic. OSA is one disturbing component contributing to insufficient sleep. OSA is categorized as primary insomnia (Yarlagadda, Kasaraneni, & Clayton, 2013).

Inadequate sleep diminishes the body's benefit of self-healing that is obtained during the deep, rapid eye movement (REM) stage of sleep. Any cause of sleep deprivation contributes to higher blood glucose levels, blood pressure, and triglycerides (Oladiran & Milligan, 2014).

It was found that two-thirds of all Americans do not get enough sleep (CDC, 2011). Eight hours is the recommended amount of sleep for adults. Insufficient sleep contributes to conditions such as weakened immune systems, obesity, mental disorders, health risk behaviors, limitations of daily functioning, injury, and mortality (CDC, 2011).

According to surveys conducted by the National Sleep Foundation from 1999 to 2004, more than half of American adults have sleeping problems for a few nights per week or more. The reasons vary from stress, distractions, or busy schedules. People go through the process of sleep every day with varying numbers of hours of sleep that depend on the mental and health status of each of them. Unfortunately, some of these

people have chronic complaints of difficulty sleeping or lack of enough sleep (National Sleep Foundation, 2013).

In America, the number of adults that suffer from chronic sleep is 50 to 70 million (Balachandran & Patel, 2014; Ju et al., 2012; Park, Ramar, & Olson, 2011; Valerio & Heaton, 2014). Epidemiological studies show that approximately 50% of all older adults have complaints of significant sleep disturbances (Russel & Duntley, 2011; Shim, Lee, Oh, & Sung, 2011). One of the reasons that people have difficulty with sleep is OSA (Amra, Farajzadegan, Fietze, & Penzel, 2011; Luo, Feng, & Li, 2013; Surani, 2013).

Definition of Obstructive Sleep Apnea

OSA is characterized by recurrent episodes of the absence (apnea) or reduction (hypopnea) of airflow for more than 10 seconds during sleep (Amra et al., 2011; Surani, 2013). Other related symptoms may include sleeping more during the day (Amra et al., 2011; Balachandran & Patel, 2014; Henrichs & Walsh, 2012; Myers, Mrkobrada, & Simel, 2013; Surani, 2013). These symptoms occur as a result of an upper airway obstruction while sleeping. This inefficient breathing pattern of OSA may lead to episodes of hypercapnia, acidosis, and hypoxemia. These events, in turn, stimulate the sympathetic nervous system to produce what is known as the fight or flight response. With this stimulation usually comes a brief awakening from sleep, disturbing the sleep cycle and REM stage sleep. This fragmented sleep pattern leaves the patient feeling tired and restless in the morning (Carlucci, Smith, & Corbridge, 2013). The activation of the sympathetic system causes vasoconstriction of the vascular system, as demonstrated by

increased blood pressure and heart rates. After reoccurring episodes, blood vessels are altered leading to the development of persistent hypertension (Carlucci et al., 2013).

The prevalence of OSA in the US is estimated to be 4% in middle-aged men and 2% of women in the same age group (Balachandran & Patel, 2014; Henrichs & Walsh, 2012; Kielb, Ancoli-Israel, Rebok, & Spira, 2012; Mold et al., 2011; Myers et al., 2013). The apnea/hypopnea episodes usually end with the person waking up during the night to allow the airway to open, following the obstruction (Kielb et al., 2012; Valerio & Heaton, 2014). Waking up several times at night results in sleeping more during the day, poor performance at work (Valerio & Heaton, 2014) and increased accidents at work or even at home (Obaseki et al., 2014; Valerio & Heaton, 2014). Untreated OSA produces a 20% reduction in work efficiency (Valerio & Heaton, 2014). Mild OSA affects one in four males and one in ten females within the general public (Toronto Western Hospital, 2012). Moderate OSA affects one in nine males and one in 20 females.

Obstructive sleep apnea is insidious and patients are often unaware of the associated symptoms. Cardinal manifestations include loud snoring, witnessed breathing pauses during sleep, disturbed sleep quality, fatigue, dry mouth, morning headache, and excessive daytime sleepiness (EDS) (Viswanath, Ramamurthy, Dinesh, & Srinivas, 2015). Other symptoms include anxiety, depression, diminished motor and cognitive functions, and reduced quality of life (Al-Jewair, Nazir, Al-Masoud, & Alqahtani, 2016). Snoring is a major symptom of OSA and has been associated with daytime sleepiness independent of the apnea/hypopnea index (AHI) (Bahammam, 2011; Henrichs & Walsh, 2012; Viswanath, Ramamurthy, Dinesh, & Srinivas). Snoring is the hallmark symptom of

OSA, which occurs in 95% of patients affected. If snoring is not present, a diagnosis of OSA is unlikely (Carlucci et al.).

Diabetes mellitus seems to be having almost the same risk factors as OSA. Thus it is considered as a comorbid disease (Heffner, Rozenfeld, Kai, Stephens, & Brown, 2012; Valerio & Heaton, 2014). The prevalence of type 2 diabetes mellitus (T2DM) in the United States has increased significantly in recent years, particularly among ethnic minorities. It has been suggested that insufficient sleep and/or sleep disorders may play an important role in the development of impaired glycemic control (Bakker, Weng, Wang, Redline, Punjabi, & Patel, 2015). Studies have reported that OSA is a highly prevalent comorbid condition in patients with type II diabetes mellitus (T2DM) (Heffner, Rozenfeld, Kai, Stephens, & Brown, 2012; Valerio & Heaton, 2014). OSA has been identified as having an independent association with altered glucose metabolism, which suggests a direct link between OSA and type II diabetes (Tasali, Mokhlesi, & Van Cauter, 2008).

According to the International Diabetes Federation (2015), diabetes is a global health priority. It estimates that 415 million people worldwide have diabetes. More than 35.4 million people in the Middle Eastern and North Africa (MENA) Region have diabetes as well. There were 325,900 cases of diabetes in Oman in 2015.

It is recommended that clinicians evaluate the risk of OSA in type II diabetics and also assess glucose tolerance in patients known to have OSA. More than 75% of obese patients who have a known diagnosis of diabetes mellitus have undiagnosed OSA (Tasali et al., 2008). A study by Pamidi and Tasali (2012) examined 52 healthy men between the

ages of 18 and 30 years of age. The subjects underwent a laboratory polysomnography followed by a morning oral glucose tolerance test. The study hypothesis was that through activation of the sympathetic nervous system, systemic inflammation is thought to change glucose metabolism. The result showed that men with OSA had a 27% lower insulin sensitivity and 37% higher total insulin secretion.

Risk Factors for OSA

Untreated OSA has been identified as a contributing factor to increased morbidity and mortality rates. If left untreated, sleep apnea contributes to comorbidities that can potentially be fatal (HHS, NINDS, 2013). Some of these risk factors are:

Gender. Several large-scale epidemiologic studies show that OSA risk factors are based on demographics that are impossible to modify to decrease risks, such as biological sex (Olbrich et al., 2009; Young, Finn, Austin, & Peterson, 2003). It is estimated to affect 4% of men and 2% of women in Western countries with a 2:1 male to female ratio (Alotair & Bahammam, 2008; Henrichs & Walsh, 2012; Kielb et al., 2012). Kielb et al. (2012) stated males are at a much higher risk of developing OSA than females.

Researchers examined the link between females and OSA development to determine that hormones may be responsible for why men are more likely to have OSA than women. Researchers looked at 589 women at varying stages of menopause (premenopausal, perimenopausal, and postmenopausal) to determine the presence of apneas through polysomnography. Researchers found that postmenopausal women were three times more likely to have moderate-to-severe OSA than were premenopausal women, suggesting that shifting hormone levels after childbearing years may increase

risk in women. This effect was found even when confounding variables such as age and weight were eliminated (Young et al., 2003).

Age. Another risk factor that cannot be modified is the age of the patient. Kielb et al. (2012) stated that the older patients are of both sexes, the higher the prevalence of OSA. A study by Larsson, Lindberg, Franklin, and Lundback (2003), looked at 5,424 subjects between the ages of 20 and 60 to determine during which ages apneas most frequently occur. The researchers found that in men, snoring and witnessed sleep apneas occurred most commonly in those between the ages of 55 and 59. On the other hand, the age in which snoring and witnessed sleep apneas occurred most frequently was 60–64 in women.

Genetics. Although the link between genetics and OSA has not been completely determined, researchers suggest that genetics may contribute in several ways (de Sousa, Cercato, Mancini, & Halpern, 2008; Patel, Larkin, & Redline, 2008; Zhang, Xiao, & Luo, 2014). One important consideration is that genetics may be in part responsible for the development of obesity through lifestyle factors and genetic predisposition (de Sousa et al., 2008; Patel et al., 2008; Zhang et al., 2014). According to Baik and colleagues there are two genetic studies that have comprehensively evaluated candidate genes, including genes related to facial anatomy, ventilator control, inflammation, sleep, obesity, and OSA-related diseases. However, their findings on significant or potentially meaningful genes that may affect OSA susceptibility were conflicting (Baik, Seo, Yoon, Kim, & Shin, 2015).

Ethnicity. It is also suggested that OSA is more prevalent within racial and ethnic minority groups than within white groups (Deng, Gu, Li, Liu, & Gao, 2014; Kielb et al., 2012; Lam, Sharma, & Lam, 2010; Leong et al., 2013; Luo, Feng, & Li, 2013). A Multiethnic Study of Atherosclerosis was designed to compare the prevalence of OSA among 211 Hispanic and 246 white Americans and 978 Japanese (Ralls and Grigg-Damberger, 2012). They said that the majority of the race/ethnic difference in OSA prevalence was explained by BMI and obesity. The results showed the prevalence of OSA was higher among Hispanics (37%) and whites (33%) than among Japanese (18%) but best corresponded with differences in BMI. BMI and sleep disordered breathing were strongly and similarly associated in Americans and Japanese.

Obesity. Some of the risk factors for OSA can be modified through lifestyle. This is the case for obesity, which has been found to be both a strong risk factor for OSA development and a determinant of OSA severity (de Sousa et al., 2008; Lopez, Stephan, Schulman, & Byers, 2008; Peppard, Young, Palta, Dempsey, & Skatrud, 2000; Young, Skatrud, & Peppard, 2004). The prevalence of OSA in obese persons is estimated to be 40% while in the morbidly obese, the prevalence rises to 70% (Bahammam, 2011; Lopez et al., 2008; Luo et al., 2013; Mold et al., 2011; Myers et al., 2013; Valerio & Heaton, 2014). There is an increase in OSA prevalence with increasing body mass index (BMI) (Bahammam, 2011; Balachandran & Patel, 2014; Henrichs & Walsh, 2012; Luo et al., 2013; Valerio & Heaton, 2014; Wall, Smith, & Hubbard, 2012), neck circumference, and waist-to-hip ratio (Henrichs & Walsh, 2012; Lim et al., 2014).

Researchers in the Wisconsin Sleep Cohort Study, a study tracking 948 participants over four years, discovered that when subjects increased their weight by 10%, they had six times the chances of developing moderate-to-severe sleep-disordered breathing. In addition, with a 10% increase in weight, participants had a 32% increase in the number of apnea events during sleep (Peppard et al., 2000). Obesity rates in the U.S. are continuing to rise. According to research conducted by the CDC in 2005–2006, 67% of American adults over the age of 20 are overweight while 34% of American adults over the age of 20 can be classified as obese. As obesity reaches epidemic proportions, so do the problems triggered by OSA.

Smoking. Cigarette smoking is another lifestyle risk factor that contributes to the development of OSA (Javaheri, Shukla, & Wexler, 2012). Smokers are expected to have three times the chance of having OSA than those who quit smoking or never smoked (Javaheri et al., 2012; Mayo Clinic, 2014). The Wisconsin Sleep Cohort Study examined the occurrence of apneas in subjects who were identified as nonsmokers, former smokers, or current smokers. They found that current smokers had three times the risk of developing OSA than nonsmokers or former smokers. Krishnan, Dixon-Williams, and Thornton (2014) said there was a strong association between smoking and OSA demonstrated in observational studies. In one small cross-sectional study, investigators found a smoking prevalence of 35% in patients with OSA (apnea-hypopnea index [AHI] >10) compared with only 18% in an unmatched group of patients without OSA (AHI < 5) ($P < .01$).

Alcohol. Experimental studies show an acute effect of alcohol on apnea and hypopnea frequency, but the effect of long-term alcohol use on the development or progression of OSA is unknown (Javaheri et al.). Gutierrez and Brady (2013) said alcohol has adverse effects on sleep. It shortens sleep latency, suppresses rapid eye movement (REM) and parasympathetic nerve activity, and can exacerbate OSA. Driving simulation studies have found that, compared with healthy individuals, those with untreated OSA are more susceptible to the effects of alcohol and at higher risk for accidents after just one drink.

Adverse Outcomes

Associated comorbidities of OSA include congestive heart failure, ischemic heart disease, asthma, pulmonary hypertension, hypothyroidism, primary open-angle glaucoma, poor neurocognitive function, and head and neck cancers (McNicholas, 2008). Other signs and symptoms associated with OSA are memory dysfunction and inability to concentrate, sexual dysfunction, irritability, chronic fatigue, and delirium.

OSA is a serious, life-altering condition that diminishes the quality of life and predisposes individuals to common comorbidities (Toronto Western Hospital, 2012). OSA prevalence is high in patients with hypertension (Balachandran & Patel, 2014; Gilat et al., 2014; Muxfeldt, Margallo, Guimarães, & Salles, 2014) and coronary heart disease (Balachandran & Patel, 2014; Luo et al., 2013; Marrone, Lo Bue, Salvaggio, Dardanoni, & Insalaco, 2013). There are also severe arrhythmic disorders (Balachandran & Patel, 2014; Gilat et al., 2014), cerebrovascular disease (Henrichs & Walsh, 2012; Luo et al.,

2013; Valerio & Heaton, 2014), and chronic heart failure of ischemic origin (Gilat et al., 2014; Henrichs & Walsh, 2012).

Excessive daytime sleepiness. Excessive daytime sleepiness and neurocognitive dysfunction have also been linked to motor vehicle and work-related accidents and also to reduced work performance (Luo et al., 2013; Valerio & Heaton, 2014). In addition, decreased school performance (Lal, Strange, & Bachman, 2012; Luo et al., 2013), fatigue (Myers, Mrkobrada, & Simel, 2013) and dissatisfaction with personal and social relationships (O'Hara, Luzon, Hubbard, & Zeitzer, 2009; Ward et al., 2013).

Road traffic accidents. Several studies related OSA with road traffic accidents, and all proved a correlation between the two (Basoglu & Tasbakan, 2014; Kales & Straubel, 2014; Sharwood et al., 2012; Valerio & Heaton, 2014). In the United States, there are 14 million commercial drivers, out of which 17–28% or 2.4–3.9 million are likely to have OSA (Kales & Straubel, 2014). Studies in which workers admitted to a history of snoring showed significantly higher rates of occupational injury (Sanna, 2012).

OSA has a great epidemiologic impact that made the United States Federal Aviation Administration (FAA) implement a federal policy to screen pilots and air traffic controllers who are overweight for OSA. This policy involves those with a BMI ≥ 40 being evaluated by a sleep specialist (Krasny, 2013). The FAA has acknowledged that OSA is almost universal in individuals with BMI ≥ 40 and a neck circumference of ≥ 17 inches (Krasny, 2013).

In the Arabian Gulf States, lack of sleep due to work requirements is also a latter day phenomenon. Omanis have become so busy with work, studies, and improving their

families' economic situations that some have lost their laid back lifestyle and extended family support. Its impact on their health and performance of work is well documented by the high number of road traffic accidents in Oman, making it one of the countries with the highest rates of road traffic accidents. Fatalities in Oman due to car accidents were estimated at around 30 deaths per 100,000 persons per year (Al Lamki, 2010). In addition to other major factors that contribute to car accidents, fatigue and lack of sleep was one of them (Al-Maniri et al., 2012; ROP, 2012).

Screening and Diagnosis of OSA

There are six instruments to screen for symptoms of OSA. They are the Epworth Sleepiness Scale (ESS) (Johns, 1991), the STOP questionnaire and the STOP-Bang questionnaire (Chung et al., 2008). In addition, there are the NAMES assessment and 4-Variable Screening Tool (Takegami et al., 2009), and the Berlin Questionnaire (BQ) (Netzer, Stoohs, Netzer, Clark, & Strohl, 1999).

Berlin Questionnaire. The BQ objective is to find high- and low-risk factors for OSA by checking signs of it. These signs are snoring behavior, wake time sleepiness or fatigue, and the presence of obesity or hypertension. The psychometric properties of the BQ had a test-retest reliability of 0.74-0.98 (Cohen's kappa) while the internal consistency with a Crobach's alpha was 0.68 – 0.98.

There are 10 questions in the BQ. Determining patients who are at high and low risk for OSA is based on responses in three categories. In category 1, high risk is defined as persistent symptoms (>3 to 4 times/week) in two or more questions about the patient snoring. In category 2, high risk is defined as persistent (>3 to 4 times/week) wake time

sleepiness, drowsy driving, or both. Finally, in Category 3, high risk is defined as someone with a history of high blood pressure or having a BMI of more than 30 kg/m². To be considered at high risk for OSA, the patient has to be diagnosed as high for at least two symptom categories. A patient who is diagnosed in only one symptom category will be considered as in a low-risk group (Netzer et al., 1999).

Epworth sleepiness scale. Another screening tool is the ESS, which was developed by Johns. It is a self-reported questionnaire to assess Excessive Daytime Sleepiness (EDS) and daytime sleep susceptibility (Johns, 1991, 1993). Excessive daytime sleep is considered to be the result of disturbed or inadequate sleep, which is very common in modern societies (Pecotic, Dodig, Valic, Ivkovic, & Dogas, 2012). The ESS is a questionnaire designed to identify persons with EDS. This is either due to lifestyle circumstances such as chronic sleep deprivation based on work or social schedules or a sleep disorder such as OSA, idiopathic hypersomnia, and narcolepsy. The ESS questionnaire is a rating scale that directs the individual to rate his/her average likelihood of falling asleep. The questionnaire had a high level of internal consistency with a Cronbach's alpha of 0.88. The rate is from 0, which corresponds to no chance of dozing to 3, which means there is a high chance of dozing during eight different common situations, such as watching television or sitting and talking to someone. A score greater than 10 indicates probable EDS.

The NAMES assessment. The NAMES assessment measures neck circumference, airway classification, comorbidities, Epworth scale, and snoring. It was designed to incorporate past medical history, current symptoms, and a physical exam into a single

assessment for OSA (Subramanian, Hesselbacher, Aguilar, & Surani, 2011). The sensitivity and specificity of the NAMES assessment for the detection of OSA were 91% and 23%, respectively. The 4-Variable Screening Tool is a tool for the identification of moderate-to-severe OSA and consists of four variables (gender, blood pressure, BMI, and self-reported snoring) (Takegami et al., 2009).

Polysomnography. Polysomnography (PSG) is the gold standard for objective diagnosis of OSA. Polysomnography is a comprehensive recording of the biological and physiological changes that occur during sleep (American Sleep Apnea Association, 2012; Epstein et al., 2009). The assessment of the PSG records the brain waves, oxygen level in the blood, the heart rate, and breathing. It also assesses eye and leg movements during the study (Aronsohn, Whitmore, Van Cauter, Tasali, 2010; Hussain et al., 2014; Laaban et al., 2009). The AHI is a measurement of the total number of apneas and hypopneas per hours of sleep. An AHI of 5–15 per hour is considered as mild, an AHI of 15–30 per hour is moderate, and an AHI greater than 30 per hour is considered severe (Carlucci et al., 2013).

Treatment Modalities for OSA

Healthy People 2020 have identified sleep health and management as a key national objective for improving the health of all (United States Health and Human Services (HHS), 2013). Two of the goals identified by Healthy People 2020 are to increase the percentage of people with symptoms of OSA who seek treatment and the number of adults having enough sleep (HHS, Healthy People 2020, 2013). The concern, need for recognition, and treatment of OSA are high.

Continuous positive airway pressure. The treatment modality for patients diagnosed with OSA is continuous positive airway pressure (CPAP) therapy; it is the gold standard treatment for OSA. CPAP consists of a breathing mask that the patient wears during sleeping hours. It uses a good fit to the patient's anatomy mask to deliver a calibrated level of positive air pressure to keep the airway open, which eliminates any apneas or hypopneas from occurring (Ancoli-Israel et al., 2008). Long-term adherence to CPAP treatment is often poor, with statistics showing only 40–60% compliance (Eastwood et al., 2011).

Studies have shown the effectiveness of CPAP in reducing symptoms of moderate-to-severe OSA. The CPAP study was done compared with a placebo and other treatment procedures such as oral devices, surgical procedures, and medications (Marshall et al., 2006; Patel, White, Malhotra, Stanchina, & Ayas, 2003). There are benefits of CPAP, such as it reduces AHI, blood pressure, and cardiac arrhythmias. It also improves sleep efficiency, oxygen saturation, self-reported sleep, and well-being. In addition, CPAP has been found to decrease work-related injuries and morbidity and mortality associated with motor vehicle accidents linked to EDS (Barbé et al., 2007; Jordan, McSharry, & Malhotra, 2014; Karimi, Hedner, Häbel, Nerman, & Grote, 2015; Marshall et al., 2006).

According to Lindberg et al., no study of CPAP has demonstrated a long-term reduction in morbidity and mortality (Lindberg, Berne, Elmasry, Hedner, & Janson, 2006). They said that one reason is that CPAP is difficult to use, which in turn affects compliance (Wang, Gao, Sun, & Chen, 2012). Patients' poor compliance is a major

barrier to evaluating its long-term benefits. Studies estimate that 65% to 89% of patients with CPAP devices use them for at least four hours a night for 70% of nights. Half of those for whom CPAP is prescribed, stop using it after two to three years. There are several risk factors and comorbid conditions associated with decreased compliance, including advanced age, diabetes, obesity, smoking, and depression.

According to Lindberg et al., improving CPAP compliance continues to be a challenge. The challenge is due to the importance of treating not only OSA but all comorbidities, particularly depression. Short-term studies have found behavioral modifications as a good solution for improving CPAP compliance (Lindberg, Berne, Elmasry, Hedner, & Janson, 2006). There are other treatment modalities, including oral appliances, surgery, or weight loss that are prescribed in situations where CPAP is not tolerated. In addition, pharmacological and surgical interventions can be used when CPAP treatment does not sufficiently improve daytime sleepiness (Antic et al., 2011).

There are many benefits of treatment of OSA, such as reverse of sleepiness and fatigue. In addition, other benefits are to restore full cognitive function and reduce the risk of accidents associated with OSA. Also, it reduces its cardiovascular and pulmonary effects. Lifestyle changes is encouraged such as weight loss and regular exercise. Avoidance of sedating drugs and alcohol for patients with OSA is also encouraged (Gutierrez & Brady, 2013).

Bi-level positive airway pressure. Bi-level positive airway pressure (BiPAP) delivers both inspiratory and expiratory pressure through a face device used in case patients are unable to tolerate CPAP (Blau et al., 2012; Jordan et al., 2014).

Weight loss. Dixon et al. said weight loss on OSA has been proven in studies of both bariatric surgery and conventional weight loss therapies (Dixon et al., 2012). Weight reduction should be encouraged for obese patients not only to improve OSA symptoms but to reduce the risk for other diseases as well.

Alcohol reduction. Alcohol has adverse effects on sleep. Driving-simulation studies have found that, compared with healthy individuals, those with untreated OSA are more vulnerable to the effects of alcohol and at higher risk of accidents after just one drink (Vakulin et al., 2009).

Mandibular repositioning devices. Mandibular repositioning devices and tongue-retaining devices are alternatives to CPAP (Chan, Lee, & Cistulli, 2007). Although both types of oral appliances are beneficial, they are less effective than CPAP (Gutierrez & Brady). Mandibular repositioning devices are available in several models, and they are more commonly used than tongue-retaining devices. A mandibular repositioning device can be custom-made to hold the lower jaw in a forward position during sleep. Another use of the mandibular repositioning device is that it can increase the space behind the tongue, which puts tension on the walls of the pharynx and the palate to reduce collapse (Chan et al., 2007). On the other hand, tongue-retaining devices are used for patients who are unable to tolerate CPAP or for mild to moderate OSA. They are supports that hold the tongue in place to keep the airway open (Chan et al.).

Surgical procedures. In addition, surgical techniques are available for treating OSA, all intended at relieving the obstruction by removing or bypassing it or increasing

airway size such as uvulopalatopharyngoplasty (Caples et al., 2010). The surgical procedure depends on the patient's anatomy and physiology decided by a surgeon who specializes in surgical treatment of OSA (Caples et al., 2010). There are also various drugs that showed a statistically significant reduction in AHI and daytime sleepiness.

Barriers to Treatment

Demographic variability. Several barriers could explain why those with OSA are not seeking a diagnosis. Adherence to therapy remains poor, with only half of the patients using CPAP for more than four hours per night. Determinants of CPAP adherence are not well understood with conflicting results from various studies. Factors that covary with demographic factors, such as race, ethnicity, and socioeconomic status (SES), may contribute to CPAP adherence (Billings et al., 2011).

According to Almeida et al., there are other factors that affect adherence to treatment, including treatment method, social and economic factors, the health-care system, and health professionals. In addition, other factors affecting adherence are characteristics of the disease, patient-related factors, and the patient's partner and family. Poor patient adherence is related to poor health outcomes and increased health-care cost (Almeida et al., 2013).

Billings et al. said that individuals with low SES and those of minority race/ethnicity have higher levels of obesity, physical inactivity, alcohol consumption, smoking, and poor medication compliance; these health behaviors may be associated with CPAP adherence (Billings et al., 2011). Those people have a greater burden of

comorbidities associated with OSA, such as poorly controlled diabetes, hypertension, obesity, stroke, and higher cardiovascular mortality (Billings et al., 2011).

Cost and inconvenience. Patients are unable to follow the treatment regimen of CPAP. The cost and inconvenience of traditional diagnosis may pose a significant barrier for those individuals. For a person to be diagnosed with OSA, it requires a person to stay in a sleep lab for up to three nights. The test can also be inconvenient for the patient as the three-night requirement may interfere with his/her work schedule and family commitments. In addition, some people may feel uncomfortable by being monitored by strangers while sleeping in an unfamiliar environment (Almeida et al., 2013). Another inconvenience that patients may face in undergoing lab testing is being placed on a waiting list for six months or more (Rice, Nelson, Rubins, Jeffrey, & Arjes, 2006). Patients living far away from the sleep lab may even have to travel to other destinations to find a lab offering OSA testing (Reichert, Bloch, Cundiff, & Votteri, 2003).

Almeida et al. also suggest that patients may prefer a device that does not make them feel embarrassed when using it around friends or bed partners and thus may feel a need to keep their use of the CPAP a secret.

CPAP device discomfort. There is discomfort associated with its use, which could be the device being hot, making marks on the face, limiting the users' mobility and prohibiting them from sleeping on their side or stomach, and leaked air which then blew into the users' eyes. The CPAP machine can also be noisy, which disturbed both the users and bed partners.

Mask discomfort. The CPAP mask can cause discomfort if poorly fitted and also could result in leaking air. Some people may experience feelings of claustrophobia from the mask, such as panic attacks.

CPAP device cleaning. Users of CPAP devices can have a hassle in cleaning the CPAP. The durability of the device and the frequency with which the device needed to be repaired or replaced can pose inconvenience (Aloia, Arnedt, Stanchina, & Millman, 2007).

Preference for a transportable device. People may prefer a transportable device, which is small and easy to pack for traveling, especially for patients who travel with minimal baggage, such as for camping, hiking, or motorcycle trips. Another concern for campers or hikers is a lack of power supply. Furthermore, a small device is better for frequent business travelers because it could be packed in carry-on luggage.

In Oman, the barrier in managing patients suffering from OSA is the absence of sleep centers in the Ministry of Health (MoH) hospital and health centers in Oman. There is only one sleep center in the entire country, which is not even related to MoH hospitals. This center is under the management of the Sultan Qaboos University Hospital. This sleep center makes it even harder for people to travel to it because it is in the capital, Muscat. Patients are referred to it from the various secondary care hospitals. Therefore, not all patients are referred or properly diagnosed and treated. People have to drive a longer distance than their original home, which makes them more susceptible to dozing off and, therefore, having road traffic accidents. The sleep center can hold only a few patients at a time, which takes about three days of admission in normal cases. This delay

causes patients to be put on the waiting list, which could take a few months. In addition, once they are discharged from the sleep center, they do not leave with the CPAP machine. They have to buy their CPAP machine if it is available. In addition, even if some of these patients can afford to buy the CPAP, it is difficult for them to operate it.

Cost of OSA-related Morbidity and Mortality

The cost of untreated OSA reaches further than just health issues. The economic burden of untreated moderate to severe OSA has been estimated to be between \$65 and \$165 billion in the US, which indicates the importance of maximizing the screening and diagnosis of this disorder (Potts, Butterfield, Sims, Henderson, & Shames, 2013; Tarasiuk, Greenberg-Dotan, Simon-Tuval, Oksenberg, & Reuveni, 2008). According to a study by the National Institutes of Health (NIH) (2010), untreated OSA has twice the risk of stroke in men. OSA is often a disorder that requires lifelong care, but treatment options do exist (Epstein et al., 2009). In the US, Medicare and Medicaid cover the comprehensive overnight sleep study when ordered by a provider. If a diagnosis of OSA is made, most insurance policies cover CPAP therapy as this equipment is considered durable medical equipment (National Sleep Foundation, 2013).

According to Al-Abri et al., (2011) it is estimated that the average untreated OSA patient's health-care costs \$1,336 more than an individual without OSA. 17 million untreated individuals account for \$22,712,000,000 in health-care costs (Al-Abri et al.). According to Bahammam (2011), the per capita polysomnography rate in Saudi Arabia was 7.1 per year per 100,000 people, whereas it was 18.3 in developed countries.

Physician claims for individuals with OSA were C\$3,972 per patient twice that of age-matched controls (C\$1,969 per patient based on data for 1984–1995 (Pagel, 2008)). Hospital stays are reduced from 1.27 days/year before the diagnosis of OSA to 0.54 days/year just one year after the diagnosis (Pagel, 2008). In addition, the total CPAP cost per person is \$414 per year (Pagel). Sleep problems were estimated to contribute to more than 100,000 motor vehicle crashes in the United States in 2007. That resulted in about 1550 deaths, 71,000 injuries, and \$12.5 billion in monetary losses annually (Carlton, Lunacsek, Regan, & Carroll, 2014).

In Oman, health services are offered free of charge in the Ministry of Health for Omani citizens. Patients have to renew their services annually by paying \$2.50. Because this sleep center is not managed by the MoH, people have to be referred to it otherwise they will not be treated. On the other hand, the CPAP machine is not free of charge for the patients.

Role of Primary Health-care Team in Screening OSA

Given the prevalence, risk factors, and comorbid diseases associated with OSA, concern has existed for the past two decades that primary health-care providers do not fully understand these illnesses (Bahammam, 2011; Valerio & Heaton, 2014; Williams et al., 2015). Recognition of OSA is important because treatments exist that reduce the risk of sleep crashes and cardiovascular risk, such as hypertension and angina produced by sleep disruption (Valerio & Heaton, 2014; Williams et al., 2015). New technologies are emerging at a rapid pace within the health-care setting; it is of vital importance that

primary health-care nurses have the skill to seek and implement evidence-based literature findings into clinical practice (Winters & Echeverri, 2012).

However, two symptoms of OSA, sleepiness and snoring, have little emphasis in medical training (Bahammam, 2011; Williams et al., 2015). Although primary health-care providers are often in a crucial situation to recognize symptoms of OSA, less than 50% of adults say their health-care providers asked them about their sleep (Williams et al., 2015). It is important to know primary health-care nurses' knowledge and attitudes about OSA to improve the situation of sleep disorders in primary health-care settings.

Primary health-care nurses play a significant role in screening for OSA that, if left untreated, can result in serious complications. They need to be well oriented about OSA to assess and refer at-risk patients. If they do not evaluate and refer, nothing is done for OSA patients making treatment delayed. Delayed treatment further increases risk of morbidity and mortality and increases the financial burden on the individual, family, and the community (Bahammam, 2011). Diagnosing OSA is critical in developing countries that don't have enough resources for screening and treating at-risk patients (Bahammam, 2011; Ozoh, Iwuala, Desalu, Ojo, & Okubadejo, 2015; Williams et al., 2015).

Another issue related to the role of primary health-care nurses is the limited sleep information received in their educational programs. Physicians reported 2.1 h of sleep education during medical school (Almohaya et al., 2013; Bahammam, 2011; Fernandez et al., 2014; Luo et al., 2013; Ozoh, Ojo, Iwuala, Akinkugbe, Desalu, & Okubadejo, 2016; Williams et al., 2015). Mindell and colleagues conducted a study of medical schools in 12 Asian countries, the United States, and Canada, regarding the number of sleep

medicine education. The result had an average time of 2.5 hours that was spent on specific sleep education. Nearly 30% of the medical schools' respondents admitted to receiving no sleep training at all (Mindell, Bartle, Wahab, Ahn, Ramamurthy, Huong, & Goh, 2011). They also said in that same study, only medical schools in the United States and Canada provided more than 3 hours of sleep training for medical students.

In addition, nurse educators reported limited sleep content in basic and advanced nursing programs (Valerio & Heaton, 2014). A study conducted by Almohaya et al. (2013) demonstrated that medical students have an inadequate knowledge base in sleep medicine and that educational institutions do not prepare students for meeting the demands of this evolving health concern. The study by Almohaya surveyed medical schools asking fourth- and fifth-year medical students about their knowledge of sleep and sleep disorders. A 30 item validated questionnaire was used known as the Assessment of Sleep Knowledge in Medical Education (ASKME). There were a total of 348 students who completed the survey, and more than 80% of respondents rated their knowledge in sleep medicine as below average. Only 4.6% of respondents correctly answered 60% or more of the questions. Of the seven schools involved in the survey, five schools had sleep medicine developed into the curriculum with a mean time of 2.6 hours of teaching on the subject. Two of the factors identified as limitations in medical programs include sleep medicine being a lower priority within the curriculum and also time constraints.

Importance of Knowledge and Attitudes on OSA

Knowledge is necessary for primary health-care nurses in primary health-care settings so that they can detect at-risk people in the community. They need to recognize

at-risk symptoms that could be noticed in those people vulnerable to OSA. Another reason that primary health-care nurses need to have the proper knowledge about OSA is to help them to ask the appropriate questions from those people to have the proper diagnosis of OSA. Better screening of patients enables the primary health-care nurses to have the proper treatment options or the necessary referral to the designated sleep center.

Attitude is important because the primary health-care nurses need to explore symptoms, patients' complaints, and view OSA as a serious issue. Primary health-care nurses need to know how to assess by being competent in gathering data and the appropriate use of the screening methods used for detecting an OSA sufferer. Attitude is also important for the primary health-care nurses toward detecting OSA patients. If those primary health-care nurses show a willingness to help OSA patients, more people will be diagnosed, treated, or referred. Primary health-care nurses' behavior and attitude will affect their judgments on screening and diagnosing, thus increasing their confidence on noticing OSA risk sufferers.

Studies to Enhance Knowledge and Improve Attitudes

There are few instruments in the field of health that measure knowledge and attitudes in different parts of the health discipline, but the most frequently used to measure knowledge and attitudes of primary health-care nurses is the Obstructive Sleep Apnea Knowledge and Attitudes (OSAKA) questionnaire (Schotland & Jeffe, 2003). The validity and reliability of the OSAKA questionnaire have been tested and found to be adequate. There are a few studies conducted using the OSAKA questionnaire in primary health care settings. Most of the studies using it were conducted in hospital settings by

either anesthetists (Aukley, Cox, Bolden, & Thornton, 2015; Wang, Li, Cai, Pan, & Min, 2012), sleep medicine (Aukley et al., 2015), general surgery (Aukley et al., 2015), cardiologists (Southwell, Moallem, & Auckley, 2008), or dentists (Bian, 2004; Bian & Smith, 2006).

Schotland and Jeffe in 2003 developed the OSAKA questionnaire in the USA (Schotland & Jeffe, 2003). The aim of their research was to design and validate a questionnaire that assesses physicians' knowledge and attitudes about OSA. The sample of their study consisted of physicians ($N = 115$) in primary health care. Some of the striking findings from this study were a negative correlation between age and knowledge. These results revealed that the older the physicians, the lower their knowledge scores. In addition, the older they were, the less confident they were in managing patients with OSA (Schotland & Jeffe, 2003).

A cross-sectional study by Ojeda et al. (2013) evaluated the attitudes and knowledge of OSA among Latin American primary care physicians using a Spanish-language version of the OSAKA questionnaire. The survey participants were South Americans ($N = 367$) from Ecuador, Peru, and Venezuela. Mean knowledge scores significantly differed among physicians surveyed in those three countries. Only a few of the knowledge items significantly differed by years since medical school graduation.

Another cross-sectional survey study using the Spanish validated version of the OSAKA questionnaire was conducted (Fernandez et al., 2014). Subjects ($N = 398$) were newly graduated physicians in Ecuador. From the study sample, 32.4% of the physicians knew there was an association between OSA and hypertension, and 54.4% were aware of

cardiac arrhythmias. From the newly graduated physicians, 54.5% had a high attitude toward feeling confident in identifying patients with OSA.

Valerio and Heaton (2014) also conducted a quasi-experimental, within-group, pretest–posttest design to determine the effects of an online educational program on nurse practitioners' ($N = 38$) knowledge on identifying and evaluating adults at risk for OSA in Alabama. The knowledge was assessed by 15 questions conducted pre–posttest after a 53-minute narrated PowerPoint educational session. All had a significant improvement in posttest scores as compared with pretest scores ($p < .001$, $t(37) = -5.024$).

In another study, Williams et al. (2015) used the OSAKA questionnaire. Community physicians ($N = 105$) in several community-based clinics in a large metropolitan area were included exploring factors that were associated with referrals for OSA evaluation in the USA. The OSA referral rate by the physicians was 75%. OSA knowledge scores ranged from 5 to 18 (mean = 14 ± 2) and from 7 to 20 (mean = 13 ± 3) for attitudes items.

Research on OSA Knowledge and Attitudes in Oman and the Arabian Gulf

There are no available studies on the knowledge and attitudes of primary health-care nurses about OSA in Oman. Nevertheless, there are some studies conducted in neighboring countries such as Saudi Arabia. There are some similarities between these countries, such as cultural, social, health systems, and educational resources for both physicians and nurses.

Little is known about knowledge and attitudes of OSA in Oman specifically in primary health-care settings where at-risk patients need to be identified for treatment and referral.

This research is planned to be conducted in Oman for the same reason as in the neighboring country of Kingdom of Saudi Arabia. That reason is the lack of awareness about OSA (Bahammam, 2011) among primary health-care nurses. In addition, primary health-care nurses are not taught about OSA in their years of college education, and if they are taught, the instruction does not exceed 3 hours (Bahammam, 2011). The referral system needs to be changed by detecting cases and following them up by better implementation of questionnaires relevant to OSA. Therefore, it is necessary to have baseline data on the effectiveness of primary health-care nurses in Oman through assessing their knowledge and attitudes on OSA. After that, a specific education program in OSA may be given to increase their professional growth and development.

Another issue is the absence of sleep centers under the umbrella of the MoH in Oman. There is only one sleep center in the entire country, which is not even associated with MoH hospitals and management. As mentioned earlier, this center is under the administration of the Sultan Qaboos University Hospital. That makes it even harder for people to travel to it because it is in the capital of the country, Muscat. Patients are referred to it from the various secondary care hospitals scattered around the country, causing some patients to not be referred or properly diagnosed and treated. Perhaps, after the conduct of this research, MoH top management level would be convinced of the necessity of establishing sleep centers in the different regions of Oman. Another reason

for the interest in conducting this research in Oman is the issue of having more people in Oman getting obese due to their lifestyle behavior and thus increasing the risk of OSA. In addition, people start driving longer distances than their original home, and that makes them more susceptible to dozing off and, therefore, having road traffic accidents.

Health Education and the Use of the Internet

Online learning is an effective means of engaging learners that allows them to learn at their pace (Bromley, 2010). Online learning meets the needs of the adult learner. Online learning is usually given in an asynchronous format giving learners the freedom to work at their pace at a time that is convenient (Keramidas, 2012). Research has shown that active learning strategies help learners to be engaged in the learning process, enhance cognition, and encourage critical thinking (Jensen, Meyer, & Sternberger, 2009).

In this proposed educational intervention study with primary health-care nurses in Oman, the intent is to use a web-based intervention rather than in-person training or lectures/seminars or the distribution and use of paper-based materials. This method of administering educational material and/or training has recently become an area of increased interest as a means of enhancing educational or behavioral program participation (Fotheringham, Owies, Leslie, & Owen, 2000).

There is a shortage of evidence in online education that supports increased teaching effectiveness, especially for primary health-care nurses. However, a study by Parsons (2007) showed that an online program effectively improved public health/community health nurse preceptors' self-efficacy and increased knowledge about the preceptor role. Parsons' study used a pre/posttest delayed posttest research design

with a sample ($N = 67$). There was a significant increase between self-efficacy pretest and immediate posttest scores ($F [1, 46] = 44.69, p < .01$). In addition, a significant increase between self-efficacy pretest and delayed posttest scores ($F [1, 46] = 47.8, p < .01$). Knowledge scores related to the role of the preceptor in public/community health nursing increased significantly ($F [1, 46] = 74.76, p < .01$) between pretest and posttest as well as ($F [1, 46] = 75.55, p = .02$) between pretest and delayed posttest (Parsons, 2007).

Research studies have used various designs in the application of e-health interventions. In research studies, most web-based interventions involve e-mail or support groups as the means for distributing health information and educating participants. There is growing evidence that e-health communications can improve behavioral outcomes through Internet interventions (Bessel et al., 2002; Kirsch & Lewis, 2004; Neuhauser & Kreps, 2003). Nursing has taken a leadership role in the development and application of computer-based health-care interventions, but few research studies are available to document a scientific base for the efficacy of these interventions.

There are limited controlled studies using internet-based interventions that focus on health-related behaviors and health outcomes (Kirsch & Lewis, 2004; Lewis, 2003). A web-based educational program was developed by Grover, Currier, Elinoff, Katz, and McMahon (2010) to address the educational needs of Internal Medicine residents about advanced procedures. These procedures are for the placement of central venous and arterial lines (Grover et al., 2010). A randomized study of Internal Medicine residents across three residency programs was conducted to evaluate the effectiveness of the web-based educational program. Two educational modules included videos (approximately 10

minutes each), procedure written summaries, and articles. The web-based education was associated with statistically significant improvements in residents' test scores ($p = .01$, $p < .001$). In addition, there was an improvement of residents' knowledge of procedures, and the modules were well accepted by residents (Grover et al., 2010).

Another study to examine the effectiveness of asynchronous, web-based learning for pediatric emergency medicine, a web-based tool was developed and piloted with a significant group of residents (Burnette, Ramundo, Stevenson, & Beeson, 2009). The web-based curriculum consisted of 21 lectures voice-over presentations, each approximately lasting 20 minutes. Residents believed the web-based lectures were useful and liked how they could view lectures in their own time, and choose the lectures that they felt they would benefit from the most. Pretest and posttest improvements were 6.2 percent for the web-based lectures, versus 1% for those viewing no lectures (95% CI) (Burnette et al., 2009).

Zahner, Tipple, Rather, and Schendzielos (2009) conducted a pilot study ($N = 13$) with nurse preceptors. The study was a one group, pre/posttest delayed posttest research design to test whether an online continuing education course was feasible to increase knowledge and self-efficacy. The course was implemented to develop the knowledge and skills needed to be effective practice-based preceptors for undergraduate nursing students. An electronic follow-up survey was used to test the knowledge retention and change in self-efficacy.

Participants' knowledge scores increased significantly from pretest to posttest and from pretest to follow-up. On the other hand, knowledge scores declined, although not

significantly from post intervention to follow-up. Self-efficacy scores detected no changes. Participants reported satisfaction with the course, suggesting that online continuing education is a feasible strategy to support preceptor learning. They suggested further research on the effectiveness of this approach in changing and retaining knowledge and improving self-efficacy.

Larson and Zahner (2011) tested the relationship between an online preceptor education program and knowledge of the preceptor role. In addition, they tested the self-efficacy to perform the preceptor role. A pre/posttest quasi-experimental design was used with a sample of public health nurses ($N = 31$). Pretest and posttest measures of self-efficacy and knowledge were collected before, immediately after, and three months after the online education program was completed. The study showed significant improvements in self-efficacy at both immediate ($F [1, 30] = 21.63, p < .001$) and the delayed posttest intervals ($F [1, 30] = 20.34, p < .001$). There was a significant increase in knowledge scores at the posttest interval only ($F [1, 30] = 116.05, p < .001$). Self-efficacy scores were found to be independent of knowledge scores at all times, nor was preceptor age found to be correlated with self-efficacy or knowledge scores. Evidence exists that an online program is beneficial for increasing knowledge and self-efficacy, particularly for primary health-care nurses (Larson & Zahner; Zahner et al., 2009).

E-learning is the gaining of new knowledge or skills through electronic instruction or study, which may include computer and/or internet-based learning, and/or learning through audio and video means. With the introduction of high-speed networks and programs for building highly interactive multimedia software, many types of e-

learning technologies already exist, including simulated patient case studies, web-based video/audio, online tutorials, CDs and DVDs, and other forms of electronic learning (Wolbrink & Burns, 2011). The advantage of e-learning is that it facilitates training unconstrained by time, location, or availability of faculty. A few studies that exist in the literature review found that e-learning was beneficial in bridging the knowledge gap. In addition, portability of the media made it superior to the traditional face-to-face model (Spiva et al., 2012).

With advances in technology, remote access to information has become an integral part of work and academic environments. Academic environments have shown great success in integrating e-learning modalities (Magnussen, 2008). In health-care environments, the technology and development of e-learning modules are evolving rapidly. Nevertheless, it is still in its early stages and is often modeled after the academic environment.

The health-care environment requires rapid dissemination of information and education, forcing health-care organizations to examine current traditional teaching modalities, in addition to venturing into nontraditional forms of course design, of which e-learning is the primary method. Consideration must be given to the transition away from the traditional classroom environment for knowledge-based content as well as “skills” content.

Research is slowly emerging on the outcomes of e-learning training programs in health care that indicate early successes with various training programs in knowledge, skills, and satisfaction. The use of e-learning methods showed improved knowledge of

the prevention of venous thromboembolism and arterial blood gas analysis, with high participant satisfaction (Schneiderman, Corbridge, & Zerwic, 2009; Wolpin et al., 2011). Chiu et al. showed improvement in nurses' neurological assessment skills in patients who had had a stroke (Chiu et al., 2009), while Chuang, Cheng, Yang, Fang, and Chen (2010) showed an enhanced demonstration of basic nursing skills in students exposed to a supplemental e-learning program compared with the control group.

Researchers indicated that, compared with traditional instruction, those taught with e-learning retained as much knowledge, were more satisfied and saved time (Chang, Hsiao Sheen, Chang, & Lee, 2008).

To succeed in implementing an e-learning course, it is necessary to design it well. McCleskey (2009) described four strategies in e-learning design that are essential in engaging the learner: structure, visual interest, emotion, and storytelling. Building learner motivation requires e-learning to get learners' attention, show them why they need to learn, build their confidence, and bring about satisfaction.

Summary

The literature review revealed limited research on the effect of an educational intervention on knowledge and attitudes of OSA among primary health-care nurses. Most of the studies researched discussed primary health-care physicians. An insufficient number of these studies had control groups and even fewer had active control groups. The literature demonstrated the evidence necessary for primary health-care nurses to engage in OSA detection and methods of screening to provide for timely interventions. The epidemic of OSA has been defined; it is through awareness, education, identification,

and interventions that lives will be saved. Primary health-care nurses' education about OSA creates awareness that will lead to screening of individuals that could be identified as being at risk. Identifying those at-risk OSA patients will lead to better referral and treatment. OSA affects at-risk individuals, which influences their quality of lives, leading to comorbidities, thus increased mortalities, which produces an economic burden to the individuals, families, and community. OSA has been acknowledged by Healthy People 2020 as a public health concern and has affirmed sleep deprivation as a new initiative. OSA is not an asymptomatic disease or a new condition. It is through the implementation of evidence into practice that OSA detection starts. Awareness and screening are the first steps in this process. Therefore, to address the gap in Omani health, the researcher will test an intervention to enhance knowledge and attitudes that will be discussed in Chapter 3.

Chapter Three Methods

Study Overview

This chapter describes the research design, target population, sample, and setting for the study. Then, the instruments are described. Following, the procedures for the data collection and analysis are outlined. This chapter concludes with the human protections considerations of the study.

Research Design

This online study assessed the knowledge and attitudes among primary health care nurses in Oman concerning adults at risk for obstructive sleep apnea (OSA). This pilot research was intended to be a randomized controlled trial with a structurally equivalent control group to measure the preliminary efficacy and feasibility of an online OSA educational intervention (Figure 4).

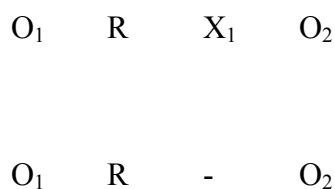


Figure 4. Intended format for a randomized controlled study

At baseline, both groups received the Obstructive Sleep Apnea Knowledge and Attitudes (OSAKA) instrument and the Diabetes Basic Knowledge Test (DBKT). However, due to a programming error in the Qualtrics software platform used to deliver

the components of the online study, each group did not receive both instruments at the posttest observation. Following their respective video program, the intervention group was presented with only the OSAKA instrument and the control group was presented with only the DBKT instrument. Therefore, the design had to be reconsidered. Figure 5 illustrates the resultant one-group, pretest-posttest design.

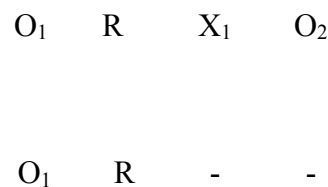


Figure 5. Resulting Format of the One-group, Pretest-Posttest Study

Population and Sample

The target population for this study was all primary health care (PHC) nurses working in primary health care centers in Oman. The PHC nurses in the sample were recruited through email information or flier delivered by their respective administrators. A PHC nurse was eligible if he or she worked with adult patients in general medicine. Excluded were nurses who were not working with the general population or were 1) midwives, 2) working in immunization clinic, 3) health educators, or 4) emergency care nurses. The feasibility component included a convenience sample of ‘in-charge’ nurses (nursing administrators) who were purposively recruited to provide feedback on the OSA educational video.

Setting

This pilot study was designed as an online format educational intervention so that nurses across the Sultanate of Oman would have an opportunity to participate. Oman has borders with the Republic of Yemen to the southwest, the Kingdom of Saudi Arabia to the west, and the United Arab Emirates to the north. It is bordered by the Indian Ocean in the east (omanet.om, 2011) (Appendix A). Oman has an estimated population of 3.93 million, ranking number 130th in the world (omanet.om, 2011). All nurses in Oman speak and write English, and it is the mode of communication in all healthcare settings whether it is a primary, secondary or tertiary healthcare setting. The health care personnel working are 4,316 general practitioners and 13,059 nurses out of which 8,541 are general nurses. The rest of the nurses are working in specialty areas such as midwifery, intensive care units, etc. (Ministry of Health Annual Statistics Report, 2013).

The PHC nurses provide primary healthcare services (prevention and basic treatment). This is the first line of contact with the patients, families, and community. Each healthcare center has an ‘in-charge’ nurse (nursing administrator). The catchment area for each of these health care centers is estimated to be 15,000 people. All healthcare services are free of charge since the government is offering free of charge services to all Omani citizens.

Study Procedures for Primary Health Care Nurses

Once the ethical approvals had been obtained, the researcher contacted the top-level management in the Ministry of Health. Once approved by the higher authority in the Ministry of Health, an invitation flier (Appendix B) with the purpose of the research was

sent to the Directors of Nursing in each of the governorates who overlooked the primary health care nurses in the primary health care centers. The Directors of Nursing announced to the administrators (nurses' in-charge) in each of the primary health care centers about the intent of conducting a study. The administrators then discussed with the primary health care nurses the purpose of the study and if they were willing to participate, then they could login to the website written in the invitation flier. The nurse could also have the hyperlink to the survey was emailed or texted to them to decrease typing errors of the link to the survey.

The participation was voluntary; thus, after logging into the designated website of the Qualtrics software, the first page was the inclusion and exclusion criteria that eliminated nurses who logged in but did not meet the eligibility criteria. Those excluded were logged out. After that, the eligible PHC nurses read the online informed consent document. They had to choose one of those forced icons; pressing on the “Yes, I would like to participate” icon declared their willingness to participate in the study. Clicking the “No, I would not like to participate” directed the nurse to a thank you note and logged them out of the study website (Appendix C).

Nurses who chose to participate in the study were then forwarded to the collection of baseline data; first, demographic information were collected. After completing the initial OSAKA and DBKT questionnaires, the subjects were automatically randomly assigned to either an intervention group or a structurally equivalent control group. The intervention group viewed a brief OSA educational video on knowledge and attitudes of obstructive sleep apnea, while the control group had a brief educational video about

diabetes mellitus. While the intent was for subjects in both the intervention group and the control group to complete both the OSAKA and the DBKT instruments, the intervention group was presented with only the OSAKA posttest and the control group was presented with only the DBKT posttest. This unforeseen technical issue with the Qualtrics removed the option to use the diabetes arm as a 'control group' as there was no parallel posttest OSAKA scores for that group. The online survey was active from January 30, 2017 to February 12, 2017 for a period of two weeks.

Component II: Primary Health Care Nurse Administrators

The inclusion criterion for the administrators is: 1) a nurse in-charge in a primary health care center supervising primary health care nurses. No exclusion criteria. There were 11 nurses' in-charge who volunteered to be interviewed.

The primary health care nurse administrators (In-Charges) were contacted by the researcher who explained the purpose of the phone call and that their input in the study was needed. After agreeing to participate in the study, appointments were made with them and appropriate day and time were selected for one-on-one interview. The administrators' roles were to watch the video "*A Brief Introduction to OSA for Omani Nurses*" and then evaluate it by giving feedback (Figure 6). The administrator interviews began on 2/20/2017 and ended on 2/23/2017.

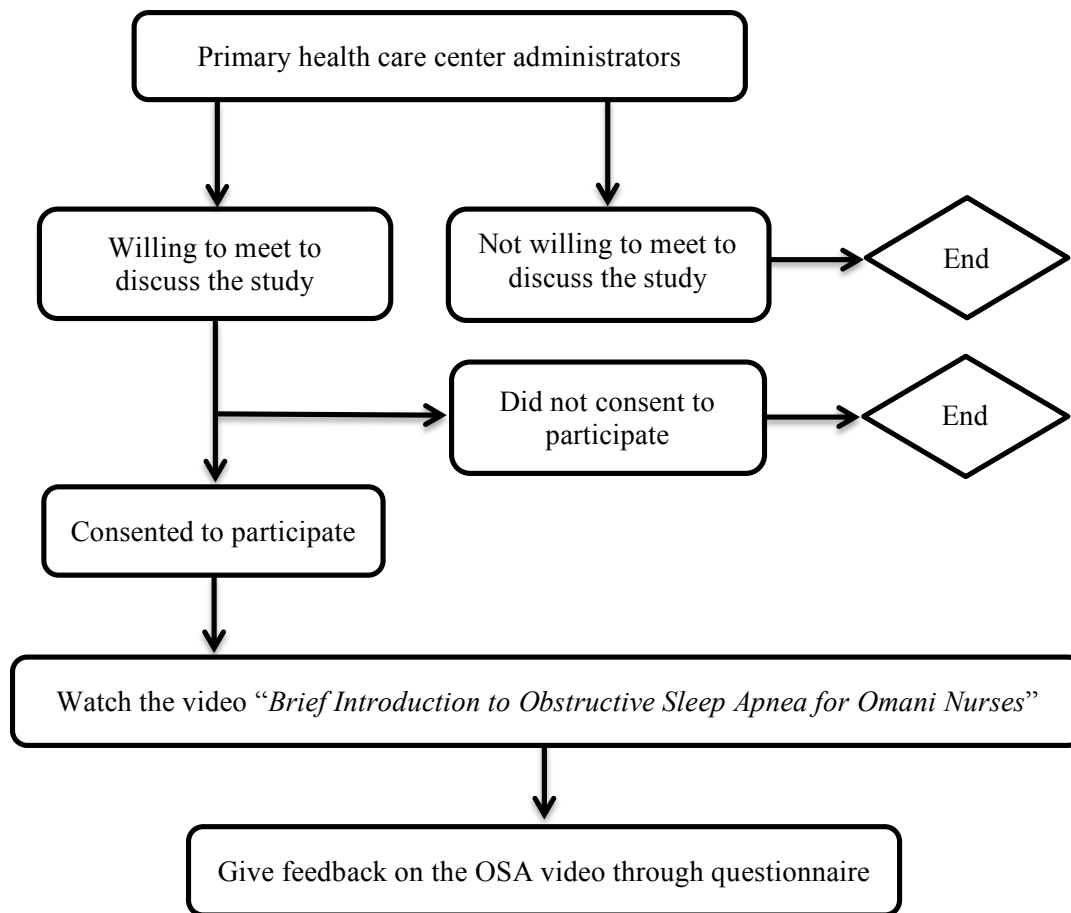


Figure 6. Flowchart of Study Procedure for Primary Health Care Nurse Administrators

The study was accessed through Qualtrics platform to login to the Internet either from their homes or workplaces. They were also able to use their cell phones provided that it had internet access since the Qualtrics had a mobile application. Participants consented online to voluntarily participate in the study by clicking the “Yes, I would like to participate” icon. After that they did the pretest, intervention or control and posttest.

For the administrators or the nurses' in-charge, they were called to discuss with them the purpose of the phone call. Then an appointment was made if they were willing

to participate and be interviewed. On the day of the appointment, the researcher had a face-to-face interview with each one of the administrators. Usability and practicality of the intervention was collected.

Study Procedures for Primary Health Care Nurses Administrators

For the administrators, as soon as all data was collected from all primary health care nurses and the survey was terminated, the researcher called 11 administrators to seek their approval for being interviewed about the video on OSA "A Brief Introduction to OSA for Omani Nurses". This participation was also voluntary. Once approved by the administrators, an appointment was scheduled. On the designated date and time, the researcher sat with each administrator and explained further the purpose of the appointment. A printed copy of the consent form was given to each administrator and asked her to go through it and asked for any clarifications (Appendix D). Once the printed consent form was signed and the administrator agreed to participate, some demographic data was sought (Appendix E). There were no exclusion criteria for the administrators. The administrator then watched the video on "Brief Introduction to OSA for Omani Nurses". After watching the video, the administrator gave her feedback on its feasibility. After that, the participation of each of the administrators was appreciated.

Baseline Assessment

There was a sample of (N = 156) who completed the survey. The pretest had a baseline data about some demographics and the two instruments. The questionnaire took about 15 minutes as anticipated to complete. An online self-reported questionnaire about demographic variables (Appendix F) deemed relevant by the researcher such as gender

and age was sought. Also, participants entered their level of education degree and the number of years of their nursing practice. There was a question on nurses' familiarity or knowing anybody diagnosed with OSA also. Another question was asking them if they knew anyone with diabetes mellitus.

All participants (N = 156) answered the "Obstructive Sleep Apnea Knowledge and Attitudes (OSAKA)" questionnaire (Appendix G) and the modified "Diabetes Basic Knowledge Test (DBKT)" (Appendix H). The DBKT was the control and so the distractor questions were used to mask the focus of the study only but were not excluded from enrollment.

Randomization

Participants had an equal chance of being randomized into one of the two conditions: the brief health educational intervention or the structurally equivalent control group. Randomization of the participants was purely generated by Qualtrics software itself that randomly assigned them to either the intervention or the control. Polit and Beck (2012) advised that the researcher avoided providing the intervention due to augmentation. Also Melynk and Morrison-Beady (2012) suggested that a researcher should not be responsible in selection of the participants to guard against selection bias.

After completing the baseline pretest, participants were randomly assigned. Due to researcher's unfamiliarity with Qualtrics software, a technical error in the order of the contents after randomization occurred. After cleaning the data, the intervention group had a subsample of (n = 73) and the control was (n = 83) (Figure 7). Participants weren't informed whether they were in the intervention or control groups, nor they were informed

of the study questions. The study was double blinded since it was online format. The researcher was not aware of which group assignments. The participants weren't aware of which group assignment they were in as well. Participants were blinded as to which group they were assigned to, to improve external validity.

Online Health Educational Intervention and Control

After randomization, participants were guided to a new screen that had about a 15-minute health educational intervention about obstructive sleep apnea (OSA) for the intervention group. On the other hand, the structurally equivalent control group was guided to a different screen that has content about diabetes mellitus. The material included simultaneously a short video for each of the two groups with almost the same length. Some true and false questions were asked while watching and listening to each of the video material. This was done to ensure that each participant watched the video and to reduce attrition due to lack of engagement. To decrease attrition, and maintain interest and retention in this study, while the participants watched the video, they were occupied by answering true/false questions to reduce boredom and increase retention.

Several procedures to assess participant fidelity to the intervention were utilized. Fidelity to the online health educational intervention was assessed via two short quizzes. Participants were asked to take true/false quizzes at the middle and end of the video. There were a total of 6 true or false questions in both intervention and control videos. The questions focused in the material the participants read or listened to in the videos to engage them in reading to reduce boredom and to ensure their comprehension of the material they read and listened to. Since the study took place at local settings and at a

small number of sites worry about contamination of the control condition was looked. To reduce this, participants were asked to sustain from discussing any material or questions to anyone of their colleagues.

Obstructive Sleep Apnea (Experimental Group)

The experimental group of the primary health care nurses accessed the video that discussed the five domains of the knowledge part and the attitudes of obstructive sleep apnea in adults. Also the video had about a two minute imbedded YouTube video about OSA. The intervention was about 15 minutes in length. This video is called “Brief Introduction to OSA for Omani Nurses”. It was done by developing PowerPoint slides incorporating all those five domains which were epidemiology, pathophysiology, symptoms, screening and treatment. The PowerPoint slides were developed by the researcher. Also, those slides were given to a technical specialist in developing PowerPoint to check for presentation of the material and layout of it. The material was taken from a clinical guideline designed to assist primary health care providers as well as sleep medicine specialists, surgeons, dentists, who cared for patients with OSA. This clinical guideline provided a comprehensive strategy for the evaluation, management, and long term care of obstructive sleep apnea in adults (Epstein, Kristo, Strollo, Friedman, Malhotra, Patil, & Weinstein, 2009). The YouTube video about obstructive sleep apnea developed by the Mayo Clinic. This is the link of the video

<https://www.youtube.com/watch?v=z12MEPiG4cg>

Diabetes Mellitus Knowledge (Structurally Equivalent Control Group)

The Structurally equivalent control group watched a video that had some material developed in PowerPoint slides as well as a short video from YouTube. It was also about 15 minutes long. The video covered materials on diabetes mellitus such as definitions, epidemiology, pathophysiology, symptoms, and management. The video was called “Brief Introduction to diabetes mellitus for Omani Nurses”. The imbedded YouTube video was about an interview with Dr. David Marrero, PhD, a professor of medicine with the Indiana State University School of Medicine, where he served as Director of the Diabetes Translational Research Center. He talked about his current biggest challenges and priorities.

https://www.youtube.com/watch?v=Wsn0O_BB5X4&index=16&list=PL9CZabk3nD4HqrFPClhzvAMG1f80tllsR

Outcome Measures (Posttest)

The primary outcome measure for this study was the increased knowledge and improved attitudes of obstructive sleep apnea among primary health care nurses in primary health care centers in Oman.

The participants accessed the posttest as soon as they completed watching the required relevant video by prompting them to do so by clicking the continue icon for it. Participants were encouraged to finish the posttest as soon as they finished watching the video to minimize the time between learning and testing. Participants weren't given any clue of the type of questionnaire they needed to finish in the posttest. To increase the respondents' rate, the participants were asked to finish in a timeframe of two weeks.

There was no test conducted, besides the immediate posttest, after the implementation of the intervention to check the amount of information retained by the participants. Valerio & Heaton (2014) in their study of the effects of an online educational program on nurse practitioners' knowledge of obstructive sleep apnea in adults implemented the posttest directly upon completing the educational program. Valerio & Heaton also suggested to identify if the educational intervention was persistent which could be done by measuring the rate of OSA diagnosis and treatment adherence at 2-month, 6-month, and 1-year intervals.

The participants who started the study and didn't complete it received two consecutive reminders to finish the remainder of the study. The first reminder was sent within a week of the commencement of the study. This will be sent to all primary health care nurses through their supervisors. The second reminder was sent before few days of closing the online survey informing them of the deadline and encouraging them to finish it before the deadline. It was worth noting that due to unforeseen technical issues with the organization of the content of the survey, the posttest was not implemented as originally planned by the researcher. The study was not piloted since this was only to check the feasibility of conducting the study in Oman in a larger scale in the future. The planned posttest was to have all the sample ($N = 156$) to do both the OSAKA questionnaire and the DBKT. However, the intervention group ($n = 73$) completed only the OSAKA questionnaire. Similarly, the control group ($n = 83$) completed the DBKT only.

OSAKA Questionnaire

The obstructive sleep apnea knowledge and attitudes (OSAKA) questionnaire was administered online to the intervention participants (Schotland and Jeffe, 2003) (Appendix G). Approval of using the OSAKA questionnaire was obtained from the original developers of the questionnaire (Appendix I).

The first section of the questionnaire asked about the knowledge of the primary health care nurses in five domains: (1) epidemiology, (2) pathophysiology, (3) symptoms, (4) diagnosis, and (5) treatments. It consisted of 18 true and false statements about OSA with 'don't know' as a third response choice. The score of "true" was given a score of 1 while the other two choices were given a score of 0. The total score had the lowest possible score as 0 indicating no knowledge of OSA at all and the highest possible score as 18 indicating the best possible score a participant could get in the knowledge part of the OSAKA questionnaire.

The second section included five items concerning the primary health care nurses' attitudes about OSA. The first item was to assess the importance of the disease as a clinical disorder. The second item was to evaluate the importance for primary health care nurses to identify OSA patients. Those first two attitudes questions asked about the importance of OSA, and responses were scored on a five-point Likert scale, ranging from 1 to 5. The scoring was as follows: 1, not important; 2, somewhat important; 3, important; 4, very important; and 5, extremely important (Schotland and Jeffe). The remaining three items were to evaluate the self-confidence of those primary health care nurses in the management of OSA patients. The last three items of the attitude choices

were similarly measured on a five-point Likert scale. The score ranged from 1 to 5. The scoring was as follows: 1, strongly disagree; 2, disagree; while score 3 was neither agree nor disagree. Score 4 meant agree; and 5, strongly agree (Schotland and Jeffe). This attitudes section had a range of 5-25 score that indicated 5 as the lowest possible score to get and 25 as the highest possible score.

Validity and reliability of the OSAKA questionnaire

The obstructive sleep apnea knowledge and attitudes (OSAKA) questionnaire developed by Schotland and Jeffe (2003) was used in this study. The aim of their research was to develop and validate a questionnaire that assessed physicians' knowledge and attitudes about OSA or what was being called the obstructive sleep apnea knowledge and attitudes (OSAKA) questionnaire. In the pilot stage of their study to check for content validity of the questionnaire items, there were (n = 20) physicians who completed the instrument. The subsequent study was composed of internal medicine physicians (N = 115). The internal consistency of items on the knowledge scale was moderately high, with a Cronbach alpha of $\alpha = 0.76$. For the five attitudes items, there was principal components factor analysis done which resulted in two factors. The first factor was a 2-item factor about the importance of OSA and its diagnosis (Cronbach alpha, $\alpha = 0.92$) and a 3-item factor about physicians' confidence in identifying and managing patients with OSA (Cronbach alpha, $\alpha = 0.75$).

Ojeda, Jeffe, Guerrero, Mantilla, Santoro, Gabino and Cherrez, (2013) evaluated the attitudes and knowledge of OSA among Latin American primary care physicians from Peru, Venezuela, and Ecuador using a Spanish-language version of the OSAKA.

The mean total knowledge score (proportion of 18 items correctly answered) was 60.0% (range, 0 – 100%) among the (n = 367) general practice physicians in the sample using the Spanish-language OSAKA questionnaire. Mean knowledge scores significantly differed using tests among physicians surveyed in Peru, Venezuela, and Ecuador. Cronbach α for the 18 items on the knowledge measure was 0.58 using the Spanish-language version of the OSAKA compared with α of 0.69 using the English-language version.

The internal consistency of the two-item factor pertaining to the importance of OSA and its diagnosis was high, with a Cronbach α of 0.86 (original version, $\alpha = 0.92$). This factor was similar in the internal consistency of the three-item factor pertaining to physician confidence in identifying and managing patients with OSA, with a Cronbach α of 0.74 (original version, $\alpha = 0.75$). The study also ran a factor analysis forcing all five items on one factor, and the Cronbach α for these five items was 0.69 (original version, $\alpha = 0.79$).

In another study by Williams and colleagues (2015) using the OSAKA questionnaire. Community physicians (N=105). OSA knowledge scores ranged from 5 to 18 (mean = 14 ± 2) and from 7 to 20 (mean = 13 ± 3) for attitudes items. Valerio and Heaton (2014) also conducted a quasi-experimental, within-group, pretest–posttest design to determine the effects of an online educational program on (N = 38) nurse practitioner’s knowledge. They found a significant improvement ($p < .001$, $t(37) = -5.024$) in posttest scores as compared to pretest scores.

The Diabetes Basic Knowledge Test (DBKT)

The Diabetes Basic Knowledge Test (DBKT) (Appendix H) was developed by Drass and colleagues (1989) to assess the level of basic diabetes knowledge' among staff nurses. It is a 45-item multiple-choice questionnaire modified from the first version of Diabetes Knowledge Test (DKT) developed by Scheiderich, Freibaum, & Peterson (1983) to test nurses' knowledge about care of patients with diabetes. According to Drass and colleagues, the revised DBKT was developed to reflect updated information on diabetes. It was submitted to six experts in the field of diabetes education for review of content validity, item construction, and test format. The DBKT demonstrated internal consistency reliability resulting in a Cronbach's alpha reliability coefficient of .79. The DBKT's 45 items are scored or rated on a scale of 0-100% accuracy and required approximately 30 min to complete. Permission to use the DBKT was obtained from Drass (Appendix J).

Since this study included the Diabetes Basic Knowledge Test only as a distractor, the researcher decreased the number of items in this study to 14 multiple choice questions (Appendix H). There was no measurement of validity and reliability for this instrument in this study. The instrument contained two questions about the etiology of Type I and Type II diabetes mellitus. Two questions were about assessment of diabetes, while one question was about diagnosis. Three of the questions were asking about the management of diabetes. Two questions asked about treatment of diabetes. The rest of the questions (4 questions) asked about patient education.

Validity and reliability of the DBKT

Baxley, Brown, Pokorny, & Swanson (1997) surveyed a convenience sample of nurses ($n = 32$) on their perceived and actual level of knowledge of diabetes mellitus in a rural 62-bed acute care hospital in the Southeastern United States. The result showed a Cronbach's alpha for internal consistency of the DBKT, a reliability coefficient of Cronbach's alpha 0.68 compared to 0.79 was found in the original study by Drass, et al. (1989).

El-Deirawi & Zuraikat (2001) studied registered nurses ($N = 79$) practicing at a 155-bed community hospital and a home healthcare agency located in Western Pennsylvania. This study assessed nurses' actual and perceived knowledge of diabetes. The findings of this study indicated that nurses had a mean score of 72.2% on the DBKT. This score was higher than that found by Drass and colleagues but lower than that achieved by Baxley, Brown, Pokorny, and Melvin (1997). A mean score of 64% was considered indicative of insufficient knowledge of diabetes by Drass et al. (1989). Baxley et al. (1997) expected nurses to have at least a score of 80% to be considered competent.

Length of the Study

The timeline acted as a communication tool for meeting deadlines, defining responsibility, and providing a progressive step-by-step plan of effective implementation. The projected timeline to meet the defined goals and objectives of this study was around 4 months in total. The timeline started as soon as the IRB approval from George Mason University and the Research and Ethical Review and Approve Committee in Oman. Online data collection of the survey took about two weeks. The evaluation process was a

continuous process. Then around two weeks were for pre-analyses of the data such as checking for missing data and cleaning it. One month was needed for analyzing the data and interpreting it. One other month was for writing the results, limitations and discussions.

Data Management and Analysis Plan

As per the preliminary efficacy and feasibility study, the proposal was submitted online via IRB.net to the Office of Research Integrity and Assurance (ORIA) at George Mason University (GMU) for review and an approval with a determination of exempt status was received from the university ORIA. Then another approval was taken from the country where the study was conducted, the Research and Ethical Review and Approve Committee of the Ministry of Health, Sultanate of Oman.

The analysis of the data was presented according to the following topics: (1) pre-analysis screening which was data cleaning and analysis, (2) descriptive analysis with sample demographics, and (3) parametric and non-parametric tests in case data was not normally distributed.

Pre-analysis Screening

All analyses were conducted using the statistical software program Statistical Package for Social Science (SPSS) version 23.0., (SPSS, Chicago, Illinois) software. Criterion for significance for all statistical tests was set at $p < 0.05$.

Data was cleaned for errors, missing data, normality and linearity. Pattern of missing data were *missing completely at random (MCAR)*. As a rule of thumb it was acceptable to replace up to 15% of data by the mean of values for that same variable, but

if the missing data for the same variable was more than 15% then it was recommended to drop that subject or variable from the analysis entirely (Polit, 2010). On the other hand, missing data which were mostly related to age of the participants were averaged and the *series mean* age was taken. A series of descriptive statistical analyses were completed to describe demographic and the OSAKA and DBKT responses by assessing frequencies and proportions.

Descriptive Analysis

The researcher performed descriptive statistics to evaluate the data and the sample characteristics. Frequencies and percentages for categorical variables, and means and standard deviations for continuous variables were computed. The nominal and ordinal level variables, such as sex, level of education were reported as frequencies and percentages. To assess the normality and linearity, histograms were examined.

In addition, bivariate descriptive statistics were conducted to explore the relationships among the variables and among the demographic data. The researcher performed Pearson correlations on continuous ratio level variables such as overall knowledge with age and years of experience. Correct responses for each item in the knowledge questionnaire were expressed as frequencies, and the total knowledge score was expressed as means \pm SD. Also there were paired samples t-tests and independent samples t-tests performed to compare the means of the same groups verses the different groups relationships.

General attitudes toward OSA were examined using descriptive analysis (presented in numbers of valid cases, means, and ranges) and compared between

intervention and control by paired samples t-tests and independent samples t-tests. The average score for the scales was calculated by adding each participant's response to each of the items on the scale. Since the attitudes items were split into two different Likert scales, the first two items had a scale from 1 (*not important*) to 5 (*extremely important*). The other three items had a scale from 1 (*strongly disagree*) to 5 (*strongly agree*) by dividing the sum by the number of items. The attitude items were positively worded; therefore, the higher the participant's total score, the more positive the attitude.

Parametric and Non-Parametric Tests

A paired samples t-tests was used to determine if there was a statistically significant difference between the pretest intervention (n = 73) and the posttest intervention group (n = 73) on knowledge subscale of the OSAKA. Independent samples t-tests were used to determine if there was a statistically significant difference between the intervention (n = 73) and the structurally equivalent control group (n = 83) the knowledge subscale of the OSAKA. Also the independent samples t-test was used to determine if there was a statistically significant difference between the posttest intervention (n = 73) and the structurally equivalent control group (n = 83) on knowledge subscale of the OSAKA.

Evaluative Feedback (Feasibility)

At the end of submitting the posttest, intervention and control groups were requested to complete a feedback with open-ended questionnaire and some Likert scale questions regarding feasibility of the online health education (Appendix K). The feasibility study was used to further test the online health education for its user-friendly

format, readability, and comprehensibility. Such questions as whether the participants think the topic was relevant and whether the material was easy to be understood. Lastly, two open-ended questions were included, asking respondents to share what they liked about the online education and what recommendations they had for future study. Once finished with the feedback and submitted, all participants were directed to an appreciation note for participating in the study.

Protection of Human Subjects

The researcher obtained ethical approval from the Human Subjects Review Board at George Mason University (Appendix L) and the Research and Ethical Review and Approve Committee of the Ministry of Health, Sultanate of Oman (Appendix M). The researcher took steps to ensure confidentiality of the study data.

All of the relevant information was given through the Qualtrics software that covered certain information. Such information as the contact details of the researcher and the rationale for conducting the survey. The inclusion and exclusion criteria were also presented. If they didn't meet the inclusion criteria, they were directed out of the study and they were appreciated for their effort.

It explained the purpose of the study and the risk and benefits, if any, of participating in the study. The informed consent clarified that strict confidentiality was maintained throughout the process of the study. In the bottom of the consent form page, participants were given two choices of either agreeing to participate or not agreeing to participate in the study. The online informed consent procedure was taken by either choosing "Yes, I would like to participate" or "No, I would not like to participate".

Clicking the “No, I would not like to participate” logged them out of the study and their effort were appreciated. The participants were told that they could exit the survey at any point in time (Waltz et al., 2010, 259-266).

Participants were informed of what was expected of them as participants. They were assured that all information was kept in strict confidence. The survey questions didn't ask for any information that was stigmatizing or sensitive. Also, reminders were sent to those participants to complete the posttest data collection or to continue where they had stopped. Once the data was downloaded for analysis, the researcher requested the Qualtrics software service providers to delete the files. Likewise, identifiers in the researcher computer would be destroyed once finished with the study after five years according to GMU IRB.

During the process of the study, from beginning to the end of it, confidentiality was maintained; instruments and any relevant data were kept in a secure location at George Mason University. The electronic data file didn't contain any personally identifying information. The electronic dataset was kept on a password-protected computer. Since this was a randomized controlled trial each participant was given an equal and fair chance to participate in the intervention by random assignment. This had fair distribution of burdens and benefits of this study by using the randomizer software embedded within the Qualtrics software.

There was no anticipated risk in participating in this study. The main benefit of this study was the development of scientific knowledge that hopefully would enrich the literature, in general, but with a special focus on Oman. This new data might help the

researcher and the Ministry of Health in Oman in the design and implementation of continuing education programs on OSA and might add some coursework material on OSA in medical and nursing education programs. This study might add insights and reveal information that could help primary health care nurses intervene appropriately and create public awareness of the health problems that affected Omanis such as OSA. Another benefit, the participants could assess themselves on how knowledgeable and confident they were in diagnosing and treating OSA patients. Finally, this study could be a cornerstone for larger scale study that could be implemented nationally. Participants had contact information for the Director of Regulatory Affairs George Mason University, which was the IRB record for this study.

Summary

The process of implementing this research was to test the preliminary efficacy feasibility of the online health educational intervention on knowledge and attitudes of obstructive sleep apnea among primary health care nurses. A predesigned method of evaluating desired outcomes (increased knowledge and improved attitudes) by using the validated OSAKA questionnaire was necessary in deciding if it was sustainable, worthwhile, and cost-effective. As practicing, primary health care nurses, it was necessary to implement evidence based practices into the clinical settings in a multidisciplinary approach.

Obstructive sleep apnea is a condition that is treatable, but first its signs must be recognized. Through the implementation of the intervention, those primary health care nurses would be familiar with the available screening methods as well as signs and

symptoms of OSA. Screening at routine admissions by using the appropriate tool could identify at risk patients. Screening for this disorder with appropriate knowledge, confidence and attitudes were just small steps but an important step in the right direction. Health education and community awareness for reduction of its prevalence were the long-term goals. Nevertheless, ethical considerations would play a great role to ensure that the data gathered was useful and taken with full cooperation by the parties concerned.

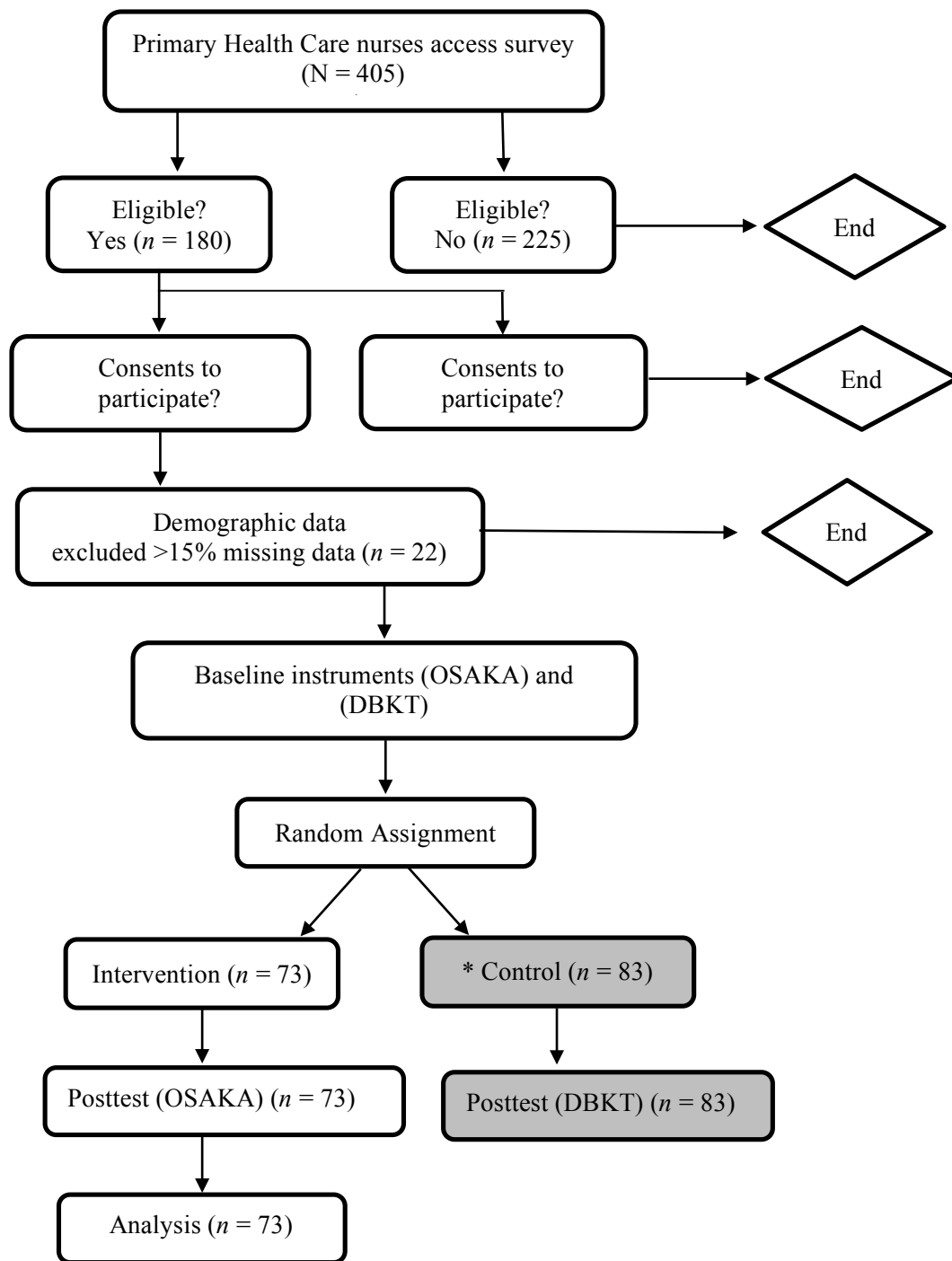
Chapter Four Results

Overview

This chapter begins with a description of the sample. the preliminary efficacy of the intervention by describing the overall knowledge and attitudes items analysis of the primary health care nurses. It answered the preliminary efficacy question and its aims and hypotheses. After that it discussed the feasibility part of the OSA online health educational video with the various aims and then went on to discuss the feasibility of the OSA online health educational video for the primary health care nurses' in-charge (N = 11) participants.

Component I: Primary Health Care Nurses

The flowchart describing the primary health care nurses who participated in this study can be seen in Figure 7. In total, 405 nurses accessed the study website to access the survey. Of these, 225 of the respondents were ineligible to complete the survey because they were not working with general adult population in primary health care centers. Out of the 180 primary health care nurses who were eligible to participate in the study, two nurses declined to participate. An additional 22 participants did not complete a requisite amount of the survey and were excluded from the study. As a result, 156 nurses were randomly assigned to the intervention or control group condition and completed the posttest and evaluation sections. As the 'control group' arm did not complete the OSAKA instrument at posttest, their data could not be used for comparison as intended.



* Please note that the shaded boxes after the random assignment [the intended control group] indicate that this subsample did not complete the posttest OSAKA instrument (the outcome variable).

Figure 7. Flowchart of Study Sample of Primary Health Care Nurses

Demographic characteristics

Table 1 displays the demographic characteristics of the primary health care nurses who completed the study. The sample was primarily female ($n = 144$, 92.3%), young

Table 1. Demographic Characteristics of PHC Nurses (N = 156)

	<i>Mean</i>	<i>SD</i>	<i>Range</i>	<i>N (%)</i>
Age	33.12	4.68	23 - 46	156
20 - 30 years				48 (30.77)
31 - 40 years				97 (62.18)
≥ 41 years				12 (7.05)
Sex				156
Male				12 (7.7)
Female				144 (92.3)
Highest Level of Education				155
3-year Diploma degree				116 (74.8)
4-year college degree (BSN)				35 (22.6)
Master's degree				4 (2.6)
Years of Nursing Practice	11.52	4.68	1 - 28	156
≤ 5 years				16 (10.26)
6 - 10 years				60 (38.46)
11 - 15 years				41 (26.28)
≥ 16 years				39 (25.00)
Knows OSA Patient				156
Yes				144 (92.3)
No				12 (7.7)
Knows diabetes Patient				156
Yes				152 (97.4)
No				4 (2.6)

adults (M= 33.1 years, SD = 4.68). A majority of participants reported their level of education as 3-year Diploma degree ($n=116$, 74.8%); fewer participants reported having 4-year college degree (BSN) ($n=35$, 22.6%) or a Master's degree ($n=4$, 2.6%). The number of years in nursing practice ranged from 1-28 years (mean = 11.52, SD = 4.68). Most of the participants ($n=144$, 92.3%) reported knowing patients with obstructive sleep apnea; even more ($n=152$, 97.4%) reported knowing patients with diabetes.

OSAKA Knowledge at Baseline

Participants who completed the study in its entirety ($N = 156$) completed the OSAKA questionnaire at baseline. Baseline mean scores for the *knowledge of OSA* subscale of the OSAKA instrument are shown in Table 2. With a possible high score of 18, the knowledge scores were low for the sample (M=8.87, SD = 2.91, Median = 9.0).

Table 2. Baseline Mean Scores on Knowledge Subscale of the OSAKA Instrument

Overall Knowledge (Possible score range 0 – 18)		<i>n</i>	Mean (SD)	Range
Entire sample	Pretest	156	8.87 (2.91) median = 9.0	0 - 15
Control	Pretest	83	8.84 (3.12)	0 - 15
Intervention	Pretest	73	8.90 (2.68)	4 - 15
Intervention	Posttest	73	9.78 (4.23)	0 - 17

The intervention subgroup ($n = 73$) had a mean knowledge score of 8.9 (SD = 2.68). Using an independent samples t-test, the control subgroup's baseline mean score was not statistically different from the intervention group mean score ($t = 0.26$, $p = 0.80$).

Relationships between OSAKA knowledge scores and demographics

The relationships between the baseline OSAKA knowledge scores and the demographic characteristics were examined. Table 3 lists each of the demographic variables, the type of test performed, and the results. An independent samples *t*-test was used to determine if there was a significant difference in OSA knowledge by level of education. Level of education was categorized into two levels; Diploma level nurses were considered as *basic nurses* while both the Baccalaureate and Masters nurses were combined as *professional nurses*. There was no significant difference in mean OSA knowledge between the two groups (Table 3).

Table 3. Relationships between Knowledge Scores and Demographics (N = 156)

Demographic data	Type of Test	Result
Gender	Independent t-test	-0.87 ($p=0.39$) <i>ns</i>
Age	Pearson's correlation	-0.029 ($p=0.72$) <i>ns</i>
Years of experience	Pearson's correlation	-0.086 ($p=0.29$) <i>ns</i>
Educational level (Basic/Professional)	Independent t-test	-0.38 ($p=0.70$) <i>ns</i>

Preliminary Efficacy of the Online Health Educational Intervention

Research question 1 was “What is the *preliminary efficacy* of a brief educational intervention to increase the levels of knowledge and attitudes for primary health care nurses in Oman? To answer the question, a paired group *t*-test was performed to measure

the difference in mean knowledge scores of the OSA intervention group from baseline to posttest. There was a significant increase in the mean score of the intervention group from pretest to the posttest ($p=.037$) following the educational intervention (Figure 8.)

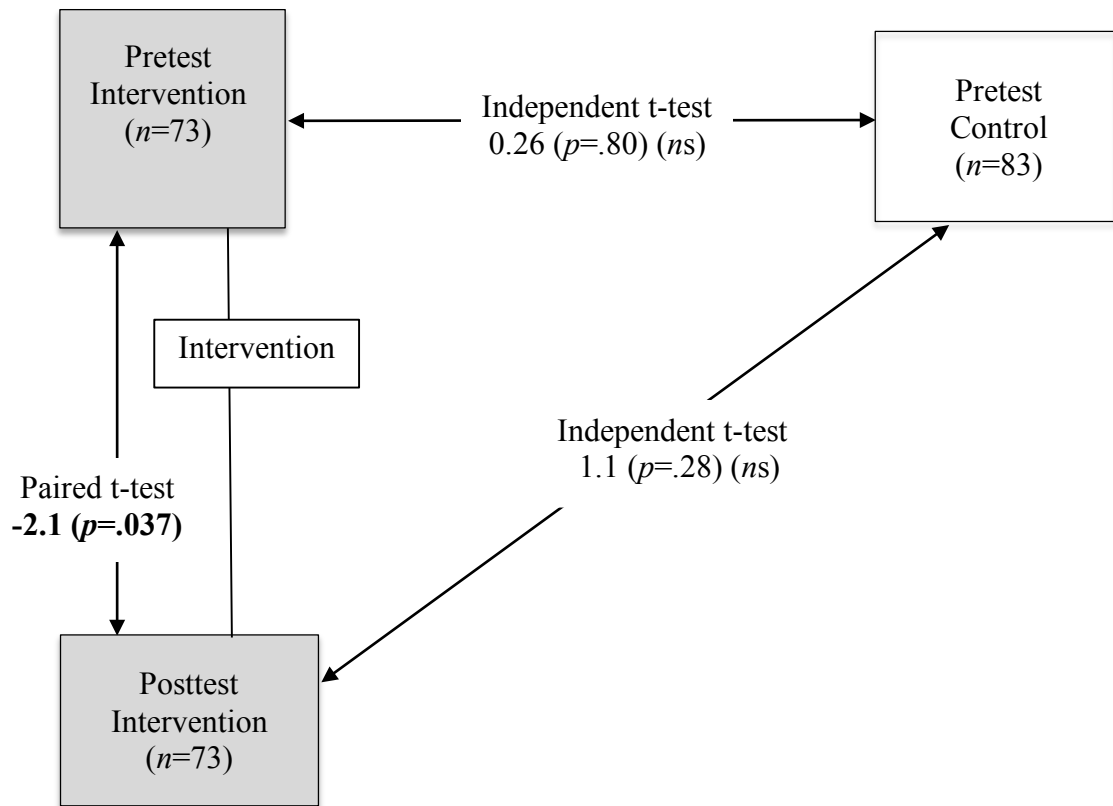


Figure 8. Calculated Differences among Pretest and Posttest Group Means

In Figure 8, it is noted that there was no significant difference in the mean OSA knowledge scores between the intervention and ‘control’ group at baseline ($t=0.26$, $p=.80$). Though the ‘control’ arm could not be used directly to make comparisons on the outcome variable, the test for differences between the mean knowledge scores for non-

intervention group at baseline and the intervention group at posttest resulted in a non-significant finding ($t=1.1, p=.28$).

Knowledge scores by condition group

Figure 9 illustrates the similar distributions of correct scores between the control and intervention groups at baseline. Table 4 details the number of participants by the number of items that they got correct on the knowledge subscale of the OSAKA

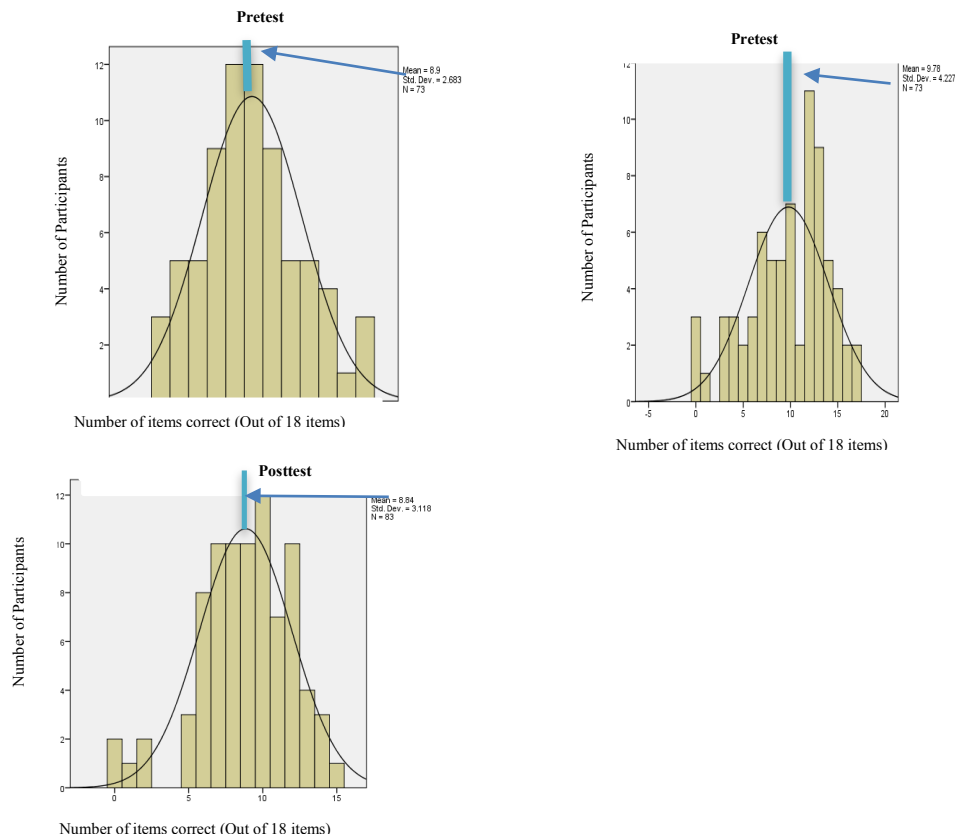


Figure 9. Distributions of Correct Scores between the Control and Intervention Groups

Table 4. Overall Correct Response Scores for Knowledge Subscale (OSAKA) between Pretest and Posttest

Correct responses on Knowledge Subscales	Sample (N = 156) N (%)	Control (n = 83)	Intervention (n = 73)	
		n (%)	n (%)	n (%)
	Pretest			Posttest
0	2 (1.28)	2 (2.41)	-	3 (4.11)
1	1 (0.64)	1 (1.20)	-	1 (1.37)
2	2 (1.28)	2 (2.41)	-	-
3	-	-	-	3 (4.11)
4	3 (1.92)	-	3 (4.11)	3 (4.11)
5	8 (5.13)	3 (3.61)	5 (6.85)	2 (2.74)
6	13 (8.33)	8 (9.64)	5 (6.85)	3 (4.11)
7	19 (12.18)	10 (12.05)	9 (12.33)	6 (8.22)
8	22 (14.10)	10 (12.05)	12 (16.44)	5 (6.85)
9	22 (14.10)	10 (12.05)	12 (16.44)	5 (6.85)
10	21 (13.46)	12 (14.46)	9 (12.33)	7 (9.59)
11	12 (7.69)	7 (8.43)	5 (6.85)	2 (2.74)
12	15 (9.62)	10 (12.05)	5 (6.85)	11 (15.07)
13	8 (5.13)	4 (4.82)	4 (5.48)	9 (12.33)
14	4 (2.56)	3 (3.61)	1 (1.37)	5 (6.85)
15	4 (2.56)	1 (1.20)	3 (4.11)	4 (5.48)
16	-	-	-	2 (2.74)
17	-	-	-	2 (2.74)
18	-	-	-	-
Total	156 (100)	83 (100)	73 (100)	73 (100)

questionnaire. Regarding knowledge, the total scores of the participants (N = 156) ranged from 0 to 15 with a possible score range from 0-18. For example, at baseline (pretest), there were 2 participants (1.28%) who answered none of the knowledge questions correctly. None of the participants scored more than 15 correct in the 18-item knowledge subscale. Only 4 of the 156 participants correctly answered 15 of the 18 items. None of the knowledge items were answered correctly by all participants at baseline.

Percentage correct by knowledge item

Table 5 lists each of the items from the OSAKA knowledge subscale; after each item, its subscale number (in parenthesis) and the correct answer for that item (**T** or **F**) are provided. The table also ranks each of the 18 knowledge items according to the percentage of the sample (N = 156) that got each item correct. The top-ranked 7 knowledge items were answered correctly by more than half of the sample. Item # 10 (*The most common cause of obstructive sleep apnea in children is the presence of large tonsils and adenoids*) was answered correctly by the largest percentage of participants (87.8%) at baseline. In contrast, item # 2 (*Uvulopalatopharyngoplasty is curative for the majority of patients with obstructive sleep apnea*) was answered correctly by only 14.8% of the participants at baseline.

Though there were minor differences, the relative rankings of each item by the percentage of nurses who answered correctly were nearly identical between the control group (n = 83) and the intervention group (n = 73) at baseline. Cronbach's α for the 18 items on the OSAKA knowledge subscale was 0.77 which showed an acceptable internal consistency in this sample.

Table 5. Percentage Correct on OSAKA Knowledge Subscale by Item

OSAKA Knowledge Questions (Item number) Correct answer (T or F)	Sample	Control	Intervention	
	%	%	%	%
	Pretest		Posttest	
The most common cause of obstructive sleep apnea in children is the presence of large tonsils and adenoids. (10) T	87.8	85.5	90.4	86.1
The loss of upper airway muscle tone during sleep contributes to obstructive sleep apnea. (9) T	82.1	80.7	85.6	75.0
The majority of patients with obstructive sleep apnea snore. (4) T	76.3	73.5	79.5	76.4
Cardiac arrhythmias may be associated with untreated obstructive sleep apnea. (18) T	74.7	74.4	75.0	68.5
A craniofacial and oropharyngeal examination is useful in the assessment of patients with suspected obstructive sleep apnea. (11) T	71.2	74.7	67.1	63.0
An overnight sleep study is the gold standard for diagnosing obstructive sleep apnea. (6) T	65.4	66.3	64.4	52.8
CPAP is the first therapy for severe obstructive sleep apnea. (16) T	53.9	57.3	50.0	61.6
Continuous Positive Airway Pressure (CPAP) therapy may cause nasal congestion. (7) T	49.0	50.0	47.9	48.6
Untreated obstructive sleep apnea is associated with a higher incidence of automobile crashes. (13) T	47.4	49.4	45.2	56.2
Alcohol at bedtime improves obstructive sleep apnea. (12) F	43.6	42.2	45.2	56.2
Obstructive sleep apnea is more common in women than men. (15) F	36.8	38.6	34.7	42.5
Laser-assisted uvulopalatopharyngoplasty is an appropriate treatment for severe obstructive sleep apnea. (8) T	35.3	33.7	37.0	45.8
The estimated prevalence of obstructive sleep apnea among adults is between 2% and 10%. (3) T	35.1	32.9	37.5	50.0
Women with obstructive sleep apnea may present with fatigue alone. (1) T	33.3	34.9	31.5	51.4
Obstructive sleep apnea is associated with hypertension. (5) T	30.8	27.7	34.2	40.3
In men, a collar size 17 inches or greater is associated with obstructive sleep apnea. (14) T	26.9	26.5	27.4	46.6
Less than 5 apneas or hypopneas per hour are normal in adults. (17) T	25.8	21.7	30.6	43.1
Uvulopalatopharyngoplasty is curative for the majority of patients with obstructive sleep apnea. (2) F	14.8	16.9	12.3	22.2

The correct response rates to the items on the knowledge subscale in the OSAKA questionnaire shown in Table 5. At posttest, the total scores of the participants in the intervention group ($n = 73$) ranged from 0 to 17 with a possible range score from 0-18 for the subscale. There were 3 participants (4.1%) who had a total score of 0 item correct on the posttest and 2 participants answered 17 items correctly. As noted in Table 2, for the posttest group the mean was 9.78 ($SD = 4.23$).

In consideration that the OSAKA instrument was originally developed to measure OSA knowledge and attitudes among physicians, this researcher reviewed each of the 18 items to determine the relevance to a nurse's scope of practice. These include the basic knowledge for identifying, assessing, and referring patients who may have obstructive sleep apnea. The gray-shaded items in Table 5 were the items (14 of the 18 items in the subscale) identified as being necessary for the primary health care nurse to know. As indicated on Table 5, the nurses scored as poorly – or worse – on these items as they did on the items categorized as more relevant to a physician's practice.

Intervention pretest and posttest by item

Table 5 also illustrates that, at the posttest, the relative positioning of items by the percentage of participants who answered them correctly had changed only slightly, with 86.1% of the intervention subgroup answering item # 10 (*The most common cause of obstructive sleep apnea in children is the presence of large tonsils and adenoids*) correctly. Also, after watching the online OSA educational program, the intervention group ($n = 73$) scored less well on 6 of these 7 items.

OSAKA Attitudes at Baseline

Participants (N = 156) responded to 5 attitudes items in the OSAKA questionnaire at baseline. Two items asked the participants to rate the *importance* of 1) the clinical disorder and 2) identifying OSA. The other 3 items asked the participants to rate their *confidence* in 1) identifying patients at-risk of OSA, 2) their ability to manage patients with OSA, and 3) their ability to manage patients with continuous positive airway pressure (CPAP). Mean scores for the five items of the *Attitudes of OSA* subscale in the OSAKA questionnaire pretest are shown in Table 6. Using an independent groups t-test, there were no statistically difference between the baseline means for the intervention and control subgroups ($t = 0.29, p = 0.77$).

Table 6. Analysis of Mean Scores on OSAKA Attitudes Subscales.

Overall Attitudes (Possible score range 5 – 25)		n	Mean (SD)	Range
Entire sample	Pretest	155	17.26 (3.17)	5 - 24
Control	Pretest	82	17.20 (3.42)	5 - 24
Intervention	Pretest	73	17.34 (2.88)	9 - 23
Intervention	Posttest	72	17.61 (4.11)	5 - 25

OSAKA Attitudes at Posttest

Table 7 illustrates that a paired samples t-test was conducted to compare the pretest and posttest means of OSA attitudes for the two groups. Using a paired samples t-test, no statistically significant difference was found between the pretest and posttest scores for the intervention subgroup ($t = -0.782, p = 0.437$). The mean for the posttest

was slightly higher than the baseline mean. In the absence of OSAKA posttest scores for the control subgroup, an independent t-test was used to compare the control subgroup pretest with the intervention posttest mean; there was no significant difference in the means ($t = 0.686, p = 0.494$).

Table 7. Tested Differences between Group Means for the OSAKA Attitudes Subscale.

Intervention (n=73) and Control pretest (n=83) at baseline	Control pretest baseline (n=83) and intervention posttest (n=73)	Intervention baseline and posttest (n=73)
<i>Independent t-test</i>	<i>Independent t-test</i>	<i>Paired t-test</i>
0.29 (0.77) <i>ns</i>	0.69 (0.49) <i>ns</i>	- 0.78 (0.44) <i>ns</i>

OSAKA Questionnaire – Attitudes Pretest and Posttest

Table 8 lists each of the items from the OSAKA attitudes subscale; the vast majority ($n=149, 96.1\%$) of the primary health care nurses considered OSA to be *important, very important* or *extremely important* (highlighted in gray shading) as a clinical disorder. Similarly, most of the nurses ($n=147, 94.9\%$) considered identifying patients with OSA as *important* to *very important*, to *extremely important*. Considerably, fewer nurses ($n=91, 59.1\%$) *agreed* or *strongly agreed* that they were confident in identifying patients with OSA. Even fewer nurses ($n=73, 47.1\%$) *agreed* or *strongly agreed* that they were confident in their ability to manage OSA patients. Similarly, less

Table 8. Responses on OSAKA Attitudes by Item Pretest and Posttest.

OSAKA Attitudes	Mean (SD)	Range	Sample (N = 156)	Control (n = 83)	Intervention (n = 73)	
			N (%)	n (%)	n (%)	n (%)
			Pretest			Posttest
Importance (2 items) (Possible range 5-25)						
1. Clinical Importance of OSA	3.79 (0.89)	1 - 5				
<i>Not important</i>			2 (1.3)	2 (2.4)	-	4 (5.6)
<i>Somewhat important</i>			4 (2.6)	2 (2.4)	2 (2.7)	3 (4.2)
<i>Important</i>			57 (36.8)	30 (36.6)	27 (37.0)	33 (45.8)
<i>Very important</i>			54 (34.8)	26 (31.7)	28 (38.4)	16 (22.2)
<i>Extremely important</i>			38 (24.5)	22 (26.8)	16 (21.9)	16 (22.2)
2. Importance of Identifying OSA Patients	3.75 (0.91)	1 - 5				
<i>Not important</i>			3 (1.9)	1 (1.2)	2 (2.7)	3 (4.2)
<i>Somewhat important</i>			5 (3.2)	3 (3.7)	2 (2.7)	4 (5.6)
<i>Important</i>			54 (34.8)	25 (30.5)	29 (39.7)	27 (37.5)
<i>Very important</i>			58 (37.4)	32 (39.0)	26 (35.6)	21 (29.2)
<i>Extremely important</i>			35 (22.6)	21 (25.6)	14 (19.2)	17 (23.6)
Confidence (3 items) (Possible range 5-25)						
3. Confident in Identifying OSA Patients	3.40 (1.05)	1 - 5				
<i>Strongly disagree</i>			9 (5.8)	1 (1.2)	3 (4.2)	7 (9.9)
<i>Disagree</i>			25 (16.2)	3 (3.7)	12 (16.7)	9 (12.7)
<i>Neither agree nor disagree</i>			29 (8.8)	25 (30.5)	10 (13.9)	10 (14.1)
<i>Agree</i>			77 (50.0)	32 (39.0)	41 (56.9)	28 (39.4)
<i>Strongly agree</i>			14 (9.1)	21 (25.6)	6 (8.3)	17 (23.9)
4. Confident with Management of OSA Patients	3.20 (1.07)	1 - 5				
<i>Strongly disagree</i>			8 (5.2)	5 (6.1)	3 (4.1)	6 (8.3)
<i>Disagree</i>			39 (25.2)	23 (28.0)	16 (21.9)	10 (13.9)
<i>Neither agree nor disagree</i>			35 (22.6)	17 (20.7)	18 (24.7)	17 (23.6)
<i>Agree</i>			60 (38.7)	32 (39.0)	28 (38.4)	23 (31.9)
<i>Strongly agree</i>			13 (8.4)	5 (6.1)	8 (11.0)	16 (22.2)
5. Confident with Management of Patients on CPAP	3.14 (1.04)	1 - 5				
<i>Strongly disagree</i>			9 (5.8)	4 (4.9)	5 (6.8)	5 (6.9)
<i>Disagree</i>			39 (25.2)	21 (25.6)	18 (24.7)	10 (13.9)
<i>Neither agree nor disagree</i>			35 (22.6)	20 (24.4)	15 (20.5)	15 (20.8)
<i>Agree</i>			65 (41.9)	34 (41.5)	31 (42.5)	27 (37.5)
<i>Strongly agree</i>			7 (4.5)	3 (3.7)	4 (5.5)	15 (20.8)

Note – Subsamples may not add up to 100% due to the number of sample calculated.

than half of the nurses (n=72, 46.4%) *agreed* or *strongly* agreed that they were confident in their ability to manage patients on CPAP therapy.

Correlations among Pretest Attitudes and Knowledge (N = 156)

Table 9 displays a correlation matrix between the overall knowledge scores and the five attitude items at baseline. There was a strong, significant correlation between the nurse's perception of the *clinical importance* of OSA and the nurse's perception of the *importance of identifying* OSA in the clinical setting ($r = .723, p < .01$).

Table 9. Correlation Matrix between Pretest OSA Attitudes and Knowledge (N = 156).

	Clinical Importance	Identify Importance	Identify Confidence	Manage Confidence	CPAP Confidence	Overall Knowledge
Clinical Importance	1					
Identify Importance	.723**	1				
Identify Confidence	.218**	.159*	1			
Manage Confidence	.099	.057	.463**	1		
CPAP Confidence	-.030	.030	.377**	.472**	1	
Overall Knowledge	.100	.077	.216**	.214**	.296**	1

** Correlation is significant at < 0.01 level (2-tailed)

* Correlation is significant at < 0.05 level (2-tailed)

Diabetes Knowledge at Baseline (N = 156)

Participants who completed the study in its entirety (N = 156) completed the Diabetes Basic Knowledge Test (DBKT) questionnaire at baseline. Mean scores for the DBKT scale at baseline are shown in Table 10. The mean score for diabetes knowledge for the entire sample was 8.04 (SD = 2.41) out of a possible 14 points. The control subgroup (n = 83) had a mean baseline knowledge score of 8.01 (SD = 2.35).

Table 10. Mean Scores on Knowledge Scale DBKT.

Overall Knowledge (Possible score range 1 – 14)		n	Mean (SD)	Range
Entire sample	Pretest	156	8.04 (2.41)	2 - 13
Intervention	Pretest	73	8.08 (2.50)	2 - 13
Control	Pretest	83	8.01 (2.35)	2 - 13
Control	Posttest	83	8.53 (2.85)	1 - 14

Using an independent samples t-test, the control group's baseline mean score was not statistically different from the intervention group mean score ($t = -0.18, p = 0.86$) (Table 11).

DBKT Knowledge (n = 83)

Table 11 also illustrates that a paired samples t-test was conducted to compare the pretest and posttest means. Using a paired samples t-test, a statistically significant difference was found between the pretest and posttest mean scores for the control subgroup ($t = -2.52, p = 0.014$). The mean for the posttest 8.53 (2.85) was slightly higher than the baseline mean 8.01 (2.35). In the absence of DBKT posttest scores for the

Table 11. Tested Differences between Group Means on Diabetes Knowledge.

Control pretest (n=83) and intervention pretest (n=73) at baseline	Control posttest (n=83) and intervention pretest (n=73)	Control pretest (n=83) and posttest (n=83)
<i>Independent t-test</i>	<i>Independent t-test</i>	<i>Paired t-test</i>
- 0.18 (0.86) <i>ns</i>	1.04 (0.30) <i>ns</i>	- 2.52 (0.014) <i>s</i>

intervention subgroup, an independent sample t-test was used to compare the intervention subgroup pretest with the control posttest mean; there was no significant difference in the group means ($t = 1.04$, $p = 0.30$).

Feasibility of the Online Health Educational Intervention

Research question 2 for this study was “*What is the feasibility of providing a brief educational intervention on the levels of knowledge and attitudes of primary health care nurses?*”

Feasibility Assessment: Primary Health Care Nurses

A secondary purpose of this study was to evaluate the *feasibility* of the online OSA educational intervention “*A Brief Introduction to OSA for Omani Nurses*.” The 7 questions for the nurses were developed for this study (Appendix K) and are listed in Table 12. Nurses who received the intervention ($n = 73$) watched the intervention video. Table 12 shows the evaluation of the online OSA educational intervention by primary health care

Table 12. Evaluation of the OSA Educational Intervention by PHC nurses ($n = 73$).

	<i>n</i> (%)	<i>Cumulative %</i>
1. Length of video		
<i>Too long</i>	7 (10.1)	
<i>Right length</i>	62 (89.9)	
2. Video online format was acceptable to me		
<i>Strongly disagree</i>	2 (2.8)	
<i>Disagree</i>	5 (6.9)	
<i>Neither agree nor disagree</i>	9 (12.5)	
<i>Agree</i>	25 (34.7)	77.8
<i>Strongly agree</i>	31 (43.1)	
3. I learned new information watching the video		
<i>Strongly disagree</i>	4 (5.5)	
<i>Disagree</i>	4 (5.5)	
<i>Neither agree nor disagree</i>	13 (17.8)	
<i>Agree</i>	19 (26.0)	71.2
<i>Strongly agree</i>	33 (45.2)	
4. Video related to my work		
<i>Strongly disagree</i>	3 (4.1)	
<i>Disagree</i>	9 (12.3)	
<i>Neither agree nor disagree</i>	10 (13.7)	
<i>Agree</i>	27 (37.0)	69.9
<i>Strongly agree</i>	24 (32.9)	
5. PHC nurses would find video easy to understand		
<i>Strongly disagree</i>	4 (5.6)	
<i>Disagree</i>	4 (5.6)	
<i>Neither agree nor disagree</i>	7 (9.9)	
<i>Agree</i>	29 (40.8)	78.8
<i>Strongly agree</i>	27 (38.0)	
6. Video would help PHC nurses be aware of OSA patients		
<i>Strongly disagree</i>	6 (8.3)	
<i>Disagree</i>	3 (4.2)	
<i>Neither agree nor disagree</i>	6 (8.3)	
<i>Agree</i>	29 (40.3)	79.2
<i>Strongly agree</i>	28 (38.9)	
7. Likely to recommend video to other health professionals		
<i>Not at all likely</i>	1 (1.4)	
<i>Unlikely</i>	-	
<i>Neither likely nor unlikely</i>	5 (6.8)	
<i>Likely</i>	38 (52.1)	91.8
<i>Very likely</i>	29 (39.7)	

*Note – Subsamples may not add up to 100% due to incomplete data.

nurses (n = 73). The time for watching the video was about 15 minutes. Out of the total number of nurses (n=69) who answered the first question, those participants who agreed that the length of the video was "*Right length*" (n= 62, 89.9%) whereas 7 participants (10.1%) answered "*Too long.*" In response to the question related to "*Learned new information watching the video*", nearly three-quarters of the participants (71.2%) commented that most of the information gathered in the video was new to them and that they learned from it. More than two-thirds (69.9%) of the participants *agreed* or *strongly agreed* that the online video was related to their work.

The "*video online format was acceptable*" to 77.8% of the subsample and whether the "*video related to their work*". When asked if "*primary health care nurses would find the video easy to understand*", 78.8% of the participants *agreed* or *strongly agreed* that the video was easy to understand.

There were 79.2% of the subsample who *agreed* or *strongly agreed* that *the video would help the primary health care nurses be more aware of patients with OSA*. Whereas the last question asked how *likely to recommend video to other health care professionals* and there were 91.8% of the participants who *agreed* or *strongly agreed* that they would likely recommend this video to other colleagues that work in the health field.

Feasibility Assessment: Primary Health Care Nurse Administrators

Table 13 shows the demographic characteristics of the primary health care nurse administrators. The participants were all females (n=11) with a mean age of 38.18 years (SD= 2.89, range 34-45 years). A majority of participants reported their level of education as 3-year Diploma Degree (n=10, 90.9%), and only one had a 4-year college

Table 13. Demographic Characteristics of PHC Nurse Administrators ($n = 11$)

	Mean (SD)	Range	N (%)
Age	38.18 (2.89)	34 - 45	
20 - 30 years			-
31 - 40 years			10 (90.9)
≥ 41 years			1 (9.1)
Sex			
Male			-
Female			11 (100)
Highest Level of Education			
3-year Diploma Degree			10 (90.9)
4-year College Degree, BSN			1 (9.1)
Master Degree			-
Doctorate			-
Years of Nursing Practice	17.27 (2.68)	12 - 23	
11 - 15 years			2 (18.2)
16 - 20 years			8 (72.7)
> 20 years			1 (9.1)
No. of Nurses supervised	33.36	15 - 76	
< 20 nurses			5 (45.46)
20 - 29 nurses			2 (18.18)
≥ 30 nurses			4 (36.36)
Knowledge of OSA			
Little			3 (27.3)
Some			8 (72.7)
A lot			-

Degree (BSN). The number of "*years of nursing practice*" for the administrators had a mean of 17.27 (SD= 2.68, range 12-23 years). The mean "*number of nurses supervised*" was 33.36 (SD=23.80, range 15-76 nurses). There were three nurse administrators who reported knowing "*Little*" about obstructive sleep apnea ($n=3$, 27.3%), while the

Table 14. OSA Video Evaluation – PHC Nurse Administrators

<i>OSA Video Evaluation</i>	OSA N (%)
Length of video	
<i>Too Long</i>	-
<i>Right Length</i>	11 (100)
Video format was acceptable to me	
<i>Strongly disagree</i>	-
<i>Disagree</i>	-
<i>Neither agree nor disagree</i>	-
<i>Agree</i>	4 (36.4)
<i>Strongly agree</i>	7 (63.6)
I learned new information watching the video	
<i>Strongly disagree</i>	-
<i>Disagree</i>	-
<i>Neither agree nor disagree</i>	-
<i>Agree</i>	2 (18.2)
<i>Strongly agree</i>	9 (81.8)
Video was related to my work	
<i>Strongly disagree</i>	-
<i>Disagree</i>	-
<i>Neither agree nor disagree</i>	-
<i>Agree</i>	7 (63.6)
<i>Strongly agree</i>	4 (36.4)
PHC nurses would find video easy to understand	
<i>Strongly disagree</i>	-
<i>Disagree</i>	-
<i>Neither agree nor disagree</i>	1 (9.1)
<i>Agree</i>	3 (27.3)
<i>Strongly agree</i>	7 (63.6)
Video would help PHC nurses be aware of OSA patients	
<i>Strongly disagree</i>	-
<i>Disagree</i>	-
<i>Neither agree nor disagree</i>	-
<i>Agree</i>	4 (36.4)
<i>Strongly agree</i>	7 (63.6)
Likely to recommend video to other health professionals	
<i>Not at all likely</i>	-
<i>Unlikely</i>	-
<i>Neither likely nor unlikely</i>	-
<i>Likely</i>	3 (27.3)
<i>Very likely</i>	8 (72.7)

remaining (n=8, 72.7%) knew "Some."

Table 14 displays the results of the administrators' evaluations of the OSA video. all of the nurse administrators reported that the video was the "*Right length*." The question related to "*primary health care nurses find the video easy to understand*" was *agreed or strongly agreed* by 90.9% of the participants. All of the nurse administrators said that they would be *likely* or *very likely* "*to recommend video to other health care professionals*."

Summary of Research Results

The primary objective of this study was to determine the preliminary efficacy and feasibility of an online OSA educational intervention for Omani primary health care nurses. Response rates to the survey website were exceptionally high and a sample of 156 participants were recruited within the timeframe of two weeks. The vast majority of eligible primary health care nurses that responded were willing to participate.

Due to unforeseen technical issue with the presentation of appropriate instruments at the posttest, the intended 'control group' of participants ($n=83$) did not complete the posttest on the OSAKA instrument as planned. Each of the two groups, the intervention ($n = 73$) and the control ($n = 83$), answered only the posttest instrument relevant to their video content instead of answering both the OSAKA questionnaire and DBKT instrument. For this reason, calculations and analysis had to be modified to suit the revised design as this study became a one-group, pretest-posttest study.

Overall, the results showed low levels of knowledge on OSA among primary health care nurses in Oman. When the mean knowledge scores for the intervention group

at baseline were compared with the posttest mean score, there was a significant difference ($t = -2.1, p = .037$), indicating an increase in OSA knowledge following the video intervention. Overall, the measures of feasibility of the online video format were high. Almost all primary health care nurses and nurse administrators reported positively about the format, timing, and relevance of the OSA video. Finally, there was excellent response from the nurse administrators to participate in the evaluation of the OSA intervention video.

Chapter Five Discussion

The purpose of the study was to test the preliminary efficacy and feasibility of an online OSA educational intervention to affect the knowledge of – and attitudes towards – OSA in a sample of primary health care nurses in Oman.

Obstructive sleep apnea (OSA) remains a highly under-diagnosed condition in the general population; most primary care providers do not systematically screen patients for OSA and fail to identify comorbidities in high-risk patients (Ojeda, et al., 2013; Schotland & Jeffe, 2003). Patients with symptoms of OSA present to primary health care centers and a basic knowledge of OSA is considered essential to identifying these patients for appropriate referral and treatment. Sleep medicine is relatively new to the Sultanate of Oman and, currently, only one teaching hospital in the capital city has a sleep laboratory with polysomnography services.

In this study, the original English version of the OSAKA questionnaire was used to measure the outcome variables; although the OSAKA the questionnaire was developed for physicians (not primary health care nurses), there was no reliable and valid instrument available that could be located to measure the nurses' knowledge and attitudes concerning OSA properly. This study surveyed primary health care nurses working with adults in primary health care centers in Oman. The study was regarding their knowledge of OSA and its treatment and their attitudes about the importance of OSA and their confidence in being able to identify and manage patients with OSA. The current literature revealed that there was no research available concerning primary health care nurses and their knowledge and attitudes of obstructive sleep apnea.

The mean for the overall OSA knowledge score among primary care nurses was 8.87 (SD = 2.91) compared to the mean of 7.6 (SD = 3.2) in the Nigerian study of physicians conducted by Ozoh and colleagues (2015). The findings of this study contribute to the literature by describing the low levels of OSA knowledge among a sample of primary health care nurses in Oman.

This study was innovative in its use of an online OSA educational program format. Further, it collected feasibility data from primary health care nurses about the intervention and its format to guide further research and instrument development. The online OSA educational intervention video "*A Brief Introduction to OSA for Omani Nurses*" may have led to a significant, though minimal, increase in the overall knowledge mean scores from the pretest to the posttest in the group that viewed the video intervention. The attitudes scores increased following the video, but did not reach the level of significance.

There was no significant difference between the overall OSAKA knowledge subscale and any of the demographic variables. Similarly, in an OSA study among physicians, the researchers found no significant difference in total OSA knowledge by gender ($X^2 = 12.6, p = 0.63$) and no significant difference with age ($r = -0.08, p = 0.35$) (Ozoh, et al., 2015). In a sample of physicians in Latin America, Ojeda and colleagues (2013) also found that OSA knowledge did not differ due to the number of years in practice (≤ 5 vs > 5 years since graduation). However, Schotland and Jeffe (2013) found a negative correlation between years in practice and OSA knowledge using the OSAKA. It demonstrated that the older the physicians, the lower their knowledge scores. In addition,

the older they were, the less confident they were in managing patients with OSA (Schotland & Jeffe). This phenomenon among the countries may reflect a lack of adequate information regarding sleep medicine at the undergraduate and graduate nursing and medical education levels. In addition, it also may reflect that this problem is the same across all other countries in the world (Mindell, et al., 2011).

When it came to the different correct items and the percentage of participants who scored correct, 7 items were answered correctly by more than half of the sample that is 50% and above. However, the posttest result showed lower results in those seven items among the intervention group ($n = 73$). There were slight similarities between this study and another study but conducted with newly graduated physicians ($N = 398$) in Latin America though used a cross-sectional survey study using the Spanish validated version of the OSAKA questionnaire by (Fernandez et al., 2014).

The internal consistency of the 18 items on the knowledge subscale of the OSAKA questionnaire in this sample of primary care nurses had an acceptable internal consistency (Cronbach's $\alpha = 0.77$) as compared to a study of physicians in Latin American (Cronbach's $\alpha = 0.58$) (Ojeda, et al., 2013). Compared to this study, 30.8% of primary health care nurses knew an association between OSA and hypertension whereas slightly more of the physicians in the Latin American study (32.4%) knew there was an association. In this study, there were 74.4% of the primary health care nurses who were aware of cardiac arrhythmias, while 54.4% in the Latin American study. More primary health care nurses (59.1%) compared to 54.5% in the Latin American study who had high attitudes toward feeling confident in identifying patients with OSA.

In this study, it was found a low level of knowledge regarding OSA epidemiology, diagnosis, and management among primary health care nurses. Despite good recognition of OSA as an *important*, *very* important or *extremely* important clinical disorder (n=149, 96.1%), the level of confidence in diagnosing and managing OSA was low, with only 47.1% of the participants agreeing or strongly agreeing that they were confident in managing OSA. This was validated by their low knowledge of OSA management, as their lowest scores regarded the treatment for OSA, questions 2 and 8 respectively.

The findings indicate low levels of OSA knowledge that may translate into practice; primary health care nurses in Oman may not possess the requisite knowledge to adequately identify patients at risk for OSA, provide the relevant assessment, or follow-up with appropriate referrals for diagnosis and treatment. This situation may contribute to higher rates of under-diagnosed OSA patients in Oman.

The low level of knowledge among primary health care nurses in developing countries regarding sleep disorders has been validated using a variety of questionnaires in other parts of the world (Mindell, et al., 2011). When this study was compared with previously published studies done in Ecuador and Nigeria, with physicians though, in which researchers also used the OSAKA questionnaire, it was found that the level of knowledge among primary health care nurses in Oman was 49.5% compared to 43% among physicians in Nigeria as well as 52% in the Latin American study) (Ojeda, et al., 2013; Ozoh, et al., 2015). This low level of knowledge among primary health care nurses regarding sleep disorders had been attributed at least in part to limited education in sleep

medicine during nursing and medical schools (Almohaya, et al., 2013; Mindell, et al., 2011; Ojeda, et al., 2013; Ozoh, et al.; 2015; Ozoh, et al., 2016; Williams, et al., 2015).

Participants in the study suggested that the information on OSA be provided across the nation and that another study might include physicians. Also, as the researcher noticed that some primary health care nurses were having difficulty to finish the survey and so they were answering the posttest haphazardly.

Underrepresentation of sleep medicine in the nursing and medical curricula have been attributed to several factors. Such factors as the belief that sleep medicine is a low priority compared to other prevalent diseases or it is irrelevant based on limited epidemiologic data from some parts of the world. Also there is the time constraints that limit formal instruction on sleep medicine; and the shortage of experienced and qualified personnel with lack of other resources for proper training (Almohaya, et al.; Mindell, et al.; Ojeda, et al., 2013; Ozoh, et al.; 2015; Ozoh, et al., 2016; Williams, et al., 2015).

In Oman, a low number of personnel specialized in sleep medicine and lack of resources are likely also to contribute to poor knowledge. For example, there are limited facilities for the diagnosis of OSA in local hospitals and health care centers. The facility is only available in the university hospital. Another factor that may contribute to poor knowledge of OSA among primary health care nurses is the lesser content of sleep medicine topics incorporated in medical and nursing textbooks; these topics are a potential source of information for self-study. From 31 medical textbooks reviewed in 2007 in 4 major subspecialties (neurology, pulmonology, psychiatry, and geriatrics), it was found that topics on sleep medicine composed only 2% of the covered content

(Bahammam, 2008; Mindell, et al.; Ojeda, et al.; Ozoh, et al.; 2015; Ozoh, et al., 2016; Williams, et al., 2015). It is imperative to recognize that OSA as a relevant, common disorder with adverse consequences. With the increasing prevalence of obesity, which is an important risk factor for OSA, there is likely to witness an increase in the burden of OSA in Oman and the Middle East (Almohaya, et al.; Bahammam, 2008). Therefore, efforts to promote the recognition and treatment of OSA is needed.

To improve OSA knowledge among nursing graduates, it has been suggested that sleep training should be included into the current nursing curriculum (Almohaya, et al.; Mindell, et al.; Ojeda, et al.; Ozoh, et al.; 2015; Ozoh, et al., 2016; Williams, et al.). This can be accomplished by including education on sleep and instruction on how to obtain information on sleep symptoms as part of the routine patient assessment. Also, the establishment of sleep clinics in various regions in Oman could provide nursing students valuable clinical rotations during nursing training. This could be also an approach that can improve the level of knowledge and confidence of the nursing students regarding OSA management. Another suggestion is to include sleep medicine during continuing nursing education programs that need to be organized more frequently to provide more opportunities for improving nurses' knowledge.

Strengths

This study had several strengths. To my knowledge, this was the first study to assess OSA knowledge and attitudes in nurses. Secondly, it is the first of its kind in Oman to assess the OSA knowledge and attitudes. This study used a reliable and valid questionnaire for the survey, though it may not have been appropriate for the scope of

nursing practice. The online study format provided for all primary health care nurses in across Oman to participate. The study participants varied in age, gender, the number of years of practice, and education level.

Limitations

More than half of all nurses who accessed the survey website (56%) were not eligible to participate in the study or chose not to participate. Response rates may have been higher if the survey had been available for more than 14 days. Since this was the first study to examine the knowledge and attitudes of primary health care nurses, the findings may not be generalizable to the overall primary health care nurses. The small number of male participants ($n = 12$) may be increased in future studies.

A major limitation to this study may have been the use of the OSAKA instrument; originally developed for physicians, it may not have been adequate in measuring the nurses' knowledge and attitudes of OSA that are most relevant to their scope of practice. All primary health care nurses in Oman use English as the mode of communications in all health care settings. Despite this, some items in the OSAKA instrument may be misunderstood or unfamiliar. This researcher could have conducted a pilot study with a sample of primary care nurses in Oman to collect their perspectives on the content, the language, and the relevance of items to their work in primary care centers. With findings from a pilot, the OSAKA instrument may have been altered for improved outcomes.

Another major limitation to this study was the loss of the randomized control arm of the sample due to an error in programming the Qualtrics program. Because the control group did not complete the OSAKA instrument at posttest, it was not possible to use their

data in the ‘randomized control trial that was intended. This could have been avoided if this researcher had conducted a pilot study of the online intervention with a sample of nurses; a pilot would have revealed the error before the study materials were available to the entire study sample.

Implications of the Findings

This study suggests a need for OSA education for nurses. It may also support the use of an online health education approach as well. For the primary health care nurses to adequately fulfill a role in screening patients for OSA risk factors and symptoms, they would need to have the requisite knowledge about the condition. From these findings, it suggests that increasing the nurses’ perception that OSA is clinically important would likely increase their perception that identifying patients at risk was important.

Recommendations for Health Care

Nursing institutes and colleges in Oman may consider curricular changes to improve nursing students’ knowledge of OSA to improve diagnosis and treatment. Inadequate training in nursing education and internship programs may underlie the low levels of knowledge of the diagnosis and treatment of OSA. Curricular changes may include some hours of education regarding sleep science and the role of nurses in identifying patients at risk, assessing for symptoms, and referring as needed to the physicians.

Recommendations for Society

People need to be aware of sleep medicine especially OSA. They need to be familiar with various signs and symptoms of it. Awareness might reduce the number of

morbidities and mortalities due to OSA. Thus, untreated OSA presents a significant burden on society. This will have a larger impact of untreated in health care expenditures.

Recommendations for Future Research

There would seem to be a need for a reliable and valid nursing instrument for assessing OSA knowledge and attitudes. Future research could focus on adapting the OSAKA instrument so that it is appropriately assessing the content that is pertinent to the role of primary care nurses. A team of experts could collaborate on the development and testing of a nurses' OSAKA-like instrument that would be available for use in future research in Oman and other countries in the world.

There must be a continued commitment to helping nurses screen for sleep disturbances. Assessments of patient health risks can improve the delivery of preventive and chronic care services making the primary health care centers more effective. It is hoped that there will be continued screening for OSA and sleep health among the patients served through the primary health care centers. This reduces the health care costs while increasing patient satisfaction.

In order to lower the OSA rate, it is necessary for primary health care nurses to be knowledgeable about the risk factors for OSA in various populations of patients. When primary health care nurses are knowledgeable about OSA, they may be more likely to assess and refer OSA patients. Future research may focus on the optimal ways to improve the nurse's OSA knowledge. Studies may be designed to measure how OSA education for primary health care nurses may vary in effectiveness; do conferences, in-services, online programs, or publications work best for nurses?

Conclusions

Primary care nurses in this study had low levels of OSA knowledge. The use of a brief online OSA knowledge intervention may have resulted in a minimal, though significant, increase in the nurses' knowledge. Overall, the intervention video and format was well-received by both the nurse participants and the nurse administrators who participated in the evaluative component of this study. Future research may focus on the development and testing of a nurse-relevant instrument to measure the OSA knowledge and attitudes that align with the scope of nursing practice. Lessons learned include having an appropriate instrument to measure the outcome variable and the need to conduct a pilot study to avoid unforeseen errors in the process that may lead to the loss of valuable data.

Summary

Obstructive sleep apnea (OSA) is a common medical condition that is often overlooked. Sleep health is vital to the natural restorative powers of the human body. Insufficient sleep contributes to a patient's risk of death, accidents (road traffic accidents or occupational health), slows cognition, and contributes to conditions such as heart disease, hypertension, stroke, and diabetes.

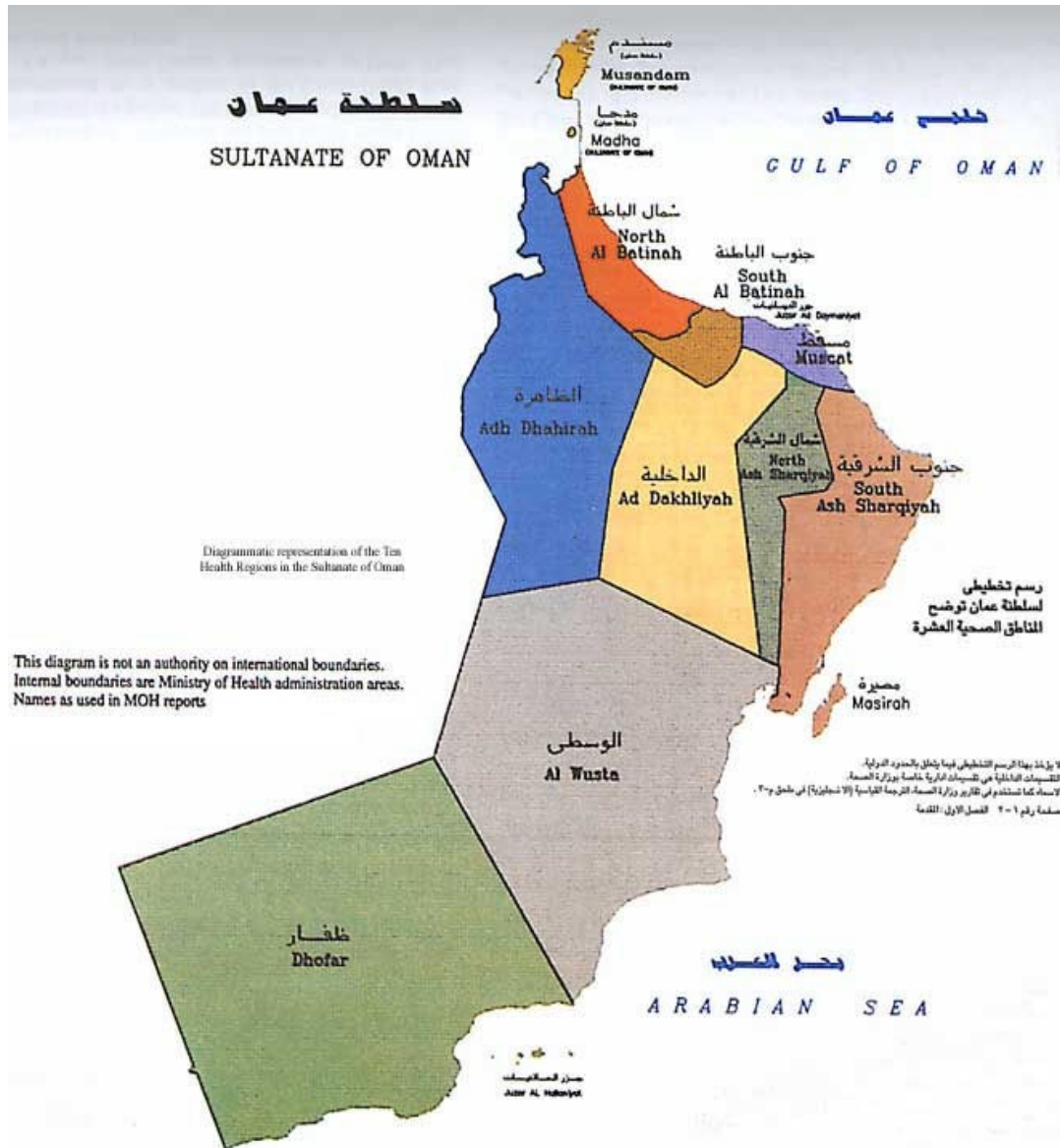
The vast majority of individuals diagnosed with OSA are typically obese older males. Primary health care providers, including nurses, often fail to identify individuals who present with symptoms and discoverable risk factors. The primary health care setting presents an important opportunity for case-finding by primary health care nurses and

other health care professionals. The importance in identifying these undiagnosed individuals should not be underestimated.

The contribution of this study is two-fold: a) it provides initial findings of primary health care nurses' knowledge and attitudes about OSA and b) it highlights awareness for all primary health care professionals regarding the existence of OSA where identification and treatment would benefit the individual, society, and the healthcare system.


Primary care nurses are dedicated to promotion of health and the prevention of disease in their communities. The first step toward diagnosing OSA is to identify the signs and symptoms of OSA while performing routine assessments on all individuals presenting for care. Only then may patients be appropriately referred for follow-up testing, diagnosis, and treatment that could lead to improved health outcomes.

Appendix A: Map of Oman



Appendix B: Recruitment Flier


Here is your chance to participate in a research study!



To participate in this study you must be:

- a nurse working in a primary health care center; and
- working with adult patients in general medicine

To access the anonymous survey, please go to: [<https://goo.gl/ED4ozg>]



This research study has received approval from the Institutional Review Board of the George Mason University in Fairfax, Virginia, USA [IRBNet # 965511-1] and the Research and Ethical Review and Approve Committee in the Ministry of Health, Sultanate of Oman.

This study is in partial fulfillment for the requirements of a PhD in Nursing
for Mr. Khamis Al Mezeini

MASON
UNIVERSITY
Office of Research Integrity
& Assurance

Project Number: 965511-2
Date Approved: 1/9/17
Approval Expiration Date: 11/9/17

IRB: For Official Use Only

Page 1 of 1

Appendix C: PHC Nurses Informed Consent

A FEASIBILITY AND PRELIMINARY EFFICACY OF OBSTRUCTIVE SLEEP APNEA INTERVENTION IN OMAN

INFORMED CONSENT FORM - Nurses

RESEARCH PROCEDURES

This is a confidential research study. You will be asked to answer some survey questions. Then, you will be shown a short video. Finally, you will be asked to answer a few more survey questions. Your participation is estimated to take approximately 1 hour of your time. Please allocate one hour of your time to finish the whole survey in one sitting.

Upon completion of the survey, you will be provided a Certificate of Attendance that is equivalent to a 1-hour of CPD (continuing professional development) credit. You may type your name on the certificate and print it out for your files.

RISKS

There are no foreseeable risks for participating in this research.

BENEFITS

There is no direct benefit to you by participating in this study. However, you may benefit from the provided health information. The findings of this research study may help in the development of professional programs for primary health care nurses in Oman.

CONFIDENTIALITY

All personal identifying information in this study will be kept confidential. You will not be asked to provide your name. No names or personal identifiers will be collected. The survey data will only be viewed by members of the research team. The research findings will only be reported in an aggregate form in presentations or publications.

PARTICIPATION

Your participation in this research study is completely voluntary. There are no costs to you. You have the right to refuse to answer any question or to withdraw from the study at any time. If you choose not to participate in this study, there will be no effect on your employment or loss of benefits to you. Completing the survey in this study will allow you to earn 1 hour of continuing professional development (CPD) credit. You will be able to print the CPD certificate once you have completed the survey.

CONTACT

If you have questions regarding this study and your rights as a participant, you may contact Khamis Al Mezeini (researcher) at +968 9932 3500 or via email at:

⁴
kalmuzay@masonlive.gmu.edu You may also contact Mr. Al Mezeini's faculty advisor, Dr. R. Kevin Mallinson, at rmallins@gmu.edu or via telephone +1 (703) 993-1941. You may also contact the George Mason University Office of Research Integrity & Assurance at +1 (703) 993-4121. This research has been approved by the George Mason University and the Research and Ethical Review and Approve Committee in Ministry of Health in the Sultanate of Oman.

CONSENT

You may print a copy of this page for your records.

By clicking on CONTINUE, I affirm that I have read and understood this consent form and voluntarily choose to participate in this survey study.

Appendix D: Administrators' Informed Consent

A FEASIBILITY AND PRELIMINARY EFFICACY OF OBSTRUCTIVE SLEEP APNEA INTERVENTION IN OMAN

INFORMED CONSENT FORM - Administrators

RESEARCH PROCEDURES

This is a confidential research study. You will be interviewed and asked to answer some questions about your response to a short educational video. The time that will be spent in watching the video and giving the feedback is approximately half an hour in total.

RISKS

There are no foreseeable risks for participating in this research.

BENEFITS

There is no direct benefit to you by participating in this study. However, you may benefit from the provided health information. The findings of this research study may help in the development of professional programs for primary health care nurses in Oman.

CONFIDENTIALITY

All personal identifying information in this study will be kept confidential. You will not be asked to provide your name. Your name will not be written on any of the interview forms. Only the members of the research team will have access to the study documents. The research findings will only be reported in an aggregate form in presentations or publications.

PARTICIPATION

Your participation in this research study is completely voluntary. There are no costs to you. You have the right to refuse to answer any question or to withdraw from the study at any time. If you choose not to participate in this study, there will be no effect on your employment or loss of benefits to you.

CONTACT

If you have questions regarding this study and your rights as a participant, you may contact Khamis Al Mezeini (researcher) at +968 9932 3500 or via email at: kalmuzay@masonlive.gmu.edu. You may also contact Mr. Al Mezeini's faculty advisor, Dr. R. Kevin Mallinson, at rmallins@gmu.edu or via telephone +1 (703) 993-1941. You may also contact the George Mason University Office of Research Integrity & Assurance at +1 (703) 993-4121. This research has been approved by the George Mason University and the Research and Ethical Review and Approve Committee in Ministry of Health in the Sultanate of Oman.

CONSENT

I have read and understood this form. All of my questions have been answered by the researcher,

and I agree to participate in this study.

Signature

Date of Signature

Appendix E: Administrators' Demographic Data

Self-report Demographic Data

Primary Health Care Nurse Administrators

Demographic data: Please answer the following demographic data

1. Sex
 - ☐ Male
 - ☐ Female
2. Age _____ years
3. Educational background (degree)
 - ☐ Diploma
 - ☐ Baccalaureate
 - ☐ Masters
 - ☐ Doctorate
4. Number of years of nursing practice _____ years
5. How many primary health care nurses do you supervise? _____
6. How do you consider your knowledge of obstructive sleep apnea?
 - ☐ Little
 - ☐ Some
 - ☐ A lot

Appendix F: Nurses' Demographic Data

Self-report Demographic Data

Primary Health Care Nurses

Demographic data: Please answer the following demographic data

2. Sex
 - ☐ Male
 - ☐ Female
3. Age _____ years
4. Educational background (degree)
 - ☐ Diploma
 - ☐ Baccalaureate
 - ☐ Masters
5. Number of years of nursing practice _____ years
6. Do you know anybody who was diagnosed with obstructive sleep apnea?
 - ☐ Yes
 - ☐ No
7. Do you know anybody who was diagnosed with diabetes mellitus?
 - ☐ Yes
 - ☐ No

Appendix G: OSAKA Questionnaire

Obstructive Sleep Apnea Knowledge and Attitude (OSAKA) questionnaire

Category I: Please answer the following questions true, false, or don't know (DK):

True False DK

- | | | | |
|--------------------------|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 1. Women with obstructive sleep apnea (OSA) may present with fatigue alone |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 2. Uvulopalatopharyngoplasty is curative for the majority of patients with obstructive sleep apnea. |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 3. The estimated prevalence of obstructive sleep apnea (OSA) among adults is between 2% and 10% |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 4. The majority of patients with obstructive sleep apnea (OSA) snore |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 5. Obstructive sleep apnea (OSA) is associated with hypertension |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 6. An overnight sleep study is the gold standard for diagnosing obstructive sleep apnea (OSA). |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 7. Continuous Positive Airway Pressure (CPAP) therapy may cause nasal congestion. |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 8. Laser-assisted uvuloplasty is an appropriate treatment for severe obstructive sleep apnea (OSA). |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 9. The loss of upper airway muscle tone during sleep contributes to obstructive sleep apnea (OSA). |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 10. The most common cause of obstructive sleep apnea (OSA) in children is the presence of large tonsils and adenoids |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 11. A craniofacial and oropharyngeal examination is useful in the assessment of patients with suspected obstructive sleep apnea (OSA) |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 12. Alcohol at bedtime improves obstructive sleep apnea (OSA) |

- | | | | |
|--------------------------|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 13. Untreated obstructive sleep apnea (OSA) is associated with a higher incidence of automobile crashes |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 14. In men, a collar size 17 inches (43.18 centimeters) or greater is associated with obstructive sleep apnea |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 15. Obstructive sleep apnea (OSA) is more common in women than men |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 16. Continuous positive airway pressure (CPAP) is the first therapy for severe obstructive sleep apnea (OSA) |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 17. Less than 5 apneas or hypopneas per hour is normal in adults |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 18. Cardiac arrhythmias may be associated with untreated obstructive sleep apnea |

Category II: Using the choices provided for each item below, please check the box that best describes your response:

A. As a clinical disorder, obstructive sleep apnea is:

Not important	Somewhat important	Important	Very important	Extremely
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
important				

B. Identifying patients with possible obstructive sleep apnea is

Not important	Somewhat important	Important	Very important	Extremely
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
important				

C. I feel confident identifying patients at-risk for obstructive sleep apnea.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

D. I am confident in my ability to manage patients with obstructive sleep apnea

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

E. I am confident in my ability to manage patients on CPAP therapy

Strongly disagree Disagree

Neither agree nor disagree

Agree Strongly agree

☐☐☐☐☐

----- Thank You! -----

Appendix H: DBKT Test

Diabetes Basic Knowledge Test (DBKT)

Instructions:

For each item, select the one best answer to the question. The last answer choice to each question, “I don’t know” should be used if you truly do not know the answer.

1. Which statement is characteristic of the etiology of Type 1 diabetes?
 - a. strongly associated with obesity
 - b. predominantly genetic
 - c. autoimmune, viral or toxic destruction of the beta cells
 - d. I do not know
2. Which of these statements about the management of Type 1 diabetes is true?
 - a. insulin injections are necessary to maintain life
 - b. Insulin injections are not always necessary if diet and exercise are well controlled.
 - c. oral hypoglycemic agents are sufficient for blood control in most patients
 - d. d. I do not know.
3. Which statement is characteristic of the etiology of Type II diabetes?
 - a. predominately non-genetic
 - b. frequently associated with obesity and resistance to insulin
 - c. autoimmune, viral or toxic destruction of the beta cells
 - d. I do not know
4. Which of these statements about management of Type II diabetes is true?
 - a. insulin injections are necessary to maintain life
 - b. a controlled diet and exercise program is the most effective treatment
 - c. oral hypoglycemic agents are sufficient for blood control in most patients
 - d. I do not know
5. What effect does insulin have on blood glucose?
 - a. insulin causes blood glucose to increase
 - b. insulin causes blood glucose to decrease
 - c. insulin has no effect on blood glucose
 - d. I do not know

6. Normal fasting blood glucose level can be best described as:
 - a. below 150 mg/dl
 - b. between 100 and 200mg/dl
 - c. between 65 and 110 mg/dl
 - d. I do not know
7. The maximum effect (peak) of regular insulin occurs:
 - a. 2-4 hours after injection
 - b. 6-12 hours after injection
 - c. 24-28 hours after injection
 - d. I do not know
8. The maximum effect (peak) of both NPH and Lente insulin occurs:
 - a. 2-4 hours after injection
 - b. 8-12 hours after injection
 - c. 24-28 hours after injection
 - d. I do not know
9. Where should one store insulin that is presently being used?
 - a. in the refrigerator near the freezer section
 - b. in the refrigerator away from the freezer section
 - c. at room temperature away from the excess light
 - d. I do not know
10. A symptom of hypoglycemia (low blood sugar) is:
 - a. frequent urination
 - b. dry mouth and dry skin
 - c. nervousness
 - d. I do not know.
11. A symptom of hyperglycemia (high blood sugar) is:
 - a. frequent urination
 - b. low grade fever
 - c. cool clammy skin
 - d. I do not know
12. What is one cause of hyperglycemia (high blood sugar)?
 - a. decreased food intake
 - b. infection
 - c. excessive insulin
 - d. I do not know

13. What effect does exercise have on blood glucose when the diabetics blood glucose is less than 300 mg/dl?
- a. decrease blood glucose
 - b. increase blood glucose
 - c. has little effect on blood glucose
 - d. I do not know
14. What effect does increased exercise have on the food needs of a person with well controlled type 1 diabetes?
- a. decreases the need for food
 - b. increases the need for food
 - c. has little effect on the need for food
 - d. I do not know

----- Thank You! -----

Appendix I: OSAKA Approval



February 8, 2016

Michael J. Muskus, PhD
Licensing Associate
Office of Technology Management
Washington University
St. Louis, MO
Via email: mmuskus@dom.wustl.edu

RE: Use of the *Obstructive Sleep Apnea Knowledge and Attitudes (OSAKA)* questionnaire by
PhD student

Dear Dr. Muskus,

One of my doctoral students, Mr. Khamis Al-Mezeini, has requested the use of the OSAKA questionnaire for his upcoming dissertation study to be conducted in the Sultanate of Oman (his home country). I am attaching (p.2) the signed Permission Statement as requested.

Should you have any further questions, feel free to contact me with the information below.

Respectfully submitted,

A handwritten signature in black ink that reads 'R. Kevin Mallinson'.

R. Kevin Mallinson, PhD, RN, AACRN, FAAN
Associate Professor
Assistant Dean for Doctoral Programs
School of Nursing – MSN 3C4
George Mason University
4400 University Dr.
Fairfax, VA 22030
rmallins@gmu.edu (703) 933-1941

WASHINGTON UNIVERSITY Copyright Notice

Copyright 2015. *The Obstructive Sleep Apnea Knowledge and Attitudes (OSAKA) Questionnaire* is a copyrighted instrument of Washington University, St. Louis, Missouri. All Rights Reserved.

Permission Statement

Washington University grants permission to use the *Obstructive Sleep Apnea Knowledge and Attitudes (OSAKA) Questionnaire* exactly as it appears here without modification or editing of any kind solely for use in medical education evaluation of obstructive sleep apnea (the "Purpose"). To the extent that you are able and is applicable by law, you agree to indemnify The Washington University for any claims arising from your use of the *OSAKA Questionnaire*. For the avoidance of doubt, the Purpose does not include the (i) sale, distribution or transfer of the *OSAKA Questionnaire* or copies thereof for any consideration or commercial value; (ii) the creation of any derivative works, including translations; and/or (iii) use of *OSAKA Questionnaire* as a marketing tool for the sale of any drug, medical device, or other product.

BY USING THE *OSAKA QUESTIONNAIRE*, YOU UNDERSTAND AND AGREE TO THESE TERMS OF USE AND THAT THE *OSAKA QUESTIONNAIRE* IS AN EDUCATIONAL RESOURCE AND NOT A SUBSTITUTE FOR CLINICAL JUDGMENT, THAT USE OF THE *OSAKA QUESTIONNAIRE* FOR THE PURPOSE REQUIRES APPROPRIATE CLINICAL JUDGMENT OF A TRAINED MEDICAL PROFESSIONAL, AND THAT WASHINGTON UNIVERSITY BEARS NO RESPONSIBILITY TO YOU OR ANY THIRD PARTY FOR THE CONSEQUENCES OF YOUR USE OF THE *OSAKA QUESTIONNAIRE*.

Please return a signed copy of this statement to Michael Muskus of The Washington University at mmuskus@dom.wustl.edu.

By: _____

Date: 3/9/16

Printed Name: Dr. Ali Andalibi

Title: Interim Director

Organization name and address:

Office of Technology Transfer
George Mason University
4400 University Drive
MSN 5G5
Fairfax, VA 22030

Appendix J: DBKT Approval

Regards,

Khamis

Sent from my Samsung Galaxy smartphone.

----- Original message -----

From: Jan Drass <jdrass@maranatha.net>
Date: 4/28/16 11:24 PM (GMT-05:00)
To: kalmuzay@masonlive.gmu.edu
Subject: RE: Using the DBKT instrument as a tool for my PhD research

Hi Khamis! Yes, you have my permission- I will attach the letter shortly!
Tahnks, Jan

From: kalmuzay@masonlive.gmu.edu [mailto:kalmuzay@masonlive.gmu.edu]
Sent: Thursday, April 28, 2016 11:34 AM
To: jdrass@maranatha.net
Cc: Robert Mallinson
Subject: Fw: Using the DBKT instrument as a tool for my PhD research

Hi Ms. Drass,

I am writing again regarding my request to use your DBKT in my PhD dissertation. I can ask my Chair to write you a letter of request for approving the test to be used for academic purposes. I will be waiting for your reply.

Thank you,

Khamis

From: kalmuzay@masonlive.gmu.edu
Sent: Friday, April 15, 2016 2:32 PM
To: jdrass@maranatha.net
Subject: Using the DBKT instrument as a tool for my PhD research

Hi Dr. Drass,

My name is Khamis Al-Mezeini. I am a student at George Mason University, College of Health and Human Services, School of Nursing at Fairfax, Virginia. I am interested in using the DBKT instrument as my measurement tool. The tool will be used only for academic purposes to finish

Appendix K: Feasibility

Evaluation of the online health educational program

“A Brief Introduction to OSA for Omani Nurses”

1. Was “Brief Introduction to OSA for Omani Nurses” too long, or about the right length? ☐ Right length ☐ Too long

These next questions ask your opinions about the online health education program. For each statement, please indicate your level of agreement by marking the appropriate box.

2. The online format of the “Brief Introduction to OSA for Omani Nurses” was acceptable to me.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

3. I learned new information while watching the video on “Brief Introduction to OSA for Omani Nurses”.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

4. The “Brief Introduction to OSA for Omani Nurses” was related to their work.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

5. Primary health care nurses would find the “Brief Introduction to OSA for Omani Nurses” easy to understand.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

6. This “Brief Introduction to OSA for Omani Nurses” would help primary health care nurses to be aware of patients presenting with signs and symptoms of obstructive sleep apnea.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

7. How likely would you be to recommend this “Brief Introduction to OSA for Omani Nurses” to other health care professionals so they may learn more about obstructive sleep apnea?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not at all Likely	Unlikely	Neither Likely nor Unlikely	Likely	Very Likely

8. What did you like about the “Brief Introduction to OSA for Omani Nurses”?

9. What would you recommend we do to improve this program?

----- Thank You! -----

Appendix L: GMU IRB Approval



Office of Research Integrity and Assurance

Research Hall, 4400 University Drive, MS 6D5, Fairfax, Virginia 22030
Phone: 703-993-5445; Fax: 703-993-9590

DATE: November 10, 2016

TO: R. Kevin Mallinson, PhD
FROM: George Mason University IRB

Project Title: [965511-1] A FEASIBILITY AND PRELIMINARY EFFICACY OF OBSTRUCTIVE SLEEP APNEA INTERVENTION IN OMAN

SUBMISSION TYPE: New Project

ACTION: APPROVED

APPROVAL DATE: November 10, 2016

EXPIRATION DATE: November 9, 2017

REVIEW TYPE: Expedited Review

REVIEW TYPE: Expedited review category #7

Thank you for your submission of New Project materials for this project. The George Mason University IRB has APPROVED your submission. This submission has received Expedited Review based on applicable federal regulations.

Please remember that all research must be conducted as described in the submitted materials.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Federal regulations require that each participant receives a copy of the consent document.

Please note that any revision to previously approved materials must be approved by the IRB prior to initiation. Please use the appropriate revision forms for this procedure.

All UNANTICIPATED PROBLEMS involving risks to subjects or others and SERIOUS and UNEXPECTED adverse events must be reported promptly to the Office of Research Integrity & Assurance (ORIA). Please use the appropriate reporting forms for this procedure. All FDA and sponsor reporting requirements should also be followed (if applicable).

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to the ORIA.

The anniversary date of this study is November 9, 2017. This project requires continuing review by this committee on an annual basis. You may not collect data beyond this date without prior IRB approval. A continuing review form must be completed and submitted to the ORIA at least 30 days prior to the

anniversary date or upon completion of this project. Prior to the anniversary date, the ORIA will send you a reminder regarding continuing review procedures.

Please note that all research records must be retained for a minimum of five years, or as described in your submission, after the completion of the project.

If you have any questions, please contact Bess Dieffenbach at 703-993-5593 or edieffen@gmu.edu. Please include your project title and reference number in all correspondence with this committee.


This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within George Mason University IRB's records.

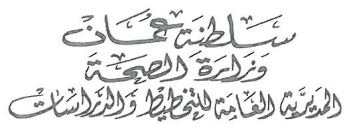
Appendix M: Oman Ethical Approval

Oman Ministry of Health Research and Ethical Review and Approve Committee

Approval

Sultanate of Oman
Ministry of Health
Directorate General of Planning & Studies





Ref. : MoH/DGPS/CSR/PROPOSAL_ APPROVED /49/2016

Date : 26.12.2016

الرقعة :
التاريخ :
الرفق :


Khamis Abdallah Al-Mezeini
Principal Investigator


Study Title : "A Feasibility and Preliminary Efficacy of Obstructive Sleep Apnea Intervention in Oman"

After compliments

We are pleased to inform you that your research proposal "A Feasibility and Preliminary Efficacy of Obstructive Sleep Apnea Intervention in Oman." has been approved by Research and Ethical Review & Approve Committee, Ministry of Health.

Regards,





Dr. Ahmed Mohamed Al Qasbi
Director General of Planning and Studies
Chairman, Research and Ethical Review and Approve Committee
Ministry of Health, Sultanate of Oman.

Cc
Day file

P.O. Box: 393, Postal code 100, Muscat, Tel:24601161, Fax:24696533

ص. ب. : ٣٩٣ ، الرمز البريدي : ١٠٠ ، مسقط ، هاتف : ٢٤٦٠١١٦١ ، فاكس : ٢٤٦٩٦٥٣٣

Appendix N: Systematic Review

Systematic Review of Knowledge and Attitudes of Primary Health Care

Professionals

Author(s)	Year and location	Title	Journal details	Purpose	Type of paper	Result	Conclusion/Outcome
Valerio & Heaton	2014 USA	The effects of an online educational program on nurse practitioners' knowledge of obstructive sleep apnea in adults	<i>Journal of the American Association of Nurse Practitioners</i> , 26(11), 603-611	To evaluate the effects of an online educational program geared towards nurse practitioner's knowledge to identify and evaluate adults at-risk of OSA (n = 38)	A quasi-experimental, within-group, pre-posttest design	NPs showed significant improvement in posttest compared to pretest scores ($p < .001$, $t(37) = -5.024$).	97.4% of NPs participants indicated they were "very likely" or "likely" to evaluate their patients for OSA after the educational session

Appendix O: Systematic Review

Systematic Review of Knowledge and Attitudes of Primary Health Care Professionals

Author(s)	Year and location	Title	Journal details	Purpose	Type of paper	Result	Conclusion/Outcome
Ojeda et al.	2013 USA	Attitudes and knowledge about obstructive sleep apnea among Latin American primary care physicians	<i>Sleep Medicine</i> , 14(10), 973-977	To evaluate Latin American primary care physicians' knowledge and attitudes about OSA using the Spanish version of the OSAKA n = 367	Cross sectional survey	Mean total knowledge (proportion of 18 items correctly answered) was 60% in a range from 0 –100%. 73.5% of the physicians felt confident in identifying patients at risk for OSA	This version of the OSAKA showed differences in physicians' knowledge about OSA and their confidence in identifying and managing their patients with OSA

Appendix P: Systematic Review

Systematic Review of Knowledge and Attitudes of Primary Health Care

Professionals

Author(s)	Year and location	Title	Journal details	Purpose	Type of paper	Result	Conclusion /Outcome
BaHammam	2000 Saudi Arabia	Knowledge and attitude of primary health care physicians towards sleep disorders	<i>Saudi Medical Journal</i> , 21(12), 1164-1167.	to assess knowledge and attitude of Primary Health Care Physicians in Riyadh, Saudi Arabia towards sleep disorders n = 209	Cross-sectional study. A self-administered questionnaire	Physicians who attended any kind of education about sleep referred significantly more patients than physicians who didn't attended any ($p=0.003$)	Poor recognition of some of the serious consequences of OSA

Appendix Q: Systematic Review

Systematic Review of Knowledge and Attitudes of Primary Health Care

Professionals

Author(s)	Year and location	Title	Journal details	Purpose	Type of paper	Result	Conclusion/Outcome
Papp, Penrod, & Strohl	2002 USA	Knowledge and attitudes of primary care physicians toward sleep and sleep disorders	<i>Sleep & Breathing</i> = <i>Schlaf & Atmung</i> , 6(3), 103-109	To assess primary care physician sleep knowledge and Attitudes n = 105	Self-administered, mailing survey was distributed using a modified Dillman method	The overall mean score on knowledge part was 34%	The majority of physicians rated their knowledge of sleep disorders as fair or poor

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Biography

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