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THE ROLE OF THE DENTAL HYGIENIST IN SCREENING FOR SLEEP APNEA

By

Bethany Bewley

A thesis

submitted in partial fulfillment

of the requirements for the degree of

Master of Science in the Department of Dental Hygiene

Idaho State University

Spring 2014

To the Graduate Faculty:

The members of the committee appointed to examine the thesis of Bethany Bewley find it satisfactory and recommend that it be accepted.

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November 8, 2013

Bethany Bewley
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Meridian, ID 83464

RE: Your application dated 11/6/2013 regarding study number 3995: The role of the dental hygienist in screening for sleep apnea

Dear Ms. Bewley:

Thank you for your response to requests from a prior review of your application for the new study listed above.

You are granted permission to conduct your study as most recently described effective immediately. The study is subject to continuing review on or before 11/8/2014, unless closed before that date.

Notify the HSC of any adverse events. Serious, unexpected adverse events must be reported in writing within 10 business days.

Submit progress reports on your project in six months. You should report how many subjects have participated in the project and verify that you are following the methods and procedures outlined in your approved protocol. Then, report to the Human Subjects Committee when your project has been completed. Reporting forms are available on-line.

Please note that any changes to the study as approved must be promptly reported and approved. Some changes may be approved by expedited review; others require full board review. Contact Tom Bailey (208-282-2179; fax 208-282-4723; email: humsubj@isu.edu) if you have any questions or require further information.

Sincerely,

Ralph Baergen, PhD, MPH, CIP
Human Subjects Chair

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ACKNOWLEDGEMENTS

I would like to thank my committee members, Dr. Tara Johnson, Professor Jacqueline Freudenthal and Dr. Jason Pilarski, for their guidance throughout the process of completing my thesis. I truly appreciate the time they spent helping me succeed with this endeavor, as well as the expertise they shared with me regarding the research process. I would also like to thank Teri Peterson for her help with the study design and data analysis. Additionally, I would like to express my appreciation to Dr. JoAnn Gurenlian for her encouragement and friendship during my academic program. Lastly, I would like to acknowledge my husband for his support and patience as I pursued my goal of obtaining a Master's degree.

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LIST OF APPENDICES

THE ROLE OF THE DENTAL HYGIENIST IN SCREENING FOR SLEEP APNEA

Thesis Abstract—Idaho State University (2014)

Problem: Sleep apnea (SA) can contribute to serious health problems and often goes undetected. Dental hygienists are able to assess patients for SA, but limited research exists on incorporating SA screenings into dental hygiene appointments.

Methods: Sixteen participants completed a pre-screening survey, screened patients for SA, then completed a post-screening survey. Screening time and BMI accuracy were also recorded.

Results: 30% of patients screened were identified as high risk for having SA. Mean screening time was 4.49 minutes. Pre-screening survey results showed 25% of participants felt it was very important to screen patients for SA, compared to 50% post-screening. Participants reported patient's willingness as the most important issue when considering incorporating SA screening into practice.

Conclusions: Results suggest dental hygienists can provide patients a valuable health service by including SA screening in routine health assessment. Dental hygienists recognize the importance of screening patients for undiagnosed medical conditions and are proficient at conducting these screenings.

SECTION I: Thesis Proposal

CHAPTER I

Introduction and Background

Sleep disordered breathing (SDB) or sleep apnea refers to a group of sleep disorders characterized by brief interruptions in breathing during sleep. There are two main types of sleep apnea—central sleep apnea and obstructive sleep apnea. Central sleep apnea occurs when there are irregularities in the brain's signals to the muscles to breath (Ho & Brass, 2011). Obstructive sleep apnea (OSA) is much more common, and is caused by complete or partial upper airway collapse during sleep. The resulting reduction in airflow decreases the amount of oxygen reaching the vital organs and causes sleep disturbances (Punjabi, 2008).

It is difficult to determine the precise number of people with obstructive sleep apnea due to differences in sampling methods, diagnosis techniques, and disease definitions (Punjabi, 2008). However, between 2000-2002 the National Heart, Lung, and Blood Institute estimated the prevalence of sleep apnea was 10% of women and 12% of men (2006). These percentages were based on self-reported physician diagnosis, and are significantly higher than the data from available population-based studies. Results from a 2001 study by Bixler et al., estimated the prevalence of obstructive sleep apnea at 3.9% of men and 1.2% of women. Similarly, a 1993 study approximated the prevalence of sleep-disordered breathing at 2 percent of women and 4 percent of men (Young et al.).

Sleep apnea can contribute to a multitude of health problems—including cardiovascular disease, stroke, and depression—and often goes undetected (Yaggi, Concato, Kernan, Lichtman, & Mohsenin, 2005; Marin, Carrizo, Vicente, & Agusti,

2005; Cheng et al., 2013). Based on the severity of these problems, it is important that people with signs and symptoms of sleep apnea be screened for the condition and receive the appropriate treatment. The diagnosis of sleep apnea is based on a number of different factors including the evaluation of the patient's clinical symptoms and risk factors, a detailed sleep history, and the results from a formal sleep study (Epstein et al., 2009).

Despite the recent increased scientific and clinical focus on obstructive sleep apnea, studies have shown that the majority of people (as many as 93% of women and 82% of men) with OSA remain undiagnosed (Young, Evans & Finn, 1997; Kapur et al., 2002). This can be attributed to patients' lack of awareness of their symptoms, as well as the fact that many healthcare professionals have not received the necessary training to aid in the early recognition and diagnosis of this condition (Punjabi, 2008). In 2006, the Institute of Medicine [IOM] published a report entitled *Sleep disorders and sleep deprivation: An unmet public health problem*. To help reduce the public health burden caused by sleep disorders, the report called for increased awareness of the condition by health care professionals and increased investment in interdisciplinary training and education regarding sleep disorders (IOM, 2006).

Since many patients visit the dental hygienist two or more times a year, dental hygienists are in an ideal position to screen patients for a variety of health conditions including sleep apnea. Dental hygienists already review medical histories, record vital signs, and perform oral examinations for each patient as part of the assessment process. The addition of sleep apnea screening to this assessment process could be an invaluable service for those patients with this undiagnosed condition. Once a patient is identified as being at risk for having sleep apnea, the dental hygienist or dentist would refer the patient

to a physician specializing in sleep medicine for follow-up testing.

Statement of Problem

Due to the high percentage of people with undiagnosed sleep apnea and the resulting health consequences, more healthcare professionals need to be trained to screen for sleep apnea. Dental hygienists are in a good position to assess patients for sleep apnea, but limited research exists on the feasibility of incorporating sleep apnea screenings into dental hygiene appointments.

Purpose of the Study

The purpose of this study was to obtain information about dental hygienists' attitudes, acceptance of, and perceived barriers to performing screening for sleep apnea during a dental hygiene appointment.

Professional Significance of the Study

This study contributes to the dental hygiene body of knowledge by evaluating the barriers and attitudes towards incorporating sleep apnea risk assessment and screening into the assessment phase of dental hygiene care. It is believed that if dental hygienists screen patients for sleep apnea, they will be able to identify patients at risk for sleep apnea and refer them for further assessment and possible diagnosis. Moreover, sleep apnea risk assessment and screening could become a routine component of total patient health assessment in the dental setting.

Research Questions

- What were dental hygienists' attitudes towards sleep apnea screening before and after using the Berlin questionnaire during a dental hygiene appointment?

- How much time was needed for dental hygienists to administer and score the Berlin questionnaire?
- How accurate were the dental hygienists in determining body mass index (BMI) and scoring the Berlin questionnaire?
- What potential barriers exist to incorporating sleep apnea screening into the dental hygiene assessment process?

Definitions

Conceptual. Apnea is defined as "cessation of airflow for at least 10 seconds" (Al Lawati, Patel, & Atas, 2009, p. 285).

Apnea-hypopnea index (AHI) is the "number of apneas plus hypopneas per hour of documented sleep" (Al Lawati et al., 2009, p. 285).

Dental sleep medicine "focuses on the management of sleep-disordered breathing disorders, which includes snoring and obstructive sleep apnea, with oral appliance therapy and upper airway surgery" (American Academy of Dental Sleep Medicine, 2008, para. 1).

Excessive daytime sleepiness refers to a "sleepiness that occurs in a situation when an individual would be expected to be alert" (Myers, Mrkobrada, & Simel, 2013, p. 732).

Hypopnea refers to "reduction in airflow with resultant desaturation of greater than or equal to 4%" (Park, Ramar, & Olson, 2011, p. 550).

Obstructive sleep apnea is "a common disease characterized by repetitive episodes of airflow cessation (apnea) or airflow reduction (hypopnea) that occur during sleep as a consequence of upper airway collapse" (Al Lawati et al., 2009, p. 285).

Polysomnogram is a "sleep test that continuously acquires physiological data obtained during sleep, including brain wave activity, eye movements, muscle activity (chin and legs), heart rate, body position, and respiratory variable, including oxygen saturation" (IOM, 2006, p. 341).

Sleep-disordered breathing "encompasses a heterogeneous group of sleep-related disorders that are characterized by abnormal pauses in breathing during sleep" (Ho & Brass, 2011, p. 60).

Operational. Attitude is defined as "a settled way of thinking or feeling about someone or something" (Oxford Dictionaries, 2013a).

Barrier refers to a circumstance or obstacle that prevents communication or progress (Oxford Dictionaries, 2013b).

The Berlin questionnaire is an instrument used to measure a patient's risk for sleep apnea. The questionnaire includes 10 questions about snoring, sleep habits, blood pressure, height, and weight.

Body mass index (BMI) is a measure of body fat that is calculated as "weight in kilograms divided by the square of height in meters" (Tishler, Larkin, Schluchter, & Redline, 2003, p. 2234).

Dental hygiene assessment is the "systematic collection, analysis and documentation of the oral and general health status and patient needs" (American Dental Hygienists' Association, 2008, p. 6).

Sleep apnea screening refers to the process of evaluating patients to detect those at risk of having sleep apnea.

CHAPTER II

Review of the Literature

Introduction

As previously stated, the purpose of this study was to characterize factors that dental hygienists perceive as affecting screening for sleep apnea during a dental hygiene appointment. The literature review will cover the following related content areas (a) sleep apnea overview, (b) sleep apnea screening tools, (c) dental sleep medicine, and (d) dental practitioners' attitudes towards medical screenings in a dental setting.

Sleep Apnea Overview

Demographic Characteristics. Data from a study aimed at better understanding the demographic patterns of sleep-disordered breathing (SDB) showed that men had 2.7 times the odds of having sleep apnea compared to women (Young, et al., 2002). The study included 5,615 participants from the Sleep Heart Health Study between the ages of 40 and 98. For the purposes of the study, the researchers defined sleep-disordered breathing as an apnea-hypopnea index (AHI) of 15 or greater (Young et al., 2002). While the study sample size was large, it did not include young adults (under 40).

The study results also showed that increased age was associated with sleep apnea. A 10-year increase in age was correlated with a 24% increase in the chance of having sleep-disordered breathing, up to the age of 60 (Young et al., 2002). A study by Bixler, Vgontzas, Ten Have, Tyson, and Kales (1998) produced similar results in regards to the effect age has on the prevalence of sleep apnea, although there were several differences in the study designs. The 1998 study only included men, and sleep-disordered breathing was defined as an AHI of 10 or greater plus daytime sleepiness or hypertension. From a

random sample of 4,364 men aged 20 to 100, 741 were selected to undergo a laboratory sleep test. Men in the 45 to 64 age group were found to have the highest prevalence of sleep apnea (4.7%). The percentage of participants with sleep apnea dropped to 1.7% in men over the age of 65. The data also revealed that while the prevalence of sleep disordered breathing increases with age up to 64, the severity of the condition decreases with age. Young subjects with sleep apnea were found to have the lowest minimum oxygen saturation (Bixler et al., 1998).

While research confirms that sleep apnea is associated with male sex and middle age, screening for the condition should not focus only on these two demographic patterns. Doing so would result in women and younger patients with severe SDB remaining undiagnosed.

Risk Factors. Obesity is a primary risk factor for sleep apnea, and is significantly associated with the odds of having an AHI of 15 or greater (Young et al., 2002). A population-based, prospective cohort study of 690 randomly selected participants demonstrated the effect change in weight has on the severity and prevalence of sleep-disordered breathing (Peppard, Young, Palta, Dempsey, & Skatrud, 2000). Obese participants were found to have an AHI of 7.4 events per hour, overweight participants had an AHI of 2.6 events per hour, and participants with normal weight had an AHI of 1.2 events per hour (Peppard et al., 2000). Furthermore, each percentage change in weight was correlated with an estimated 3% change in AHI (Peppard et al., 2000). Weight gain was not only associated with increased severity of SDB, but also predicted the development of moderate-to-severe sleep apnea in participants who initially had no or mild sleep apnea (Peppard et al., 2000).

Smoking has also been shown to be a risk factor for SDB (Wetter, Young, Bidwell, Badr, & Palta, 1994). A research study that used 811 participants from the Wisconsin Sleep Cohort Study revealed that current cigarette smokers are at a greater risk of developing sleep apnea compared to former smokers and never smokers (Wetter et al., 1994). Additionally, the amount of cigarettes smoked per day is related to the risk of developing SDB (Wetter et al, 1994). Heavy smokers (defined as 40 or more cigarettes per day) had 6.74 times the odds of having mild SDB and a 40.47 times the odds of having moderate-to-severe SDB (Wetter et al., 1994).

Results from a 2000 study by Bixler et al. showed that SDB was associated with hypertension in both men and women, even when adjusting for other contributing factors such as BMI, smoking, and age. The study included 1,741 participants selected from a sample of 4,364 men and 12,219 women based on the presence of sleep apnea risk factors. The participants had a thorough medical examination and underwent a laboratory sleep study. Participants with moderate-to-severe sleep apnea (defined as an AHI of 15 or greater) were 6.85 times as likely to have hypertension when compared to the control group with no SDB (Bixler et al., 2000). The data also revealed the association between hypertension and SDB was the strongest in younger participants. This finding is in agreement with the results from the 1998 study by Bixler et al. showing the severity of sleep apnea is greater in younger persons.

Snoring is strongly correlated with sleep apnea. The data from the Sleep Heart Health Study described previously was also used to evaluate the relationship between snoring and SDB (Young et al., 2002). The odds ratio for having an AHI of 15 or greater for participants with self-reported snoring was 2.9 (Young et al., 2002). The odds ratio

increased to 4.0 for participants with very loud snoring or breathing pauses (Young et al., 2002). Snoring is a confirmed risk factor for SDB and should be considered when screening for the condition.

Sleep Apnea Screening Tools

There are a variety of different sleep apnea screening tools available, including the Epworth sleepiness scale, the Berlin questionnaire, the STOP-BANG questionnaire, and the Wisconsin sleep questionnaire (Ho & Brass, 2011; Abrishami, Khajehdehi & Chung, 2010). A number of studies have been performed to determine the validity of each questionnaire.

Ramachandran and Josephs (2009) conducted a meta-analysis of clinical screening tests for obstructive sleep apnea. An electronic and manual literature search of PubMed, Ovid, and Cochrane Controlled Trials register generated 6,816 studies, but only 26 met the inclusion standards. The included studies pertained to both questionnaires and clinical models. Sensitivity for the Berlin questionnaire ranged from 61.8% to 85.5% and specificity ranged from 42.7% to 95.2% (Ramachandran & Josephs, 2009). Based on the results of the meta-analysis, the authors concluded that the Berlin questionnaire was the most accurate at predicting OSA, but no single questionnaire or clinical model proved to be optimal for screening preoperative patients (Ramachandran & Josephs, 2009).

A 2010 systematic review of screening questionnaires for OSA revealed that the Berlin questionnaire had the highest specificity for predicting OSA in patients with no history of sleep-related disorders (Abrishami et al, 2010). The literature search was conducted through the Cochrane Library, CINAHL, and MEDLINE, and two different independent reviewers assessed the results. Ten of the 4,105 studies found through the

literature search met the requirements for eligibility and were included in the review (Abrishami et al., 2010). Four of the ten studies involved the Berlin questionnaire, and it was validated in a variety of different patient populations (Abrishami et al., 2010). The pooled sensitivity for the Berlin questionnaire among patients without a history of SDB was 77.0%, and the specificity was 74%. The Berlin questionnaire also showed the highest specificity for predicting severe OSA, while the STOP-Bang showed the highest sensitivity (defined as an AHI of 30 or more events per hour) (Abrishami et al., 2010). The authors concluded that the Berlin and Wisconsin questionnaires were shown to be valuable for screening patients without a history of SDB. However, the authors suggested that the STOP-BANG questionnaire be used for OSA screening in surgical patients based on the ease of use and high methodological validity (Abrishami et al., 2010).

A 2011 study by Enciso and Clark compared the Berlin questionnaire and the ARES questionnaire for OSA screening among dental patients. The case-control study included 53 participants with moderate-to-severe OSA (respiratory disturbance index (RDI) of 15 or greater) and 31 controls with a RDI of less than 15 events per hour. All participants were interviewed by a blinded researcher, completed both questionnaires, and had a two-night in-home sleep study with the ARES Unicorder (Enciso & Clark, 2011). The results revealed a sensitivity of 90.6%, specificity of 43.2%, positive predictive value (PPV) of 73.8%, and negative predictive value (NPV) of 73.7% for the ARES questionnaire. The Berlin questionnaire had a sensitivity of 67.9%, specificity of 54.8, PPV of 72%, and NPV of 50% (Enciso & Clark, 2011). The study authors concluded that the ARES questionnaire performed better than the Berlin questionnaire in this situation, but the Berlin questionnaire is more accessible as a screening tool (Enciso

& Clark, 2011). This study had several limitations that may compromise the results. First, the cut off for RDI's for the controls was 15 or less. Generally a RDI of 5 to 15 is considered mild SDB, and a RDI of less than 5 is considered normal. Therefore, most of the study controls were actually patients with mild, instead of no, OSA.

The available literature on screening tools for sleep apnea suggests that a suitable questionnaire should be chosen based on the type of population that will be screened (general, high-risk, surgical), the intended purpose of the screening, as well as the ease of use and availability of the screening tool.

Sleep Apnea and Oral Health

Several recent studies have demonstrated an association between sleep apnea and periodontal disease. The authors of a 2009 pilot study hypothesized that because periodontal disease and obstructive sleep apnea are both associated with systemic inflammation, there might be a link between the two conditions (Gunaratnam, Taylor, Curtis, & Cistulli). The results from the study did suggest that OSA and periodontitis are related, but did not clarify the nature of the relationship. The study included 66 men and women who had recently been diagnosed with OSA. The participants underwent a comprehensive periodontal exam to determine clinical attachment level (CAL) and probing pocket depth (PPD). For the purposes of the study, periodontal disease was defined using two definitions: “the presence of two or more interproximal sites with greater than or equal to 4 mm CAL, not on the same tooth, or two or more interproximal sites with PPD greater than or equal to 5 mm, not on the same tooth” and “the presence of a least one periodontal pocket with a probing depth of 4 mm or more and CAL greater than or equal to 3 mm at the same site on a tooth” (Gunaratnam et al., 2009, p. 235). The

sample included patients with OSA ranging from mild to moderate, determined by a standard polysomnography. The final data showed a fourfold increase in the prevalence of periodontitis in the sample group compared to the Australian national average. However, the study was not able to conclusively prove that the increased prevalence of periodontal disease was due to an association with OSA. It is possible that the increased prevalence could be due to several overlapping etiological factors, such as diabetes and obesity (Gunaratnam et al., 2009).

A much larger, population-based study also found a relationship between OSA and chronic periodontitis (Keller, Wu, Chen, & Lin, 2013). The study included 7,673 subjects with OSA and 21,963 control subjects without OSA. All OSA patients were diagnosed with polysomnography. Patients chosen as the chronic periodontitis (CP) cases "had at least three primary CP diagnoses and received either deep cleaning (root planing or scaling) or a surgical procedure (periodontal flap surgery or gingivectomy) for the treatment of CP" (Keller et al., 2013, p. 112). The study took place in Taiwan, where a PPD of 3 mm or more constitutes a diagnosis of periodontitis. The study results showed a difference in the prevalence of CP between OSA controls (22.6%) and cases (33.8%). Even after making adjustments for income, location, diabetes, obesity, alcohol consumption, tobacco use, hypertension, COPD, and CHD, the odds of OSA cases having a previous diagnosis of CP was 1.75 times greater than OSA controls. Similar to the Gunaratnam et al. study above, the study authors were not able to make an conclusions about causality between OSA and periodontal disease (Keller et al., 2013). Although this study included a large number of subjects, one limitation is that diagnoses of OSA and CP were based on information from an administrative database.

A 2013 cross-sectional study similarly showed a positive association between periodontitis and OSA (Seo et al.). The study included 687 participants who underwent polysomnography and periodontal examinations. The periodontal exam was performed by a blinded dentist and included measurements for BOP, PPD, CAL, plaque index, and gingival index. The study authors defined periodontitis as "the presence of at least four teeth with one or more interproximal sites with a probing pocket depth of greater than or equal to 4 mm and CAL greater than or equal to 6 mm at the same site on a tooth" (Seo et al., 2013, p. 502). The prevalence of periodontal disease in the participants was determined to be 17.5%. OSA (defined as AHI greater than or equal to 5) prevalence was 46.6%, and 60% of the participants had both OSA and periodontitis. The OSA group had a higher overall incidence of periodontal disease (22.5%) compared to the non-OSA group (13%). There was also a positive association between a higher AHI (greater than or equal to 10) and periodontitis. However, OSA was only positively associated with periodontitis, PPD, and CAL in the 55 years and older age group. There was no association noted in younger age groups (Seo et al., 2013).

Dental Sleep Medicine

As an alternative to a CPAP machine, oral appliances are increasingly being used to treat obstructive sleep apnea in some patients. Therefore, the dentist is an important part of the health care team responsible for the management of patients with sleep apnea. The American Academy of Sleep Medicine (2006) Practice Parameters stated that oral appliances are not as effective as CPAP, but are indicated for patients with mild to moderate OSA who do not respond to, or are unable to use, CPAP. The Practice Parameters also recommend the presence or absence of obstructive sleep apnea be

determined before oral appliance therapy is initiated (Kushida et al., 2006). Dentists who undertake the management of OSA with oral appliances should have additional training in sleep medicine, and should take care to follow the proper protocol for diagnosis, treatment, and follow-up (Kushida et al., 2006).

A 2008 retrospective study aimed at determining the prevalence of OSA in dental patients showed a high percentage of patients with undiagnosed sleep apnea (Levendowski et al., 2008). The ARES questionnaire was used to screen patients from two dental clinics in California for OSA, and a total of 331 completed questionnaires were obtained and included in the study (Levendowski et al., 2008). Of the 331 study participants, 67% of the men and 28% of the women were identified as high-risk for having at least mild sleep apnea, and 33% of men and 6% of women were predicted to have severe or moderate sleep apnea (Levendowski et al., 2008). A subgroup of 105 patients (75 men and 30 women) identified as high-risk from the questionnaire underwent a two-night in-home sleep study, and 96% were confirmed to have at least mild SDB (Levendowski et al., 2008). Based on the study results, the authors concluded that dentists could provide their patients a valuable service by incorporating sleep apnea screening into their practices (Levendowski et al., 2008).

There is little research regarding sleep apnea screening as part of the dental hygiene assessment process. An extensive search of the literature revealed only one study related to dental hygienists and OSA screening (Kandray & Yacovone, 2011). The 2011 study looked at the effects of implementing a program to train dental hygiene students on how to incorporate OSA screening methods into the dental hygiene examination. For this study, the students were shown how to use the Epworth Sleepiness Scale and the

Modified Mallampati classification. The results revealed the dental hygiene students were able to effectively utilize the two measurement tools to screen patients for OSA risk factors (Kandray & Yacavvone, 2011).

The purpose of this study is to characterize factors that dental hygienists perceive as influencing screening for sleep apnea during a dental hygiene appointment. It is hypothesized that this study will introduce additional evidence that dental hygienists can and are willing to provide a valuable service by recognizing the signs and symptoms of sleep apnea and making the appropriate referrals for diagnosis and treatment.

Dental Practitioners' Attitudes Towards Medical Screenings in a Dental Setting

While it appears that dental hygienists' attitudes towards sleep apnea screening are still unclear, there are several studies that looked at dental professionals attitudes towards various medical screenings. A 2012 study by Barasch et al. focused on the feasibility of conducting blood glucose screenings to detect undiagnosed or poorly controlled diabetes mellitus in dental practices. Practitioners from 28 dental offices and 498 patients were surveyed regarding the perceived benefits and barriers to glucose testing. The patient population included patients 19 and older with a BMI greater than or equal to 25 kg/m^2, self-reported history of hypertension or high cholesterol, and or a diagnosis of diabetes mellitus. Participating dentists and dental staff were trained to use a glucometer.

After testing was completed, the patients and dental practitioners were asked to fill out questionnaires designed to rate the benefits and obstacles of glucose testing in the dental office. The responders were asked to rate their agreement or disagreement with each statement with a 5-point Likert scale. Ninety-three percent of dental practitioners

involved in the study returned the surveys. Eighty-five percent agreed that testing was beneficial to patients, 69% agreed that patients may get better glucose control if tested in the dental office, and 88% felt that glucose testing would help promote interest in patient's general health. A majority of practitioners disagreed with the statements "glucose testing is too time-consuming to complete in a dental setting" and "patient's glucose levels were not relevant to dental practice". Practitioners were also asked how long glucose testing took during a dental appointment and reported that, on average, it took two to five minutes for each test. The majority of responders (59%) felt that lack of insurance coverage was a barrier to routine testing in dental offices. Overall, the data showed that both the dental staff and patients positively viewed glucose testing in a dental setting Results also showed the testing was well received by the patients. Four hundred thirteen patient respondents (83%) thought glucose testing was a good idea in the dental office and 422 (85%) felt the testing was an easy process. Furthermore, 90% of patients felt the testing demonstrated a high level of care. Limitations to this study include the possibility of bias as participation of practitioners was voluntary based on interest in the study topic, and although the total number of patients was large, a relatively small number were screened at each study site (Barach et al., 2012).

A 2010 study by Greenberg, Glick, Frantsve-Hawley and Kantor also found dentists believe it is important to conduct chairside medical screenings in the dental office. The study method included a national, random survey of dentists practicing in the U.S. The survey consisted of five Likert scale questions about incorporating medical screenings in general into the dental practice, as well as specific questions on screening for hypertension, cardiovascular disease, diabetes, hepatitis, and HIV. Out of the 7,400

questionnaires mailed, 1,945 dentists responded. The majority of respondents felt it was important for dentists to conduct chairside screenings for hypertension (85.8%), cardiovascular disease (76.8%), diabetes (76.6%), hepatitis (71.5%), and HIV (68.8%). Most of the dentists (83.4%) were willing to conduct chairside screenings that yielded immediate results compared to 45.9% who were willing to conduct screenings that needed to be sent to a lab. Almost all respondents (96.4%) stated they were willing to refer a patient for a medical consultation. Patients' willingness was ranked as the most important barrier to including medical screenings at a dental appointment, while insurance coverage was ranked as the least important. 57.4% of the dentists felt insurance coverage was very important.

While the previous study sample was large, due to response rate, it may not be entirely representative of the total population of dentists in the U.S. The study sample included older dentists, fewer women, Asians and blacks. It is also possible that those dentists who chose to respond to the questionnaire already had strong opinions about the subject one way or the other. Overall, the study results pointed to the idea that dentists are aware of the importance of incorporating medical screenings into their practice and are willing to do so (Greenberg et al., 2010). Conclusions of these studies point to the importance of dental professionals being trained to recognize when and how to conduct health screenings.

CHAPTER III

Methodology

This section will review the study participants, sampling, measuring instruments, procedures, design, and analysis.

Overview of Study

As previously stated, the primary purpose of this study was to determine the attitudes of dental hygienists and barriers toward screening patients for sleep apnea in a dental hygiene setting.

Design

Research Questions. The study aims to address the following questions:

- What were dental hygienists' attitudes towards sleep apnea screening before and after using the Berlin questionnaire during a dental hygiene appointment?
- How much time was needed for dental hygienists to administer and score the Berlin questionnaire?
- How accurate were the dental hygienists in determining body mass index (BMI)?
- What potential barriers exist to incorporating sleep apnea screening into the dental hygiene assessment process?

Variables. Participating dental hygienists used the Berlin questionnaire to screen for sleep apnea. The questionnaire included the following variables: height, weight, age, sex, snoring, apnea, fatigue, daytime sleepiness, falling asleep while driving, hypertension, and BMI. The survey administered to the participating dental hygienists included demographic questions and items relating to attitudes and barriers to screening

for sleep apnea by dental hygienists. In addition, accuracy in determining a BMI and time spent administering the Berlin questionnaire was collected.

Research Method or Design. A descriptive test/retest survey method was employed for this pilot study.

Description of Setting

Participants completed the survey in their practice setting during a time when patients were not scheduled. Using the Berlin questionnaire, participants screened 5 adult patients for sleep apnea during their dental hygiene appointment. Following completion and within 2 days of the screenings, participants completed the same survey in their practice setting.

Research Participants

Sample Description. A convenience sample of at least 15 practicing dental hygienists was used for this study. Dental hygienists were recruited from those affiliated with the ISU Department of Dental Hygiene and the Pocatello and Meridian Family Practice Dentistry Program.

Sample Inclusion and Exclusion Criteria. Participating dental hygienists had to be licensed to practice dental hygiene in Idaho, practice in a private dental and community setting at least one day per week, and consent to participate in the study.

Human Subjects Protection. Approval to conduct this study was required by the Institutional Review Board (IRB) at ISU. The study parameters qualified it for a Certificate of Exemption from full Board review.

Data Collection

Procedure. Prior to the beginning of the study, the PI mailed the study participants a packet with the informed consent documents, the pre and post screening surveys, copies of the Berlin questionnaire, instructions on how to administer and score the Berlin questionnaire, and informational pamphlets on sleep apnea. The sleep apnea information was for the dental hygienists to read to familiarize themselves with the condition before conducting the screenings. Before the beginning of the study, the dental hygienists read the informed consent documents. Consent was provided by mailing back the completed surveys and questionnaires. Prior to screening patients, the hygienists filled out a 6-question pre-screening survey about their perceptions regarding screening for sleep apnea and other medical conditions in a dental hygiene setting as well as barriers to screening. The pre-screening surveys were returned in a pre-paid, addressed envelope. Surveys were coded for anonymity.

During the designated screening period, dental hygienists screened at least 5 consecutive patients for sleep apnea. All patients 18 and older who had not previously been diagnosed with or tested for sleep apnea were eligible for the sleep apnea screening. If the patient consented to screening, he or she was asked to fill out the Berlin questionnaire (Appendix B). If the patient was under 18, had already been screened/diagnosed with sleep apnea, or did not want to be screened, the hygienist did not screen the patient and screened the next eligible patient.

The total time to administer and score the questionnaire was recorded by the dental hygienist for each patient. The dental hygienist recorded the start time when the

screening process began and recorded the stop time once the questionnaire had been completed and scored. The consent process was not included in the screening time. The start and stop times were recorded directly on the patient's questionnaire. The BMI was determined using the chart provided and recorded on the questionnaire (Appendix C). The BMI chart was obtained from the U.S. Department of Health and Human Services National Center on Sleep Disorders' website.

Patients determined to be at high risk for sleep apnea based on the results of their Berlin questionnaire were referred to their primary physician for further assessment. If the patient did not have a primary care physician, he or she was given a list of sleep physicians in the area. The dental hygienists were provided with this referral list.

At the end of the screening period, each dental hygienist completed the post-screening survey to see if their perceptions about medical and sleep apnea screening in a dental hygiene setting had changed post-screening. The completed Berlin questionnaires and the post-screening survey were returned using the provided pre-paid, addressed envelope.

Instruments. The Berlin questionnaire was used as the screening instrument for the study. The Berlin questionnaire was created as part of the Conference on Sleep in Primary Care held in Germany in 1996 (Netzer, Stoohs, Netzer, Clark, & Strohl, 1999). The questionnaire focuses on known risk factors for sleep apnea. There are five questions regarding snoring, three questions regarding daytime sleepiness, one question regarding sleepiness while driving, and one question regarding hypertension (Netzer et al., 1999). Additionally, patients are asked about their age, weight, sex, and height (Netzer et al.,

1999). The dental hygienists used the provided BMI chart to determine the BMI after the questionnaire had been completed.

The survey instrument was adapted from surveys developed by Greenberg, Glick, Frantsve-Hawley, & Kantor (2010), and Barasch et al. (2012). The pre and post screening surveys are the same, and were designed to measure the dental hygienists' opinions regarding the importance of and barriers to screening for sleep apnea in a dental setting. The survey also includes basic demographic information. See Appendix A for a copy of the survey.

Reliability and Validity. The Berlin questionnaire has been previously validated as an accurate sleep apnea screening tool in multiple research studies, and is very easy to administer (Netzer et al., 1999; Abrishami et al., 2010; Ramachandran & Josephs, 2009).

The survey in the Greenberg et al. (2010) study was used to determine dentists' attitudes toward screening for medical conditions in the dental office. The Barasch et al. (2012) survey was used as part of a study on blood glucose testing in dental practices. Both surveys have been previously shown to be valid and reliable instruments. The survey that was used in this study had been slightly adapted from the originals, so it was first tested for content validity and clarity by four practicing dental hygienists. The dental hygienists used for the pilot test did not participate in the actual study.

Limitations

One limitation to this study was the sample size. The resources available to the PI limited the sample size. Without additional funding and time, the PI was not able to complete the study with a larger sample size. This study was intended to be a pilot study.

The convenience sample used in this study was not representative of the entire population of practicing dental hygienists and therefore is subject to coverage error.

There is no a single questionnaire that is an optimal method for sleep apnea screening for all populations (Ramachandran & Josephs, 2009). However, the Berlin questionnaire was chosen as the most accurate instrument for this population study based on the current research (Netzer et al., 1999, Abrishami et al., 2010; Ramachandran & Josephs, 2009).

Proposed Statistical Analysis

The following aspects of the study were used for statistical analysis:

- Average amount of time needed to administer and score the Berlin questionnaire
- Accuracy in determining BMI and scoring the questionnaire
- Comparison of pre and post survey results

Percentages and frequencies were determined for the data. The Wilcoxon signed-rank test was used to compare the Likert scale pre and post screening survey responses. Fisher's exact test was used to compare the percent of female and male patients found to be at high risk for sleep apnea.

References

Abrishami, A., Khajehdehi, A. & Chung, F. (2010). A systematic review of screening questionnaires for obstructive sleep apnea. *Canadian Journal of Anesthesia, 57*, 423-438. doi: 10.1007/s12630-010-9280-x

Al Lawati, N. M., Patel, S. R., & Ayas, N. T. (2009). Epidemiology, risk factors, and consequences of obstructive sleep apnea and short sleep duration. *Progress in Cardiovascular Diseases, 51*(4), 285-293.

American Academy of Dental Sleep Medicine. (2012). *Obstructive Sleep Apnea*. Retrieved from http://www.aadsm.org/sleepapnea.aspx

American Academy of Dental Sleep Medicine. (2008). Academy publishes definition of dental sleep medicine. Retrieved from http://www.aadsm.org/articles.aspx?id=1100

American Dental Hygienists' Association. (2008). Clinical standards for dental hygiene practice. Retrieved from http://www.adha.org/resources-docs/7261_Standards_Clinical_Practice.pdf

Barasch, A., Safford, M. M., Qvist, V., Odont, Palmore, R., Gesko, D., & Gilbert, G. H. (2012). Random blood glucose testing in dental practice: A community-based feasibility study from The Dental Practice-Based Research Network. *Journal of the American Dental Association, 143*(3), 262-269.

Bixler, E. O., Vgontzas, A. N., Lin, H., Ten Have, T., Rein, J., Vela-Bueno, A., & Kales, A. (2001). Prevalence of sleep-disordered breathing in women. *American Journal of Respiratory and Critical Care Medicine, 163, 608-61.*

Bixler, E. O., Vgontzas, A. N., Ten Have, T., Tyson, K., & Kales, A., (1998). Effects of

age on sleep apnea in men. *American Journal of Respiratory and Critical Care Medicine, 157*, 144-148.

Bixler, E. O., Vgontzas, A. N., Lin, H., Have, T. T., Leiby, B. E., Vela-Bueno, A., & Kales, A. (2000). Association of hypertension and sleep-disordered breathing. *Archives of Internal Medicine, 160*, 2289-2295.

Cheng, P., Casement, M. D., Chen, C.-F., Hoffmann, R. F., Armitage, R., & Deldin, P. J. (2013), Sleep-disordered breathing in major depressive disorder. *Journal of Sleep Research*. doi: 10.1111/jsr.12029

Enciso, R. & Clark, G. T. (2011). Comparing the Berlin and the ARES questionnaire to identify patient with obstructive sleep apnea in a dental setting. *Sleep Breath, 15*(1), 83-89. doi:10.1007/s11325-010-0328-5

Epstein, L. J., Kristo, D., Strollo, P. J., Friedman, N., Malhotra, A., Patil, S. P., … Weinstein, M.D. (2009). Clinical guideline for the evaluation, management and long-term care of obstructive sleep apnea in adults. *Journal of Clinical Sleep Medicine, 5*(3), 263-276.

Glick, D. B., Cooper, R. M., & Ovassapian, A. (2013). *The difficult airway.* New York: Springer.

Greenberg, B. L., Glick, M., Frantsve-Hawley, J., & Kantor, M. L. (2010). Dentists' attitudes toward chairside screening for medical conditions. *Journal of the American Dental Association, 141*(1), 52-62.

Gunaratnam, K., Taylor, B., Curtis, B., & Cistulli, P. (2009). Obstructive sleep apnoea and periodontitis: A novel association? *Sleep and Breathing, 13*, 233-239. doi:10.1007/s11325-008-0244-0

Ho, M. L., & Brass, S. D. (2011). Obstructive sleep apnea. *Neurology International, 3*(15), 60-66. doi:10.4081/ni.2011.e15

Institute of Medicine (US) Committee on Sleep Medicine and Research, Colten, H.R, & Altevogt, B. M. (Eds.) (2006). *Sleep disorders and sleep deprivation: An unmet public health problem.* Washington, DC: National Academies Press.

Kandray, D. P., & Yacovone, M. L. (2011). *Collaboration between two health disciplines to train dental hygiene students to identify risk factors for obstructive sleep apnea.* Poster session presented at 2nd North American Dental Hygiene Research Conference Bethesda, Maryland.

Kapur, V., Strohl, K. P., Redline, S., Iber, C., O'Connor, G., & Nieto, J. (2002). Under-diagnosis of sleep apnea syndrome in US communities. *Sleep and Breathing, 6*, 49–54.

Keller, J. J., Wu, C. S., Chen, Y. H., & Lin, H. C. (2013). Association between obstructive sleep apnoea and chronic periodontitis: A population-based study. *Journal of Clinical Periodontology, 40*, 111-117.

Kushida, C. A., Morgenthaler, T. I., Littner, M. R., Alessi, C. A., Bailey, D., Coleman, J., ..., Pancer, J. P. (2006). Practice parameters for the treatment of snoring and obstructive sleep apnea: An update for 2005. *Sleep, 29*(2), 240-243.

Levendowski, D. J., Morgan, T., Montague, J., Melzer, V., Berka, C., & Westbrook, P. R. (2008). Prevalence of probable obstructive sleep apnea risk and severity in a population of dental patients. *Sleep and Breathing, 12*, 303-309. doi: 10.1007/s11325-008-0180-z

Marin, J.M., Carrizo, S.J., Vicente, E., & Agusti, A.G. (2005) Long-term cardiovascular

outcomes in men with obstructive sleep apnoea-hypopnoea with or without treatment with continuous positive airway pressure: an observational study. *Lancet, 365*, 1046–1053.

Myers, K. A., Mrkobrada, M., & Simel, D. L. (2013). Does this patient have obstructive sleep apnea? *JAMA, 310*(7), 731-741. doi:10.1001/jama.2012.276185

National Heart, Lung and Blood Institute. (2006). Incidence & Prevalence: 2006 chart book on cardiovascular and lung diseases. Retrieved from http://www.nhlbi.nih.gov/resources/docs/06a_ip_chtbk.pdf

Netzer, N. C., Stooks, R. A., Netzer, C. M., Clark, K., & Strohl, K. P. (1999). Using the Berlin questionnaire to identify patients at risk of sleep apnea syndrome. *Annals of Internal Medicine, 131*(7), 485-491.

Oxford Dictionaires. (2013a). *Attitude.* Retrieved from http://www.oxforddictionaries.com/us/definition/american_english/attitude?q=attitude

Oxford Dictionaries. (2013b). *Barrier*. Retrieved from http://oxforddictionaries.com/definition/english/barrier

Park, J. G., Ramar, K., & Olson, E. J. (2011). Updates on definition, consequences, and management of obstructive sleep apnea. *Mayo Clinic Proceedings, 86*(6), 549-555. doi: 10.4065/mcp.2010.0810

Peppard, P. E., Young, T., Palta, M., Dempsey, J., & Skaturd, J. (2000). Longitudinal study of moderate weight change and sleep-disordered breathing. *JAMA, 284*(23), 3015-3021.

Punjabi, N. M. (2008). The epidemiology of adult obstructive sleep apnea. *Proceedings*

of the American Thoracic Society, 5, 136-143.

Ramachandran, S. K., & Josephs, L. A. (2009). A meta-analysis of clinical screening tests for obstructive sleep apnea. *Anesthesiology, 110*(4), 928-939.

Seo, W. H., Cho, E. R., Thomas, R. J., An, S. Y., Ryu, J., Kim, H., & Shin, C. (2013). The association between periodontitis and obstructive sleep apnea: A preliminary study. *Journal of Periodontal Research, 48*, 500-506.

Sleep Diagnostics of Michigan. (n.d.). *Berlin Questionnaire*. Retrieved from http://www.michigansleep.com/files/sleep-diagnostics/Berlin_Sleep_Eval.pdf

Tishler, P. V., Larkin, E. K., Schluchter, M. D., & Redline, S. (2003). Incidence of sleep-disordered breathing in an urban adult population. *JAMA, 289*(17), 2230-2237.

U. S. Department of Health and Human Services. (2008). *Dietary guidelines for Americans 2005*. Retrieved from http://www.health.gov/dietaryguidelines/dga2005/document/html/chapter3.htm

Wetter, D.W., Young, T. B., Bidwell, T. R., Badr, M. S., & Palta, M. (1994). Smoking as a risk factor for sleep-disordered breathing. *Archives of Internal Medicine, 154*, 2219-2224.

Yaggi, H.K., Concato, J., Kernan, W.N., Lichtman , J.H., Brass, L.M., Mohsenin, V. (2005). Obstructive sleep apnea as a risk factor for stroke and death. *New England Journal of Medicine, 353*, 2034–2041.

Young, T., Palta, M., Dempsey, J., Skaturd, J., Weber, S., & Badr, S. (1993). The occurrence of sleep-disordered breathing among middle-aged adults. *The New England Journal of Medicine, 328*(17), 1230-1235.

Young, T., Evans, L., & Finn, L. (1997). Estimation of the clinically diagnosed proportion of sleep apnea syndrome in middle-aged men and women. *SLEEP, 20*, 705-6.

Young, T., Shalar, E., Nieto, J., Redline, S., Newman, A. B., Gottlieb, D. J., … Samet, J. M. (2002). Predictors of sleep-disordered breathing in community-dwelling adults. *Archives of Internal Medicine, 162*, 893-900.

Appendix A

Pre/Post Screening Survey

Pre/Post-Screening Survey

Question	Very Important	Somewhat Important	Not Sure	Somewhat Unimportant	Very Unimportant
1. How important do you think it is for dental hygienists to screen patients for undiagnosed medical conditions?					
2. How important do you think it is for dental hygienists to screen patients for sleep apnea?					
3. If you or your dentist were considering incorporating sleep apnea screenings into your practice, how willing would you be to do each of the following?	Very Willing	Somewhat Willing	Not Sure	Somewhat Unwilling	Very Unwilling
Refer a patient for consultation with a physician					
Conduct a chairside screening that yields immediate results					
Discuss screening results with patients during the dental visit immediately after screening					
4. If you or your dentist were considering incorporating sleep apnea screening into your practice, how important would each of the following issues be?	Very Important	Somewhat Important	Not Sure	Somewhat Unimportant	Very Unimportant
Patient's willingness					
Liability					
Cost					
Time					
Insurance coverage					
Dentist's philosophy					
Other: _____					
	Strongly Agree	Somewhat Agree	Undecided	Somewhat Disagree	Strongly Disagree
5. Conducting sleep apnea screenings would help promote the perception that the dental hygienist and dentist are interested in the patient's general health.					
6. Conducting sleep apnea screenings would increase patients' confidence in the practice and the dental hygienist.					

Demographic Information

1. Gender:

   a) Female
   b) Male

2. Age:

   a) 20 - 30
   b) 31 - 40
   c) 41 - 50
   d) 51 - 60
   e) Over 60

3. How many years have you been a practicing dental hygienist?

   a) Less than 1
   b) 1 - 5
   c) 6 - 10
   d) 11 - 15
   e) 16 -20
   f) Over 20

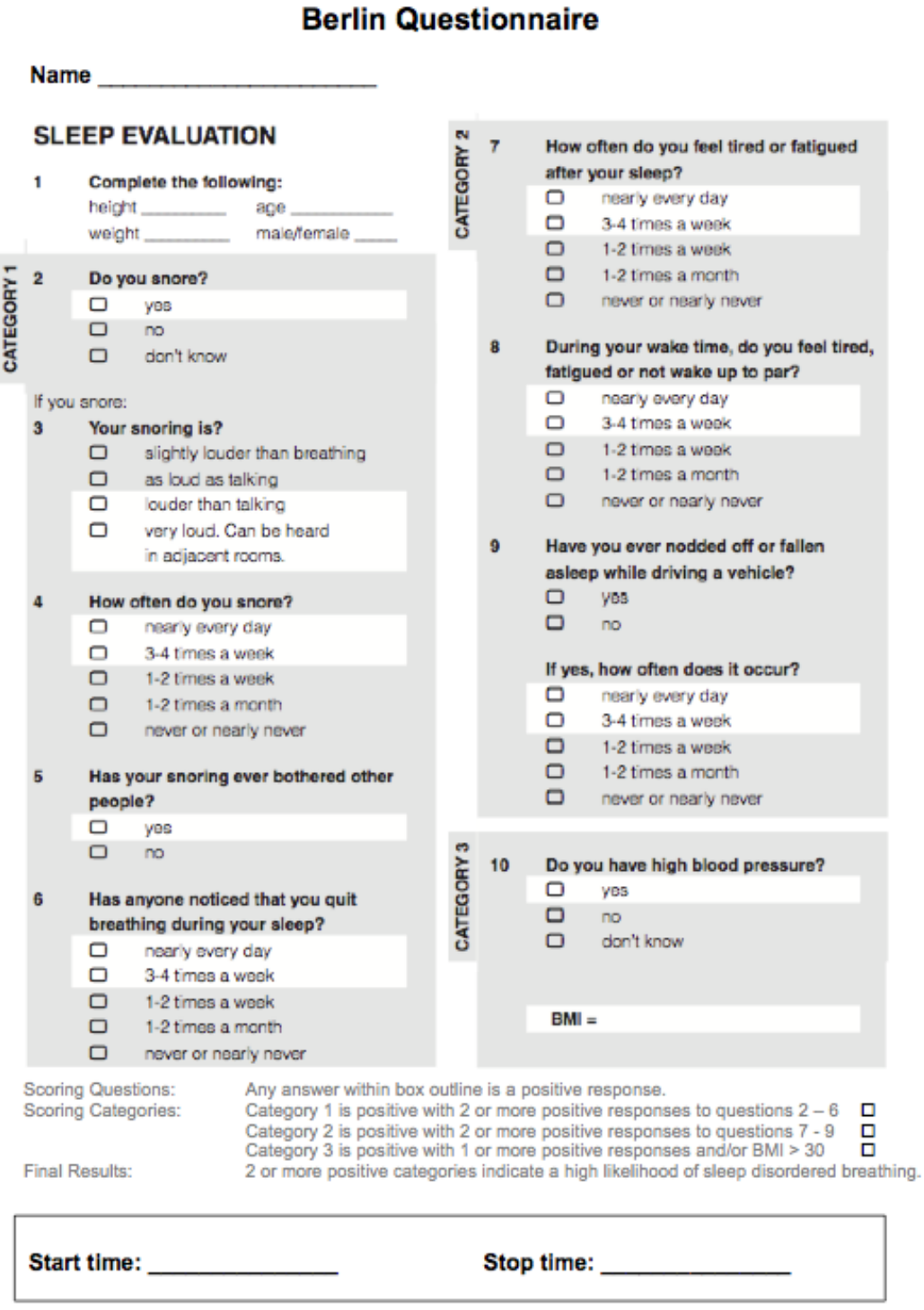
4. In which setting do you primarily practice?

   a) Private dental office
   b) Dental residency program
   c) Educational dental hygiene clinic

5. What is the highest level of education you have completed?

   a) Associate's degree
   b) Bachelor's degree
   c) Master's degree
   d) PHD

Appendix B



Berlin Questionnaire

Name _____

SLEEP EVALUATION

1 **Complete the following:**
height _____ age _____
weight _____ male/female ____

CATEGORY 1

2 **Do you snore?**
- ☐ yes
- ☐ no
- ☐ don't know

If you snore:

3 **Your snoring is?**
- ☐ slightly louder than breathing
- ☐ as loud as talking
- ☐ louder than talking
- ☐ very loud. Can be heard in adjacent rooms.

4 **How often do you snore?**
- ☐ nearly every day
- ☐ 3-4 times a week
- ☐ 1-2 times a week
- ☐ 1-2 times a month
- ☐ never or nearly never

5 **Has your snoring ever bothered other people?**
- ☐ yes
- ☐ no

6 **Has anyone noticed that you quit breathing during your sleep?**
- ☐ nearly every day
- ☐ 3-4 times a week
- ☐ 1-2 times a week
- ☐ 1-2 times a month
- ☐ never or nearly never

CATEGORY 2

7 **How often do you feel tired or fatigued after your sleep?**
- ☐ nearly every day
- ☐ 3-4 times a week
- ☐ 1-2 times a week
- ☐ 1-2 times a month
- ☐ never or nearly never

8 **During your wake time, do you feel tired, fatigued or not wake up to par?**
- ☐ nearly every day
- ☐ 3-4 times a week
- ☐ 1-2 times a week
- ☐ 1-2 times a month
- ☐ never or nearly never

9 **Have you ever nodded off or fallen asleep while driving a vehicle?**
- ☐ yes
- ☐ no

If yes, how often does it occur?
- ☐ nearly every day
- ☐ 3-4 times a week
- ☐ 1-2 times a week
- ☐ 1-2 times a month
- ☐ never or nearly never

CATEGORY 3

10 **Do you have high blood pressure?**
- ☐ yes
- ☐ no
- ☐ don't know

BMI =

Scoring Questions: Any answer within box outline is a positive response.
Scoring Categories: Category 1 is positive with 2 or more positive responses to questions 2 – 6 ☐
Category 2 is positive with 2 or more positive responses to questions 7 - 9 ☐
Category 3 is positive with 1 or more positive responses and/or BMI > 30 ☐
Final Results: 2 or more positive categories indicate a high likelihood of sleep disordered breathing.

Start time: _____ **Stop time:** _____

(Sleep Diagnostics of Michigan, n.d.)

Appendix C

BMI Chart

BMI	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Height	Weight in Pounds																
4'10"	91	96	100	105	110	115	119	124	129	134	138	143	148	153	158	162	167
4'11"	94	99	104	109	114	119	124	128	133	138	143	148	153	158	163	168	173
5'	97	102	107	112	118	123	128	133	138	143	148	153	158	163	158	174	179
5'1"	100	106	111	116	122	127	132	137	143	148	153	158	164	169	174	180	185
5'2"	104	109	115	120	126	131	136	142	147	153	158	164	169	175	180	186	191
5'3"	107	113	118	124	130	135	141	146	152	158	163	169	175	180	186	191	197
5'4"	110	116	122	128	134	140	145	151	157	163	169	174	180	186	192	197	204
5'5"	114	120	126	132	138	144	150	156	162	168	174	180	186	192	198	204	210
5'6"	118	124	130	136	142	148	155	161	167	173	179	186	192	198	204	210	216
5'7"	121	127	134	140	146	153	159	166	172	178	185	191	198	204	211	217	223
5'8"	125	131	138	144	151	158	164	171	177	184	190	197	203	210	216	223	230
5'9"	128	135	142	149	155	162	169	176	182	189	196	203	209	216	223	230	236
5'10"	132	139	146	153	160	167	174	181	188	195	202	209	216	222	229	236	243
5'11"	136	143	150	157	165	172	179	186	193	200	208	215	222	229	236	243	250
6'	140	147	154	162	169	177	184	191	199	206	213	221	228	235	242	250	258
6'1"	144	151	159	166	174	182	189	197	204	212	219	227	235	242	250	257	265
6'2'	148	155	163	171	179	186	194	202	210	218	225	233	241	249	256	264	272
6'3'	152	160	168	176	184	192	200	208	216	224	232	240	248	256	264	272	279
	Healthy Weight						Overweight					Obese					

(U.S. Department of Health and Human Services, 2008)

SECTION II: Publishable Manuscript

ABSTRACT

Sleep apnea (SA) can contribute to a variety of health problems and often goes undetected. Dental hygienists are capable of assessing patients for SA, but limited research exists on the subject. The purpose of this exploratory study was to obtain information about dental hygienists' attitudes and perceived barriers to performing SA screening during dental hygiene appointments. Sixteen dental hygienists were recruited to complete a pre-screening survey, screen five patients for SA, and then complete a post-screening survey. Individual screening time and accuracy determining BMI were recorded. Of the eighty-one patients screened, 30% were identified to be at high risk of having SA. Participants determined the BMI correctly for 89% of patients, and the mean time spent on screenings was 4.49 minutes. Pre-screening survey results showed 25% of participants felt that it was very important for dental hygienists to screen patients for SA, compared to 50% post-screening. Participants reported patient's willingness as the most important issue when considering incorporating SA screening into practice. Results suggest dental hygienists can provide patients a valuable health service by including SA screening as part of routine assessment. Dental hygienists recognize the importance of screening patients for undiagnosed medical conditions and are proficient at conducting screenings.

KEY WORDS

- Obstructive sleep apnea
- Berlin questionnaire
- Dental hygienist
- Sleep apnea screening
- Survey

Introduction

Sleep disordered breathing or sleep apnea (SA) refers to a group of sleep disorders characterized by brief interruptions in breathing during sleep. There are three types of sleep apnea—central sleep apnea, obstructive sleep apnea, and mixed sleep apnea. Central sleep apnea occurs when there are irregularities in the brain's signals to the muscles to breath (Ho & Brass, 2011). Obstructive sleep apnea (OSA) is much more common, and is caused by complete or partial upper airway collapse during sleep. The resulting reduction in airflow decreases the amount of oxygen reaching the vital organs and causes sleep disturbances (Punjabi, 2008). As the name implies, mixed sleep apnea is a combination of obstructive and central sleep apneas and involves both a pause in the respiratory system and an obstruction of the airway (Tagluk & Sezgin, 2009).

It is difficult to determine the precise number of people with OSA due to differences in sampling methods, diagnosis techniques, and disease definitions (Punjabi, 2008). However, between 2000-2002 the National Heart, Lung, and Blood Institute estimated the prevalence of sleep apnea was 10% of women and 12% of men. These percentages were based on self-reported physician diagnosis, and are significantly higher than the data from available population-based studies. Results from a 2001 study by Bixler et al., estimated the prevalence of OSA at 3.9% of men and 1.2% of women. Similarly, a 1993 study approximated the prevalence of sleep-disordered breathing at 2 percent of women and 4 percent of men (Young et al.).

Sleep apnea can contribute to a multitude of health problems—including cardiovascular disease, stroke, and depression—and often goes undetected (Yaggi, Concato, Kernan, Lichtman, & Mohsenin, 2005; Marin, Carrizo, Vicente, & Agusti,

2005; Cheng et al., 2013). Based on the severity of these problems, it is important that people with signs and symptoms of sleep apnea be screened for the condition and receive the appropriate treatment. The diagnosis of sleep apnea is based on a number of different factors including the evaluation of the patient's clinical symptoms and risk factors, a detailed sleep history, and the results from a formal sleep study (Epstein et al., 2009).

Despite the recent increased scientific and clinical focus on OSA, studies have shown that the majority of people (as many as 93% of women and 82% of men) with the condition remain undiagnosed (Young, Evans & Finn, 1997; Kapur et al., 2002). This can be attributed to patients' lack of awareness of their symptoms, as well as the fact that many healthcare professionals have not received the necessary training to aid in the early recognition and diagnosis of sleep apnea (Punjabi, 2008). In 2006, the Institute of Medicine [IOM] published a report that called for increased awareness of the condition by health care professionals and increased investment in interdisciplinary training and education regarding sleep disorders (IOM, 2006).

Since many patients visit the dental hygienist two or more times a year, dental hygienists are in an ideal position to screen patients for a variety of health conditions including sleep apnea. Dental hygienists already review medical histories, record vital signs, and perform oral examinations for each patient as part of the assessment process. The addition of sleep apnea screening to this assessment process could be an invaluable service for those patients with this undiagnosed condition. The purpose of this study was to obtain information about dental hygienists' attitudes, acceptance of, and perceived barriers to performing screening for sleep apnea during a dental hygiene appointment.

Methods

A descriptive test/retest survey method was employed for this pilot study. Approval to conduct the study was received by the Institutional Review Board (IRB) at Idaho State University. The study parameters qualified it for a Certificate of Exemption from full Board review.

Study Sample

A preliminary power analysis demonstrated fifteen participants to have a power of 0.80. The study sample consisted of 16 practicing dental hygienists. Dental hygienists were recruited from those affiliated with the ISU Department of Dental Hygiene. Participating dental hygienists had to be licensed to practice dental hygiene, practice in a private dental, community, or dental residency setting at least one day per week, and consent to participate in the study. The study sample was varied in regards to age, years in practice, education level, and primary practice setting. See Table 1. for detailed demographic data.

Data Collection

Prior to the beginning of the study, participants were mailed a packet with the informed consent documents, the pre and post-screening surveys, copies of the Berlin questionnaire, study instructions, BMI chart, and informational pamphlets on sleep apnea. Before the screening period, the dental hygienists were instructed to read the consent forms and study protocol. Participants provided their informed consent by mailing back the completed surveys and questionnaires. Those who did not consent to participate in the study were instructed to discard the study packet.

Before screening patients, the hygienists filled out a 6-question pre-screening survey about their perceptions regarding screening for sleep apnea and other medical conditions in a dental hygiene setting as well as barriers to screening. The pre-screening survey also included basic demographic information. The surveys were returned in a pre-paid, addressed envelope. Surveys were coded for anonymity. The survey instrument used in the study was adapted from surveys developed by Greenberg, Glick, Frantsve-Hawley, & Kantor (2010), and Barasch et al. (2012). Both of these surveys have been previously shown to be valid and reliable instruments. The survey that was used in this study was modified from the originals, so it was first tested for content validity and clarity by a panel of four experts. The pilot test showed 100% content validity.

During the designated screening period, November 2013 through February 2014, dental hygienists were asked to screen at least five consecutive patients for sleep apnea. All patients 18 and older who had not previously been diagnosed with or tested for sleep apnea were eligible for screening. If the patient consented to screening, he or she was asked to fill out the screening questionnaire. If the patient was under 18 years of age, had already been screened/diagnosed with sleep apnea, or did not want to be screened, the hygienist was instructed to not screen that patient and move on to screen the next eligible patient.

The Berlin questionnaire was selected as the screening instrument for use in this study. The Berlin questionnaire was created as part of the Conference on Sleep in Primary Care held in Germany in 1996 (Netzer, Stoohs, Netzer, Clark, & Strohl, 1999). The questionnaire focuses on known risk factors for sleep apnea. There are five questions regarding snoring, three questions regarding daytime sleepiness, one question regarding

sleepiness while driving, and one question regarding hypertension. Additionally, patients are asked about their age, weight, sex, and height. The dental hygienists used the provided BMI chart to determine the BMI after the patient had completed the questionnaire. The Berlin questionnaire has been previously validated as an accurate sleep apnea screening tool in multiple research studies, and is very easy to administer (Netzer et al., 1999; Abrishami et al., 2010; Ramachandran & Josephs, 2009).

The total time to administer and score the questionnaire was recorded by the dental hygienist for each patient. The dental hygienist recorded the start time when the screening process began and recorded the stop time once the questionnaire had been completed and scored. The consent process was not included in the screening time. The start and stop times were recorded directly on the patient's questionnaire. The BMI was determined using the chart provided and recorded on the questionnaire. The BMI chart was obtained from the U.S. Department of Health and Human Services National Center on Sleep Disorders' website.

Patients determined to be at high risk for sleep apnea based on the results of their Berlin questionnaire were referred to their primary physician for further assessment. If the patient did not have a primary care physician, he or she was given a list of sleep physicians in the area or referred to a physician of the dental hygienist or dentist's choice.

Within two days after the end of the screening period, each dental hygienist completed the post-screening survey to see if their perceptions about medical and sleep apnea screening in a dental hygiene setting had changed. The post-screening survey was the same as the pre-screening survey, with the exception of the demographic information.

The completed Berlin questionnaires and the post-screening survey were returned using the provided pre-paid, addressed envelope.

Statistical Analysis

Data was analyzed using IBM SPSS Statistics for Windows software, Version 21.0, released 2012. The exact confidence intervals were determined using Minitab 16 Statistical Software, Version 16.2.4, released 2013. The majority of data was analyzed using descriptive statistics. Additionally, the Wilcoxon signed-rank test was used to compare the Likert scale pre and post-screening survey responses, and Fisher's exact test was utilized to compare the proportion of males and females found to be at high likelihood of having sleep apnea.

Results

All 16 participants returned completed pre and post-screening surveys. Based on the results of the pre-screening survey, the majority of the study participants already felt that it was very important (63%) and somewhat important (25%) for dental hygienists to screen patients for undiagnosed medical conditions. On both the pre and post-screening surveys, all the participants reported being very or somewhat willing to refer a patient for consultation with a physician regarding sleep apnea, conduct a chairside screening that yields immediate results, and discuss screening results with patients. Patient's willingness was found to be the most important issue when considering incorporating sleep apnea screening into practice. All sixteen participants (100%) said it was very important on the pre-screening survey and fifteen of the participants (94%) reported it being very important on the post-screening survey. See Table 2 for a comparison of all the pre and post-screening survey responses.

The Wilcoxin signed-rank Test was used to compare the pre and post-screening survey results to see if there was a significant change after participants completed the SA screenings. Question number two was the only question that had a result suggestive of a significant change ($p = .034$). Prior to completing the screenings, only 25% of participants felt that it was very important for dental hygienists to screen patients specifically for sleep apnea. This number increased to 50% on the post-screening survey. The Bonferroni correction was not used due to the small sample size. The Wilcoxin signed-rank test revealed some change in a positive direction between the pre and post-screeing survey responses for several other questions, but not enough to be statistically significant (Q4b and Q4d $p=.109$). If a larger sample size were employed, it might be possible to see a statistically significant difference for these survey items.

The majority of participants screened five patients each. However, two dental hygienists screened six patients and two dental hygienists only screened four patients. A total of 81 patients were screened for SA as part of the study. Gender was recorded for all but one of the patients. There were 44 females (55%) and 36 males (45%) screened. The mean patient age was 50 and the median was 52, with a standard deviation of 15. The age range was 19 to 82.

Screening time was documented for eighty of the eighty-one patients. Time recorded on the questionnaires as less than one minute was entered as one minute for purposes of analysis. The mean time spent on screening for all the participants was 4.49 minutes, with a standard deviation of 3.04. The median time spent was 4 minutes, and the range was 1 to 18 minutes. The mean time spent on screenings was also determined for each individual participant. The shortest time was 1.2 minutes and the longest was 10

minutes. Over 75% of the participants took five minutes or less per screening and 95% took 10 minutes or less. Of the 16 participants, 13 had an average screening time of 5 minutes, while only 3 had a mean time of more than 5 minutes.

Body mass index (BMI) was determined and recorded for seventy-eight patients. The BMI was not recorded for two patients, and could not be determined for one patient because the patient did not disclose his/her weight. The participants located the correct BMI using the provided chart for 72 of the 78 patients (92.3%) (95% confidence interval (CI), 84% to 97%). The BMI was recorded incorrectly for 6 patients. Eleven participants correctly determined BMI 100% of the time. Four participants determined it correctly for all but one patient, while one participant recorded the incorrect BMI for two patients.

After the completed Berlin questionnaires were returned, the PI scored them to determine each patient's likelihood of having sleep apnea. Based on the results of the screenings, 30% (95% CI, 20% to 40%) of patients were found to be at high risk of having sleep apnea. Fisher's exact test was used to determine whether the proportion of males with a high likelihood of having SA was higher than females. The results did reveal that 33% of males were at high risk compared to 27% of females ($p = .365$). However, this is not statistically significant due to the small sample size. The mean age of patients at high risk was 54, compared to 48 for those not at high risk ($t = 1.936$, 64 df). This is also not significant at the .05 confidence level, but is suggestive that the mean age of those patients at high risk for SA is higher than those not at high risk.

Discussion

While the patient gender and age data from the Berlin questionnaires did not return significant results, it does follow the same trends described in the OSA literature.

Male gender has been shown to be associated with OSA. Data from a study aimed at better understanding the demographic patterns of sleep-disordered breathing (SDB) showed that men had 2.7 times the odds of having sleep apnea compared to women (Young, et al., 2002). The study included 5,615 participants from the Sleep Heart Health Study between the ages of 40 and 98. While the study sample size was large, it was limited in that it did not include young adults (under 40).

The higher mean age of patients at high risk of having SA from this study is also consistent with published data. Research has shown that increased age is associated with sleep apnea. One study revealed that a 10-year increase in age was correlated with a 24% increase in the chance of having sleep-disordered breathing, up to the age of 60 (Young et al., 2002). A study by Bixler, Vgontzas, Ten Have, Tyson, and Kales (1998) produced similar results in regards to the effect age has on the prevalence of sleep apnea. Men in the 45 to 64 age group were found to have the highest prevalence of sleep apnea (4.7%) (Bixler et al., 1998).

Of the 81 patients screened for sleep apnea as part of this study, 30% were found to have a high likelihood of having sleep apnea. This suggests that there are dental hygiene patients with undiagnosed sleep apnea. A 2008 retrospective study aimed at determining the prevalence of OSA in dental patients also showed a high percentage of patients with undiagnosed sleep apnea (Levendowski et al., 2008). The ARES questionnaire was used to screen patients from two dental clinics in California for OSA, and a total of 331 completed questionnaires were obtained and included in the study (Levendowski et al., 2008). Of the 331 study participants, 67% of the men and 28% of the women were identified as high-risk for having at least mild sleep apnea, and 33% of

men and 6% of women were predicted to have severe or moderate sleep apnea (Levendowski et al., 2008). A subgroup of 105 patients (75 men and 30 women) identified as high-risk from the questionnaire underwent a two-night in-home sleep study, and 96% were confirmed to have at least mild SDB (Levendowski et al., 2008).

There is little research regarding SA screening as part of the dental hygiene assessment process. An extensive search of the literature revealed only one study related to dental hygienists and OSA screening (Kandray & Yacovone, 2011). The 2011 study looked at the effects of implementing a program to train dental hygiene students on how to incorporate OSA screening methods into the dental hygiene examination. For this study, the students were shown how to use the Epworth Sleepiness Scale and the Modified Mallampati classification. Although the screening tools used were different than this study, the results support the idea that dental hygienists are able to effectively screen patients for OSA risk factors (Kandray & Yacavvone, 2011).

While there is no available data specifically about dental hygienists' attitudes towards medical screenings, a 2010 survey by Greenberg, Glick, Frantsve-Hawley and Kantor found dentists believe it is important to conduct chairside medical screenings in the dental office. The survey consisted of five Likert scale questions about incorporating medical screenings in general into the dental practice, as well as specific questions on screening for hypertension, cardiovascular disease, diabetes, hepatitis, and HIV. Most of the dentists (83.4%) were willing to conduct chairside screenings that yielded immediate results compared to 45.9% who were willing to conduct screenings that needed to be sent to a lab. Almost all respondents (96.4%) stated they were willing to refer a patient for a medical consultation. Patients' willingness was ranked as the most important barrier to

including medical screenings at a dental appointment, while insurance coverage was ranked as the least important. These results are consistent with the results of this study in that all the participants were either very or somewhat willing to refer a patient for a consultation with a physician, and patients' willingness was considered the most important and insurance coverage the least important issue when considering incorporating SA screening into practice.

Limitations

One limitation to this study is the small sample size. The study was intended to be a pilot study and a study with a larger sample size would need to be conducted to obtain statistically significant results. The convenience sample used in this study was comprised of dental hygienists affiliated with Idaho State University. It is possible that the participants possessed similar attitudes towards dental hygienists performing medical screenings as part of the assessment process, so there is the possibility of bias. Also, it is likely that dental hygienists who were already familiar with or interested in learning more about sleep apnea screening were more willing to participate in the study. Therefore, the convenience sample used is not representative of the entire population of practicing dental hygienists and is subject to coverage error.

There is no a single questionnaire that is an optimal method for sleep apnea screening for all populations (Ramachandran & Josephs, 2009). The Berlin questionnaire was chosen as the most accurate instrument for this population study based on the current research, but the results of the screenings may not be entirely reflective of how many of the patients actually have OSA (Netzer et al., 1999, Abrishami et al., 2010; Ramachandran & Josephs, 2009).

The BMI chart used in the study has a maximum height of 6'3" and weight of 279 pounds. There were several patients screened who were taller and/or weighed more, so it was not possible to accurately calculate the BMI. In these instances, the dental hygienists correctly recorded the BMI as more than 30, which is the largest BMI on the chart. Not being able to determine the exact BMI over 30 did not affect the screening results, but for future studies, it would be more accurate to use a different BMI chart or calculator.

Conclusion

Results of this pilot study suggest dental hygienists can provide patients a valuable health service by including screening for sleep apnea as part of routine health assessment. The study participants were proficient at conducting SA screening during dental hygiene appointments and were able to identify patients with a high likelihood of having SA. Additionally, the dental hygienists who participated in the study recognize the importance of screening patients for undiagnosed medical conditions and are willing to do so. To substantiate the results, a study with a larger, more diverse sample would need to be conducted.

Acknowledgements

The primary author would like to acknowledge Dr. Daniel Bruce for serving as a consultant on sleep apnea and dental sleep medicine throughout the research process.

References

Abrishami, A., Khajehdehi, A. & Chung, F. (2010). A systematic review of screening questionnaires for obstructive sleep apnea. *Canadian Journal of Anesthesia, 57*, 423-438. doi: 10.1007/s12630-010-9280-x

Bixler, E. O., Vgontzas, A. N., Lin, H., Ten Have, T., Rein, J., Vela-Bueno, A., & Kales, A. (2001). Prevalence of sleep-disordered breathing in women. *American Journal of Respiratory and Critical Care Medicine, 163, 608-61.*

Bixler, E. O., Vgontzas, A. N., Ten Have, T., Tyson, K., & Kales, A., (1998). Effects of age on sleep apnea in men. *American Journal of Respiratory and Critical Care Medicine, 157*, 144-148.

Cheng, P., Casement, M. D., Chen, C.-F., Hoffmann, R. F., Armitage, R., & Deldin, P. J. (2013), Sleep-disordered breathing in major depressive disorder. *Journal of Sleep Research*. doi: 10.1111/jsr.12029

Epstein, L. J., Kristo, D., Strollo, P. J., Friedman, N., Malhotra, A., Patil, S. P., … Weinstein, M.D. (2009). Clinical guideline for the evaluation, management and long-term care of obstructive sleep apnea in adults. *Journal of Clinical Sleep Medicine, 5*(3), 263-276.

Greenberg, B. L., Glick, M., Frantsve-Hawley, J., & Kantor, M. L. (2010). Dentists' attitudes toward chairside screening for medical conditions. *Journal of the American Dental Association, 141*(1), 52-62.

Ho, M. L., & Brass, S. D. (2011). Obstructive sleep apnea. *Neurology International, 3*(15), 60-66. doi:10.4081/ni.2011.e15

Institute of Medicine (US) Committee on Sleep Medicine and Research, Colten, H.R, & Altevogt, B. M. (Eds.) (2006). *Sleep disorders and sleep deprivation: An unmet public health problem.* Washington, DC: National Academies Press.

Kandray, D. P., & Yacovone, M. L. (2011). *Collaboration between two health disciplines to train dental hygiene students to identify risk factors for obstructive sleep apnea.* Poster session presented at 2nd North American Dental Hygiene Research Conference Bethesda, Maryland.

Kapur, V., Strohl, K. P., Redline, S., Iber, C., O'Connor, G., & Nieto, J. (2002). Under-diagnosis of sleep apnea syndrome in US communities. *Sleep and Breathing, 6*, 49–54.

Marin, J.M., Carrizo, S.J., Vicente, E., & Agusti, A.G. (2005) Long-term cardiovascular outcomes in men with obstructive sleep apnoea-hypopnoea with or without treatment with continuous positive airway pressure: an observational study. *Lancet, 365*, 1046–1053.

Myers, K. A., Mrkobrada, M., & Simel, D. L. (2013). Does this patient have obstructive sleep apnea? *JAMA, 310*(7), 731-741. doi:10.1001/jama.2012.276185

National Heart, Lung and Blood Institute. (2006). Incidence & Prevalence: 2006 chart book on cardiovascular and lung diseases. Retrieved from http://www.nhlbi.nih.gov/resources/docs/06a_ip_chtbk.pdf

Netzer, N. C., Stooks, R. A., Netzer, C. M., Clark, K., & Strohl, K. P. (1999). Using the Berlin questionnaire to identify patients at risk of sleep apnea syndrome. *Annals of Internal Medicine, 131*(7), 485-491.

Punjabi, N. M. (2008). The epidemiology of adult obstructive sleep apnea. *Proceedings*

of the American Thoracic Society, 5, 136-143.

Ramachandran, S. K., & Josephs, L. A. (2009). A meta-analysis of clinical screening tests for obstructive sleep apnea. *Anesthesiology, 110*(4), 928-939.

Tagluk, M. E., & Sezgin, N. (2009). Classification of sleep apnea through sub-band energy of abdominal effort signal using wavelets + neural networks. *Journal of Medical Systems.* Retrieved from http://link.springer.com.libpublic3.library.isu.edu/article/10.1007/s10916-009-9330-5/fulltext.html#CR5

U.S. Department of Health and Human Services, National Center on Sleep Disorders Research. (2003). *Sleep-disordered breathing*. Retrieved from http://www.nhlbi.nih.gov/health/prof/sleep/res_plan/section5/section5a.html

Yaggi, H.K., Concato, J., Kernan, W.N., Lichtman , J.H., Brass, L.M., Mohsenin, V. (2005). Obstructive sleep apnea as a risk factor for stroke and death. *New England Journal of Medicine, 353*, 2034–2041.

Young, T., Palta, M., Dempsey, J., Skaturd, J., Weber, S., & Badr, S. (1993). The occurrence of sleep-disordered breathing among middle-aged adults. *The New England Journal of Medicine, 328*(17), 1230-1235.

Young, T., Evans, L., & Finn, L. (1997). Estimation of the clinically diagnosed proportion of sleep apnea syndrome in middle-aged men and women. *SLEEP, 20*, 705-6.

2008

Tables

Table 1. Participant Demographic Data

Gender	**Frequency**	**Percent**
Female	16	100%
Age	**Frequency**	**Percent**
20-30	4	25%
31-40	3	19%
41-50	4	25%
51-60	4	25%
Over 60	1	6%
Years in Practice	**Frequency**	**Percent**
1-5	2	13%
6-10	5	31%
11-15	0	0%
16-20	2	13%
Over 20	7	44%
Primary Practice Setting	**Frequency**	**Percent**
Private dental office	12	75%
Dental residency program	1	6%
Educational dental hygiene clinic	2	13%
Private dental office and educational dental hygiene clinic	1	6%
Highest Education Level	**Frequency**	**Percent**
Associate's degree	3	19%
Bachelor's degree	13	81%
Master's degree	0	0%

Table 2. Comparison of the participants' pre and post-screening survey responses. The frequency, percentage and mean are shown for each question.

Scale	1		2		3		4		5		Mean	
Question	**Very Important**		**Somewhat Important**		**Not Sure**		**Somewhat Unimportant**		**Very Unimportant**			
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
1. How important do you think it is for dental hygienists to screen patients for undiagnosed medical conditions?	10 (63%)	13 (81%)	4 (25%)	3 (19%)	2 (13%)	0 (0%)					1.50	1.19
2. How important do you think it is for dental hygienists to screen patients for sleep apnea?	4 (25%)	8 (50%)	8 (50%)	6 (38%)	4 (25%)	2 (13%)					2.00	1.63
3. If you or your dentist were considering incorporating sleep apnea screenings into your practice, how willing would you be to do each of the following?	**Very Willing**		**Somewhat Willing**		**Not Sure**		**Somewhat Unwilling**		**Very Unwilling**		**Mean**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
Refer a patient for consultation with a physician	14 (88%)	14 (88%)	2 (13%)	2 (13%)							1.13	1.13
Conduct a chairside screening that yields immediate results	9 (56%)	10 (63%)	5 (31%)	6 (38%)	2 (13%)	0 (0%)					1.56	1.38
Discuss screening results with patients during the dental visit immediately after screening	9 (56%)	10 (63%)	7 (44%)	6 (38%)							1.44	1.38
4. If you or your dentist were considering incorporating sleep apnea screening into your practice, how important would each of the following issues be?	**Very Important**		**Somewhat Important**		**Not Sure**		**Somewhat Unimportant**		**Very Unimportant**		**Mean**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
Patient's willingness	16 (100%	15 (94%)	0 (0%)	1 (6%)							1.00	1.06
Liability	14 (88%)	11 (69%)	1 (6%)	2 (13%)	1 (6%)	2 (13%)	0 (0%)	1 (6%)			1.19	1.56
Cost	7 (44%)	10 (63%)	6 (38%)	4 (25%)	2 (13%)	1 (6%)	1 (6%)	0 (0%)	0 (0%)	1 (6%)	1.81	1.63
Time	13 (81%)	12 (75%)	3 (19%)	2 (13%)			0 (0%)	1 (6%)	0 (0%)	1 (6%)	1.19	1.56
Insurance coverage	7 (44%)	4 (25%)	3 (19%)	3 (19%)	4 (25%)	5 (32%)	1 (6%)	3 (19%)	1 (6%)	1 (6%)	2.13	2.63
Dentist's philosophy	12 (75%)	11 (69%)	1 (6%)	3 (19%)	2 (13%)	2 (13%)	1 (6%)	0 (0%)			1.50	1.44
Other: Follow-up with a physician	1 (6%)	0 (0%)										
RDH's philosophy	0 (0%)	1 (6%)										
How do you feel about the following statements?	**Strongly Agree**		**Somewhat Agree**		**Undecided**		**Somewhat Disagree**		**Strongly Disagree**		**Mean**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
5. Conducting sleep apnea screenings would help promote the perception that the dental hygienist and dentist are interested in the patient's general health.	13 (81%)	12 (75%)	2 (13%)	4 (25%)	1 (6%)	0 (0%)					1.25	1.25
6. Conducting sleep apnea screenings would increase patients' confidence in the practice and the dental hygienist.	7 (43%)	8 (50%)	4 (25%)	5 (31%)	3 (19%)	2 (13%)	2 (13%)	1 (6%)			2.00	1.75

Appendix D

Journal of Interprofessional Care Author Guidelines

Instructions for Authors

Aims and Scope

The ***Journal of Interprofessional Care*** aims to disseminate research and new developments in the field of interprofessional education and practice. We welcome contributions containing an explicit interprofessional focus, and involving a range of settings, professions, and fields. Areas of practice covered include primary, community and hospital care, health education and public health, and beyond health and social care into fields such as criminal justice and primary/elementary education. Papers introducing additional interprofessional views, for example, from a community development or environmental design perspective, are welcome. The Journal is disseminated internationally and encourages submissions from around the world.

Electronic Submission

Manuscripts for consideration should be submitted online via the Journal's ScholarOne Manuscripts website: http://mc.manuscriptcentral.com/cjic

Manuscripts must be written in English and should be double spaced and use 12 pt font. The main document, title page, and any tables/figures should each be submitted as separate files. The main document that will be sent for review should contain no identifying information. The title page, submitted as a file not for review, should include the title of the paper, author names and affiliations, contact information, keywords, and running head. Manuscripts should be prepared in accordance with American Psychological Association's (APA) guidelines – see below for further details.

All submissions are initially assessed by the Editor-in-Chief and Managing Editor for their suitability for *Journal of Interprofessional Care*. A letter will be sent to the authors, usually within two to three weeks, if a manuscript is rejected at this stage. Manuscripts that are assessed as having potential for publication in *JIC* are sent, with no identifying author information, to two peer reviewers. Associate Editors oversee the process of assessing reviewer feedback, corresponding with authors, and making recommendations for publication. A manuscript may need to undergo a number of revisions prior to a final acceptance. Accepted articles may be edited to meet certain standards. Authors can track the progress of their manuscript on the ScholarOne website.

The following issues must be addressed by authors submitting manuscripts to *Journal of Interprofessional Care*:

All submissions to the Journal must include full disclosure of all relationships that could be viewed as presenting potential conflicts of interest. If there are no conflicts of interest, authors should state that there are none. The information must be stated in the manuscript, after the main text under a subheading "Declaration of Interest". If there is a conflict of interest, this must be indicated in the appropriate field during the submission process.
All research submissions should include information about approval by the relevant research ethics board.
All authors must comply with the following policies: Authorship, submissions, Plagiarism and Peer Review; Clinical Trials Registry; and Copyright and Submissions.

For further details please see the Acknowledgements section below.

Types of Papers Accepted

The **Journal of Interprofessional Care** publishes the following types of articles:

1. Peer-reviewed Original Research Articles, systematic/ analytical reviews, and theoretical papers that focus on an element of interprofessional education or practice.
2. Peer-reviewed short reports that describe research in progress or completed, or an innovation in the field of interprofessional care.

Original Research Articles, systematic/ analytical reviews, and theoretical papers
These papers have a maximum of 5,000 words *including* abstract, main text, tables and figures, and references. This total number of words should be indicated in the appropriate space during the online submission process.

Abstract: The abstract should be written in paragraph form (not structured with sub-headings), and describe the main elements of the manuscript using no more than 200 words.

Keywords: 4-6 keywords, that address both methodological and content areas, should be selected. Keywords should be listed both in ScholarOne Manuscripts during the submission process, as well as on the title page.

Text: The text should in general, but not necessarily, be divided into sections with the headings: Introduction, Methods, Results, Discussion, and Conclusion. Main headings should be in bold; subheadings in italics.

Tables and Figures: Tables and figures should be referred to in text as follows: Figure 1, Figure 2; Table 1, Table 2, etc. The place at which a table or figure is to be inserted in the printed text should be indicated clearly on the manuscript. Each table and/or figure must have a legend that explains its purpose without reference to the text. Each table and/or figure must be uploaded separately from the main document. Charts and tables are considered textual and should also be supplied in a format compatible with MS Word.

Footnotes: Number all text footnotes consecutively throughout the manuscript and compile them on a separate page at the end of the manuscript

Short Reports
The Short Reports section is for papers that describe research plans, either in progress or completed, or an innovation in the field of interprofessional care. These papers have a maximum of 1,000 words and six references, and may contain one table or figure. Short reports should also have an abstract no more than 150 words written in paragraph form (not structured with sub-headings). Authors should include between 4-6 keywords. The text should in general, but not necessarily, be divided into sections with the headings: Introduction, Methods, Results, Discussion, and Conclusion. Main headings should be in bold; subheadings in italics. References should be APA style as noted above.

Editorials and Book Reviews
In addition, each issue of the Journal contains editorials and book reviews. Suggestions for editorials and book reviews need to be discussed with the Editor-in-Chief and Book Reviews Editors respectively, before submission

References

References should be in APA (American Psychological Association) 6th Edition referencing style. The instructions below are taken from: http://owl.english.purdue.edu/owl/resource/560/03/. Please refer to this site for more specific guidelines when preparing your manuscript.

All references cited in the text should be listed in alphabetical order in the reference section at the end of the manuscript text. All citations in the text should include the author last name and the year of publication e.g. (Smith, 2008) or "Smith (2008) demonstrated the importance of..." For a work by two authors, both authors are listed in the signal phrase or in the parentheses each time the work is cited. Use the word "and" between the authors' names within the text and use "&" in the parentheses. For a work by three to five authors, list all the authors the first time the source is cited, and use only the first author's last name followed by "et al." in subsequent citations. For a work by six or more authors, use the first author's name followed by et al. for all citations. Below are some examples; please refer to the website listed above for further instructions.

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Books:
Jelphs, K., & Dickinson, H. (2008). *Working in Teams*. Bristol: Policy Press.

Book Chapters:
Wee, B. & Goldsmith, J. (2008). Preparing facilitators for interprofessional learning. In E. Howkins & J. Bray (Eds.), *Preparing for Interprofessional Teaching: Theory and Practice* (pp. 55-68). Abingdon: Radcliffe Publishing.

Websites:
Health Canada. (2009). *Interprofessional education for collaborative patient-centred practice.* Retrieved from http://www.hc-sc.gc.ca/hcs-sss/hhr-rhs/strateg/interprof/index_e.html.

Acknowledgments and Declaration of Interest sections

Acknowledgments and Declaration of interest sections are different, and each has a specific purpose. The Acknowledgments section details special thanks, personal assistance, and dedications. Contributions from individuals who do not qualify for authorship should also be acknowledged here. Declarations of interest, however, refer to statements of financial support and/or statements of potential conflict of interest. Within this section also belongs disclosure of scientific writing assistance (use of an agency or agency/ freelance writer), grant support and numbers, and statements of employment, if applicable.

Acknowledgments section
Any acknowledgments authors wish to make should be included in a separate headed section at the end of the manuscript preceding any appendices, and before the references section. Please do not incorporate acknowledgments into notes or biographical notes.

Declaration of Interest section
All declarations of interest must be outlined under the subheading "Declaration of interest". If authors have no declarations of interest to report, this must be explicitly stated. The suggested, but not mandatory, wording in such an instance is: *The authors report no declarations of interest.* When submitting a paper via ScholarOne Manuscripts, the "Declaration of interest" field is compulsory (authors must either state the disclosures or report that there are none). If this section is left empty authors will not be able to progress with the submission.

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