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Student's Oral Health Knowledge, Oral Health Practices, and Their Susceptibility to Oral Health Diseases at a Midwestern University

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Student's oral health knowledge, oral health practices, and their susceptibility to oral health diseases at a Midwestern University

By

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A Thesis Submitted in Partial Fulfillment of the
Requirements for the Degree of
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Student's oral health knowledge, oral health practices and their susceptibility to oral health diseases at a Midwestern University

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This thesis has been examined and approved by the following members of the students' committee.

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“Surely there is ease after hardship” Quran (94:6)

Abstract

Poor oral health knowledge and poor oral health practices have been a silent epidemic in the United States of America. This self-perpetuating cycle of poor oral health knowledge and poor oral health practices have affected groups of people in the United States with low income who are at risk of population due to the lack of insurance. Scholars have shown that poor oral health can result from a lack of access to preventive care (dental appointments) and restorable care when dental diseases or issues may be fixed. Poor oral health knowledge may lead to poor oral health self-care practices down the road. This study investigates oral health knowledge, oral health practices and susceptibility to oral health diseases at a Midwestern university among health 101 students. A sample of 214 students from health 101 classes were taken to participate in the survey. The Results displayed students had a moderate score when it came to oral health knowledge but could show improvements on their oral health practices. Males felt like they were more susceptible to oral health diseases rather than females.

Table of Contents

Acknowledgement.....	III
Abstract.....	IV
Chapter 1: Introduction	1
Statement of the Problem.....	1
Purpose of Study.....	3
Significance of the Problem.....	3
Research Questions.....	4
Limitations	5
Delimitations.....	5
Assumptions.....	5
Definitions.....	5
Chapter 2: Review of Literature	7
The Definition of Oral Health.....	7
Common Oral Diseases.....	8
Dental caries.....	8
Periodontal disease.....	10
Oral cancer.....	12
Smoking & Oral Cancer.....	12
Drinking and Oral Cancer.....	13
Risk Factors for Oral Diseases.....	13

High sugar consumption’s impact on oral health.	13
Impact of tobacco use.	15
Best Oral Hygiene Practices.	16
Studies in the United States	17
Dental Health Practices in United States College Students	20
Flossing Habits of College Students	20
Conclusion	22
Chapter 3: Methodology.....	23
Description for Research Design	23
Research Sample.....	24
Survey Instrument.....	24
Data Collection Procedures.....	26
Data Analysis	26
Chapter 4: Results and Discussion	28
Response Rate.....	28
Demographics and Background Statistics	28
Research Question 1	29
Results Oral Health Knowledge.....	29
Research Question 2	29
Oral Health Practices Results.....	30
Research Question 3	30
Students’ Perception of Susceptibility to a Disease.....	30
Research question 4	31

Research question 5	31
Research question 6	31
Chapter 5: Discussion, Summary, Conclusions, Recommendations.....	34
Discussion.....	34
Conclusions and Summary	35
Recommendation for Future Research.....	37
Recommendations for Health Education Practice	39
References	41
Appendix A.....	48
Acquired Permission to use Survey	48
Appendix B.....	50
Oral Health Survey Instrument (OHSI)	50
Appendix C.....	53
Appendix D.....	55
Consent Form.....	55

Chapter 1: Introduction

The Surgeon General's Report on Oral Health in 2000 (U.S. Department of Health and Human Services [USDHHS], 2000) concluded oral disease is a "silent" epidemic in the United States. According to the National Institute of Dental and Craniofacial Research's (NIDCR) (2000) press release and interview with Surgeon General David Satcher, there are many populations in the United States, including those below the poverty line (especially children and the elderly), members of racial and ethnic communities, and people with disabilities or complex health problems, who suffer disproportionately from a number of oral diseases due to a lack of knowledge. Poor oral health can cause trouble with breathing, eating, sleeping, swallowing, and speaking (NIDCR, 2000). In fact, bad oral hygiene practices can contribute to major medical problems later in life, such as heart attack, stroke, diabetes, bacterial pneumonia, and pulmonary disease (Becker, 2008; Gurenlian, 2006; USDHHS, 2000). The increasing prevalence of oral health disease is also substantiated by NIDCR's (2000) report and attributed to a lack of dental services in many communities, as well as the absence of efforts to educate the people about the necessity to practice good oral health habits for lifelong health (Allukian, 2000). Exacerbating this silent epidemic is the lack of dental insurance for more than 125 million people (Allukian, 2000).

Statement of the Problem

Tooth decay resulting in the development of dental caries is one of the most prevalent chronic diseases in the world. Everyone is susceptible to tooth decay throughout their lifetime (Selwitz, Ismail, & Pitts, 2007). In the United States tooth decay

is the most common chronic childhood disease, and its prevalence among adults is equally troubling. Studies have shown the prevalence of tooth decay among adults is similar if not higher than among children (Selwitz et al., 2007).

The prevalence of periodontal disease is a concern. Severe cases of periodontal disease can affect the jawbone with a severe and sudden onset of gum disease known as trench mouth. In the late 2000s, trench mouth was particularly common among teenagers and young adults (Paradox, Odle, & Costello, 2009).

With the established link between periodontal disease and the development of coronary heart disease (Tuominen, Reunanen, Paunio, Paunio, & Aromaa, 2003), good oral health became even more important.

Given the importance of good oral health, it is important to identify factors contributing to tooth decay and periodontal disease. One factor is nutrition. Research has shown poor nutrition influences oral health in college students (Lemaster & Maready, 2014). Higher intake of sugar correlates to increases in periodontal disease and tooth decay (Lula, Ribeiro, Hugo, Alves, & Silva, 2014; Malinauskas, Aeby, Overton, Carpenter-Aeby, & Barber-Heidal, 2007; Miller, 2008; Pihlstrom, Michalowicz, & Johnson, 2005; Touger-Decker & van Loveren, 2003).

Specifically, research documents an increase in the consumption of sweetened beverages such as energy drinks among college students and explains that poor oral health practices increase the likelihood of developing periodontal disease (Smith West et al., 2006). This is particularly true when students are not knowledgeable about the diseases associated with such behavior (Smith West et al., 2006).

Research suggests that a lack of knowledge contributes to oral diseases (USDHHS, 2000). Not only have college students been associated with high sugar intake, but they are also at risk for other unhealthy behaviors such as tobacco use. A link has been established between tobacco use of any type and the development of periodontal disease (Kulkarni, Uttamani, & Bhatavadekar, 2016). Unfortunately, there is a misconception among college students that the use of alternative tobacco products is less harmful than cigarette smoking.

Lastly, there are oral health disparities in the United States related to age, sex, and race (Health, United States, 2014). In 2014, 17.5% of the 18 and 19 year olds had dental caries, and 27.4% of the 20-44 year olds also had dental caries (CDC, 2014). Additionally, men have a higher rate of periodontal disease than women (Health, United States, 2014). The racial groups that had the poorest oral health were non-Hispanic blacks, Hispanics, American Indians, and Alaska Natives (Dewald, 2016, p. 27).

Purpose of Study

The purpose of this study is to determine the knowledge, oral health practices, and susceptibility to oral health diseases such as periodontal disease, dental caries, and oral cancer of students at a midwestern university. Another purpose is to determine if there is a correlation between knowledge pertaining to oral health, oral health practices, and susceptibility to oral health diseases of the students at a midwestern university.

Significance of the Problem

The problems associated with tooth decay, periodontal disease, and poor oral health practices create a huge financial burden which often impacts the economically disadvantaged in the United States. USDHHS (2000) indicated dental care would cost

more than 60 billion dollars. This report also indicated if one does not take care of one's oral health, one may be susceptible to diseases such as heart disease, diabetes, and stroke. In addition college students abandoned dental health habits such as brushing and flossing while in college (Dewald, 2016). Due to the prevalence of oral health diseases and the high costs of dental care, research is needed to identify what college students know and do not know about the causes of oral health diseases. The results of this study will guide dental professionals on what information to provide college students to improve their oral health.

Research Questions

- 1.) Is there a statistically significant difference in the level of knowledge pertaining to oral health among a sample of college students based on age, sex, year of study, or race?
- 2.) Is there a statistically significant difference in oral health practices among a sample of college students based on age, sex, year of study, or race?
- 3.) Is there a statistically significant difference in susceptibility to oral health diseases among a sample of college students' based on age, sex, year of study, or race?
- 4.) What is the correlation between a sample of college students' level of knowledge pertaining to oral health and their oral health practices?
- 5.) What is the correlation between a sample of college students' level of knowledge pertaining to oral health and their susceptibility to oral health diseases?

- 6.) What is the correlation between a sample of college students' oral health practices and their susceptibility to oral health diseases?

Limitations

- 1.) The respondents' self-report data may report better behavior than they practice.
- 2.) The sample does not represent the general population.

Delimitations

- 1.) The respondents were between the ages of 18-25 years.
- 2.) Data collection was from a limited sample of midwestern university students.
- 3.) Due to limited time and resources no pilot study was conducted.

Assumptions

- 1.) Respondents answered the questions on the survey honestly.
- 2.) Enough time was allowed to complete the survey.
- 3.) Students understood and were able to complete the survey.

Definitions

Cavities/Tooth decay: damaged areas in part of the tooth that develop a tiny opening or hole, these are usually caused by consuming sugary snacks or drinks and not brushing thoroughly. If the cavity is not treated well, it can lead to pain or even tooth loss (Thivierge, 2015).

Oral health: the overall health of the mouth including the following: gums (gingiva) and their supporting connective tissues, ligaments and bone, the hard and soft palate, the soft mucosal tissue lining of the mouth and throat, the tongue, the lips, the salivary glands, the chewing muscles, and the upper and lower jaws, which are connected

to the skull by the temporomandibular joints. Good oral health means being free from any chronic pain or conditions of the mouth such as cancer, soft tissue lesions, periodontal disease, or cleft palate (NIDCR, 2000).

Oral health knowledge: students' known facts of oral health practices as indicated by their answers to questions on the health survey.

Oral health practices: students' oral health practices of how often they brush and floss their teeth.

Oral health susceptibility belief: students' opinion or conviction about their susceptibility to oral health diseases.

Chapter 2: Review of Literature

In order to demonstrate the danger behind negative or apathetic student attitudes toward oral healthcare, this chapter first defines oral health and several oral diseases before reviewing risk factors associated with illness and best oral hygiene practices. The Surgeon General (USDHHS, 2000) has referred to oral health as a silent epidemic and as a mirror for the general health and the well-being associated with oral health problems. The study also indicated that oral health is vital to a person's overall health. This is followed by a discussion of the Health Belief Model and the important role played by knowledge, perceptions, attitudes, and beliefs of oral healthcare practices in the motivation of individuals to engage in those practices. Finally, this chapter identifies the oral health risks college students face if they lack the necessary knowledge about oral health, have bad oral health practices such as not brushing and flossing, and being susceptible to oral health diseases.

The Definition of Oral Health

Oral health includes not only the mouth, but also the gums, supporting connective tissue, ligaments and bone, the hard and soft palate, lips, chewing muscles, and upper and lower jaws. In 1948 the World Health Organization expanded the definition of oral health to include the overall well-being of an individual (USDHHS, 2000). The report indicated that oral health must also include the well-being of a person beyond the health of their mouth and related systems, to include their social well-being and psychological health. This means the mental and social being of an individual's oral health such as how they

feel about their teeth because the functionality of their teeth goes hand-in-hand with the overall body.

The oral cavity begins between the skin and the lips which is known as the vermillion border. It then leads to the roof of the mouth formed by the hard palate. The oral cavity then leads into the oropharynx which includes the soft palate, tonsils, and tongue. The buccal mucosa is the mucous lining of the inner cheek. The vestibule is the space bounded by the cheeks and lips and the facial surfaces of the teeth and gingivae. The labial commissure is the junction of the upper and lower lips in the corner of the mouth (Darby & Walsh, 2010). These systems handle many responsibilities for our bodies, including eating, breathing, and speaking. Such a complex organ system can be severely damaged by bad oral hygiene practices, which makes it worthwhile to investigate ways to minimize the greater risk of contracting oral disease.

Common Oral Diseases

Oral disease is the result of genetic and environmental factors. In this section, three common oral diseases (dental caries, periodontal disease, and oral cancer) are discussed in terms of their symptoms, risk factors, and interactions with other illnesses.

Dental caries.

Dental caries are a common form of oral disease. Langha (2004) described caries as a disease of behavior due to the fact that they are largely preventable with effective oral hygiene practices. Dental caries occur when teeth are demineralized by acids created as oral bacteria break down dietary carbohydrates (e.g., sugars, breads, and starches), and the surface of the tooth is degraded or begins to break down (Benjakul & Churnarrom, 2011; Ehlen, Marshall, Qian, Wefel, & Warren, 2008; Touger-Decker & van Loveren,

2003). Erosion can be predicted by the titratable acidity and pH balance of the beverages consumed by individuals (Benjakul & Churnarrom, 2011). Demineralization occurs with the consumption of certain foods or beverages or when the pH level drops below 5.5. During demineralization, the hydrogen ions react with apatite crystals and break down the phosphate and calcium ions. This process can also create white spots on the teeth (Featherstone, 2008).

When properly treated, it may be possible to reverse the damage of erosion and dental caries (American Dietetic Association, 2007; Touger-Decker & van Loveren, 2003). Remineralization naturally occurs in the body's repair process in the oral cavity that helps repair the process for noncavitated lesions (Featherstone, 2008). It is a process that occurs when calcium and phosphate ions are found in the saliva and assisted by fluoride to rebuild new surface on the existing crystal remnants in the subsurface of the tooth (Featherstone, 2008).

Not only can dental caries be dangerous for our teeth, but there has been a link to demineralization of the tooth (Featherstone, 2008). Based on statistics compiled by the USDHHS (2016), in 2011 and 2012, 17.6% of the males and 15.5% of the females between ages 5-19 had untreated dental caries. In addition, in that age group 14.5% of whites, 23.2% of African Americans, 15.2% of Asians, and 22.4% of Hispanics had untreated dental caries. For ages between 20-44, 29% of males and 25.9% of females had untreated dental caries. In that age group 22.1% of whites, 41.4% of African Americans, 17.7% of Asians, 35.7% of Hispanics had untreated dental caries. For ages 45-64, 31.7% of males and 20.3% of females had untreated dental caries. Whites 22.1%, African American 43.2%, 16.0% Asian, and 36.1% Hispanic had untreated dental caries. For

those 65 or older, 20.8% of males and 17.3% of females had untreated dental caries. Whites 15.5%, African Americans 40.9%, Asian 27.3%, and Hispanics 26.7% had untreated dental caries.

Periodontal disease.

Pihlstrom et al. (2005) defined periodontal disease as “any inherited or acquired disorder of the tissues surrounding or supporting the teeth (periodontium)” (p. 1809) but argued that it usually refers to gingivitis and periodontitis, diseases caused by pathogenic bacteria and a build-up of biofilm or plaque on the teeth. *Gingivitis* is the mildest form of periodontal disease and is reversible with intervention, but when untreated leads to chronic gingivitis or periodontitis. *Chronic gingivitis* is the inflammation of the gums surrounding the teeth. In chronic gingivitis, the gums become weak and pockets form around the teeth which leaves the plaque and tartar to build up in the pockets. Additionally, chronic gingivitis may lead to tooth loss. Chronic gingivitis can also manifest as discolored teeth and tender gums with red blotches on the gums (Lohr, 2011).

Periodontitis can be a serious disease. It can involve the gingiva, periodontal ligaments, and the alveolar bone. The periodontal pockets can be destroyed by plaque, debris from food, and calculus. If not treated properly, the periodontal ligament will be destroyed leaving the teeth to move freely and will lead to tooth loss. Periodontitis can lead to damage in underlying supportive tissue and bone and create serious health problems. Periodontitis can be accelerated by systemic illnesses and other external variables (e.g., diabetes, HIV/AIDS, osteoporosis, stress, and poor nutrition) (Pihlstrom et al., 2005).

Chronic gingivitis and periodontitis have been shown to negatively impact other organ systems (e.g., liver, kidneys, and brain) as bacteria has greater access to the bloodstream through the affected teeth (Gurenlian, 2006). Bacteria from plaque cause inflammation and other immune responses which can, as a result, initiate the onset of other systemic disorders (cardiovascular disease, stroke, diabetes, and pulmonary disease) (Pihlstrom et al., 2005).

Linden, Lyons, and Scannapieco (2013) explained how Chronic Obstructive Pulmonary Disease (COPD) is an obstruction of air and inflammation in the airways. COPD is usually associated with smoking tobacco which in turn can cause bacterial and viral infections characteristic of periodontitis. A study of adults between the ages 70-79 found an association between periodontitis and obstructive airway disease of former smokers, but they did not find the disease in people who had not smoked. (Linden et al., 2013).

Linden et al. (2013) further explained chronic kidney disease may be associated with periodontitis especially in Mexican-Americans older than 40 years of age. There was also a bidirectional relationship between Mexican-Americans and chronic kidney disease, because most of them who could not afford to get their chronic kidney disease treated could also not get treated for their periodontitis (Linden et al., 2013).

Seymour, Ford, Cullinan, Leishman, and Yamazaki (2007) described how cardiovascular disease accounts for 40% of all deaths worldwide. The researcher stated periodontal disease is the most prevalent chronic infection in humans. Advanced forms of the periodontal disease can be found in 10-15% of the population worldwide and can cause an increased risk of developing cardiovascular disease. Research has also shown

bad oral health has been strongly correlated with fatal coronary events leaving one susceptible to myocardial infarction, atherosclerosis, and stroke (Seymour et al., 2007).

Oral cancer.

Oral cancer is a serious illness. In 2012, more than 4,000 people died from this disease in the United States (USDHHS, 2013). The USDHHS (2013) estimated in 2015 there would be 45,780 people diagnosed with oral cancer in the United States with 8,650 dying from the disease. Oral cavity and pharynx cancer is most frequently diagnosed among people between the ages of 55-64. Males were more likely to be diagnosed with oral cancer than females, at about 32,670 to 13,110 cases per year. Out of those diagnoses the estimated deaths for males were 6,010 and females were 2,640 (Siegel, Miller, & Jemal, 2015).

Smoking & Oral Cancer.

Tobacco smoking is one of the most common risks associated with oral cancer (Zain et al., 2011) and is one of the biggest causes of noncommunicable diseases in the world (Jha & Peto, 2014). It is also the leading cause of preventable death (Rendu, Peoc'h, Berlin, Thomas, & Launay, 2011). As many as 1 in 5 people die from cardiovascular disease. Additionally, links have been established between poor oral health and dental caries; people with poor oral health also have an increased risk of oral cancer, and pharyngeal cancer (Chang et al., 2013). Additionally, oral cancer was more common than the categories of leukemia, brain, liver, stomach, and kidney cancer (Kressen & DeSouza, 2002).

Drinking and Oral Cancer.

For the past 50 years alcohol has been recognized as an important factor contributing to the development of oral cancer (Ogden, 2005). Alcohol has been long recognized as placing people at an increased risk for developing cancer in the head and neck, such as the pharyngeal and laryngeal cancer (Reidy, McHugh & Stassen, 2011). Oral cancer has been increasingly associated with alcoholism, and nearly 75% of all cases of oral cancer are associated with alcohol consumption (Reidy et al., 2011). People who consume large amounts of alcohol may suffer from such side effects as parotid gland enlargements. Chronic consumption of alcohol may also lead to atrophy and the transformation of the parotid and submandibular glands. This results in impairing the saliva flow (Reidy et al., 2011). Therefore, it is not surprising dentists and medical doctors acknowledge the need for making the general populace aware of the link between alcohol consumption and oral health cancer (Ogden, 2005).

Risk Factors for Oral Diseases

The risk factors for oral diseases are complex and multifaceted. This section describes in detail the risk factors for various oral diseases, including a discussion of populations that are identified as being at greater risk than others. Risk factors covered in this section include high sugar consumption and tobacco use. In addition an argument is made for the use of the Health Belief Model as a means of identifying oral health behaviors and perceptions among young college students.

High sugar consumption's impact on oral health.

According to Ogden, Kit, Carrol, and Park (2011), in the past 30 years, sugar consumption has increased in the United States in both children and adults. The average

sugar consumption by a male in the United States is 72 tablespoons per day, while the average for a female is 67 tablespoons per day. For teenagers and young adults the averages were significantly higher. Males ages 18-19 had 138 tablespoons, and females ages 18-19 had 72 tablespoons. Males ages 20-39 had 137 tablespoons, and females ages 20-39 had 69 tablespoons.

Ogden et al. (2011) recommended a daily intake of 30 teaspoons of sugar for young adult males and 15 teaspoons of sugar for young adult females.

High sugar intake can be detrimental to one's oral health. More alarmingly, energy drinks have rapidly gained popularity among college students (Malinauskas et al., 2007). Energy drinks usually contain 80-120 mg of sugar which is equivalent to 53 teaspoons, close to double the daily recommended intake of sugar. One energy drink is equivalent to drinking two 12-ounce cans of Mountain Dew, Pepsi, Coca Cola, or Dr. Pepper.

A correlation has been established between high sugar consumption and bad oral health, particularly dental erosion (Ehlen et al., 2008). Darby and Walsh (2010) described dental erosion as the loss of the tooth surface caused by chemical agents. Dental erosion can also happen when tooth enamel wears away, when the tooth loses its hard tissue due to exposure to acidic or sugary beverages, and is considered a major oral health concern by Ehlen et al. (2008). However, dental erosion has received little attention in the United States. Energy drinks, sports drinks, sodas, and juice all can cause dental erosion. It usually does not involve bacteria but instead is caused by poor dietary practices such as frequent intake of acidic or sugary foods and beverages (Touger-Decker & van Loveren, 2003).

Impact of tobacco use.

As previously noted, use of tobacco is positively correlated to higher rates of periodontal disease and oral cancer. According to Paul, Soni, Vaid, Basavaraj, and Khuller (2014), smokers are five times more likely to develop severe periodontitis than nonsmokers. Smokers also tend to have greater numbers of deep periodontal pockets and higher averages of periodontal probing depth. This means they have more spots displaying the effects of periodontitis and the pockets that form between the gums and teeth are deeper (Paul et al., 2014). It has also been documented that periodontal inflammatory conditions are likely to occur with patients who smoke and use tobacco rather than individuals who do not smoke and use tobacco (Javed, Ahmed, & Romanos, 2014). Not only smoking causes periodontal disease, second hand smoke is also associated with periodontal disease (Javed et al., 2014). Second hand smoke, also known as environmental or passive smoking, is the third leading preventable cause of death in the United States. It is estimated that 53,000 people die annually in the United States from inhaling passive smoke (Arbes, Agustsdottir, & Slade, 2001).

Cigarette smoking is a contributing factor to the development of oral cancer. These effects include vasoconstriction caused by nicotine and a decrease in oxygen tension which promotes colonization of bacteria and a subgingival environment. Evidence has also shown nicotine can suppress osteoblast proliferation, causing the neutrophils and chemotaxis to be suppressed (Arbes et al., 2001). According to Warnakulasuriya et al. (2010), tobacco use constitutes more than 80% of the risk associated with oral cancer. Additionally, smoking has been shown to be associated with greater loss of teeth and implant failure.

Oral cancer accounts for 2.5% of all types of cancer in the United States (Viswanath, Kerns, Sorkin, Dwyer, Groves, & Steinberger, 2013). In 2011, more than 39,400 people were diagnosed with oral cancer located in the the oral cavity and the pharynx. Tobacco causes more than 90% of oral cancer in men and 60% in women (Viswanath et al., 2013). People who smoke cigarettes are five times more likely to get oral cancer than nonsmokers. Ninety-five percent of all cancer causes oral squamous cell carcinoma through smoking and tobacco usage (Darby & Walsh, 2010). Darby and Walsh (2010) explained oral cancer needs to be detected early due to the fact more than 52% of cases tend to advance and show evidence of invasion and metastasis (Darby & Walsh, 2010). The literature clearly establishes the detrimental effects of high sugar intake and cigarette smoke to dental and overall physical health. Therefore, it is important for one to stay away from habits such as smoking, and to monitor the daily sugar intake in order to keep healthy teeth.

Best Oral Hygiene Practices.

Today there is increasing knowledge and awareness of good oral hygiene practice. People may brush their teeth for multiple reasons such as feeling fresh, avoiding bad breath, or even have a clean oral cavity (Van Der Weijden & Slot, 2011). Brushing teeth twice daily with fluoride toothpaste has been a generally accepted practice in Western culture and society (Van Der Weijden & Slot, 2011). Ashkenazi, Cohen, and Levin (2007) suggested children who are younger than 7 years old often lack the ability to brush effectively due to their insufficient hand-eye coordination, and therefore an adult should brush their teeth. When children are 11 years old, they have better hand-eye coordination and are able to brush their teeth and floss on their own (Ashkenazi et al., 2007).

Studies in the United States

There have been limited studies in the United States pertaining to behaviors, knowledge, and attitudes in oral health. Langha (2004) specifically measured knowledge, behaviors, and attitudes when examining the oral health of students at a midwestern university. In a population of 400 students, 377 completed a health survey instrument. The instrument included 23 questions designed to evaluate knowledge, attitude, and behaviors associated with oral hygiene as well as demographic questions. The first 10 questions pertained to oral health knowledge and were multiple choice questions. Question 10 had five options and the students were to check all that applied. Potential scores ranged from 0-14. The attitude section had five questions based on a Likert scale ranging from strongly disagree to strongly agree. Potential scores ranged from a 5-25 with a high score denoting a good attitude towards oral health. The last section was the behavior section and included six questions. The behaviors section used two different scales identifying how often people brushed their teeth, and flossed, and used mouthwash. A scale was used for that section from 1 to 5. A high score indicated a positive behavior. A second scale identified the frequency of other oral habits such as smoking, use of tobacco, and soft drinks. This scale was reversed coded 4, 3, 2, and 1 with the highest score denoting positive oral behavior. Scores in this section ranged from 12 to 3. The sum of the scores for both scales ranged from 6 to 27, with a high score indicating good oral health behaviors (Langha, 2004). More than half of the survey participants were female (57.3%) and Caucasian (67.5%). A little over a quarter of the survey participants were African American (25.8%). The distribution of survey participants based on year of study was fairly even with 29.6% freshman, 23.5%

sophomores, 14.7% juniors, and 31.7% seniors. The age range was between 18 and 24 years (Langha, 2004).

Results showed that college students at this midwestern university were knowledgeable about their oral health with a mean score of 10.43 out of 14 with a $SD = 1.92$. With regards to oral health attitudes, scores on the survey were positive with a mean score of 18.46 out of 25 with a $SD = 2.95$. Although students were knowledgeable and had a positive attitude towards oral health, they nevertheless engaged in poor oral health habits such as smoking. The last section indicated that students whose family income exceeded \$90,000 had higher oral health knowledge and more positive oral health attitudes, but there was not a difference in their oral health behaviors compared to students from lower economic backgrounds (Langha, 2004). In conclusion, students who reported a positive attitude on their oral health had a higher knowledge score; however, they did not practice proper oral health behaviors. This was demonstrated when most students reported they did not floss their teeth nor did they use adequately mouthwash. Overall, there was not a difference in the knowledge, attitude, and behaviors of males and females at this midwestern university (Langha, 2004).

Another study was done at the University of California that examined the oral health knowledge and preventative practices among students who were majoring in the health sciences (Starkenber, 2015). Ages ranged from 19-31 with 78% of the students being female and 21.3% of the students being male. The survey was adopted from the American Dental Association (ADA) and focused on the four domains of basic knowledge of oral hygiene practices, knowledge about the generic behavior, health risk

for gum disease, and knowledge of specific gum diseases such as symptoms, prevention, and care.

Junior and senior college students with concentrated majors in education in the field of Community Health took the survey (N = 122). On the basic oral health hygiene knowledge section, 66.4% of students correctly answered that toothbrushes should be replaced every 4 months, while 72.1% could not identify the number of times they should floss their teeth on a daily basis. Additionally, 58.2% of the students believed that occasional bleeding of the gums was normal when brushing and flossing the teeth. In the risk factor category of the knowledge section, 81% of students were able to correctly identify that smoking and nutrition factors may lead to the development of gum disease; however, 73.8% of participants were not able to identify that inflamed gums can lead to bleeding if the individual is a smoker. Most students (77%) did not know that red swollen gums may be considered an early sign of gum disease. The last domain looked at knowledge. 36.2% of the students could not identify that bleeding of gums is a sign of gum disease. In conclusion, females had more knowledge in the general oral hygiene category, risk factors for gum disease, and prevention, and care for gum disease than males (Starkenbergs, 2015).

Another study conducted at another midwestern university had 105 males and 91 females and evaluated oral hygiene practices by gender. The results indicated 75% of the sample brushed their teeth twice a day, and females brushed their teeth more often than males (Luebke & Driskell, 2010). The study also indicated only 1/3 of the students flossed their teeth daily. Luebke and Driskell (2010) concluded college students need to improve their oral hygiene practices.

Dental Health Practices in United States College Students

College students are at risk for oral health problems because they do not have their parents to remind them to brush their teeth multiple times a day or even floss (Dewald, 2016). Some may go days without brushing or flossing. College students often abandoned healthy lifestyle habits including oral health habits. Only 8.67% of the males in college had their teeth cleaned in the last year while 13.49% of the females got their teeth cleaned in the last year (Dewald, 2016). Ethnic differences for dental exams were also huge. The study indicated that 56% of white college students got an annual dental cleaning while less than 10% of other ethnic groups such as black, Asian, Hispanics, or Native Americans, had an annual checkup (Dewald, 2016).

Flossing Habits of College Students

Flossing is a preventative health behavior that can remove plaque from areas in the mouth that the toothbrush cannot reach. Making flossing a habit is a critical part of good oral hygiene. A study was conducted to examine flossing and how people acquire the habit of flossing. To encourage the participants to floss, they were given motivational interventions and were instructed to floss daily in order to prevent dental decay, gum disease, and bad breath. The participants were asked to floss before bed and were also given instructions on how to floss and clean their teeth (Judah, Gardner, & Aunger, 2013).

Memory aids were used in order to reinforce their flossing behaviors and to create a memory stimulus for them to floss once a day after brushing their teeth (Judah et al., 2013). As part of the study, text messages were sent to the participants as reminders to floss their teeth (Judah et al., 2013). Receiving text messages socially pressured

participants into flossing their teeth. Participants were more likely to floss after taking a shower and brushing their teeth. Additionally, when the participants felt like there was a rewarding outcome to flossing, they flossed more and their attitudes measured favorably toward flossing because of the appearance of their teeth, how they felt about their oral health, and their attitudes about their personal oral hygiene. By adding this repetitive behavior, a new habit was formed for the participants to floss every time they were done brushing their teeth (Judah et al., 2013).

College is a stressful time period in students' life and can affect how students perceive things when it comes to their health (Yan, Li, & Sui, 2014). The assumption is that college students do not think it is necessary to floss their teeth because they may feel that they are not susceptible to future diseases. Perceived susceptibility is a powerful influence for getting people to adopt healthier behaviors in order to reduce risks for future diseases (Skinner, Tiro, & Champion, 2015). This relates to the Health Belief Model regarding how students would view their susceptibility to diseases, the perceived benefits and seriousness of oral health practices, the barriers they face, their cues to action for flossing, and lastly, self-efficacy or doing something about their flossing for them to feel better about their oral hygiene and to prevent future diseases (Skinner et al., 2015).

This alludes to the perception among the students who may not feel susceptible to a disease, and as a result they think that flossing is not important whatsoever. The notion would explain that although students may have average knowledge of oral hygiene, it does not necessarily mean that they are practicing such behaviors like flossing. An intervention may be needed on university campuses to get the students involved in paying

more attention to their teeth and to know the possible diseases that may occur if oral hygiene is abandoned.

Conclusion

As demonstrated in this chapter, there are many oral health diseases that may put one at risk for one's oral health and overall health. College students might be at higher risk for poor oral health and oral diseases than other populations because of their poor oral health practices and when they leave home not having responsibility of taking care of their oral health. Langha (2004) and Luebke and Driskell (2010) have shown that these behaviors were not the best among college students.

Chapter 3: Methodology

For this study students at a midwestern university were recruited to participate in a survey examining their knowledge pertaining to oral health, oral health practices regarding their oral health, as well as their susceptibility to oral health diseases. Research questions were: Is there a statistically significant difference in the level of knowledge pertaining to oral health among a sample of college students based on age, sex, year of study, or race? Is there a statistically significant difference in oral health practices among a sample of college student's based on age, sex, year of study, or race? Is there a statistically significant difference in susceptibility to oral health diseases among a sample of college students' based on age, sex, year of study, or race? What is the correlation between a sample of college students' level of knowledge pertaining to oral health and their oral health practices? What is the correlation between a sample of college student's level of knowledge pertaining to oral health and their susceptibility to oral health diseases? What is the correlation between a sample of college students' oral health practices and their susceptibility to oral health diseases? These questions will be useful for determining the need for future intervention(s) to improve students' oral health at this midwestern university. In addition, the results of this study will help dental professionals and health educators develop plans to improve the oral health practices of college students.

Description for Research Design

With the intent to identify areas of concern regarding oral health among college students, descriptive statistics were collected and analyzed. To increase the likelihood of

a high response rate, the survey was distributed to students enrolled in general education Health 101 classes. Additionally, paper surveys were used because it has been well-documented that surveys distributed online do not generate a high response rate, whereas distributing paper surveys in class helps to improve the response rate (Dommeyer, Baum, Hanna, & Chapman, 2004).

Research Sample

Students enrolled in general education course Health 101 were selected as a convenient representative sample of the midwestern university's student population. A list of Health 101 sections was taken from the institution's website, which showed the instructors teaching each section. Identified instructors were contacted via email to obtain their permission to solicit participation of their students in the survey. Three instructors granted the researcher permission to come and collect data from their class. Two instructors had two different sections while one instructor had one section, so a total of five different sections were sampled.

Only students between the ages of 18 and 25 were included. Participants could not complete the survey who were below the age of 18 because they would not have met the Institutional Review Board (IRB) guidelines and would have needed permission from their guardian. Additionally, a committee member advised that participants above age 25 should not be included. There were no participants under 18 who completed the survey.

Survey Instrument

The Oral Health Survey Instrument (OHSI) was originally developed in 2003 by Anjum, Memon, and Honkala in Kuwait (Langha, 2004). This instrument was revised by Langha (2004), after consulting with dentists and professors to ensure the instrument was

valid for a study that was conducted in 2004. In order to determine the validity of the instrument, Langha conducted a stability and reliability test, to determine if the answers correlated between the first and second administration of the instrument.

The researcher acquired permission from Langha to make modifications to the OHSI (see Appendix A). Changes included minor modifications to the wording of the knowledge section and removal of questions pertaining to students' and their parents' socioeconomic status, their feelings about the appearance of their teeth, and to their current dental insurance status. The deletion of these questions was to avoid asking students questions that might be too personal.

The revised OHSI focuses on the relationship between students' knowledge pertaining to oral health, perceived susceptibility to oral health disease, and oral health practices. The first 11 questions queried students' knowledge pertaining to oral health. The next five questions attempted to determine students' oral health practices and perceived susceptibility to oral health disease.

The scoring of the modified OHSI was as follows. A total of 40 points was awarded to the three sections of the instrument. For the knowledge section, 19 points were allocated to determine their knowledge pertaining to oral health. The oral health practices section had two questions and a reverse Likert scale to assign 12 points based on frequency of oral health practices. Finally, perceived susceptibility to oral health disease represented nine points for the three different questions. The last question asked how often students visited the dentist. The modified OHSI is found in Appendix B.

Data Collection Procedures

Prior to collecting data, approval was obtained from the Institutional Review Board IRB at the midwestern university on March 18, 2016 (see Appendix C). Data was collected upon IRB approval from five sections of Health 101 between March 21 and March 24, 2016. Participants heard an explanation of the informed consent form (see Appendix D) and completed the modified OHSI. It was explained that there was no pressure to complete the survey and that it was their choice to complete the participate. Ample time was provided to ask and answer questions related to the study. After all questions were answered, the instrument was distributed, and the researcher left the room.

After completing the survey, students were instructed to give their surveys to the instructor. Those who did not wish to complete the survey were asked to give their blank survey to the instructor. After all surveys had been given to the instructor, the researcher returned to the room, thanked the class, collected the envelope with the surveys, and left. The time commitment was approximately 15 minutes, 5 minutes for the explanation and 10 minutes to complete the survey. To further protect the confidentiality of participants, the surveys were placed in a locked file in the Health Science Department at the midwestern university to secure the data.

Data Analysis

These variables were computed and correlations were calculated between them. The knowledge portion pertaining to oral health was the sum of oral health knowledge questions that were answered correctly. The maximum score was 19. Oral health practices was calculated by giving 6 points to participants who brushed their teeth twice a

day, 5 points once a day, 4 points once every 2-3 days, 3 points once every 4-6 days, 2 points once a week, and 1 point spontaneously. This pattern was applied to dental flossing. The maximum score was 12. Lastly, susceptibility to oral health disease was examined for perceived susceptibility to periodontal disease, caries and oral cancer. If the participant felt they were not susceptible to these diseases, they received a score of 1. If they felt they may not be susceptible, they received a score of 2. If they felt that they were susceptible to these diseases, they received a score of 3. The maximum score was 9.

With the intent to identify areas of concern regarding oral health among college students, descriptive statistics were collected and analyzed. Analysis of survey results included calculation of the mean, chi-square, ANOVA, *t*-test, and correlation. Statistical Package for the Social Sciences (SPSS) version 22 was used to analyze the data collected from the participants.

Chapter 4: Results and Discussion

The purpose of this study was to determine the level of oral health knowledge among a sample of students enrolled in a Health 101 course at a Midwestern university. In addition to identifying their oral health practices, susceptibility to oral health diseases and dental visits were examined.

Response Rate

There were 294 students in five sections of Health 101 during spring semester 2016. Of the 294 students, 71 students were absent the days the oral health survey instrument was administered leaving 223 to participate in the survey. However, nine surveys were discarded, because six surveys were incomplete and three were completed by students older than 25. Hence, there were 214 usable surveys for a response rate of 73%.

Demographics and Background Statistics

More than half of the participants were female (134) while only a little over one-third were male (78). The racial composition of the survey population was 79% ($n= 169$) Caucasian, 10.3% ($n= 22$) African-American, 3.7% ($n= 8$) self-identified as other, 4.2% ($n= 9$) Asian, and 2.8% ($n= 6$) Hispanic. The mean age of the survey participants was 19, $S.D. = 1.33$. As to matriculation, 54% ($n= 116$) were freshmen, 28% sophomores ($n= 60$), 15% ($n= 31$) juniors, and 3% ($n= 7$) seniors. (See Table 1). Additionally, descriptive statistics were looked at on how often participants visited the dentist. Fifty-eight percent ($n=125$) of participants reported seeing the dentist within the last six months, 29% ($n= 61$) of participants reported seeing the dentist within the past year, 7% ($n= 14$) of

participants reported seeing the dentist within 2 years, and lastly, 7% ($n= 14$) of the participants reported dental visits within the last 3 years or more.

Research Question 1

Is there a statistically significant difference in the level of knowledge pertaining to oral health among a sample of college students based on age, sex, year of study, or race?

Results Oral Health Knowledge

Overall students' scores on the knowledge section of the OHSI survey was 14.21 ($SD = 2.53$) out of 19 possible questions. (Please refer to Table 1). Frequency counts showed that 97% ($n= 208$) of participants answered their daily eating habits affected their oral health, while 82% ($n= 176$) answered that the use of chewing tobacco was less harmful than a smoking a cigarette. Eighty-two percent ($n= 176$) answered correctly that if one takes proper care of his or her teeth, they can last a life time. A One-way ANOVA was conducted to determine if the knowledge scores differed for the following: age, year of study, or race. For age, there was not a statistical significant difference in knowledge $F(6, 207) = .59, p = .74$. Year of study also did not have a statistically significant difference $F(3, 210) = .22, p = .88$. Race did have a statistically significant difference $F(4, 209) = 2.60, p = .04$. An independent t-test was used to look at sex $t(210) = -1.50, p = .14$, there was not a statistically significant difference in knowledge scores when comparing males and females.

Research Question 2

Is there a statistically significant difference in oral health practices and behaviors among young adults based on age, sex, level of educational attainment, or race?

Oral Health Practices Results

Oral health practices were examined to determine how often students brush and floss their teeth. The average score for oral health practices and behaviors survey participants was 8.77 out of 12 possible points. A One-way ANOVA test was used to look at age $F(7, 206) = 1.05, p = .39$, year of study $F(7, 206) = 1.52, p = .16$, and race $F(7, 206) = .75, p = .62$. Independent t-test was used to look at sex $t(210) = -.704, p = .48$ (Please see Table 2). There were not a statically significant difference in age, year of study, race, and sex for oral health practices. Frequency test was also looked at to see how often students brushed their teeth and flossed them. Seventy-nine percent ($n = 170$) participants brushed their teeth twice a day, 19% ($n = 41$) brushed their teeth once a day, 1% ($n = 3$) brushed their teeth every 2-3 days. For flossing 8% ($n = 17$) flossed 2+ a day, 20% ($n = 43$) flossed once a day, 18% ($n = 38$) flossed once every 2-3 days, 9% ($n = 19$) flossed every 4-6 days, 12% ($n = 26$) flossed once a week, and lastly 33% ($n = 71$) flossed spontaneously.

Research Question 3

Is there a statistically significant difference in susceptibility to oral health diseases among a sample of college student's based on age, sex, year of study, or race?

Students' Perception of Susceptibility to a Disease

It is important to examine college students' perception regarding the link between oral health hygiene and susceptibility to diseases such as oral cancer, periodontal disease, and caries. The highest possible score they could have received was 9 for susceptibility to oral health diseases. The mean score for males 5.00 ($SD = 1.86$), while females had a mean score of 4.86 ($SD = 1.53$). (Please refer to Table 2). A One-way ANOVA test was

used to look at age $F(6, 207) = 1.46, p = .19$, year of study $F(6, 207) = .99, p = .43$, race $F(6, 207) = .64, p = .69$. There was not a statistically significant difference for age, year of study or race. Independent t-test was used to look at sex $t(210) = .56, p = .57$. There was not a statistically significant difference in susceptibility when comparing sex.

Research question 4

What is the correlation between a sample of college students' level of knowledge pertaining to oral health and their oral health practices?

Pearson product moment correlation was conducted to determine if students level of knowledge pertaining to oral health practices were related to oral health practices. The analysis was not significant, $r(214) = -.90, p > .05$

Research question 5

What is the correlation between a sample of college students' level of knowledge pertaining to oral health and their susceptibility to oral health diseases?

Pearson product moment correlation was conducted to determine if students level of knowledge pertaining to oral health practices were related to susceptibility to oral health diseases. The analysis was not significant, $r(214) = -.007, p > .05$

Research question 6

What is the correlation between a sample of college students' oral health practices and their susceptibility to oral health diseases?

Pearson product moment correlation was conducted to determine if students' oral health practices were related to susceptibility to oral health diseases. The analysis was not significant, $r(214) = -.090, p > .05$

Table 1

Demographic Characteristics of the Sampled Population.

		Demographic of Characteristics of Population		Statistics of Knowledge Scores	
		<i>n</i>	%	Mean of knowledge scores	Standard deviation
Sex	Overall	214		14.21	2.53
	Male	78	36.4	13.88	2.72
	Female	134	62.6	14.42	2.36
	Other	2	0.9		
Race	Caucasian	169	79	14.46	2.52
	African American	22	10.3	13.05	2.52
	Hispanic	6	2.8	14.17	1.94
	Asian	9	4.2	12.56	1.74
	Other	8	3.7	14.25	2.87
Year of Study	Freshman	116	54.2	14.2	2.62
	Sophomore	60	28	14.1	2.14
	Junior	31	14.5	14.35	2.99
	Senior	7	3.3	14.86	2.27
Age (years)	18	48	22.4	13.94	2.85
	19	88	41.1	14.58	2.21
	20	41	19.2	13.98	2.80
	21	18	8.4	14.11	2.03
	22	10	4.7	13.70	3.02
	23	6	2.8	13.67	3.72
	24	3	1.4	14.67	1.16

Table 2

Summary of Characteristics of Participants

			Mean of oral health practice s	Standard deviation	Mean of susceptibility scores	Standard deviation	Percentage of Dental visits within 6 months
Sex	Overall	214	8.81	1.92	4.90	1.66	N/A
	Male	78	8.67	2.06	5	1.86	52%
	Female	134	8.87	1.85	4.86	1.53	62%
	Other	2					
Race	Caucasian	169	8.76	1.91	5	1.69	62%
	African American	22	9	2.07	4.50	1.40	45%
	Hispanic	6	9.50	1.37	4.83	2.14	66%
	Asian	9	8.88	2.31	4.33	1.41	22%
	Other	8	8.75	1.9	4.62	1.59	63%
Year of Study	Freshman	160	8.96	1.88	4.87	1.68	64%
	Sophomore	60	8.85	1.92	4.83	1.59	63%
	Junior	31	8.19	1.92	5.29	1.79	39%
	Senior	7	8.71	2.42	4.28	1.11	29%
Age (years)	18	48	8.79	1.84	4.70	1.47	63%
	19	88	8.97	1.80	5.05	1.75	68%
	20	41	8.39	2.07	4.63	1.37	54%
	21	18	8.00	1.71	5.22	1.76	22%
	22	10	9.40	2.37	4.40	1.42	30%
	23	6	10.33	2.25	5.16	2.56	67%
	24	3	10.33	1.15	6.33	3.05	67%

Chapter 5: Discussion, Summary, Conclusions, Recommendations

Examining the differences among college students based on age, sex, race, and year of study as they relate to college students' level of knowledge pertaining to oral health, oral health practices, and susceptibility to oral health diseases found no statistically significant differences. There was a statistical significant difference in race pertaining to the level of knowledge. Furthermore, data indicated there was no correlation existing between understanding the importance of practicing good oral hygiene and the predisposition to practice good oral hygiene. Aggregate data indicated the participants possessed a moderate level of knowledge about oral health, which also reflected their predisposition toward practicing good oral health hygiene.

Discussion

There was a common theme between Langha's 2004 and this study, both conducted at a midwestern universities. Langha, 2004 concluded college students were knowledgeable about their oral health but failed to practice proper oral health practices such as flossing. Most students brushed their teeth twice a day, but did not floss their teeth on a daily basis. Similar results were found when conducting this study at a Midwestern university. Students' level of oral health practices were acceptable in brushing their teeth, but failed to floss daily. Another midwestern university also reported results that 1/3 of students flossed their teeth daily (Luebke & Driskell, 2010).

Regarding perceived susceptibility to oral health diseases, there is a possibility that participants did not find themselves susceptible to diseases like periodontal disease or oral cancer because they still think that they are young and that these diseases cannot

harm them at this age or in the near future. One limitation to findings is that participants may have never heard of the dental diseases assessed in the survey such as; periodontal disease and dental carries which may have lead the participant to indicate they were not susceptible to disease, since they may have not known the medical terminology in the dental industry.

When it came to dental visits, 52% of males visited the dentists every 6 months while 62% of females did so. These somewhat low percentages could possibly be attributed to the fact sampled students were living away from their family dentist and their parents were not around to remind them of the importance of visiting the dentist and taking care of their oral health. In addition the stress of living away from home for the first time and learning to become independent may not be a priority going to the dentist to having a check-up or even a cleaning. One more factor that could also attribute to the low percentage of dental visits is not being able to locate a dental office near the midwestern university leaving the participants to wait until they go home to their parent's house or just prolong the process of visiting a dentist.

Conclusions and Summary

The purpose of this study is to determine the knowledge, oral health practices, and susceptibility to oral health diseases. Demographic data included age, race, sex, and year of study of the participants. The data was collected using a paper and pencil survey instrument. A total of 294 students were enrolled in of five sections of Health 101 during the spring semester 2016. Of the 294 students, 223 elected to participate in the survey. The findings indicated that the knowledge portion of college students was moderate regarding their oral health knowledge. However there was not a statistically significant

difference when it came to age, sex, and year of study, but there was a statistically significant difference between the race. Additionally, in the knowledge portion a frequency count was used to determine what percentages of the questions students got the most right. Ninety-seven percent of students responded correctly that their nutrition and daily eating habits would affect their overall health. Eighty-two percent of students answered correctly that the use of chewing tobacco is not less harmful than a cigarette, but where students struggled in the knowledge portion of the surveys that only 34% of them answered correctly that carbonated beverages, foods in high in natural sugar, foods in high processed sugar, foods that are acidic, and foods that are sweet and sticky damage their teeth.

The oral health practices section examined how often students brushed and flossed their teeth. Although the practices were moderate, flossing was an issue for most of the students. Only 19% of males flossed their teeth once a day while 21% of females flossed their teeth once a day. There was not a statistical significant difference in the behaviors between sex, race, age, and year of study.

This study sought to determine if students felt like they were susceptible to periodontal disease, caries, or oral cancer. Males felt like they were more susceptible to diseases than females. Although there was not a statistically significant difference in the susceptibility between sex, race, age, and year of study.

Regarding dental visits, 52% of males reported visiting a dentist every 6 months while 62% of females reported visiting a dentist every 6 months.

Lastly, a Pearson product moments correlation looked at correlations between level of knowledge pertaining to oral health and their oral health practices, level of knowledge

pertaining to oral health and susceptibility to oral health diseases, and oral health practices and susceptibility to oral health diseases. There was not a significant correlation in any of the three categories.

Recommendation for Future Research

For future studies related to knowledge, susceptibility, and behaviors, the researcher recommends the following: since survey participants were students enrolled in Health 101, a general education, it is possible given their interest in the topic their knowledge and practice of good oral health was greater than the general student population. To mitigate this factor, different general education classes should be used to gather data in order to get a broader range of students. Examples of this include Sociology 101, Psychology 101, English 101, etc. If future studies are still interested in using the Oral Health Survey Instrument it is recommended to do a comparison between other universities to compare the results.

To more accurately measure participants' knowledge of good oral health practices, questions identifying the consumption of alcohol, energy drinks, and soft drinks should be included in the survey as well to determine if varying family income levels impact dental hygiene and behaviors. It was found that age did not matter with knowledge of oral health. Future research should attempt to ask more in-depth questions to determine what information was obtained from dental practitioners or from attending classes. Finally, a larger sample size should be taken in order to see the trends within the oral health.

This study only included students from a midwestern university which limits the generalizability of the results presented in this study; therefore, in order to make more

general statements, the study should be replicated at other universities. The results of replicated studies could identify possible changes needed to be made in the curriculum to teach students about diseases and better practices.

Future research should also not only focus on young adults who attend college, but those who do not attend college. Such data may identify patterns or trends. For example, do young adults who do not attend college have less knowledge about oral health practices than those who do attend college? This could identify potential health disparities.

Future research will also need to identify potential barriers to the practice of good oral health. One such barrier may be if students have dental health insurance and/or access to dental health care. If these factors are indeed identified as barriers to the practice of good oral health, college and universities may want to consider providing basic dental insurance to college students along with their general health insurance for those who do not have insurance. It might also be beneficial to see how many patients between ages 18-25 are actually seeing dentists and adhering to good oral health practices once they leave home. Additionally, reaching out to dentists who are willing to cooperate with universities in educating students on potential diseases can be beneficial by setting the standards and educating young adults.

Though this research was minimal with regard to participants representing various demographics, it indicates improvement in the behavioral section for flossing. Oral health is critically important to overall wellness, and society needs to better prepare people for long-term oral health. The effort should be systematic from multiple levels, including: legislators, schools, oral health professionals, health educators, and government officials.

Without proper oral health practices, deleterious effects on overall health can quickly arise and negatively impact a person's life. This research indicates a clear need for overall action to promote better oral health practices and encourage good oral health behaviors.

Recommendations for Health Education Practice

Data suggest there should be a focus on educating young adults about the benefits of good oral health practices. Introducing good oral health practices to young adults early on in their educational career can promote overall health, particularly as they age. To accomplish this it is necessary to integrate good oral health education into the health curriculum developed for high school and college students. Optimally it is best to begin teaching oral health practices to children as early as preschool age. At this young age, parents need to be actively involved in teaching their young children about the necessity to brush and floss their teeth regularly. For this study, given the diverse population of the university it is essential to direct educational efforts towards members of underrepresented and economically insecure populations to ensure they understand the importance of visiting a dentist on an annual basis.

In addition, health practitioners need to change the public perception about oral health. Many people do not consider oral health important to their overall health and fail to understand the role it plays in preventing future diseases. If health practitioners effectively communicate the importance of oral health and its impact on the body, it will encourage people to visit the dentist and thus prevent future disease. It behooves health care professionals to encourage young adults to maintain good oral health practices by brushing and flossing their teeth daily, as well as visiting a dentist for an annual check-

up. It is vital to establish a line of communication between dentists and medical doctors to ensure an individual's oral and physical health are concomitantly examine in an effort to minimize the onset of future health problems.

Once the importance of good oral health practices is established, the next challenge is to address the lack of dental insurance among the general populace. Providing affordable dental health insurance encourages people to visit the dentist and maintain good oral health. Providing dental health services on university campuses serves to improve accessibility to such services and encourages college students to visit the dentist when the need arises or for an annual check-up.

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Appendix A

Acquired Permission to use Survey



Koubaytari, Mouhamed Nour

Tue 11/4/2014, 3:06 PM

Ylanga@yahoo.com



Reply all

You forwarded this message on 11/4/2014 3:12 PM

Good evening Dr. Langha,

My name is Mouhamed Koubaytari, I am from Minnesota State University, Mankato. I was the student that called your clinic earlier seeking your permission to use your survey instrument, and if I may make some changes to it. Thank you for your time and cooperation.

Mouhamed Koubaytari

Dental Intruement from Thesis

0 1 ▾



Yunus Langha <ylangha@yahoo.com>

Tue 11/4/2014, 7:03 PM



Thanks for your mail.

What program are you studying and when do you graduate?

I grant you permission for using my Survey Instrument for your research purpose.

Good luck with you study and keep me posted with the results.

let me know if I can be of any assistance in future.

Email is the best way to reach me.

Regards,

Dr.Yunus Langha

Diplomate, American Board of Pediatric Dentistry.

Appendix B

Oral Health Survey Instrument (OHSI)

College Student Survey

Directions: Please answer each question. All responses will be kept anonymous and confidential.

- 1.) What is the **main** cause of tooth decay? (circle one only)
 - a.) Bacteria plaque present on the teeth
 - b.) Not brushing properly
 - b.) Eating sugary foods
 - c.) Not going to the Dentist
 - d.) Drinking soda's with sugar
 - e.) Weak Enamel
 - f.) Drinking soda's without sugar (diet)

- 2.) Which of the following would **prevent** your gums from bleeding? (circle one only)
 - a.) Brushing and flossing teeth
 - b.) Going to the dentist for regular checkup
 - c.) Both of the above
 - d.) Eating less sugar
 - e.) Using toothpaste containing fluoride

- 3.) Is bleeding of the gums while brushing your teeth normal? (circle one only)
 - a.) Yes
 - b.) No
 - c.) Unsure

- 4.) Can advanced periodontal disease contribute to heart disease? (circle one only)
 - a.) Yes
 - b.) No
 - c.) Unsure

- 5.) Is it normal to lose teeth as one gets older? (circle one only)
 - a.) Yes
 - b.) No
 - c.) Unsure

- 6.) How often should you visit the dentist? (circle one only)
- a.) At least once every six months
 - b.) At least once a year
 - c.) At least once every two years
 - d.) When there is real need
 - e.) Never
- 7.) If one takes proper care of his or her teeth, can they last for a life time? (circle one only)
- a.) Yes
 - b.) No
 - c.) Unsure
- 8.) My nutrition or daily eating habits affect my oral health? (circle one only)
- a.) Yes
 - b.) No
- 9.) I believe that eating or drinking any the following items **damage** my teeth. (check all that apply).
- a.) Carbonated beverages
 - b.) Foods high in natural sugars (grapes)
 - c.) Foods high in process sugar (cookies)
 - d.) Food that are acidic (organs, lemons, limes, coffee, iced tea)
 - e.) Food that are sweet and sticky (fruit rollups, raisins)
- 10.) Is the use of chewing tobacco less harmful than smoking a cigarette? (circle one only)
- a.) Yes
 - b.) No
- 11.) For what reason(s) one should go to the dentist? (Check all responses that are appropriate)
- Check-up
 - Tooth hurts, tooth ache
 - When my teeth need cleaning
 - Straightening of misaligned teeth
 - Oral sores in my mouth

Please check the appropriate box for you.	2+ times a day	Once a day	Once every 2-3 days	Once every 4-6 days	Once a week	Spontaneously
12.) How often do you brush your teeth?						
13.) How often do you use dental floss?						

Please check the appropriate box for your susceptibility of the following diseases.	I am not susceptible to this disease	I may be susceptible to this disease.	I am susceptible to this disease
14.) Periodontal Disease			
15.) Cavity			
16.) Oral Cancer			

Demographic Information: All information will be kept anonymous and confidential.
(2015 United states Census)

Age: ___ years

Sex: ___ Male ___ Female ___ Other

Year of Study: ___ Freshman (1st year) ___ Sophomore (2nd year) ___ Junior (3rd year) ___ Senior (4th year)

Race: ___ Caucasian ___ African American ___ Hispanic ___ Asian ___ Native Hawaiian ___ Other ___

When was your last dental visit? ___ Within the last six months ___ Within the past year ___ Within the past 2 years ___ It was more than 3+ years ago

Appendix C

Institutional Review Board (IRB) Approval



March 18, 2016

Dear Mark Windschitl, PhD:

Re: IRB Proposal entitled "[875171-5] Oral health knowledge behaviors of college students at a Midwestern university"
Review Level: Level [I]

Your IRB Proposal has been approved as of March 18, 2016. On behalf of the Minnesota State University, Mankato IRB, we wish you success with your study. Remember that you must seek approval for any changes in your study, its design, funding source, consent process, or any part of the study that may affect participants in the study. Should any of the participants in your study suffer a research-related injury or other harmful outcome, you are required to report them to the Associate Vice-President of Research and Dean of Graduate Studies immediately.

When you complete your data collection or should you discontinue your study, you must submit a Closure request (see <http://grad.mnsu.edu/irb/continuation.html>). All documents related to this research must be stored for a minimum of three years following the date on your Closure request. Please include your IRBNet ID number with any correspondence with the IRB.

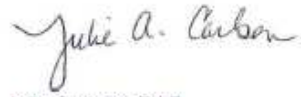
Sincerely,

A handwritten signature in black ink, appearing to read "Mary Hadley".

Mary Hadley, Ph.D.
IRB Coordinator

A handwritten signature in black ink, appearing to read "Sarah Sifers".

Sarah Sifers, Ph.D. LP
IRB Co-Chair



Julie Carlson, Ed.D.
IRB Co-Chair

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

Appendix D

Consent Form

Oral Health Knowledge and Behaviors at Midwestern University

Faculty advisor: Mark Windschitl

Student investigator: Mouhamed Koubaytari

IRBNET #: 875171

ANONYMOUS SURVEY CONSENT

You are requested to participate in research supervised by Dr. Mark Windschitl on college students' knowledge and behavior in Oral Health. This survey should take about 10 minutes to complete. The goal of this survey is to understand what college students know about their knowledge regarding oral health and their behaviors that are associated with oral health. If you have any questions about the research, please contact Dr. Mark Windschitl at mark.windschitl@mnsu.edu

Participation is voluntary. You have the option not to respond to any of the questions. You may stop taking the survey at any time. Participation or nonparticipation will not impact your relationship with Minnesota State University, Mankato. **If you have questions about the treatment of human participants** and Minnesota State University, Mankato, contact the IRB Administrator, Dr. Barry Ries, at 507-389-1242 or barry.ries@mnsu.edu.

Responses will be anonymous, and the risks of participating are no more than are experienced in daily life. There are no direct benefits to you for participating. Dental practitioners might benefit by the increased understanding of knowledge and behaviors regarding oral health in college students.

Submitting the completed survey will indicate your informed consent to participate and indicate your assurance that you are at least 18 years of age. This research presents no more than minimal risks beyond what a person would experience on a day to day basis.

Please keep this consent form for your records.

Date of MSU IRB approval: March 18, 2016