

**The Evaluation of a Dental Hygiene Education Intervention on the Oral Health Practices
and Knowledge of Residents of Kimuli Village, Uganda**

by

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Abstract

According to Muhirwe (2003), Uganda has no structured oral healthcare system which might possibly allow the citizens to acquire the knowledge and access to appropriate oral healthcare. Since Ugandan villagers have limited access to healthcare and Uganda as a country has basically unstructured healthcare, individuals within Ugandan villages may not be aware of their susceptibility to disease. Educational interventions have changed individual's attitudes and influenced practice (Brijlal & Gordon, 2005; Macnab & Kasangaki, 2012; Tapsoba, & Deschamps, 1997). There has been a lack of research and educational interventions within Ugandan villages to identify or change attitudes toward oral health and practices in personal oral health maintenance. The purpose of this study was to assess the oral health knowledge and dental health of the oral cavities of the residents of the Kimuli Village in Uganda. This study also evaluated the effects of a dental hygiene education intervention upon the currently practiced oral health cleansing methods. An oral health pretest questionnaire was administered before and after the intervention and it was based on World Health Organization criteria and provided recommended data collection methods. The oral cavities of the participants were disclosed which revealed the level of plaque biofilm on the teeth through a minimally invasive examination of their teeth. Plaque scores were recorded before and after the intervention and coded into a confidential document. The change in pre- and post-test plaque scores for this study indicated a strong positive relationship between a dental hygiene educational intervention and the level of

plaque scores in villagers of Kimuli. The findings of this study are consistent with the findings of previous studies which stressed the importance of educational intervention in order to enlighten and inform a population of the state of their health. Through the acquisition of education, the population may elect to exchange poor health habits for more favorable habits.

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CHAPTER 1

INTRODUCTION

In *Diffusion of Innovations* by Evert Rogers (1995), Rogers stated, “Getting a new idea adopted, even when it has obvious advantages, is difficult” (p. 1). Dentistry began as a humble profession where one might pull a tooth for a customer as they mentioned a toothache during their haircut (Bailey, 2003). Dentistry became a respected profession of its own and another branch of medicine and dental schools was established. Dental research was identifying bacterial theories and thus, preventive measures to prevent dental disease were also being identified. Dentists then began to realize the need additional assistance in educating the public about preventive measures and someone to work alongside the dentist to help clean teeth and prevent dental disease from progressing. As the dental hygienist position in dentistry took form and became a reality, the Theory of the Health Belief Model became a theory of importance as it implied that a person must realize their susceptibility to disease before they would become ready and willing to change (Hollister & Anema, 2004). Rogers (1995) discussed how difficult it may be to get someone to adopt an idea or innovation that is a new idea. The idea of new adoption of ideas may be increasingly difficult in the light of cultural barriers, gender inequality issues, and environmental barriers encountered especially in remote African villages.

According to the World Health Organization (WHO) (2003a), changes in lifestyles and habits have led to systemic disease and illness in most of the world. While many of these systemic illnesses are predominately found in developed countries, the rates of such illnesses are

progressively rising in underdeveloped nations (Peterson, 2004; Peterson, 2008). Further, many systemic conditions have strong connections to the presence of oral disease (Gibson-Howell, 2010). Oral disease not only has devastating effects on the oral cavity, but research suggests that the damages reach much farther into the human body and affect the general or systemic health and quality of life in affected individuals (Ehrlich, 1994; Nathe, 2011; Palmer, 2007; Peterson, 2008). The mouth may be viewed as the mirror to the rest of the body as it is a reflection of the overall health of the body (Ehrlich, 1994; Nathe, 2011; Palmer, 2007; U.S. Department of Health and Human Services, 2000). Poor oral health affects the quality of life of the individual because oral health disease such as periodontal disease and caries may lead to speech problems, the inability to chew, lack of appetite and poor self-esteem. Individuals who are most affected by the effects of poor oral health and general health are those who are of low socioeconomic status and they may encounter barriers to needed healthcare (Kelly, Binkley, Neace, & Gale, 2005).

According to Muhirwe (2003), Uganda has no structured oral healthcare system which might possibly allow the citizens to acquire the knowledge and access to appropriate oral healthcare. In the 1950s, Hockbaum fashioned the health belief model (Harris, Garcia-Godoy, & Nathe, 2014). The U.S. Public Health Service accepted the model in the 1970s. This theory stressed the importance of the learner's attitude in relation to the desire to change and adopt more healthy behavior and lifestyle (Harris et al., 2014). The theory of the Health Belief Model proposed that individuals must be educated regarding the details of possible disease and about their susceptibility to said disease through health interventions (Harris et al., 2014; Janz & Becker, 1984; Nathe, 2011; Richards & Digger, 2011). The Health Belief Model theory consists of stages the individual must progress through to adopt healthier behaviors for their lives. The stages are dependent upon each other. The first stage involves the individual's acceptance that

they are susceptible to a disease or condition. Second, the individual must acknowledge the seriousness of a disease or condition. Third, the individual must have confidence in there being an effective intervention for the disease or condition. Finally, the individual must utilize the intervention to overcome any barriers that may be preventing their acceptance of healthier behaviors or lifestyle changes (Harris et al., 2014). As the U.S. Public Health Service utilizes this theory for health interventions, this theory may also be applied in an underdeveloped nation to convey oral health education and dental hygiene interventions. According to Nathe (2011), “...when individuals have accurate information, they will make better choices including those pertaining to health” (p. 122). The four stages of the Theory of the Health Belief Model include susceptibility, serious consequences, benefit, and salience. Adults learn due to a felt need and based upon applicability to their life’s situation (Wlodkowski, 1991). It has been determined that one reason the rates of oral disease are high in underdeveloped countries is a lack of education (Keenen, 2009; Muhirwe, 2003; Peterson, 2008; WHO, 2003a). According to Muhirwe (2003), if individuals have no prior knowledge, as in the case of Uganda, citizens there may be categorized at the initial stage of the Theory of the Health Belief Model and be in great need of oral health education and dental hygiene intervention due to the fact that they are not even aware of their personal susceptibility. According to Wlodkowski (1991), adults may be educated most effectively through the identification of a problem that represents a high level of felt need.

STATEMENT OF THE PROBLEM

According to Muhirwe (2003), Uganda has no structured oral healthcare system to allow citizens the ability to acquire the knowledge and provide access to appropriate oral healthcare. Since Ugandan villagers have limited access to healthcare and Uganda as a country has an unstructured healthcare system, individuals within Ugandan villages may not be aware of their

susceptibility to disease; however, they are certainly aware of the discomfort caused by poor oral health. Educational interventions have shown to change individuals' attitudes and influence practice (Janz & Becker, 1984; Nathe, 2011; Richards & Digger, 2011). There has been a lack of research and educational interventions within Ugandan villages to identify or change attitudes toward oral health and practices in personal oral health maintenance.

PURPOSE OF THE STUDY

The purpose of this study was to assess the oral health knowledge and dental health of the oral cavities of the residents of the Kimuli Village in Uganda. This study also evaluated the effects of a dental hygiene education intervention upon the currently practiced oral health cleansing methods.

RESEARCH QUESTIONS

To accomplish this purpose, the following research questions guided the study:

1. What were selected demographic characteristics of participants in dental hygiene educational sessions in Kimuli Village in Uganda?
2. What were current practices and beliefs concerning dental hygiene held by Kimuli Villagers in Uganda?
3. What is the impact of a dental hygiene educational intervention on the oral health knowledge and behaviors of the Kimuli Villagers in Uganda?
4. What is the impact of a dental hygiene educational intervention on the plaque scores on the teeth of Kimuli Villagers in Uganda?
5. Could a predictive model be identified using selective demographics to predict plaque scores for participants?

LIMITATIONS/DELIMITATIONS OF THE STUDY

This study was conducted in a remote area in rural Uganda. This study did not include residents of Uganda outside of the Kimuli Village and was limited only to the villagers who volunteered to participate in the study. The results of this study may only be generalized to the villagers of Kimuli. Quantitative data collection through pre- and post-test questionnaires also delimits the study. Study participants self-reported their answers which may also be considered a limitation to the study. The majority of participants reported no prior dental or oral health instruction or dental experience. Prior experience with oral health instruction or prior dental experience may have impacted attitudes, behaviors, and oral health knowledge levels.

Many environmental factors may have limited this study. According to Darby and Walsh (2010), electricity, ventilation, electricity, and acoustics impact the reception of information to the learner. Another environmental consideration was the close proximity of the study participants to each other. As there were approximately five people per bench and the benches were closely placed next to each other, the assumption was made that the participants were truthful with their answers regarding their demographics and oral health knowledge and behaviors. Confidentiality may have been compromised.

Another limitation to this study was the fact that the study was conducted via a Type 4 or very basic screening. To read the plaque scores from the disclosed teeth, pen lights, flash lights, headlamps, and natural day light were used for illumination. The tongue and cheeks were retracted through the utilization of tongue blades. This type of screening may have limited the true reading of the scores, so in the future, a Type 3 examination or inspection would be recommended. To perform a Type 3 inspection, this would require dental instruments (dental

mirror and explorer) and adequate illumination. As the Kimuli Village was rural and isolated from electricity, the Type 3 inspection was not an option at the time this study was performed, therefore the study location would either have to be changed, or the Kimuli Village would need to acquire electricity before the study could be repeated.

This study may also have been limited by the fact that only 2 % of the study population did not use any method to attempt to maintain their oral hygiene. Therefore, an overwhelming majority of the study participants may have had a preexisting interest in their oral hygiene or they would not have shown up for the dental hygiene educational sessions.

For the pre-test, there were only 71 people present. As word spread throughout the village of the classes and the fact that the post-test was completed on the parents' day at the school, acquisition of data was quite difficult as there were upwards of 450 people present in the open-air church. It was raining, therefore, all parents, volunteer study participants, and all children were present during the data collection. These conditions created a chaotic environment, therefore, post-test data collection for some of the questionnaires was incomplete which may have skewed the results.

ASSUMPTIONS OF THE STUDY

There were three assumptions made from this study regarding the pre- and post-test questionnaires and the participants. First, the assumption was made that the participants answered truthfully and honestly. Second, since there was no foreseeable benefit to misreporting, the answers given by the participants were accepted as given based upon the level of the participants' knowledge. The third assumption was that the pre- and post-test questionnaires

asked the correct questions to properly assess the level of oral health knowledge and behavior of participants.

The assumption was also made that the interpreters were fluent in English. The researcher assumed that the interpreters were knowledgeable regarding all questions on the pre- and post-test questionnaires. When asked if they understood everything, they confirmed that they understood.

DEFINITION OF TERMS

Acquired Pellicle—coating of saliva origin which forms on teeth (Harris et al., 2014).

Anticipatory Guidance—oral hygiene education given to warn of potential problems that may occur systemically and orally (Wilkins, 2009).

Barriers to Care—obstacles that may make the acquisition of healthcare more difficult for people (Nathe, 2011).

Cementoenamel Junction—the point at which the enamel covering the crown of a tooth and the cementum of the tooth meet (Nield-Gehrig & Willmann, 2011).

Cervical Enamel Projections—defect of enamel which contributes to dental plaque biofilm accumulation, thereby creating an environment for periodontal destruction (Perry, Beemsterboer, & Essex, 2014)

Chemical Injuries—injury to the tissues caused by topical application of aspirin, cocaine, etc. (*Mosby's Dental Dictionary*, 2008).

Dental Caries—infectious degradation of teeth by microbial attack (Daniel, Harfst, & Wilder, 2008).

Dental Hygienist—specialist whose primary concerns include the maintenance of oral health and prevention of dental disease (Wilkins, 2009)

Dental Hygiene—occupation in which the primary focus is on the maintenance of oral health and prevention of dental disease through patient self-care and professional dental care (*Mosby's Dental Dictionary*, 2008).

Dental restorations—term given to fillings, crowns, bridges, etc. that replace lost or decayed tooth structures (*Mosby's Dental Dictionary*, 2008).

Dental Plaque Biofilm—accumulation of bacteria, food, protein from saliva, and polysaccharides on the teeth (Daniel et al., 2008).

Dental Disclosing Solution—a dye or preparation which stains dental plaque biofilm to enable it to be readily seen (Sharma, 2010).

Disclosure—full explanation of all details (Daniel et al., 2008).

Disease susceptibility—the degree to which one is prone to a disease (*Mosby's Dental Dictionary*, 2008).

Distal—surfaces of the teeth that are away from the midline (*Mosby's Dental Dictionary*, 2008).

Educational Intervention—method of education designed to stop the progression of an occurrence (Daniel et al., 2008).

Exodontics—division of dentistry focused on the extraction of teeth (Weinberg, Westphal, Froum, Palat, & Schoor, 2010).

Factitious Disease—an area of gingiva scratched or gouged away due to a patient's habits (Weinberg et al., 2010).

Flora, Normal Oral—the bacteria that are normally found in the mouth (*Mosby's Dental Dictionary*, 2008).

Gingivitis—inflammation of the gingiva that results in damage that is reversible (Nield-Gehrig & Willmann, 2011).

Health Belief Model—an assessment of perceptions of how susceptible one is to a health problem and whether one believes that recommended preventive behaviors will result in less susceptibility (Geurink, 2005).

Health Promotion—concept concerning the process of helping people and communities to gain control over their health so as to improve their health (Geurink, 2005).

Healthy People 2010—document containing health objectives disease prevention and health promotion for the nation (Geurink, 2005).

Host Factors—issues that affect one's susceptibility and resistance to disease (Geurink, 2005).

Incisal—the cutting edge of the tooth (*Mosby's Dental Dictionary*, 2008).

Index—a graduated numeric scale with upper and lower limits; scores correspond to a specific criterion for individuals or populations (Geurink, 2005; Wilkins, 2009).

Interproximal—surfaces located between the teeth (*Mosby's Dental Dictionary*, 2008).

Junctional Epithelium—gingival epithelium where the gingiva is joined to the tooth and forms the gingival sulcus (Nield-Gehrig & Willmann, 2011).

Malocclusion—misalignment of teeth that may be detrimental to the oral health of an individual (*Mosby's Dental Dictionary*, 2008).

Material Alba—whitish, soft deposits found around the cervical third of teeth which are composed of food debris, mucus, and dead tissue; it may provide a harbor for bacteria and may be indicative of poor oral hygiene (*Mosby's Dental Dictionary*, 2008).

Mesial—surface of the tooth toward the midline of the body (*Mosby's Dental Dictionary*, 2008).

Oral Cavity—another term for the structures in and around the mouth

Oral Health Education— learning directed at preventing oral disease (Geurink, 2005).

Oral Hygiene—the practice of personal maintenance of oral cleanliness (*Mosby's Dental Dictionary*, 2008)

Palatogingival Groove—developmental anomalie where a groove presents on a tooth which contributes to dental plaque biofilm accumulation (Perry et al., 2014)

Patient literacy—the ability of patients to read and comprehend medical information (Giorgianni, 1998)

Periodontal disease—state in which the gingiva, periodontal ligament, and alveolar bone which surround the teeth are inflamed (Nield-Gehrig & Willmann, 2011).

Periodontitis--bacterial infection of the mouth that causes destruction of the bone, fibers, and tissues around the teeth (Daniel et al., 2008).

Periodontium—term describing the periodontal ligament, alveolar bone, and gingiva which comprises the support system for teeth (Perry, et al., 2014)

Plaque index—uniform method used to catalog or measure the extent and whereabouts of plaque biofilm in the mouth (Daniel et al., 2008).

Primary prevention—services that aim to prevent disease before it occurs (Geurink, 2005).

Quality of life—a measure of the energy that gives one the ability to live successfully make it with the challenges of day to day life (*Mosby's Dental Dictionary*, 2008).

Risk—the likelihood that an experience will take place, although not as a result of a causal relationship (Nathe, 2011).

Risk management—proposes risks may be handled via an organized or structured manner (Geurink, 2005).

Socioeconomic status—measure of one's educational level, occupation, residence, income, and possibly ethnicity and religion (*Mosby's Dental Dictionary*, 2008).

Systemic—referring to the whole body (Daniel et al., 2008).

ORGANIZATION OF THE STUDY

The introduction of this study begins in Chapter 1 with the problem statement, research questions, limitations and delimitations of the study, assumptions, a list of defined terms found in

the study, and concludes with the organization of the study. Chapter 2 contains a review of the literature pertaining to the history of dentistry and dental hygiene, the state of oral health in Uganda, and the investigation of the proposed link between oral and systemic health. Chapter 3 contains the methods used to conduct the study including sampling methods and research questions. Chapter 4 contains the results of the study and the interpretation of the analysis of the data collected. The summary of the study, conclusions, and recommendations for future study are included in Chapter 5.

CHAPTER 2

REVIEW OF LITERATURE

The purpose of this review of literature was to examine current and historical documents that were relevant to this study. It was important to fully investigate previous work to guide this study effectively. This review of literature will include the following topics to accomplish this purpose: the history of dentistry, the history of dental hygiene, periodontal disease, adult education, oral health promotion, and Uganda.

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The History of Dentistry

The history of dentistry can be found in literature divided up into three very broad categories or periods, Antiquity, The Middle Ages, and Modern Times (Prinz, 1945). The history from the period of Antiquity is interpreted from ancient writings and artifacts from various locations including Samaria, India, Babylon, China, Egypt, Rome, Assyria, and Greece (Guerini, 1977; Lufkin, 1948; Newman, Takei, Klokkevold, & Carranza, 2012; Prinz, 1945; Ring, 1985). Toothpicks have been found dating back 3,000 years (Daniel et al., 2008). The history of dentistry has been recorded in historical documents such as the ancient Sumerian text known as the Legend of the Worm, the Agurveda text from India, the recorded laws of King Hammurabi from Babylon, and the Papyrus Ebers which were found in a tomb in Egypt (Ebbell, 1937). These ancient texts explain how the ancients viewed and treated dentally related conditions. These documents include modern day topics such as bacteria, inflammation, calculus, and even the systemic manifestation of dental disease. Cures for dental maladies were placed in the hands of priests. Pain and bodily disease was attributed to demon possession or punishment from an angry god. Priests attempted healing of the suffering person through methods which had been passed down for generations and may have included chants and incantations to the angry god to

drive out the demon. According to a cuneiform tablet inscribed by Nabunadinirbu, the god Ea was called upon to exercise the demon of the worm that caused toothache (Lufkin, 1948).

Other remedies for tooth maladies have been preserved in the Papyrus Ebers which are writings found in an ancient Egyptian tomb and were purchased by Professor Georg Ebers in 1873. Professor Ebers translated and published *The Papyrus Ebers* which included remedies for dental maladies such as mobility, calculus buildup, scurvy, ulcers and inflammation (Ebbell, 1937). Remedies for mobility in *The Papyrus Ebers* included filling the tooth with a mixture containing yellow ochre and honey. When the gingiva was found to be exuding pus, which may have been considered indicative of periodontal disease, the recommended remedy included grounding and combining a mixture which included the fruit of a sycamore, unspecified beans, and honey. Rinses for gingival ailments, treatments for ulcers, and scurvy were also described in detail in *The Papyrus Ebers*.

The early civilizations contributed to the history of dentistry through other writings such as ancient Hebrew writings known as the Talmudic writings which described the effects of periodontal disease on the gingiva, periodontal ligament, and alveolar bone (Newman et al., 2012). Periodontal effects and a focus on proper oral hygiene were also the focus of ancient medical writings of India and China as well (Newman et al., 2012). It was during this period that Hippocrates made significant contributions to medicine and dentistry. Hippocrates' profession was that of a physician, but he invented the first dentifrice for brushing teeth. Included in his writings was much discussion regarding the possibility of a link between calculus buildup, bleeding gums, and periodontal infection (Perry et al., 2014). Aristotle, who lived after Hippocrates, described scalers for calculus removal from teeth and he also hypothesized that women had fewer teeth than men (Weinberger, 1948b).

The second period, The Middle Ages includes evidence of dental intervention and illness as found in literary works and dental artifacts from locations including Naples, Italy, Paris, Bombay, and England (Prinz,1945). During this period, the dental mentality changed from “a tooth worm” infection to a more intervening approach characterized by interventions which included surgery to help alleviate disease (Newman et al., 2012). Albucasis, a twelfth century renowned Islamic surgeon, wrote a thirty volume medical encyclopedia. This encyclopedia was entitled *al-Tasrif* and it was a text used in European medical schools until the seventeenth century. According to Newman et al. (2012), Albucasis made significant contributions to dentistry and medicine. His contributions to dentistry included crafting a set of dental instruments for scaling calculus deposits, gold wire splints for mobile teeth, fillings for large cavities, and development of a theory regarding the injurious aspects of calculus formation.

Other well-known persons from the Middle Ages regarding dentistry include Paracelsus, AmbroiseParé, Bartholomeus Eustachius, Girolamo Cardano, and Anton van Leeuwenhock. They each contributed to dental history in new and unique ways. Paracelsus presented a new theory that is now known as the doctrine of calculus. The doctrine of calculus proposed that heavy calculus buildup contributed to toothaches. This theory proposed that the same type of buildup in other organs of the body probably contributed to pain in them in the same way (Newman et al., 2012). Eustachius wrote one of the first books concentrating solely on dentistry entitled *Libellus de Dentibus*, “A Little Treatise on the Teeth.” It was thirty chapters long and it included an anatomical description of the periodontal structures, disease states of the oral cavity, and recommended treatment regimens for periodontal diseases. Eustachius (1563) also recommended periodontal scaling and gingival curettage to allow the gingival tissues to reattach. Paré was a French surgeon and he also linked calculus to periodontal disease and recommended

scaling of the deposits to restore periodontal health (Newman et al., 2012). Hoffman-Axthelm (1981) also described the opinion of Magitot, a Parisian physician which named diabetes and gout as suspects as possible etiologies of periodontal disease.

Modern times brought about distinct changes in dentistry that can still be seen today. The history of dentistry in modern times may be divided into centuries. Pierre Fauchard was a famous dentist in the eighteenth century. According to Newman et al. (2012), Fauchard may be thought of as the man who helped to create dentistry as the profession it is today. He wrote a book, *The Surgeon Dentist*, which covered all aspects of dentistry from oral surgery to periodontology including the instruments and technique he used for periodontal debridement.

The nineteenth century saw much innovation in regards to oral hygiene and the responsibility of the patient (Newman et al., 2012). Some of the new recommendations that evolved in the mid-1850s included the stressed importance of calculus removal, the use of soft toothbrushes, and rinsing with medicinal mouthwash were all recommended to patients suffering from periodontal ailments (Hoffman-Axthelm, 1981). Leonard Koecker was one of the forerunners during this period. Koecker (1821) stressed the importance of brushing with a powder dentifrice mornings and after meals. He also stressed the importance of the removal of severely infected teeth to help with the overall or general health of the patient. Levi Spear Parmly earned the name “the father of oral hygiene” during this time as he invented dental floss. Other major dentistry events that occurred during the nineteenth century included the invention of local anesthesia by ophthalmologist Carl Köeller, the discovery of the germ theory of disease by Louis Pasteur, and the discovery of radiographs by a German physicist, Wilhelm Röntgen. It was also during this period that the true study of periodontology occurred. According to Newman et al. (2012), credit was given to Adolph Witzel for the identification of bacteria as the

etiologic agent in periodontitis. In the mid to late nineteenth century, thirteen dental schools were established, but not all of them continued. The leaders of dentistry during this century requested more formal training, but they had a difficult time gaining the respect of the medical community (Daniel et al., 2008) (see Figure 1).

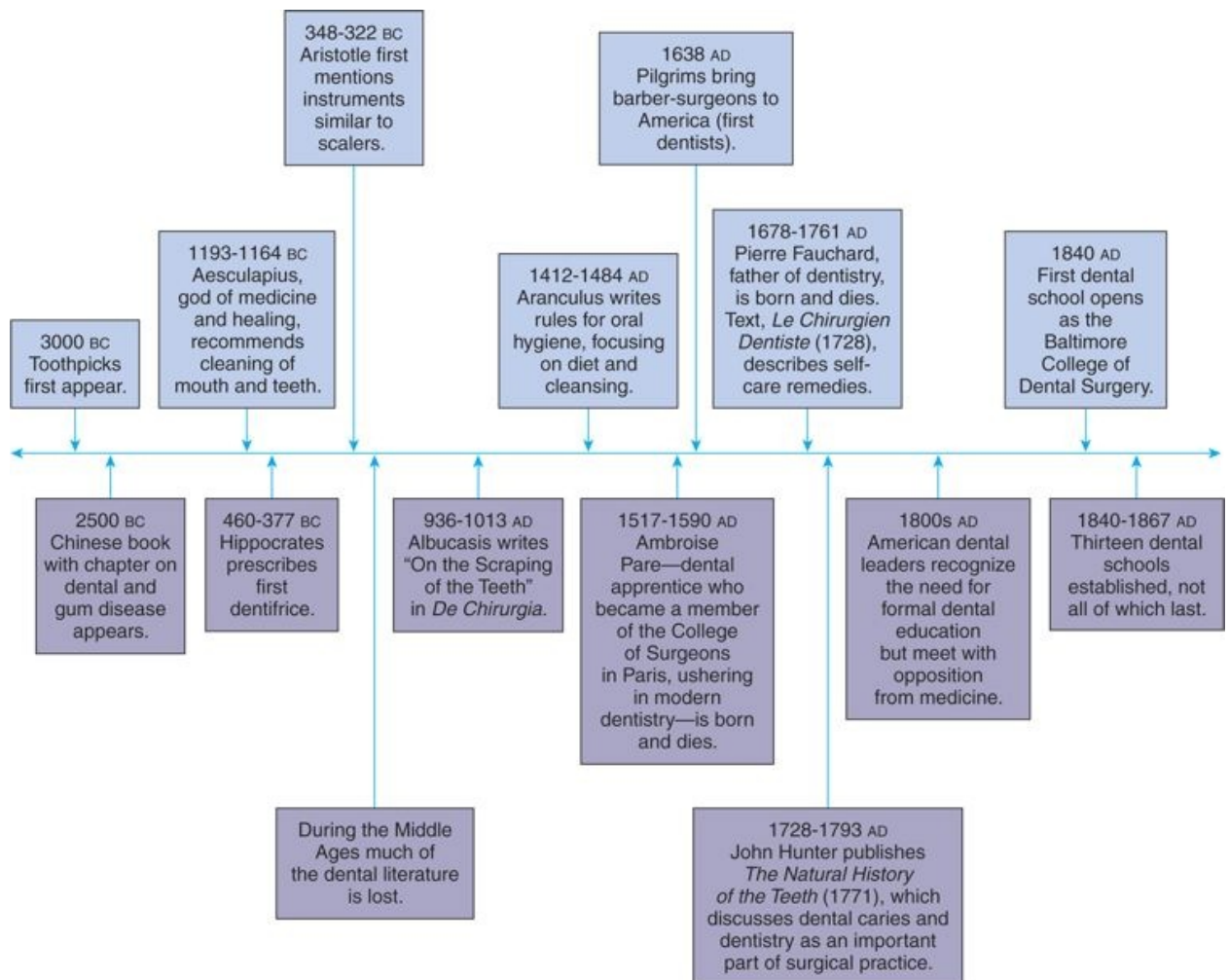


Figure 1. The history of dentistry demonstrated in timeline fashion from antiquity through 1867 which is the time of the establishment of the first dental schools. (Daniel et al., 2008).

The twentieth century saw much change and growth in dentistry as schools for dentistry were established. This was a change as dentistry had been seen as a secondary profession for barbers and not as another branch of medicine. As dentistry developed as a branch of health, the

change in the oral health of citizens of the world began to change. As evidenced by the archeological findings of ancient remains, dentistry had existed in the world in some form since ancient times (Perry et al., 2014; Prinz, 1945; Ring, 1985). Throughout the ages, literature has identified oral maladies, their etiologies, cures, and effects on the body. Thus dentistry has evolved in developed countries in such ways that the oral health and general health has improved for citizens in these more developed parts of the world (Harris et al., 2014; Nathe, 2011, Perry et al., 2014). This development may be due to the oral-systemic link, which still remains a heavily researched issue presently.

The idea of the oral-systemic link has been a subject of interest since antiquity (Newman et al., 2012). The ancient Babylonians believed that there was a “tooth worm” that infected the oral cavity, and thus the body (Lufkin, 1948; Weinberger, 1948a). The legend of the tooth worm has lasted throughout centuries. It was believed that the worm was a demon that infected the body. The tooth worm chewed at the tooth from the inside out and it was believed that it must be destroyed. According to the philosopher Empedocles, the body was thought to be made up of four elements which included blood, phlegm, and yellow and black bile (Weinberger, 1948a). It was believed that the blood, systemic in nature, contained the “poison” of illness and by draining some of it from the body, the body was ridded of poisons that caused illness. Therefore, this theory led to the idea of bloodletting which was practiced for centuries, even in Colonial America and the symbolism still exists today as evidenced by the barber poles at some barber shops (Daniel et al., 2008; Perry et al. 2014; Prinz, 1945; Ring, 1985, Weinberger, 1948b). Historically, barber shops were operated by barber-surgeons whose job descriptions included hair treatments, facial shaving, bloodletting, and tooth extractions. Bloodletting is still practiced in sub-Saharan Africa. It has little to no value or could even be harmful, yet it is still practiced

there as it has been practiced in the world for centuries (Chap-Jumbo, 2008; Daniel et al. 2008; Perry et al. 2014; Prinz, 1945; Ring, 1985; Weinberger, 1948b). The barber pole is a present day reminder of the beginnings of dentistry as the colors symbolize blood from procedures, white for clean bandages, and the bowl on the bottom symbolized the receptacle that was to contain the blood. Since many people in the medieval days were illiterate, the barber pole was a sign representing or advertising a place of available health care (Bailey, 2003).

The systemic link has been sought for years and hypothesized in many theories, one of them being the theory of focal infection (Newman et al., 2012). The concept of focal infection or the spreading of infection from one area to other organs or systems in the body is a longstanding concept (Carranza & Shklar, 2003; Miller, 1891). Since ancient times, the idea that infection could start in one area of the body and spread to other parts of the body or other organs has been a topic of discussion amongst medical and dental practitioners (Carranza & Shklar, 2003; Smith, 1952). The teeth and the mouth easily manifest localized pain and discomfort when infection is present. Because of this, the concept of focal infection resulted in many teeth being extracted. Through extraction, it was thought that the infection and resulting pain would be removed from the body, and therefore the body may be restored to health. However, the extraction of teeth could create more disharmonies for the mouth and the body. Extraction could result in occlusal problems such as teeth drifting out of their normal alignment in the mouth which creates unharmonious occlusal relationships. Another problem with extractions is that they may eventually lead to a partially edentulous state or even edentulism which could result in a reduced quality of life for an individual as oral habits such as eating and speaking could become more difficult and esthetics are now affected (Carranza & Shklar, 2003; Ehrlich, 1994, Nathe, 2011; Palmer, 2007; Peterson, 2008). The theory of focal infection was proven to be wrong as cases of

periodontal infections were treated by extraction of all teeth did not lead to the elimination of other systemic problems the patient was suffering from (Newman et al., 2012). As years progressed, it was later found that there was another option besides extracting the infected teeth. Affected teeth could be restored to health and thus maintain the dentition and the quality of life of the individual. The restoration of teeth allows the mouth to regain occlusal harmony and help to rid the body of the resultant bacterial infection (Carranza & Shklar, 2003).

According to the World Health Organization (WHO) (2003a), changes in lifestyles and habits have led to systemic disease and illness in most of the world. While many of these systemic illnesses are predominately found in developed countries, the rates of such illnesses are progressively rising in underdeveloped nations (Peterson, 2008). Further, many systemic conditions have strong connections to the presence of oral disease (Elter, Champagne, Offenbacher, & Beck, 2004). Oral disease not only has devastating effects on the oral cavity, but research suggests that the damages reach much farther into the human body and affect the general or systemic health and quality of life in affected individuals (Carranza & Shklar; 2003; Ehrlich, 1994; Frisbee, Chambers, Frisbee, Goodwill, & Crout, 2010; Nathe, 2011; Palmer, 2007; Peterson, 2008). The mouth may be viewed as the mirror to the rest of the body as it is a reflection of the overall health of the body (Ehrlich, 1994; Nathe, 2011; Palmer, 2007; U.S. Department of Health and Human Services, 2000). Poor oral health affects the quality of life of the individual because oral health disease such as periodontal disease and caries may lead to speech problems, the inability to chew, lack of appetite and poor self-esteem. Individuals who are most affected by the effects of poor oral health and general health are those who are of low socioeconomic status and they may encounter barriers to needed healthcare (Carranza & Shklar; 2003; Ehrlich, 1994; Nathe, 2011; Palmer, 2007; Peterson, 2008). Therefore, as suggested by

Frisbee et al. (2010), the dentist and dental hygienist comprise an essential component of the healthcare system.

The History of Dental Hygiene as a Profession

As dentists transitioned their approach to taking care of the mouth from one of removing teeth to one of maintenance and prevention, the concept of the dental hygienist was conceived. As Levi Parmly published *A Practical Guide to the Management of the Teeth* in 1819, he exposed the public and the dental community to the concept of daily oral hygiene consisting of brushing, flossing, and toothpaste as a way to maintain and prevent disease in the mouth (Darby & Walsh, 2010; Parmly, 1819). Dental hygiene education began around 1900 in the United States after forerunners such as John W. Riggs, D. D. Smith, R. B. Adair, and W. J. Younger, and Alfred C. Fones began to transition dentistry from a surgically oriented profession to one in which the focus was on oral cleanliness to prevent disease (Daniel, 2008, Fones, 1912; Nathe, 2011; Newman et al., 2012; Riggs, 1999). In the early 1900s, Dr. Alfred C. Fones trained the first dental hygienist, Irene Newman. Newman was Fones' dental assistant (Daniel et al., 2008; Darby & Walsh, 2010; Harris et al., 2014; Nathe, 2011). Women began receiving formal schooling and training around 1900. They were trained as dental nurses with their educational focus being the oral health of children in schools (Motley, 1986; Rhein, 1903; Wright, 1902). Trained dental hygienists were also hired by factories. The first dental hygiene school was opened in 1913 in Bridgeport, Connecticut (see Figure 2). Dental hygiene school has evolved over the years. No longer are dental hygienists called dental nurses and they no longer wear nursing uniforms and caps or stand to clean teeth (Carranza & Shklar, 2003; Nathe, 2011; Perry et al., 2014), but they are still educated regarding the same basic subjects which include histology, oral anatomy, head and neck anatomy, and even inflammation and the study of

deposits on the teeth (Bunting, 1957; Darby & Walsh, 2010; Fones, 1921). However, in spite of all of the progress that has been made in more developed countries of the world, there is still poor oral health in many parts of the world.

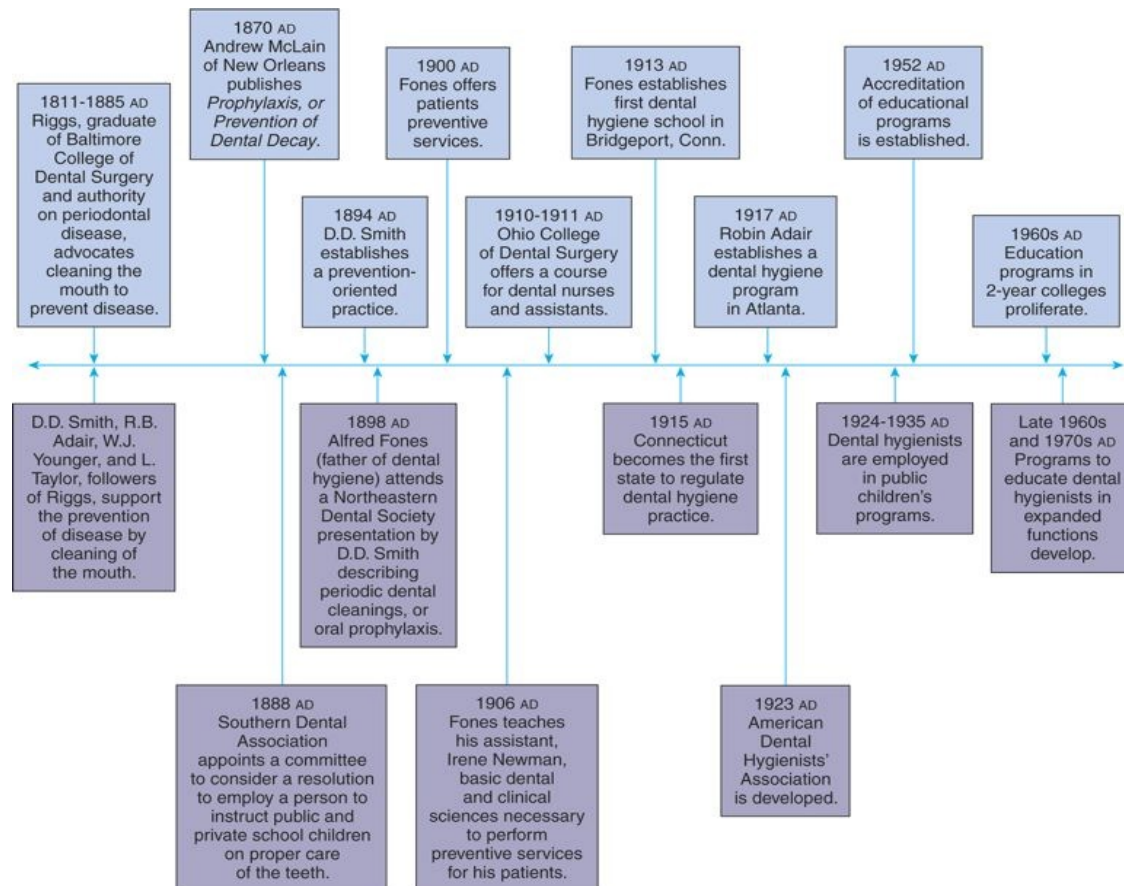


Figure 2. The history of dental hygiene demonstrated in timeline fashion from antiquity through 1867 which is the time of the establishment of the first dental schools (Daniel et al., 2008).

The dental hygienist may perform one or more of the five major roles of the dental hygienist in the field of dentistry (Darby & Walsh, 2010; Nathe, 2011) (see Figure 3). In the past, the career path of a dental hygienist was primarily one of private practice in a dental office, but today, a hygienist may be found employed as an independent employer and practitioner, working in public health, working as representatives for dental supply companies, and working for

consulting firms (Darby & Walsh, 2010). The five major roles include clinician, educator, administrator or manager, advocate, and researcher (see Figure 3).

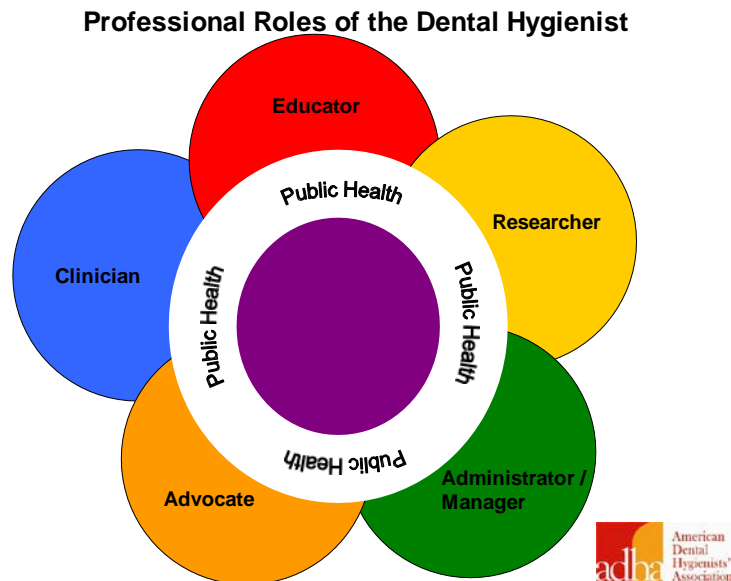


Figure 3. The five major roles of the dental hygienist include clinician, educator, administrator or manager, advocate, and researcher (ADHA, 2012). Reprinted with permission.

For a dental hygienist, the role of clinician involves the assessment of the whole patient. The dental hygiene clinician approaches each patient in a series of five steps which include 1) assessment of risk factors, signs and symptoms of any oral disease, 2) constructing a dental hygiene diagnosis, 3) treatment planning, 4) implementation of the proposed treatment plan, and 5) evaluation of the provided dental hygiene treatment (Nathe, 2011). The dental hygiene clinician's responsibilities include the provision of oral hygiene education, preventive care, and therapeutic care. The laws and statutes of states and provinces regulate and guide the dental hygienist's scope of practice (Geurink, 2005). In general, the dental hygiene clinician may assess the patient's medical and dental history, perform extra- and intraoral examination, complete dental and periodontal examinations, expose necessary radiographs, assess the patient for risk

factors for caries via nutritional counseling and disclosants, provide oral hygiene instructions, deplaque and debride the entire mouth, take impressions, and place sealants. Where the statutes and laws allow it, dental hygiene clinicians may administer local anesthesia and nitrous oxide-oxygen, remove periodontal sutures, and even restore teeth (Darby & Walsh, 2010).

Dental hygienists are oral health educators of both individuals in a private practice and of the community in a community setting. According to Croffoot, Bray, Black, and Koerber (2010), “Education of individuals of groups is a primary role of dental hygienists” (p. 57). In the role as an educator, the dental hygienist may find employment in private dental practices, public health centers, school programs, as faculty in dental hygiene and dental schools. The dental hygiene educator must be able to effectively communicate and motivate the student whether the student is found in the classroom or the dental chair. The dental hygiene educator should be able to encourage the patient that demonstrates good oral hygiene as well as educate and motivate the patient with oral disease.

As an administrator or manager, the dental hygienist may find employment in community based settings, in dental or dental hygiene schools, private dental practices, state dental health programs, or in other avenues of oral health industries (Darby & Walsh, 2010). The dental hygiene administrator may be in charge of guiding others in the work place. The dental hygiene administrator generally has an advanced degree and helps with organization, making decisions, directing staff, coordination and planning. This line of work may also allow the hygienist to find employment in private companies or they may even work as college deans and associate deans (Geurink, 2005).

The role of the dental hygiene advocate is vital for the representation of underserved populations. This role allows the hygienist to advocate for the patient and to help foster change where needed in the health care system. Also, when patients need help understanding recommended treatment or procedures and help connecting with recommended referrals to physicians or other dental professionals, the dental hygiene advocate is ready and able to assist them.

The role of the dental hygienist as a researcher is also important (Nathe, 2011). Dental hygienists learn in dental hygiene school how to research and provide evidence based treatment to their patients. Through this learning, hygienists are inspired and trained to be lifelong learners so that they may stay current with technology and dental hygiene clinical care products and procedures thus providing their patients with the best care possible (Darby & Walsh, 2010). Some dental hygiene researchers may focus on research throughout their career. This focus helps to make certain that current evidence based treatment options are provided for patients (Nathe, 2011).

Periodontal Disease

Periodontal disease is a contagious bacterial infection which results in destruction of the periodontium (Daniel et al., 2008; Darby & Walsh, 2010; Newman, Takei, Klokkevold, & Carranza, 2012; Perry et al., 2014). According to Chapple (2009), 15 percent of the world suffers from periodontal disease. Although systemic disease alone does not cause periodontal disease, many factors may contribute to dental plaque biofilm retention which may result in inflammation of the periodontium which may increase the likelihood of periodontal disease development (Chapple, 2009; Christersson, Grossi, Dunford, Machtei, & Genco, 1992; Cutler, Wadfy, Ghaffar, Hosni, & Loyd, 1994; Page, 1998). Local irritating factors may include dental calculus

or the presence of anatomic factors such as cervical enamel projections and palatogingival grooves. Iatrogenic factors such as faulty restorations, exodontics, or orthodontics may contribute to dental plaque accumulation (Papapanou, 1996). Traumatic factors such as toothbrush abrasion, factitious disease, food impaction, chemical injuries, malocclusion, and oral piercings may contribute to environments in which the potential for periodontal disease progression may be increased.

The oral-systemic connection has been a topic in the literature for many years (Carranza & Shklar, 2003; Weinberg et al., 2010). Literature indicates a possible connection between periodontal disease and systemic disease (Carranza & Shklar, 2003; Frisbee et al., 2010; Newman et al. 2012; Perry et al., 2014; Weinberg et al., 2010). Such diseases may include diabetes mellitus, coronary heart disease, respiratory disease, pre-term, low-birth-weight babies and Alzheimer's (Chapple, 2009; Frisbee et al., 2010; Galea, Aganovic, & Aganovic, 1986; Jeffcoat et al., 2003; Lopez, Smith, & Gutierrez, 2002; Michalowicz et al., 2006; Offenbacher et al., 1996; Page, 1998; Safkan, -Seppälä, & Ainamo, 1992). According to Carranza and Shklar (2003), one of the first studies investigating periodontal disease and the possible relationship to heart attack and stroke was conducted in 1989 by Mattila, Nieminen, Valtonen, Rasi, Kesäniemi, Syrjälä, Jungell, Isoluoma, Hietaniemi, Jokinen, and Huttunen. Mattila et al. (1989) completed two case control studies that provided results that may have indicated an oral-systemic connection. According to Arbes, Slade, and Beck (1999), one in five deaths in America may be attributed to coronary heart disease and periodontal disease may be associated with coronary heart disease. Frisbee et al. (2010) suggested some factors associated with periodontal disease that may contribute to the development of coronary heart disease include the presence of the abundant accumulation of periodontal pathogens, high levels of c-reactive proteins and

interleukin-6, and elevated systemic biochemical mediators or inflammatory markers that are released by the body when pathogenic bacteria invade the body (Iacopino, 2001). The release of the above mentioned mediators is a result of the body's host response to inflammation (Iacopino, 2001; Nield-Gehrig & Willmann, 2011; Perry et al., 2014). In 1996, Beck, Garcia, Heiss, Vokonas, and Offenbacher stated, "It is our central hypothesis that periodontal diseases, which are chronic gram-negative infections, represent a previously unrecognized risk factor for atherosclerosis and thromboembolic events" (p. 1123). According to a study by Galea et al., (1986), diabetics who are insulin dependent may develop calculus and experience exacerbated periodontal pockets than other individuals of similar ages in the general population. Treatment of periodontal disease may help reduce the severity and outcomes of systemic disease (Arbes et al., 1999; Nield-Gehrig & Willmann, 2011). One such treatment still under consideration is the use of bisphosphonates for the treatment of periodontal disease (Almazrooa & Woo, 2009; Nield-Gehrig & Willmann, 2011). There are presently no bisphosphonate regimens being prescribed specifically for the treatment of periodontal disease, however bisphosphonates have been utilized to treat osteoporosis for years (Nield-Gehrig & Willmann, 2011). It has been suggested that bisphosphonates may prevent some loss of alveolar bone in periodontal disease (Almazrooa & Woo, 2009).

Loe (1993) suggested that diabetic persons had more incidence and severity of periodontal disease and that periodontal disease was the sixth complication of diabetes. According to Nield-Gehrig and Willmann (2011), there appears to be a bidirectional relationship between periodontitis and diabetes. First, diabetic persons have trouble regulating their glycemic control which makes their bodies more susceptible to infection and second, periodontitis is an infection which may cause the body to become resistant to the proper workings of insulin.

According to Mealey and Oates (2006), in the past 50 years, there has been over 200 articles published regarding this oral-systemic link.

Since the early 1960s, research articles have been published that suggest an oral-systemic link to osteoporosis and periodontal disease. According to Daniell (1983), although the oral-systemic link has been suspected, it had not been presented in medical or dental textbooks. Since then, studies have been conducted that suggest that the link may exist and this research has made it into textbooks where the various systemic diseases and their potential links to oral health and the treatment for maintenance and prevention of periodontal diseases are discussed at length now (Newman et al., 2012; Nield-Gehrig & Willmann, 2011; Perry et al., 2014; Weinberg et al., 2010). It is now thought that the “periodontal-related systemic inflammation may begin before the onset of clinical disease with poorer oral dental hygiene” (Frisbee, et al., 2010).

The treatment of oral disease may be the most identifiable portion of the dental hygienist’s jobs to the dental patient (Darby & Walsh, 2010). The treatment portion is only one aspect of the dental hygiene treatment plan created for a patient. According to Frisbee (2010) the effective dental hygiene treatment could lead to decreased inflammation and improved periodontal health and less systemic inflammation and a lowered risk for systemic diseases. According to Perry et al. (2014), the dentist and dental hygienist have important roles in the treatment and maintenance of a patient’s oral disease, but if the patient does not participate and fulfill their obligation in the dental hygiene treatment plan, no matter the quality of the treatment given by dental professionals, the patient’s oral disease will most likely worsen. According to Becker and Maiman (1980), patient cooperation may be the most important and most difficult barrier a practitioner faces in influencing patients to accept treatment recommendations.

The prevention of oral disease is accomplished by the dental hygienist through the planned avoidance or elimination of the causative factors of oral disease. This planned prevention of oral health may occur in three levels: primary prevention, secondary prevention, and tertiary prevention (Darby & Walsh, 2010).

Primary prevention of oral disease encompasses a large amount of time with the patient as it focuses on various strategies implemented to change the outlook patients may have on various life activities or habits (Darby & Walsh, 2010). Examples of these strategies include tobacco cessation, nutritional counseling for the prevention of dental caries, and making mouth guards for athletes to help prevent oral injury due to sports participation. Nutritional counseling is of utmost importance as it may contribute to the breakdown of the periodontium and the development of periodontal diseases (Crandon, Lund, & Dill, 1940).

Secondary prevention of oral disease includes the dental hygienists' identification of oral disease in its incipient stages so as to prevent its progression. Oral hygiene education falls into this level of disease prevention. As Ben Franklin once said, "An ounce of prevention is worth a pound of cure." Other activities that might be instigated during the secondary phase include desensitizing agents to enable the patient to adequately clean all tooth surfaces and individualized oral hygiene instructions for the patient who may be suffering from the early stages of gingivitis (Darby & Walsh, 2010).

The third level of oral disease prevention may be labeled the tertiary level. At the tertiary level, the dental hygienist may intervene to restore the oral cavity to full function or to prevent further destruction or loss of function of the periodontium. The primary way in which the dental hygienist operates in the tertiary level of disease prevention is through the completion of

periodontal debridement or nonsurgical periodontal therapy. The success of all forms of treatment, primary, secondary, or tertiary may be determined through evaluation (Nathe, 2011). This evaluation may occur in private practices at recall appointments or in public health programs in clinical or nonclinical settings.

For evaluating the effectiveness of a public health program, evaluations may be performed in clinical or nonclinical settings. Nonclinical evaluations may be accomplished via methods including surveys, interviews, direct observation, document analysis, or focus groups. Clinical evaluation methods include basic screenings and epidemiological examinations (Nathe, 2011). There are four levels or types of clinical examinations that may be undertaken to assess the effectiveness of a public health program. Clinical exams range from very basic to comprehensive. Type 1 is called a complete examination and may be accomplished through the use of dental instruments, a dental mirror, a dental light, complete radiographs, and dental indices to acquire epidemiological data. Type 1 is an examination that is comprehensive and is indicative of the examination one would receive at the dental office and it is not typically used for public health programs. A Type 2 examination is identified as a limited examination utilizing a dental mirror, a dental explorer, limited radiographs, and some form of lighting. A Type 3 examination is identified as an inspection and is performed through the use of a dental mirror, a dental explorer, and some form of lighting. This type of examination is commonly used in public health. A Type 4 screening is a basic screening and it is accomplished through the use of a tongue depressor and whatever light is available. This type of screening, which was used in this study, may commonly be used in remote areas, villages, or communities where electricity and modern amenities are scarce or unavailable. Screenings of any type are often paired with dental indices which allow for epidemiological data collection and analysis.

Dental indices may be utilized to acquire and analyze epidemiological data regarding many oral health conditions (Nathe, 2011). According to Darby and Walsh (2010), a dental index is a tool used to collect data and convert clinical observations to numeric values that can be “quantified, summarized, analyzed, and interpreted” (p. 279). To be considered an effective dental index, the index must meet the following criteria: be simple to use, cause the participant no discomfort, not require huge time commitments to acquire data, not require huge amounts of money or equipment to perform, be valid and reliable, and allow the transfer of clinical observations to quantitative data (Darby & Walsh, 2010; Nathe, 2011). Other important functions of dental indices are to aid in patient education regarding their personal oral hygiene performance and documentation of patient oral healthcare progress (Daniel et al., 2008). Dental indices cover many oral conditions including caries experience, decayed, missing, or filled teeth, dental plaque biofilm accumulation, gingival bleeding, root caries experience, fluorosis, malocclusion, and periodontal bone loss (Daniel et al., 2008; Nathe, 2011). There are several different indices dedicated to the identification of dental plaque biofilm and soft deposits on the teeth (Daniel et al., 2008).

One such oral hygiene index that utilizes disclosants to aid in the analysis of the amount of dental plaque biofilm present in a patient’s mouth is the Patient Hygiene Performance (PHP). The PHP was developed in 1968 by Podshadley and Haley as a tool for dental students at the University of Kentucky to evaluate their performance with their oral hygiene instruction during patient education. The development of the PHP came as a follow-up to the simplified oral hygiene index (OHI-S), which was developed in 1964 by Vermillion and Greene, as a more simple and accurate index for the measurement of dental plaque biofilm (Daniel et al., 2008; Darby & Walsh, 2010; Perry et al., 2014; Podshadley & Haley, 1968; Wilkins, 2009). The PHP

is used to identify how much dental plaque biofilm and material alba may be present on six teeth in the mouth and the examination proceeds in the following order: the facial surfaces of the maxillary right first molar (#3), the maxillary right central incisor (#8) and the maxillary left first molar (#14). The examination then proceeds to the mandible where the lingual surfaces of the following teeth are evaluated: the mandibular left first molar (#19), and the mandibular left central incisor (#24), and the examination concludes with the mandibular right first molar (#30) (Darby & Walsh, 2010; Podshadley & Haley, 1968). Substitutions are made if the specified tooth happens to be missing, been crowned, be partially erupted, or decayed severely. The second molar may be substituted for the first molar and if the second happens to be unusable, the third may be substituted. In the case that there are no molars present, an M may be indicated on the chart for missing. For the central incisors, if the central incisor indicated is missing, the adjacent central may be substituted. If there are no centrals present, an M may be indicated on the chart for missing.

The indicated tooth is conceptually divided into five divisions by the dental hygienist. The middle third of the tooth makes up the first three divisions of the index. The middle third from the gingival margin to the incisal edge is divided vertically into three sections, cervical, middle, and incisal. The remaining mesial and distal interproximal portions of the tooth make up the fourth and fifth divisions of the index (see Figure 4).

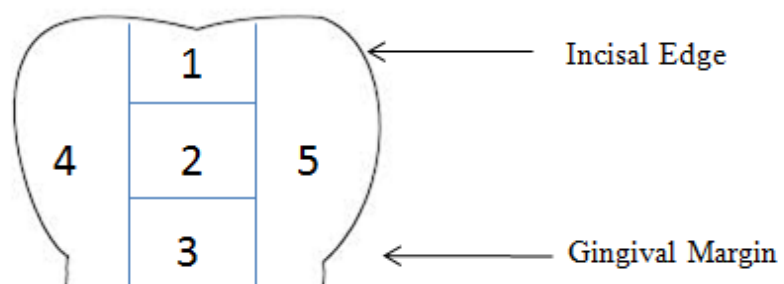


Figure 4. The five divisions of a tooth crown utilized to quantify a plaque score after disclosing.

After the teeth have been disclosed, each division is visually inspected. Dental plaque disclosing agents are solutions, lozenges or tablets that are used to dye plaque on the teeth so that it shows up in sharp contrast to gingiva (Darby & Walsh, 2010). As dental plaque biofilm is generally almost invisible except when stained by food or drinks, disclosants make existing deposits readily visible (Daniel et al., 2008; Darby & Walsh, 2010; Wilkins, 2009).

Dental disclosing agents will not adhere to clean tooth surfaces, so through the use of dental disclosing solutions on the teeth, both the practitioner and the patient are enabled to easily identify the extent of dental plaque biofilm present on the teeth (Daniel et al., 2008; Sharma, 2010; Wilkins, 2009). This ease of visibility can be an important motivational teaching tool to be used with the patient (Daniel et al., 2008; Darby & Walsh, 2010; Sharma, 2010; Wilkins, 2009).

The PHP allows the patient to easily understand if their oral hygiene has improved or gotten worse since the last visit. For the PHP, if there is no dental plaque biofilm present after disclosing, the division is given the score of zero; if dental plaque biofilm is present, the division is given a score of 1. The score for each tooth could total a maximum of five points per tooth. The scores for all six teeth are then added together and then divided by the number of teeth examined to get the debris score for that patient (Darby & Walsh, 2010; Nathe, 2011; Podshadley & Haley, 1968; Wilkins, 2009). Scoring is as follows: 0.0 is excellent, 1.7 good, 1.8-3.4 fair, and 3.5-5.0 poor (Darby & Walsh, 2010; Nathe, 2011; Wilkins, 2009).

Disclosing solution was first utilized by Skinner in 1914 when he used it as an educational tool with patients regarding their oral home care (Sharma, 2010; Wilkins, 2009). At that time, the connection between dental plaque and gingivitis had not been proven. According to

Sharma (2010), it would be 50 years before the connection between dental plaque and gingivitis would be made.

Iodine had been used for years as an antiseptic and antibacterial preparation for wounds and tissues (Darby & Walsh, 2010; Sharma, 2010). The tissue was dyed when it came into contact with the first dental plaque disclosing agents that were made from iodine. Iodine was replaced by a more natural type of dye partially due to undesirable side effects caused by the iodine and its unpleasant taste (Sharma, 2010; Wilkins, 2009). The dental plaque disclosing solutions that followed were made from mercurochrome, Bismarck brown, merbromin, erythrosine, fast green, fluorescein, two tone solutions, and basic fuchsin (Sharma, 2010; Wilkins, 2009). The new two-tone solutions act to stain old dental plaque biofilm blue and newer dental plaque biofilm red so the patient may be able to easily distinguish between dental plaque biofilm that has been missed for a long period of time as they have tried to clean their mouth (Daniel et al., 2008; Sharma, 2010; Wilkins, 2009). The most commonly used disclosant dye presently utilized in dentistry is erythrosin dye (Daniel et al., 2008; Darby & Walsh, 2010). Disclosants may also be prepared at home using food dye diluted with water applied to the teeth with a cotton swab (McCarron, 2010).

Disclosants are available over the counter and may be purchased in tablet, lozenge, or liquid forms (Harris et al., 2014; Newman et al., 2012; Wilkins, 2009). The agents that stain plaque should stain brightly, yet only remain in the mouth temporarily. However, they should have the substantivity to remain on the plaque long without rinsing off quickly. The taste of disclosants should not be unpleasant to further encourage their usage. The agents also should not be irritating to tissues in the mouth (Harris et al., 2014; Wilkins, 2009).

Dental plaque disclosing agents are an educational tool used by practitioners in a variety of ways. One of the main ways these agents are used is to help individualize oral hygiene instruction for patients. When a patient can see the areas missed by their usual oral hygiene routine, they are able to make the necessary modifications for a cleaner mouth (Harris et al., 2014). Many practitioners may send dental disclosing tablets home with patients so they may personally evaluate the effects of their oral health routine. Dental plaque disclosing agents may also be used as motivational educational tools to help both the practitioner and the patient to see the continual personal oral care progress made at routine recall dental appointments or dental maintenance appointments for periodontally involved patients. As dental plaque biofilm is exposed in a person's mouth, they realize they have a potentially infectious disease causing agent living in their mouths, thus their susceptibility to disease becomes a reality. Another area of use for the disclosant is the area of research. Disclosants are often used for dental plaque biofilm identification for dental indices (Darby & Walsh, 2010; Sharma, 2010). For research purposes, the disclosant may aid to study the frequency and development of dental plaque biofilm and calculus and the efficiency of the usage of the patients' oral hygiene aids. Disclosants may also help to determine the effectiveness of oral hygiene group educational instruction programs (Daniel et al., 2008; Wilkins, 2009). As disclosants are used, the health or disease state of the periodontium may be revealed (Wilkins, 2009).

The periodontium, or structural parts of the teeth in the mouth may be found in one of three states which are health, gingivitis, or periodontitis. A healthy periodontium may be characterized by the junctional epithelium being coronal to the cemento-enamel junction on the tooth, intact connective tissue attachment, periodontal ligament fibers attached to alveolar bone, and intact supportive and protective alveolar bone. In the gingivitis state, the junctional

epithelium is still located at the cementoenamel junction, but the intercellular junctions are widened, the connective tissue is damaged, and both the periodontal ligament fibers and alveolar bone are still in good shape. It is when the periodontium reaches the state of periodontitis that things begin to change drastically. In gingivitis, inflammation, erythema, and edema of tissues are reversible, whereas in periodontitis the damage that occurs is not reversible. In periodontitis, the junctional epithelium drifts apically to the cementoenamel junction, connective tissue fibers and periodontal ligament fibers begin to be destroyed, and alveolar bone is destroyed (Nield-Gehrig & Willmann, 2011). This destruction could possibly lead to tooth mobility or even tooth loss if the destruction is left to progress without intervention (Nield-Gehrig & Willmann, 2011) (see Figure 5). This destruction is a result of the host, or the body's reaction to the infection caused by the bacterial assault on the periodontium (Chapple, 2009; Perry et al., 2014).

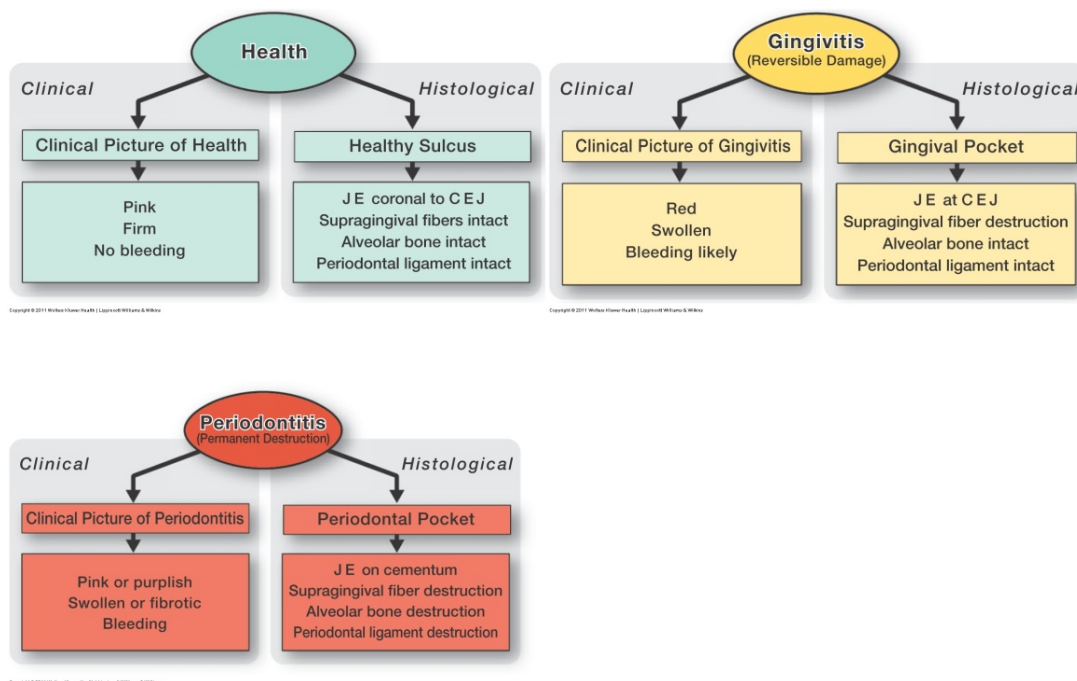


Figure 5. The three states in which the periodontium may be found: health, gingivitis, and periodontitis (Nield-Gehrig & Willmann, 2011).

Oral infection can lead to a general degradation of the health of an individual. For infectious disease to occur, sequential steps of progression must take place (Miller & Palenik, 2010). In order for one to be susceptible to infection, there is a chain of infection that must be complete (see Figure 6). There must be a microorganism that is virulent enough to be infectious. The microorganism must be present in large enough numbers to overcome the immune system of the host. The immune system of the susceptible host must be low enough so that it may be overcome and unable to fight off the infective microorganism. The last link in the chain of infection is a portal of entry. There must be a convenient way for the virulent, infectious microorganism to enter the susceptible host. Pathogens may be bloodborne or airborne. If pathogens are bloodborne, they must enter the body through the bloodstream via an open wound or a needle stick. If pathogens are airborne, they enter the body through the mouth or nose through the mucous membranes (Bird & Robinson, 2012).

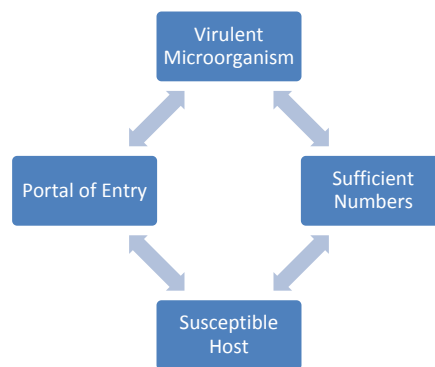


Figure 6. The Chain of Infection. Adapted from Bird and Robinson, 2012.

To break this chain of infection, dental healthcare workers must practice standard precautions which means that nonintact skin, mucous membranes, and all bodily fluids except sweat are treated as infectious, therefore, techniques to reduce the likelihood of disease transmission are limited through engineering and work practice controls. These engineering and

work practice controls may include handwashing, proper handling of contaminated sharps, and wearing personal protective equipment (Miller & Palenik, 2010). Handwashing should be performed before and after patient procedures to prevent contamination in case of accidental exposure to contaminated fluids, mucous membranes, nonintact skin, or inanimate objects (Daniel et al., 2008). Periodontal disease is contagious, therefore, the chain of infection will be broken due if these protective measures are taken. The idea that periodontal disease is contagious has not always been the accepted theory of etiology (Nield-Gehrig & Willmann, 2011).

Theories regarding the etiology of periodontal disease have changed over time (Carranza & Shklar, 2003). Prior to 1960, the etiology of periodontal disease was thought to be the presence of calculus. If supragingival calculus could be seen on the teeth, then mineralized build-up was the cause. To treat the periodontal patient during this time period, the patient was scheduled for routine professional cleanings biannually and meticulous oral hygiene was emphasized at these visits (Nield-Gehrig & Willmann, 2011).

For the next twenty years, from 1968 to 1985, the theory that evolved identified plaque in the calculus as the causative agent in periodontal disease. It was during this period that discoveries were being made that indicated a possible relationship between dental plaque biofilm and gingivitis (Loe, Theilade, & Jensen, 1965; Nield-Gehrig & Willmann, 2011; Perry et al., 2014). Dental prophylaxes during this period were being recommended to patients on a more frequent basis. Patients with active disease were advised to have their teeth cleaned every 2 to 3 months. The patient was taught strict and meticulous oral home care during this period and if the patient's disease was no better at subsequent appointments, it was purely a reflection of a failure

on the part of the patient. The patient was to blame for not doing a sufficient job with their oral hygiene at home (Loe et al., 1965).

The third period concerns the time from 1985 to the present. The paradigm has shifted from one of calculus to dental plaque biofilm to the interaction of the plaque with the response of the host. How the body reacts to the dental plaque biofilm determines whether or not gingivitis and periodontitis develop or progress. Local factors such as systemic disease, patient habits, and genetics are taken into consideration now. Dental treatment is much more individualized at the present. Patients receive individualized oral hygiene instruction and recall intervals and if a patient returns for a recall visit or reevaluation appointment and their oral condition is no better or worse than it was at the previous appointment, an investigation follows to discover the reason. No longer is the patient blamed for not doing their homecare. Periodontal disease research had entered a new phase and a new paradigm was on the horizon (Nield-Gehrig & Willmann, 2011).

Prior to 1980, periodontal disease was thought to be a constantly progressive disease and a constant eroding factor in the whole mouth. The Continuous Progression Theory proposed that periodontal disease affected every tooth in the mouth the same at a constant rate. However, the current theory, the Intermittent Progression Theory, proposes that the progression of periodontal disease is intermittent and the disease progresses and regresses with periods of remission and exacerbation that may last months (Nield-Gehrig & Willmann, 2011). These periods of disease activity or inactivity rely heavily on the response of the host to the bacterial assault on the body (Genco, 1996).

The reaction of the host to the bacterial assault on the periodontium depends heavily on the health of an individual's immune system (Genco, 1996; Nield-Gehrig & Willmann, 2011;

Perry et al., 2014; Newman et al., 2012). People are exposed to bacteria on a daily basis. Bacteria are invisible, yet they may be found everywhere, floating in the air and lying on surfaces (Miller & Palenik, 2010). Bacteria may survive in areas where there is and is not oxygen. Bacteria thrive in colonies called biofilms. Dental plaque biofilm consists of hundreds of bacteria and systems or canals which allow the transport of nutrients and waste (Nield-Gehrig & Willmann, 2011). Although there are hundreds of bacterial species present in dental plaque, only a small percentage of them are pathogenic or disease causing; the rest are part of the normal oral flora (Weinberg et al., 2010). Specific bacteria must be present to cause the development of gingivitis or periodontitis (Perry et al., 2014; Weinberg et al., 2010). Biofilms thrive in areas that remain wet. According to Nield-Gehrig and Willmann (2011), approximately 65% of diseases may be caused by biofilm. Biofilm that provide housing and nutrition for bacteria may be readily found in areas that remain wet such as water lines, glass of fish tanks, and in the mouth (Nield-Gehrig & Willmann, 2011). Inside the mouth, there may be thousands of bacteria and when this bacteria is left undisturbed, it colonizes and can become virulent. The dental plaque biofilm provides protection and nutrition for bacteria and allows the bacteria in the pocket to survive through extreme conditions in the pocket or sulcus unless it is mechanically interrupted (Hunt & James, 2013). Plaque biofilm is the major culprit of the majority of periodontal disease in the mouth (Carranza & Shklar, 2003; Daniel, et al., 2008; Newman et al., 2012; Nield Gehrig & Willmann, 2011; Perry et al., 2014 Wilkins, 2009). Dental plaque biofilm must be removed mechanically from all surfaces to prevent disease progression (Perry, et al., 2014).

Dental plaque biofilm formation is a methodical series of events (Nield-Gehrig & Willmann, 2011). Teeth are covered by a pellicle which is a thin cuticle or membrane on exposed tooth structure to which bacteria attach and begin colonization or biofilm formation (Weinberg et

al., 2010). An acquired pellicle forms on newly cleaned teeth within just minutes (Nield-Gehrig & Willmann, 2011). This acquired pellicle acts as a piece of double-sided tape as it may act as protection for the enamel on one side and allow bacterial adhesion on the other. Within hours of acquired pellicle formation, bacteria begin to adhere. Once bacteria adhere, they secrete substances that attract other bacteria which begin to form a slimy extracellular slime layer which protects the resident bacteria and attracts and allows attachment for new bacteria. Bacteria then begin to multiply into microcolonies through cell division and these microcolonies begin to take on a mushroom appearance as they begin to grow out away from the tooth. Microcolonies may contain thousands of bacteria that are harmonious and various microcolonies may contain different bacteria and be present in different environmental conditions such as the oxygen concentration present, the pH, and temperature. Dental plaque biofilm and its components are alive and may change and evolve based on circumstances and it can be potentially infectious if left undisturbed (Harris et al., 2014; Newman et al., 2012; Perry, et al., 2014; Weinberg et al., 2010).

Patients have a major responsibility to maintain their oral health on a daily basis to prevent dental plaque biofilm from evolving from an immature plaque state to one of maturity (Becker & Maiman, 1980). Perry et al. (2014) stated, “Successful prevention of gingivitis and periodontitis begins with good personal oral hygiene and periodic professional maintenance care to minimize or eliminate the etiologic factors that lead to the pathogenic state” (p. 289).

The immature dental plaque biofilm is quite innocuous, but it does lay the foundation for the formation of other layers of more virulent types of bacteria. Early colonizers in the immature dental plaque biofilm may include *Streptococcus mitis*, *Streptococcus oralis*, and *Actinomyces viscosus* (Nield-Gehrig & Willmann, 2011). These early colonizing bacterial species

actually signal for the attachment of more virulent species. The more virulent species are referred to as intermediate and late colonizers and the late colonizers are considered periodontal pathogens. When left undisturbed, the periodontal pathogens set off a chain of events including inflammation and the host's response to the inflammation which may result in destruction of the periodontium (Carranza & Shklar, 2003; Newman, 2012; Nield-Gehrig & Willmann, 2011; Wilkins, 2009).

When analyzing healthcare literature and disease epidemiology, certain demographics appear to be more susceptible to disease (Berkanovic, Telesky, & Reeder, 1981; Rosenstock, 1966). According to Nield-Gehrig and Willmann (2011), these demographics include age, gender, socioeconomic status and educational level, access to dental treatment and race. It appears that the older a person gets, the more progressive and aggressive periodontal disease may become (Nield-Gehrig & Willmann, 2011; Pappas Queen, Hadden, & Fisher, 1993; Perry et al., 2014; U.S. Department of Health and Human Services [USDHHS], 2007). According to the U.S. Department of Health and Human Services (2007), of adults ranging in age from 20 to 64, 8.52 % have some form of periodontal disease. Approximately 5.08% of American adults have a moderate to severe form of periodontal disease. The demographics of both groups include older persons, Black and Hispanic adults, smokers, and persons of lower socioeconomic status and lower educational levels. Although the definitive reason for the higher rates of periodontal disease in the aged has not been specifically defined, speculation has been made to the possible connection of age with higher rates of exposure to risk factors over the years to unhealthy influences such as medications, stress, tobacco use, and sickness throughout life and a loss of dexterity which may be necessary for oral hygiene practices to prevent disease (Nield-Gehrig & Willmann, 2011; USDHHS, 2007). Higher periodontal disease rates in the United States may be

found among persons of lower socioeconomic status, especially Black and Hispanic males. Persons of lower income and educational levels in the United States also have higher incidence of periodontal disease (Nield-Gehrig & Willmann, 2011; Perry et al., 2014; USDHHS, 2007; Wells, 2008).

In a study conducted by Wells (2008), residents of the Lumbee Tribe in Southeastern North Carolina held many misconceptions regarding losing teeth as a consequence of age and were unknowledge about the oral health systemic health link. The tribe members also faced barriers to care including a lack of providers, fear of dental treatment, and financial constraints (Mofidi, Rozier, & King, 2002). Consequently, periodontal problems along with the oral affects and myths surrounding it is a global disease found in all cultures and countries; it is not confined to the United States (Nathe, 2011; Newman et al., 2012; Salleh & Abdul-Kadir, 2010; Wells, 2008) . As suggested by Keenan (2009), health care professionals must become humble and be aware that all people are cultural beings so that cultural barriers may be broken down and thus allow for more reception of health care education and thus increase the likelihood that concepts taught may be passed from the learners to other acquaintances and family members.

Underdeveloped countries appear to have higher rates of chronic periodontitis (Nield-Gehrig & Willmann, 2011; USDHHS, 2007; Weinberg, et al., 2010). This may be due to lack of education regarding preventive measures that may be taken to avoid disease (Nield-Gehrig & Willmann, 2011; USDHHS, 2007). Lack of access to dental treatment due to barriers that may be encountered by people may also contribute to the development and progression of periodontal diseases. These barriers may hinder those who need or want dental care (Nathe, 2011; Nield-Gehrig & Willmann, 2011; Perry et al., 2014; USDHHS, 2007).

Research has shown several specific barriers to dental care (Nathe, 2011). According to Nathe (2011), barriers are any limiting factors that may hinder the access one has to dental care. These barriers may hinder those who most need dental treatment from receiving access to care (Daniel et al., 2008). Some of these barriers may include age, cultural background, patient habits, time, transportation, finances, dental anxiety, occupations, and hobbies (Daniel et al, 2008; Darby & Walsh, 2010; Nathe, 2011).

Dentistry is not the only sector of the healthcare system in which people may experience hindrances to the care they need. According to Berkanovic, Telesky, and Reeder (1981), one of the most important factors that influence a person to seek treatment was a felt need for treatment, but when the patient was unable to pay for services or if their insurance benefits would not cover the recommended treatment or visit, the variable of need was not sufficient to influence the person to seek treatment. Patient compliance is a problem in many aspects of healthcare and some professionals categorize patient compliance as the number one barrier on the list (Becker & Maiman, 1980). Therefore, the lack of finances and insurance coverage became an impetus for patient noncompliance. When a patient does not follow through with the health professional's recommended treatment, the time invested and the services offered and recommended get cancelled out (Becker & Maiman, 1980). Various barriers have been identified that may lead to noncompliance.

Another major barrier that may contribute to lack of patient compliance may include a lack of patient understanding the information provided regarding treatment and maintenance procedures (Becker & Maiman, 1980; Macek, Hayenes, Wells, Bauer-Leffler, Cotton, & Parker, 2010; Macek et al., 2011). It is important that patients are capable of understanding educational materials that may be relayed to them by healthcare professionals (Giorgianni, 1998). The

amount of education, the literacy of the patient, and language of the patient should be taken into consideration as patients are educated about their specific health condition (Mayeux, Murphy, Arnold, Davis, Jackson, & Sentell, 1996). According to Davidhizar and Brownson (1999), patient literacy in the US is deficient with the majority of patients reading on a fifth grade or below reading level. Most health education materials created and distributed by medical facilities are written on a ninth grade reading level, so a large gap or disparity exists. In the event that the patient is illiterate, or if the educational materials are not available in the patient's native language, accommodations should be made (Giorgianni, 1998). According to Glanville (2000), "investing in the time required for patient education ultimately reduces health care costs by earlier detection of disease, fewer medical complications with chronic illnesses, less hospitalization, and perhaps even fewer office visits" (p. 57).

Maslow's Hierarchy of Needs established human needs in order from low level needs to higher level needs (Maslow, 1954). Lower level needs included psychological or basic life needs such as food, clothes, and a place to live. The next level above the psychological needs is safety needs. Safety needs included things such as law and order which lead to feeling secure in life. Above the level of safety needs is the level of belongingness and love which includes family and affection. The next highest level was the esteem level where one's reputation, self-esteem, and confidence were included. The last level was the level of self-actualization where creative thinking and personal growth are included. Higher needs may never be attained unless lower needs are met (Maslow, 1954; Nathe, 2011). According to Maslow (1954), both types of needs present themselves at different priority levels and lower needs are much more tangible than higher level needs. For instance, a person suffering from hunger or nakedness may be obvious as opposed to someone who is suffering from a lack of belongingness or of love. Also according

to Maslow (1954), “Living at a higher level means greater biological efficiency, greater longevity, less disease, better sleep, appetite, etc.” (p. 98). According to the WHO (2003b), “Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (para. 1). Considering Maslow’s Hierarchy of Needs, in order to be and stay healthy, lower order needs must be met (Maslow, 1954; Nathe, 2011). According to the National Institute of Dental and Craniofacial Research (2000), oral health is imperative for good general health as the mouth may become a portal for disease in other areas of the body. When the mouth is healthy, or free of disease, the person is able to enjoy all kinds of foods which help to maintain a healthy body. When the body is healthy, work and life may be free from safety needs which may lead to confidence to pursue relationships or belongingness and self-esteem which may allow for critical thinking to occur and personal growth (Darby & Walsh, 2010; Maslow, 1954). The environment in which one lives may not always allow one to pursue health. One of the responsibilities of the dental hygienist is the promotion of health.

The dental hygienist must consider the entire individual as they walk through the phases of the dental hygiene process of care (assessment, dental hygiene diagnosis, treatment planning, treatment implementation, and evaluation of treatment) (Wilkins, 2009). To accomplish this task, the hygienist may perform the treatment, prevention, and/or promotion of oral health. Through health promotion, the dental hygienist considers the entire individual and tries to analyze what barriers stand in the way of health for the individual (Burt & Eklund, 2005). More than analysis, the dental hygienist may work with the person to help establish an environment which will allow the person to increase the control they have over their current state of health and at the same time work with the individual to improve their current and future state of health (Darby & Walsh, 2010; Nathe, 2011). Many factors determine how healthy an individual may be including their

social and economic status, their level of education and where they live. According to Darby and Walsh (2010), people are products of their surroundings. When they live in an area where health knowledge is available, they are more likely to be knowledgeable about healthy behaviors, therefore, they are more likely to practice healthy behaviors and thus be healthier individuals. Health promotion strategies are important when trying to reach a population (Darby & Walsh, 2010; Geurink, 2005; Nathe, 2011). Some health promotion strategies include mass media, community organization, and health education. There are some barriers to the reception of knowledge which may be related to the environment in which the instruction or education is delivered (Darby & Walsh, 2010). Temperature control, lighting, acoustics, and ventilation may all affect the ability of the learner to assimilate the knowledge being conveyed. Another concern in dentistry is the factor of confidentiality. If people do not feel a sense of security, or if the area of treatment is too close to others so that they may be overheard by others, they may be reluctant to speak truthfully (Darby & Walsh, 2010).

Other factors that may interfere with the reception of knowledge are related to internal and relational factors. How a message is sent by the dental hygienist and how it is received by the learner may be entirely different based upon the values, perceptions, knowledge level, and level of need of the learner. Especially in different cultures, dental hygienists must be culturally aware of their audience so that the knowledge they wish to impart may be best received (Gibson-Howell, 2010). If the dental hygienist is of a different race, from a different socioeconomic level, speaks a different language, or a different religious background, barriers may need to be overcome before education may be imparted to the learner (Keenen, 2009). According to Darby and Walsh (2010), Western medical philosophies may not be well received by other non-Western cultures. If the educator were to establish a relationship with a member of the cultural group to

be presented to, cultural barriers may be broken through the credibility established and the educational material may be more readily received by the learners (Falvo, 2004).

Relational factors also include the social group with which the learner associates. A learner who has a diverse social circle as opposed to someone who is exposed primarily to the same people daily is more likely practice preventive health behaviors (Langlie, 1977; Rosenstock, 1966). These relational factors may contribute to the readiness of an individual to act or change which relates to the Theory of the Health Belief Model (Rosenstock, 1966).

For dental hygienists, often teaching does not occur in a classroom with students. The learners may be dental patients or simply members of the community meeting in informal settings (Geurink 2005; Nathe, 2011). The theoretical basis of the adult education taught by dental hygienists to their patients may be traced back to the Theory of the Health Belief Model (Daniel et al. 2008) which was developed in the mid-1900s by social psychologists working for the U.S. Public Health Service (Darby & Walsh, 2010, Langlie, 1977). These psychologists sought to discover why only a few eligible people took advantage of available preventive health care services. The Theory of the Health Belief Model proposes that individuals must be educated regarding the details of possible disease and about their susceptibility to disease. Following this enlightenment of the patient, a readiness to change may occur and change may occur through the help of health interventions (Janz & Becker, 1984; Langlie, 1977; Nathe, 2011; Richards & Digger, 2011). The U.S. Public Health Service utilizes this theory for health interventions and it may be applied in an underdeveloped nation to convey oral health education and dental hygiene interventions. According to Nathe (2011), "...when individuals have accurate information, they will make better choices including those pertaining to health" (p.122).

The four stages of the Theory of the Health Belief Model include susceptibility, serious consequences, benefit, and salience. Adults learn due to a felt need and based upon applicability to their life's situation (Wlodkowski, 1991). It has been determined that one reason the rates of oral disease are high in underdeveloped countries is due to a lack of education (Keenen, 2009; Muhirwe, 2003; Peterson, 2008; World Health Organization, 2003a). According to Muhirwe (2003), if individuals have no prior knowledge about oral disease they may be found at the initial stage of the Theory of the Health Belief Model and be in need of oral health education and dental hygiene intervention because they were not aware of their personal susceptibility. According to Wlodkowski (1991), adults may learn a skill better when they feel a sense of need to learn the skill.

Dental hygienists' work and education efforts may be based on a continuum of healthcare which includes three levels primary, secondary, and tertiary. At the primary level, education of the individual is the focus. Oral health education is given regarding toothbrushing, flossing, toothpaste use, fluoride, and nutritional counseling. Mechanical removal of dental plaque biofilm is imperative to prevent the progression or development of periodontal diseases. Interproximal cleaning of the tooth surfaces may be stressed at this level. According to Rasines (2009), interdental brushes are most effective for dental plaque biofilm removal interproximally. However, the physical disruption of the biofilm may still be accomplished via string or the use of wooden sticks such as may be available in remote areas (Daniel et al., 2008; De la Rosa, Guerra, Johnston, & Radike, 1979; Perry et al., 2014). At the secondary level, periodontal debridement, or the removal of hardened deposits from the teeth, is included along with fluoride application to help remineralize, harden incipient carious lesions or cavities in the teeth. At the third stage, or tertiary stage on the continuum of care, referrals are given for treatment by a specialist for

periodontal surgery and extractions. No matter the level of education, whether it is at the primary, secondary, or tertiary level, the dental hygienist spends the majority of the appointment time educating his or her patients (Darby & Walsh, 2010). The dental hygienist must be perceptive as to the barriers present and try to promote the health of the patient through education (Daniel et al., 2008).

Adult Education

Adult education may have origins dating back to antiquity and Biblical times. Documentation is recorded in the Bible of Jesus Christ as He taught groups of adults through oral presentations from a boat as they congregated on seashores to hear Him speak from a boat or as He spoke to them on top of a mountain as in the Sermon on the Mount (King James Version). Another early adult educator included Socrates who was credited with a method still used to teach medical and dental students. The method developed by Socrates is called the Socratic Method. In this method, the professor essentially instructs students by asking them question after question to evoke interaction and increasing critical thinking skills (Archer, 2011).

The citizens that arrived in the American colonies in the 1600s were a tough people who had left their mother country in search of religious freedom. According to Knowles (1977), this tenacity to leave gave a sense of urgency to learn. Therefore, America became the land of opportunity where religious and political freedom could be found. In Colonial America, education was a top priority (Knowles, 1977; Stubblefield & Keane, 1994). Because America was a new nation that was to be self governed, the leaders of the new nation realized that the citizens must be educated so they could make appropriate decisions as they voted to govern the nation (Knowles, 1977; Stubblefield & Keane, 1994). Only a small portion of the new nation was

comprised of the English elite who had formal education (Stubblefield & Keane, 1994). Many common folk such as tradesmen, farmers, and storekeepers comprised the landscape of Colonial America. Formal education was seen as an institution reserved for the elite citizenry but a more informal type of education, although unorganized and based primarily on the vocation of the learner, evolved. This type of informal education developed and met the needs of the common citizen (Knowles, 1977).

One of the earliest forms of adult education was the Junto or Society of the Leather Apron which was established by Benjamin Franklin in the 1700s (Knowles, 1977; Stubblefield & Keane, 1994). The Junto was a volunteer adult men's group which met and discussed pertinent topics of the day such as proper moral behavior, political views, and personal philosophy (Knowles, 1977; Stubblefield & Keane, 1994). The Junto still has roots today in many institutions including public libraries. The Junto members compiled collections of books into a central library for which they would charge two pounds per person for visiting the library and reading. Outsiders could check out books for a small weekly fee (Stubblefield & Keane, 1994). One of the major themes behind the Junto meetings was self-improvement which is still evident today as many Americans are life long learners who continue to learn into their later years (Jarvis, 2004; Knowles, 1977).

A second venue by which adult education was delivered was the lyceum style of education. The lyceum movement began in 1826 in Millbury, Massachusetts. Josiah Holbrook is given credit for the lyceum movement in America. He was a traveling lecturer who would go from town to town in New England providing lectures that were to provide the education needed by citizens to improve their lives. The lyceums spread from being local meetings to encompassing county and state lyceums with representatives from each that would meet at a

national meeting. There are still remnants of the lyceum movement evident in America today as various local service clubs and parent-teacher associations in schools still exist (Knowles, 1977; Stubblefield & Keane, 1994).

Colonial America was thirsty for knowledge as more and more people began to become literate (Knowles, 1977). As more citizens became literate and began writing poetry and books, newspapers and libraries began to emerge. Although private libraries were in existence, the need for a public library was becoming an increasing necessity for the young country. The first free public library was established in Peterborough, New Hampshire in 1833. This first free public library was made possible and maintained through the revenue generated by a municipal tax paid by the citizenry (Knowles, 1977). Through the establishment of these libraries, more and more literate adults gained access to knowledge than ever before. In 1862, two events occurred that helped to shape adult education in the United States. The United States Department of Agriculture (USDA) was established and The Land Grant or The Morrill Act was passed. According to Knowles (1977), The USDA had a major impact on the citizenry as America was primarily an agrarian society and the USDA was established to help promote “the welfare of the rural population” (p. 24). The Morrill Act helped to gain federal support for educational institutions to teach agricultural and mechanical arts. The access to knowledge for the citizenry was paramount as the new found knowledge began to take shape and citizens began to form institutions by which they could assemble with likeminded individuals to increase their knowledge and reflect (Knowles, 1977; Stubblefield & Keane, 1994).

In 1874, the institution known as Chautauqua was established by Dr. John Vincent and Lewis Miller as a normal school for Sunday school teachers. It became much more than a school for Sunday school teachers as more and more adults expressed a desire to learn about different

subjects. These subjects expanded to include history and literature and courses were structured into yearly cyclical correspondence courses that concluded in the adult earning a diploma when the student completed the complete four years of course offerings. The effects of the Chautauqua are still evident in America today as it helped to establish summer schools and correspondence courses which are utilized by public schools, university extension, and colleges (Knowles, 1977). Other institutions soon followed. Such institutions included agricultural societies, workers' unions for tradesmen and industrial workers, and the institutions of extension education through colleges and universities. With the establishment of colleges and universities that were open to the common man, not just the elite, through extension came graduates who might reach the masses through extension education. In the early 1900s Alfred C. Fones graduated dental school and began to persuade the dental community of the need for a dental hygienist. He described the position as an occupation that would be responsible for oral health education and promotion (Fones, 1926; Motley, 1988; Nathe, 2011). According to Felton, Chapman, and Felton (2009), "Oral health is central to our general well-being...Patients need trained oral health educators and promoters to help prevent and control dental conditions and disease" (preface).

Oral Health Promotion and Adult Learning

The goals of oral health promotion are motivating and informing people, individually or as a community group, so their current and future state of oral health improves (Croffoot et al., 2010; Darby & Walsh, 2010; Geurink, 2005; Nathe, 2011). According to Geurink (2005), "Health promotion goes beyond prevention of disease and reduction of health risks. Aspects of health promotion may include 1. Advocacy 2. Efforts to change organizations, policies, and environments 3. Political considerations 4. Ethical responsibilities" (p. 225). At a much broader level, health promotion is not just an individualized concept but includes aspects of life at all

ages, cultures, socioeconomic levels, and educational levels (Gibson-Howell, 2010). These influences include community concepts, institutional concepts, and governmental concepts that are influencing and educating people daily (Darby & Walsh, 2010; Geurink, 2005). According to Darby and Walsh (2010), the concept of health promotion has been discussed in publications such as *Health Promotion and Oral Health by the U.S. Surgeon General, Healthy People 2010* which was written by the U.S. Department of Health and Human Services, the World Health Organization's position on oral health. As a dental hygienist develops a dental hygiene treatment plan, the focus of the plan should be on the environment in which the patient lives and the plan will have a better chance of success (Darby & Walsh, 2010). Elements of a person's environment that impacts their state of health may include their financial state, their level of education, and the location where a person lives. According to Darby and Walsh (2010), a person may engage in healthy behaviors if they have the education to know what those behaviors are and how to apply that knowledge. The application of health promotion strategies help to increase acceptance and utilization of available resources, but change is often difficult for patients, especially when changes to their values may be brought into question (Geurink, 2005; Nathe, 2011). Health promotion is especially important as it is taught to parents. According to Akpabio, Klausner, Inglehart, and Habil (2008), educating parents about dental prevention should be a top priority and done early so their children may live in a better environment in which they do not suffer from dental disease. However, knowledge may be imparted, yet it still may not spark the interest necessary to initiate change in daily oral hygiene habits that may endure the test of time (Croffoot et al., 2010).

New ideas presented to patients by dental hygienists are often met with resistance on the part of the patient and may result in the failure of adoption of the recommendations. In order for

real and lasting change to occur, patients are fully responsible to make the necessary changes as change comes from within the person (Croffoot et al., 2010). Motivational interviewing may be a feasible approach to influencing patients to adopt better oral health practices. Motivational interviewing is comprised of four basic components which are the utilization of open ended questions, affirmation for the patient, reflective listening on the part of the clinician, and summations. Open ended questions provide more detailed answers from the patient which allows the clinician insight into what the patient might be truly feeling, thinking, or struggling with. Affirmations help to reinforce positive patient behavior and through this communication, affirmations also allow the clinician to build a good rapport with the patient (Carpenter & Bell, 2002). Reflective listening may be accomplished as the clinician listens closely and through eye to eye contact and a nodding of the head, the patient may be made to feel the clinician is empathetic to the patient's circumstances and therefore a positive rapport may be built between the two (Cipriano, 2007). Summations of the patient's statements allow the clinician to repeat back to the patient what they heard and this also may allow the patient to clarify in case of a misunderstood statement. Through summations, miscommunication may be avoided, thus allowing the true barriers to implementation of oral health education may be broken down (Croffoot et al., 2010; Nield-Gehrig, 2011).

In *Diffusion of Innovations* by Evert Rogers (1995), Rogers stated, "Getting a new idea adopted, even when it has obvious advantages, is difficult" (p. 1). The new innovation was the first element of consideration, to increase the likelihood of adoption. He stressed the importance of the following considerations when attempting the implementation of a new innovation: the relative advantage of the new innovation, the compatibility with existing values and practices,

the complexity and ease of use of the new innovation, the trialability of the new innovation, and if there are observable results associated with the new innovation.

Rogers stressed the idea that people do not change; it is the innovation itself that needs to change in order for a new innovation to be adopted. Therefore, the innovation itself is the first major element to consider and five characteristics of the innovation, according to Rogers, must be considered. First, one must consider the relative advantage of the new innovation. When considering the relative advantage of a new idea, one must decide if it is superior to what is being used already. Second, the compatibility of the new innovation must be considered. As far as the compatibility of a new innovation is concerned, he stressed that one must consider how closely it aligns with current practice or beliefs. Third, the complexity of the new innovation must be considered. If a new innovation presents complications which surpass current practice, the likelihood of adoption may be low. Fourth, the trialability, or the ability of the innovation to be experienced on a trial basis, must be considered as well. Last, the ability of the innovation to be observed by the people who are considering adopting or not adopting must be deliberated.

The second major element which impacted adoption of a new innovation was communication. When an innovation is promoted through a social system, diffusion occurs (Rogers, 1995). The third major element of impact described by Rogers was time itself. The fourth major element of diffusion of innovation was the social system into which the innovation was to be introduced. Rogers stressed the impact of the social system and all of the indigenous beliefs, values, and knowledge should never be underestimated. He stressed that each of these major elements must be considered when one is attempting to be the change agent for a new innovation. Each major element must be taken into consideration as one attempts to become a change agent for an innovation such as the one inherent in dental or oral hygiene education in a

remote African village. The change agent must pay close attention to all five major elements. The change agent should demonstrate the relative advantage of the innovation.

There are five stages in the diffusion of innovation according to Rogers and the stages include knowledge, persuasion, decision, implementation, and confirmation. The knowledge stage is important because this is the time when mass communication and advertising is vital to make sure the person who may adopt the innovation is fully aware of the innovation and its potential. During the persuasion stage, interpersonal communication is essential. During the decision stage, the potential adopter makes a decision to adopt the new innovation or to reject it. During the implementation stage, the adopter actually implements the innovation. And during the last stage, the confirmation stage, the person searches for confirmation to support their decision to adopt or reject the innovation. Also during the confirmation stage, the adopter may change their mind or they may decide to stick by their decision to adopt the innovation.

According to Rogers, there are five different categories of potential adopters. Innovators make up the first category and they comprise about 2.5 % of this population. Early adopters comprise the second category and they make up 13.5 %. The third category of the population is comprised of the early majority which makes up 34% of the population. The late majority also makes up 34 % of the population. Lastly, the laggards comprise the last category and they comprise 16 % of the population of adopters. Possibly the laggards need more motivation which may be instrumental in effectively reaching adult learners (Wlodkowski, 1991).

Teaching strategies based upon the motivation and felt needs of a learner may determine the amount of success the learner may have in the classroom (Galbraith, 2004; Merriam & Brockett, 1997). The effective teacher may employ methods to discover the needs of their student and therein discover the motivating factors behind the student's desire to learn (Wong &

Wong, 2009). With the help of an effective instructor, students may be motivated to learn and have a successful journey on the road to a degree, certificate, or any type of learning activity they may choose to undertake.

Adult learners may have many reasons for deciding to acquire new knowledge or skills. Adults may find themselves categorized as a displaced worker, an employee needing new skills for their current position, or adults may decide to learn just for the enjoyment of learning. Realizing one may lose their job, their livelihood, or that the skills they have been using for years are outdated and no longer needed may discourage adult learners and lead to a feeling of incompetence. According to Wlodkowski (1991), adults enjoy learning and through learning they gain a sense of competence and control over their life's situation. Almost all adults undertake at least one or two major learning activities a year, with the average number being about eight (Tough, 1979). According to Jarvis (2004), adults do not need a teacher or even a school to initiate and fulfill their learning activity. Adults learn due to felt needs and they also like to be able to apply what they learn to their lives and this application may be a driving force behind their motivation to learn (Wlodkowski, 1991).

To understand adult learning, instructors may need to understand and investigate what motivates adult students to acquire new knowledge (Merriam & Brockett, 1997). Learners are motivated by many different factors which may range from a need to change a tire to self-defense to the joy of painting (Davis, 1993; Knowles, Holton, & Swanson 2011; Wlodkowski, 1991). Effective instructors may actually take the time and effort to investigate the motivating factors that are influencing their learners (Wlodkowski, 1991). As stated by Merriam and Brockett (1997), "Educators who wish to work successfully with adult learners need to understand who adult learners are and how they learn" (p. 138). Why did they enroll in the

course? What skills or information are they expecting to glean from the course? According to Wlodkowski (1991), based upon their felt needs, learners are motivated to learn at the beginning of the process. As stated by Wong and Wong (2001), “What you do on the first days of school will determine your success or failure for the rest of the school year” (p. 3). To discover learners’ needs early on and to answer these questions, a needs assessment may be a necessary undertaking (Beebe, Mottet, & Roach, 2004; Crux, 1991). Needs assessments may be accomplished through many different methods including assessment tests, interviews, observation, or surveys. Surveys are efficient and may be electronically submitted to students prior to the first day of class. Formats for surveys may include checklists, yes/no type questions, or likert scale items. Interviews may be accomplished either individually or via focus group interviews. Although interviews may be time consuming, they allow the instructor to glean much information from the participants. Observation allows the instructor to watch participants work which allows the instructor to discover what difficulties the participants may be having. The two types of needs assessment tests mentioned by Beebe et al. (2004) were formal and informal.

Both formal and informal needs assessments may disclose valuable information that may be useful for designing instruction. Both have pros and cons. An in-depth formal needs assessment has the major advantage of being extremely thorough, but it may require more time and money than the instructor may be able to afford (Beebe et al., 2004; Crux, 1991). In this instance, the alternative may be an informal needs assessment. While an informal needs assessment may not be as thorough as the formal needs assessment, it may be less expensive and disclosure of the participants’ felt needs may still be accomplished.

To accomplish an informal needs assessment, instructors may contact participants prior to the first class meeting to gain knowledge of their expectations and range of experience with the

topic to be covered via email or phone. Another alternative is to assess levels of knowledge and experience at the beginning of a course by devoting some of the first meeting to getting acquainted with the participants. A simple ice-breaker of introduction including a question regarding the reason the person is taking the class may expose the felt needs of the person (Davis, 1993; Wlodkowski, 1991).

Sometimes adults would like to gain new knowledge, but they may have barriers in their lives that hinder learning. Such barriers may include money, family obligations, time, physical limitations, or transportation (Wlodkowski, 1991). The top of the list according to Wlodkowski (1991), may often be the issue of time. Sometimes, the primary barrier to adult learning may be the teacher. Ineffective instructors may be perceived as de-motivational. According to Wlodkowski (1991), “A learner’s negative attitude toward an instructor makes that instructor a *barrier* between the material to be learned and the learner” (p. 75). Negative instructors may commonly place blame on learners when exam scores or performance are below average.

When an adult is motivated to learn, an instructor may be the factor that determines the success or failure of the student to thrive in the classroom. The instructor may be perceived by the learner as a motivational factor or as a de-motivational factor to the course. There are many characteristics of the effective instructor. These characteristics may include: empathy, enthusiasm, encouragement, expertise, compassion, organization, and clarity (Nathe, 2011; Wlodkowski, 1991; Wong & Wong, 2001). According to Wlodkowski (1991), the most important characteristics are expertise, empathy, enthusiasm, and clarity (p. 17).

To motivate learners, effective teachers may include strategies such as the utilization of a variety or combination of teaching methods that may appeal to the different learning styles in

their lesson plans (Nathe, 2011). Lessons may be created that make learning easier for the auditory, visual, or tactile learner. Wlodkowski (1991) also stressed that the instructor's abilities to expertly give practical examples and to teach spontaneously are hallmarks of effective teaching. Working some humor into lessons may also aid in attention retention. The importance of the instructor being available to students and prompt feedback were also important characteristics of effective instructors mentioned by Wlodkowski (1991).

Uganda

Uganda is a landlocked country on the continent of Africa. In 2012, the population of Uganda was 36,345,860 (World Bank, 2013a). It is bordered on the north by South Sudan, the south by Lake Victoria, Kenya, and Tanzania, the east by Kenya, and the southwest by Rwanda. The country of Uganda is located on the equator and has many agricultural resources including abundant rainfall. According to World Bank Group (2013b), Uganda may be considered one of the poorest nations in the world as there is approximately 37.7% of the population living on less than \$1.25 per day. Although poverty has decreased since 1992, poverty is still a problem in the more rural and agricultural sections of the country where 87% of the population of the country lives (International Fund for Agricultural Development [IFAD], 2012). According to the World Bank Group (2005), Ugandan women share the majority of the work load and they are working longer hours than do men. Gender equality is one of the main issues contributing to the poverty of the Ugandan nation. Women are overburdened with work as they work long hours in agricultural pursuits to produce food for their families (Gender Action, 2002). According to World Bank (2005), women work an average of fifteen hours daily and men work only an average of nine hours daily. The women have the responsibility of planting, harvesting, and preparing most food for the family. Women focus mainly on crops such as sweet potatoes,

cassava, beans, and plantains because these crops produce food needed to feed their families.

Men, on the other hand, concentrate on crops such as coffee and vanilla as they are crops that can be sold and make a profit (World Bank, 2005). Women also have increased burdens in addition to food production related to their responsibilities to take care of orphaned children and the elderly (IFAD, 2012). According to the World Bank Group (2005), some reasons that many of the men do not help women with the family relate to alcoholism and gender inequality issues such as a bride price which insinuates that the wife is the property of the husband and therefore, she works for him. Women also complain that they lack control over the resources they are able to produce. If any excess remains, they have no control over the selling of it (World Bank Group, 2005). Excess production of food is usually not a problem as the amount of food produced is not even enough to meet the needs of the family (IFAD, 2012). According to the World Bank Group:

Women have few assets, and land insecurity, among other issues, is likely to prevent them from contributing equally to, or benefiting equally from, trade expansion. Where women earn income, men often control its use, while women often have to contribute disproportionately to household expenses. This in turn negatively affects the capacity of women to start or expand their own businesses.” (2013a, pg. xiii)

It was suggested that men also may be abusive to their wives due to the idea of bride price and ownership as 40 percent of women reported having suffered from domestic violence (World Bank, 2005). According to Bishop Vincent Victours, teeth are even utilized in the Kimuli Village in Uganda as self-defense for women. He stressed the importance of the women in the Kimuli

Village keeping their teeth so that they may defend themselves against an abusive spouse (personal communication, February 13, 2013).

The gender inequality that may contribute to women being financially disadvantaged may also lead them to be less educated in Uganda. As women strive to provide for their families through agricultural pursuits, the young female children help the mother to plant and harvest instead of attending school (World Bank, 2005). To attend school in Uganda, fees and supplies are required and this financial burden may also present a challenge that may prevent youngsters from attending school. According to the Central Intelligence Agency (2009), Uganda's literacy rate for those 15 years and older is 66.8%. Of this percentage, males represent 76.8% and females represent 57.7%. There appears to be a relationship between poor oral health and low literacy rates (Macek et al., 2011). Populations with low literacy rates exhibit lower levels of healthy behaviors and lower understanding regarding how disease is managed evidenced through lower rates of utilization of preventive services and poorer health status (Macek et al., 2011). A major component of literacy when considering healthcare is health literacy (Macek et al., 2011).

Another problem that may contribute to the level of poverty in Uganda is the fact that Uganda is a landlocked country which presents challenges as far as exports within the nation and outside of Uganda are concerned (IFAD, 2012). For exports to be taken to other regions and countries, long treks across land and countries around Uganda must be made to distant ports. As rural Ugandan farmers produce food and agricultural products, they are often unable to export their goods. Roads and transportation vehicles are lacking for moving their goods in country to market for profit. The rural farmer suffers from a lack of access to markets which also results in a lack of access to technology and financial help which might help them to create their own businesses and increase their profits (IFAD, 2012).

One measure to determine the health of a country is the Human Development Index. According to the Human Development Reports published by the United Nations Development Programme (2013), the Human Development Index (HDI) was established in 1990 to create a picture of the social and economic state of a country through analysis of the following factors: life expectancy, educational levels, and income of its citizens. The United States scored third on the HDI 2013 report and Uganda scored 161 out of 187 countries. The report indicated that Uganda has made progress in the past few years; however this score indicates that Uganda is in the low category for human development (see Figure 7).

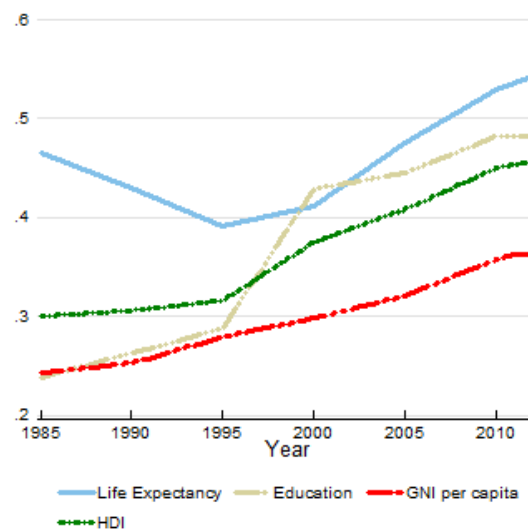


Figure 7. Trends in Uganda's HDI since 1985 (United Nations Development Programme, 2013).

In developing nations, oral health promotion is an essential component to the improvement of oral health (Macnab & Kasangaki, 2012; Peterson, 2004; Tapsoba, & Deschamps, 1997; Thorpe, 2006). However, oral health promotion is made difficult in African countries due to a lack of organized oral health programs (Peterson, 2004; Thorpe, 2006). Although there have been health promotion programs established in some African countries, dental or oral health promotion may be omitted from the program (Brijlal & Gordon, 2005;

Macnab & Kasangaki, 2012; Tapsoba, & Deschamps, 1997). Research conducted by Macnab and Kasangaki (2012) integrated oral health lessons into classrooms of four rural Ugandan schools. The reasons given for successful integration of oral health education at the schools included students having limited time with their families outside of school hours because of long walks to and from school and lack of lighting in homes after school. Oral health promotion taught in the schools resulted in less halitosis, more frequent brushing habits, and the learners promoted the new found knowledge with family members (Macnab & Kasangaki, 2012). Oral health promotion in developing countries may encounter barriers. Oral health promotion strategies implemented by outside entities may not be successful due to lack of access to health services and health programs. The strategies help only temporarily as they are not sustainable without the support of in-country established health programs (Brijlal & Gordon, 2005). In order for health promotion strategies to be successful, governmental structure must guide and support oral health measures (Brijlal & Gordon, 2005; Macnab & Kasangaki, 2012; Peterson, 2004; Tapsoba, & Deschamps, 1997; Thorpe, 2006). Oral health promotion strategies must be planned well and implemented properly otherwise change will not take place and the efforts will be ineffective (Brijlal & Gordon, 2005).

Summary

The purpose of this review of literature was to examine current and historical documents that were relevant to this study. It was important to fully investigate previous work to guide this study effectively. This review of literature included the following topics to accomplish this purpose: the history of dentistry, the history of dental hygiene, periodontal disease, adult education, oral health promotion, and Uganda. Although literature may be found regarding oral health promotion strategies in developing countries, there is a paucity of literature regarding the

potential effects of a dental hygiene educational intervention on remote adult villagers' oral health. Through this study, it is hoped that this hole in the literature may become less significant.

CHAPTER 3

METHODS

PURPOSE OF THE STUDY

The following chapter provides a description of the methods employed in this study. Patient demographics including gender, age, approximate monthly income, highest grade completed, and past dental experience, oral health practices, beliefs, knowledge, and behaviors were assessed through the use of pre- and post-test oral health questionnaires which concluded with a plaque score. Dental hygiene educational sessions were conducted between the oral health questionnaire pre- and post-tests. Pre- and post- plaque scores were compared to determine significance and demographic characteristics were employed to develop a model of prediction concerning dental plaque scores. Linear multiple regression was employed to develop this model.

The purpose of this study was to assess the oral health knowledge and dental health of the oral cavities of the residents of the Kimuli Village in Uganda. This study also evaluated the effects of a dental hygiene education intervention upon the currently practiced oral health cleansing methods.

RESEARCH QUESTIONS

To accomplish this purpose, the following research questions guided the study:

1. What were selected demographic characteristics of participants in dental hygiene educational sessions in Kimuli Village in Uganda?
2. What were current practices and beliefs concerning dental hygiene held by Kimuli Villagers in Uganda?
3. What is the impact of a dental hygiene educational intervention on the oral health knowledge and behaviors of the Kimuli Villagers in Uganda?
4. What is the impact of a dental hygiene educational intervention on the plaque scores on the teeth of Kimuli Villagers in Uganda?
5. Could a predictive model be identified using selective demographics to predict plaque scores for participants?

Participants

Permission was granted for this study through the Auburn University Institutional Review Board (See Appendix C). A total of 71 people responded to the invitation participated in the oral health research study. Even though English is the official language of the country of Uganda, many villagers did not speak English fluently. The interpreters were fluent in both English and the primary language of the villagers, Lugandan. The data were collected with assistance from eleven Ugandan interpreters who went from participant to participant with assistance from a volunteer from the study. Volunteers were from the U.S. and spoke English fluently. These non-dental volunteers helped record information for both the interpreters who asked the pre- and post- test knowledge and behavior based questions and they also recorded for the registered dental hygienists as they worked to complete the disclosing of teeth and reading of participants' plaque scores. All non-dental volunteers and interpreters participated in a training

session where they were educated and instructed regarding the pre- and post-test questionnaires and procedures to be followed for the study.

Instruments

This study was designed to evaluate oral health knowledge and behaviors of the residents in the Kimuli Village. Following informed consent, an oral health pretest questionnaire was given to consenting participants. The questionnaire and the clinical data collection methods were based on World Health Organization [WHO] criteria and recommended data collection methods (WHO, 1987; Zhu, Peterson, Wang, Bian, & Zhang, 2005). The pre-test questionnaire consisted of 14 questions to assess the villagers' oral health behaviors. Behaviors topics included methods and frequencies of mechanical dental plaque biofilm removal and reasons for brushing teeth. The pre-test questionnaire also contained an open ended question regarding any discomfort in the study participant's mouth. When the Oral Health Knowledge and Perceptions Pre-Test Questionnaire was administered, participants reported various methods for maintaining their oral hygiene. Demographic questions assessed the participants' age, highest grade in school completed, approximate monthly household income, and gender. There were 16 questions that assessed the villagers' level of oral health knowledge. Knowledge topics included methods and frequencies of toothbrushing and how often a toothbrush should be changed, reasons teeth should be brushed, and the oral-systemic link and contagious effects of plaque.

A plaque score concluded the pre-test. The post-test questionnaire was comprised of 16 questions in which participant behavior was assessed by 4 questions and knowledge by the other 12. A plaque score concluded the post-test. Some of the questions on the pre-test were combined on the post-test into one general question. Demographics were assessed at the pre-test. At the

time of the post-test, there were over 400 villagers present for the dental hygiene educational sessions which caused much chaos and crowding inside the open air church. Due to the chaos, the post-test was condensed and therefore it was not identical to the pre-test. Both instruments were evaluated for content validity by a panel of experts and for face validity by a panel of volunteers whose only dental experience included their personal experience of routine dental visits. The panel of experts consisted of three registered dental hygienists and two doctors of dental surgery. Both doctors reported having participated in dental mission trips to developing countries in the past. Both instruments were then revised and adjusted based on the feedback given by the panel of experts. Expert recommended changes included basic changes in the wording of a few questions to make the language more elementary.

As Uganda struggles near the bottom of the Human Development Index, many of the lower order needs may be unfulfilled possibly leading to unhealthy states of disease which in turn may prevent attaining higher levels of needs being met. Regarding mass media and health promotion, this study was advertised via flyer two weeks prior to the event. As far as community organization is concerned, the dental hygiene educational sessions were held in an open air church and as the sessions progressed, more and more people attended and were educated even though they were not participants in the study. Oral health education was given for four days to help promote better health.

Procedures

Bishop Vincent Victours served the Kimuli Village not only as a spiritual leader, but also as a village patriarch. By Ugandan tradition, village patriarchs are charged with overseeing much of what happens in their village to ensure that the best interest of the villagers is served.

Therefore, Bishop Victours was in a position to grant permission to carry out this study, so he was contacted to gain approval for conducting the study in the village. Flyers were provided to him to be hung up around the village to invite participants approximately two weeks before the study was conducted. Participants were informed to be at the Union Grove Church in Kimuli Village on February 7, 2013 at 9:00 a.m. if they wished to participate in the oral health research study. Kimuli Village is approximately 15 miles from any electricity and did not possess any running water. The closest area with electricity and running water was Mityana which was a one hour drive from Kimuli Village.

Once the participants arrived, the informed consent letter was provided to the participants and the researcher explained that their participation was purely voluntary. Participants were also told that dental hygiene educational sessions would be held daily at 9:00 a.m. for the next four days and on the final day, a post-test would be given and a plaque score would be taken to evaluate their level of dental plaque.

Utilizing a combination of natural daylight, small flashlights, and pen lights, three registered dental hygienists from the United States collected data clinically as they went from participant to participant disclosing the teeth and reading the plaque scores. The disclosant, or solution used to dye the dental plaque biofilm, was applied with cotton tipped applicators which revealed the level of plaque biofilm on the teeth through a minimally invasive examination of their teeth. Three dental hygienists donned personal protective equipment including safety glasses, dental procedural masks, barrier gowns, and treatment gloves. An alcohol based hand rub was used on ungloved hands before donning gloves and after glove removal as no facilities were available for handwashing with soap and water.

The plaque score was based upon six teeth which included tooth numbers 3 (maxillary right first molar buccal), 8 (maxillary right central incisor facial), 14 (maxillary left first molar buccal), 19 (mandibular left first molar lingual), 24 (mandibular right central incisor facial), and 30 (mandibular left first molar lingual). In cases where one of the specifically designated teeth was missing, a tooth present immediately adjacent was substituted. The plaque score was based upon the Patient Hygiene Performance (PHP) plaque index in which each tooth buccal or lingual was divided into five sections and if plaque was present in a section, one point was given for a possibility of five points per tooth or a total of 30 points per participant.

The interpreters went from participant to participant with non-dental American volunteers to complete both the pre- and post-tests. To read the plaque scores from the disclosed teeth, the registered dental hygienists used pen lights, flash lights, headlamps, and natural day light for illumination. The tongue and cheeks were retracted through the utilization of tongue blades. Based on the screening method employed, the screening would be considered a Type 4 screening. Seven non-dental volunteers wrote the participants' answers on the pretest as the interpreters asked and reported participants' answers. As the registered dental hygienists proceeded from participant to participant, treatment gloves were changed and disclosant soaked swabs were disposed of to prevent cross contamination. Plaque scores were recorded and coded into a confidential document by non-dental volunteers at the direction of the registered dental hygienists.

Following the completion of the pre-test, participants were informed of educational session topics that would follow and any participant questions were answered. Pre-test data was analyzed at the conclusion of the first session and educational sessions were formulated to meet the oral health educational needs of the villagers. Questions included on the pre-test were both

behavior based and knowledge based. Each oral health education session was held in the Union Grove Church in the Kimuli Village with the help of Ugandan interpreters. Benches in the church held approximately five people. There were 71 total participants. Session topics included nutrition, the use of floss, a toothbrush, and toothpaste. Each session was comprised of two main components, lecture and demonstration. After oral health concepts were explained through lecture and demonstrated in front of the entire group of participants, large typodont sets of plastic teeth, oversized toothbrushes, and various other oral health aids, depending on the topic for the day, were carried by the registered dental hygienists from bench to bench. A demonstration of the oral hygiene aid demonstrated during educational session in front of the whole group was demonstrated to the study participants individually. The participants were then asked individually to demonstrate the use of the oral hygiene aid on the typodonts. Participants' questions were answered throughout the session as they were presented. A question and answer session was held at the end of the session for any further questions the participants may have had. Sessions lasted on average four hours.

At the end of the four days of dental hygiene educational sessions, each participant was given a post-test. The interpreters went from participant to participant with non-dental American volunteers to complete the post-test questionnaires. Seven non-dental volunteers wrote the participants' answers on the pretest as the interpreters asked and reported participants' answers. The registered dental hygienists went from participant to participant applying disclosant to the teeth and reading the plaque scores to complete the post-test questionnaire. To read the plaque scores from the disclosed teeth, the registered dental hygienists used pen lights, flash lights, headlamps, and natural day light for illumination. As the registered dental hygienists proceeded from participant to participant, treatment gloves were changed and disclosant soaked swabs were

disposed of to prevent cross contamination. Plaque scores were recorded and coded into a confidential document by non-dental volunteers at the direction of the registered dental hygienists. The post-test plaque score was taken to allow comparison and study the relationship between dental hygiene educational sessions and the pre-test plaque scores.

CHAPTER 4

FINDINGS

PURPOSE OF THE STUDY

The following chapter provides participant demographics for the study. The demographics include gender, age, approximate monthly income, highest grade completed, and past dental experience. Participants' oral health practices, beliefs, knowledge, and behaviors were also assessed through the use of an oral health questionnaire which concluded with a plaque score. Dental hygiene educational sessions were conducted between the oral health questionnaire pre- and post-tests. Pre- and post- plaque scores were compared to determine significance and demographic characteristics were employed to develop a model of prediction concerning dental plaque scores. Linear multiple regression was employed to develop this model.

The purpose of this study was to assess the oral health knowledge and dental health of the oral cavities of the residents of the Kimuli Village in Uganda. This study also evaluated the effects of a dental hygiene education intervention upon the currently practiced oral health cleansing methods.

RESEARCH QUESTIONS

To accomplish this purpose, the following research questions guided the study:

1. What were selected demographic characteristics of participants in dental hygiene educational sessions in Kimuli Village in Uganda?
2. What were current practices and beliefs concerning dental hygiene held by Kimuli Villagers in Uganda?
3. What is the impact of a dental hygiene educational intervention on the oral health knowledge and behaviors of the Kimuli Villagers in Uganda?
4. What is the impact of a dental hygiene educational intervention on the plaque scores on the teeth of Kimuli Villagers in Uganda?
5. Could a predictive model be identified using selective demographics to predict plaque scores for participants?

The findings will be presented according to the corresponding research question which will be restated immediately prior to the appropriate findings.

Research Question 1- What were selected demographic characteristics of participants in dental hygiene educational sessions in Kimuli Village in Uganda?

Demographic Data

A total of 71 people responded to the posted flyers and came for voluntary participation in the oral health research study and completed the pre- and post-tests. The participant population consisted of 57 females or 70.2% of the population and 14 males which comprised 29.8% of the participant population.

At the time of the study, one dollar was equivalent to 2,640 Ugandan shillings. The approximate monthly household income ranged from 0 to 100,000 shillings. There was one participant who reported an approximate monthly household income of 800,000 shillings which

was considered an outlier and so this piece of data was thrown out. Ages of participants ranged from 19 to 85 years of age. There were 15 participants or 27% of the participant population which ranged from 19 to 30 years of age. There were 10 participants or 18.1% of the population which ranged in age from 31 to 40 years old. There were 15 participants of 26.8% of the population which ranged in age from 41 to 50 years of age. There were nine participants or 16.2% of the population which ranged in age from 51 to 60 years old. There were three participants or 5.4% of the population which ranged in age from 61 to 70 years of age. The oldest category was comprised of individuals 71 years of age and older. There were four total participants or 7.2% of the population in this category.

Of the participants, 31 or 43% of the population reported having seen a dentist in their lifetime, although the visits reported were not preventive in nature and were basically emergency visits. This question was not answered by two participants or 2% of the population. Those reporting that they had never seen a dentist in their life were 38 participants, or 53% of the population.

Participants' level of education ranged from the completion of 12 grades down to no education. Only one participant or 1.8% of the population had completed twelve grades. Eleven participants or 19.6% of the population had completed seven grades. Three participants or 5.4% of the population had completed six grades. Twenty-two participants or 39.3% of the population had completed from one to five grades and 19 participants or 33.9% of the population reported no education (see Table 1). Uganda grades in school were comparable to U.S. grades in school.

Table 1

Participant Demographics

Participants		<i>n</i>	%
Gender	Male	17	29.8
	Female	40	70.2
Age	19-30	15	27
	31-40	10	18.1
	41-50	15	26.8
	51-60	9	16.2
	61-70	3	5.4
	71 and older	4	7.2
Highest Grade Completed			
	12	1	1.8
	7	11	19.6
	6	3	5.4
	5 and below	22	39.3
	0	19	33.9
Approximate income in shillings*	50,000-100,000	4	7.5
	30,000-49,000	9	16.7
	10,000-20,000	13	24.1
	5,000-10,000	1	1.9
	0	27	50
Ever seen a dentist before	Yes	31	43
	No	38	53

Note. * At the time of this study, one dollar was equivalent to 2,640 Ugandan shillings.
N=71

Research Question 2- What were current practices and beliefs concerning dental hygiene held by Kimuli Villagers in Uganda?

Participants' Practices and Beliefs

Participants reported taking care of their teeth either morning only, evening only, and after meals, and variations thereof. At the time of the pre-test, 43 participants, or 60% of the population brushed only in the morning. At the time of the post-test, the number of morning only brushers was reduced to 18 participants, or 25% of the population. The number of evening only brushers included 1 participant or 1% of the population at the time of the pre-test. At the time of

the post-test, no participants reported being evening only brushers. The number of participants who reported brushing in both the morning and evening were 12 or 16% of the population at the time of the pre-test. The number of participants that reported brushing both morning and evening at the time of the post-test rose to 35, or 49% of the population. There were six participants or 8 % of the population that reported brushing after meals at the time of the pre-test and this number was reduced to three or 4% of the population at the time of the post-test. There were other frequencies mentioned by six, or 8% of the participants at the time of the pre-test. The other frequencies of brushing mentioned at the time of the pre-test included a varying schedule, three times daily, and more than three times daily. At the time of the post-test, other frequencies of brushing habits were also mentioned by seven, or 9% of the population of participants. The other frequencies of brushing mentioned at the time of the post-test included a combination of morning, evening, and after meals and a combination of morning and after meals. Therefore, when combining the participants which reported habitual brushing of 1) morning and evening, 2) after meals, and 3) the combinations of morning and evening and after meals and morning and after meals, there were a total of 45 participants or 63% of participants reporting brushing at least twice daily at the time of the post-test. For the pre-test, only one participant, or 1% of the population did not answer this question. This question was not answered by seven, or 9% of the population of participants for the post-test (see Table 2).

When the Oral Health Knowledge and Perceptions Pre-Test Questionnaire was administered, participants reported various methods for maintaining their oral hygiene. The use of a toothbrush alone was reported by 11 participants or 15.4% of the population. The use of floss alone was reported by four participants or 5% of the population. A combination of floss, a toothbrush, and toothpaste was utilized by one person or 1% of the population. The use of

toothpaste alone was reported by one person or 1% of the population. The utilization of a toothbrush and toothpaste together was reported by 41 participants or 56.3% of the population. The utilization of other tools including sticks, trees, ash or charcoal from wood, a combination of salt and soap, a combination of a toothbrush and soap, a combination of a toothbrush, liquid mouthwash, and a stick were reported by 11 participants or 15.4% of the population. Only two participants or 2% of the population reported not cleaning their teeth with anything at all (see Table 2).

Prior to the dental hygiene educational intervention, the majority of participants believed that one time per day brushing was enough to clean their teeth. After the dental hygiene educational intervention, the majority correctly indicated that teeth should be brushed twice daily. The data showed that beliefs and practices concerning types of toothbrushes that should be used and the frequency that the toothbrush should be exchanged changed substantially as a result of the educational intervention. Further, participants' beliefs and practices concerning various aspects of oral hygiene practices changed dramatically between their responses before the intervention and the responses after the intervention (see Table 2).

Table 2

Participants' Pre and Post Practices and Beliefs Concerning Dental Hygiene

(*N* = 71)

Question	Response	Before Educational Intervention		After Educational Intervention	
		<i>n</i>	%	<i>n</i>	%
Do you clean your teeth?*	Yes	2	2.8		
	No	68	95.8		
What tools do you use to clean your teeth?	Brush only	11	15.4	2	2
	Floss only	4	.05	1	1
	Toothpaste only	1	.01	0	0

	Toothbrush, floss, and toothpaste	1	.01	36	50
	Toothbrush and toothpaste	41	56.3	4	5
	Other	11	15.4	0	0
	Nothing used	2	.02	2	2
How often do you brush your teeth?*	Seldom or never	4	5.6		
	Once daily	42	59.2		
	Twice daily	15	21.1		
	Other	10	14		
Have you always brushed your teeth?*	Yes	52	74.6		
	No	14	19.7		
What time of day do you brush your teeth?	Morning only	43	.60	18	.25
	Evening only	1	.01	0	0
	After Meals	6	.08	3	.04
	Morning and Evening	12	.16	35	.49
	Other	6	.08	7	.09
	Does not brush	2	.02	1	.01
If you use a toothbrush, what type of toothbrush do you use?*		8	11.2		
	Big head, hard bristle				
	Small head, hard bristle	17	23.9		
	Big head, soft bristle	5	7		
	Small head, soft bristle	8	11.3		
	I don't know	21	29.6		
	Other	6	8.4		
		28	39.4		
What are your reasons for brushing your teeth?*	Clean, bright teeth				
	Prevention of oral ulcers	7	9.9		
	I do not brush my teeth	1	1.4		
	Prevention of cavities	24	33.8		
	Prevent foul breath	6	8.5		
	Other	6	8.5		
	Prevention of bleeding gums	13	18.3		

	To set a good example to others	6	8.5		
If you do not brush, what are your reasons for not brushing your teeth?	My teeth bother me too much	2	2.8	0	0
	Good teeth are hereditary	2	2.8	1	1.4
	I have no money for brush and toothpaste	0	0	12	16.9
	I forget to brush	1	1.4	3	4.2
	Other	3	4.2	1	1.4
	I have no time for brushing	8	11.3	2	2.8
	Gums bleed if I brush	1	1.4	6	8.5
	I don't know of any benefits from brushing	0	0	2	2.8
	I don't like the smell or taste of toothpaste	0	0	0	0
	Brushing is useless	0	0	2	2.8
	Nobody in my family brushes	0	0	0	0
Do you use toothpaste?*	Yes	37	52.1		
	No	22	31		
Do you use floss, toothpicks, or other items to clean between your teeth?*	Yes	34	47.9		
	No	26	36.6		
Do you have sweet foods between meals?*	1-3 times per day	41	57.7		
	No	17	23.9		
	4-6 times per day	3	4.2		
	7-10 times per day	5	7.0		
If you use toothpaste, does it contain fluoride to help prevent cavities?*			25.4		
	Yes	18			
	No	10	14.1		
How much time do you spend cleaning your teeth each time you brush?	I don't know what fluoride is.	40	56.3		
	2 minutes or less	38	53.5	33	46.5
	2 minutes or more	28	29.4	27	38

Note. * This question did not appear on the post-test.

Research Question 3-What is the impact of a dental hygiene educational intervention on the oral health knowledge and behaviors of the Kimuli Villagers in Uganda?

Impact on Knowledge and Behaviors

Prior to the dental hygiene educational intervention, the majority of participants believed that bad teeth and gums would not lead to poor health of the body. After the dental hygiene educational intervention, the majority correctly indicated that bad teeth and gums could lead to poor health of the body. The data showed that knowledge concerning bad teeth and gums being passed from parents to children changed substantially as a result of the educational intervention. Further, participants' knowledge concerning various aspects of oral hygiene practices changed dramatically between their responses before the intervention and the responses after the intervention (see Table 3).

Table 3

Participants' Pre and Post Knowledge of Oral Health Care

Question	Response	Prior to educational intervention		After educational intervention	
		<i>n</i>	%	<i>n</i>	%
How often should you brush your teeth?	Seldom or never	2	2.8	1	1.4
	Once daily	32	45.1	15	21.2
	Twice daily	16	22.5	37	52.1
	I don't know	11	15.5	1	1.4
What type of toothbrush should you use?	Hard bristle	15	22.7	14	19.7
	Soft bristle	33	50	50	70.4
	I don't know	18	27.2	2	2.8
How often should a toothbrush be exchanged for a new one?	1-3 months	27	46.5	48	67.6

Why should teeth be brushed?	4-6 months	6	10.3	5	7
	7-12 months	2	3.4	3	4.2
	More than 1 year	4	6.8	4	5.6
	I don't know	19	32.7	2	2.8
	Clean bright teeth	28	39.4	29	40.8
	Prevention of oral ulcers	7	9.9	1	1.4
	Prevention of cavities	24	33.8	8	11.3
	Prevent foul breath	6	8.5	5	7.0
	Prevention of bleeding gums	13	18.3	8	11.3
	To set a good example to others	6	8.5	8	11.3
Should you use something to clean between your teeth?*	All the above	5	7.0	19	26.8
	Yes	39	54.9		
Can bad teeth and gums lead to poor health of the rest of the body?	No	21	29.6		
	Yes	39	54.9	61	85.9
Can bad teeth and gums be passed from parents to children?	no	19	26.8	2	2.8
	Yes	33	46.5	57	80.3
Are baby teeth important to the development of permanent teeth?	No	26	36.6	7	9.9
	Yes	36	50.7	53	74.6
Do teeth help you speak?	No	24	33.8	9	12.7
	Yes	52	73.2	63	88.7
Should you have sweet foods between meals?	No	7	9.9	2	2.8
	Yes	44	62	34	47.9
Should toothpaste contain fluoride to help prevent cavities?	No	22	31	25	35.2
	Yes	20	28.2	43	60.6
Where does dental plaque stick?	No	7	9.9	1	1.4
	I don't know what fluoride is.	40	56.3	15	21.1
	On the tongue	1	1.4	2	2.8

On the tongue, gums, and teeth	7	9.9	17	23.9
On the gums	13	18.3	16	22.5
On the teeth	29	40.8	11	15.5
I have never heard of dental plaque.	18	25.4	10	14.1

Note. * This question did not appear on the post-test.
N=71

Research Question 4-What is the impact of a dental hygiene educational intervention on the plaque scores on the teeth of Kimuli Villagers in Uganda?

Impact on Plaque Scores

An independent samples t-test was conducted to compare the two groups, plaque scores before and after the four days of dental hygiene educational sessions. The plaque scores based upon the Patient Hygiene Performance (PHP) plaque index served as the dependent variables. The results of the independent samples t-test were statistically significant, $t(137)=11.596$, $p < .05$, with the mean plaque score for the pre-test group of 21.7 (SD = 6.54) and the post-test group with the mean of 10.02 (SD = 5.23). The effect size ($f = 1.97$) was large. Thus, results suggested that a dental hygiene educational intervention does affect the level of plaque scores in the villagers of Kimuli.

Research Question 5- Could a predictive model be identified using selective demographics to predict plaque scores for participants?

Demographics for Predicting Plaque Scores

The demographic characteristics were used to develop a model of prediction concerning dental plaque scores. There is sufficient literature to support a relationship in America between the demographics and poor oral health (Nathe, 2011; Reisine & Psoter, 2001; Wiener, Crout, &

Wiener, 2009; Wiener et al., 2012), therefore the same results were expected in this study. However, the relationship between these demographic characteristics and dental plaque scores among the villagers of the Kimuli Village in Uganda was not identified in this study. Linear multiple regression was employed to develop this model. Dummy coding was used for the categorical variable gender. The investigation of this model did not reveal any significant relationships between age, gender, highest grade completed, and approximate monthly income or the independent and the dependent variables which were participants' plaque scores. The R square and Adjusted R square show no significant relationships between the demographic characteristics and plaque scores (see Table 4). These weak relationships are further substantiated by the ANOVA table that reveals no significant relationships (see Table 5). An evaluation of the standardized beta weights for the predictors revealed that age contributed the most toward prediction but still did not account for any substantial portion of the variance (see Table 6). Therefore, the demographic variables were not accurate and reliable predictors of dental plaque scores in the vast majority of cases.

Possible factors that may have prevented the detection of differences between demographic groups included the fact that villagers were all from the same remote village where dental health had not been promoted. Further, the lack of education and income could have contributed to the homogeneity of this group. Of the participants in this study, 50% had no income and 33.9% had no education. The income reported by participants ranged from 0 to 100,000 shillings, which is still just less than \$50/month, therefore they are all considered poor by U.S. standards. As all of the participants lived in the same remote village in Uganda and had the same educational background, there may not have been enough differences between the

wealthier and the poorer villagers to provide a line of demarcation that would reveal differences in dental plaque scores.

Table 4

Linear Regression Model Summary Using Demographics for Predicting Plaque Scores

Model	R	R Square	Adjusted R Square	Standard Error of The Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.216 ^a	.047	-.031	6.75966	.047	.601	4	49	.664

Predictors: (Constant), AproxIncome, Age, Gender, Highestgrade

Table 5

ANOVA Table

	Sum of Squares	Df	Mean Square	F	Sig
Regression	109.876	4	27.469	.601	.664 ^a
Residual	2238.957	49	45.693		
Total	2348.833	53			

Dependent Variable: Plaquescore

a. Predictors: (Constant), AproxIncome, Age, Gender, Highestgrade

Table 6

Coefficients Related to Predictor Demographic Variables

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig
	B	Std. Error	Beta		
Constant	22.839	4.355		5.244	.000
Age	-.089	.077	-.197	-1.162	.251
Highest Grade	.096	.408	.040	.234	.816
Gender	1.671	2.369	.108	.706	.484
Approx. Income	-2.195E-005	.000	-.059	-.389	.699

Dependent Variable: Plaquescore

In summary, the participant population was mostly females. Approximate monthly household income ranged from 0 to 100,000 shillings. Participant levels of education ranged from none to 12 grades completed. Past dental experience was reported by 43% of participants. The pre-test questionnaire also contained an open ended question regarding any discomfort in the study participant's mouth. Some participants (N=40) reported dental pain. Participants' beliefs and practices concerning various aspects of oral hygiene practices changed dramatically between their responses before the intervention and the responses after the intervention. Dental hygiene educational sessions were conducted between the oral health questionnaire pre- and post-tests. Results suggested that a dental hygiene educational intervention does affect the level of plaque scores in the villagers of Kimuli. Pre- and post-plaque scores were also compared to determine significance and demographic characteristics were employed to develop a model of prediction concerning dental plaque scores. Linear multiple regression was employed to develop this model. The investigation of this model did not reveal any significant relationships between the independent and the dependent variables.

CHAPTER 5

SUMMARY, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

PURPOSE OF THE STUDY

The villagers of Kimuli were ready and willing to learn and apply the oral health concepts taught. Even though conditions for teaching and learning were not perfect, teaching and learning was accomplished. Rural remote villages are in need of oral health education and the field is wide open for adult educators, service learning organizations, faith-based organizations, dentists, and dental hygienists to work with villagers living there.

The purpose of this study was to assess the oral health knowledge and dental health of the oral cavities of the residents of the Kimuli Village in Uganda. This study also evaluated the effects of a dental hygiene education intervention upon the currently practiced oral health cleansing methods.

RESEARCH QUESTIONS

To accomplish this purpose, the following research questions guided the study:

1. What were selected demographic characteristics of participants in dental hygiene educational session in Kimuli Village in Uganda?
2. What were current practices and beliefs concerning dental hygiene held by Kimuli Villagers in Uganda?

3. What is the impact of a dental hygiene educational intervention on the oral health knowledge and behaviors of the Kimuli Villagers in Uganda?
4. What is the impact of a dental hygiene educational intervention on the plaque scores on the teeth of Kimuli Villagers in Uganda?
5. Could a predictive model be identified using selective demographics to predict plaque scores for participants?

Summary

The majority of study participants were uneducated females ranging in age from 19 to 50 years who reported having no income. The majority of participants reported never having seen a dentist in their lives. Of the study participants who did report having seen a dentist in their lifetime, the majority only saw the dentist for emergency visits, not preventive visits. Prior to the dental hygiene educational intervention, the majority of participants believed that one time per day brushing was enough to clean their teeth. After the dental hygiene educational intervention, the majority correctly indicated that teeth should be brushed twice daily. The data revealed that beliefs and practices concerning types of toothbrushes that should be used and the frequency that the toothbrush should be exchanged changed substantially as a result of the educational intervention. Further, participants' beliefs and practices concerning various aspects of oral hygiene practices changed dramatically between their responses before the intervention and the responses after the intervention. Participants' knowledge concerning various aspects of oral hygiene practices such as the communicability of periodontal diseases and the importance of primary teeth changed dramatically between their responses before the intervention and the responses after the intervention. Concerning plaque scores, results suggested that a dental hygiene educational intervention may dramatically affect the level of plaque scores in the

villagers of Kimuli. There is sufficient literature to support a relationship in America between the demographics of this study and poor oral health. There was no relationship between these demographic characteristics and dental plaque scores among the villagers of the Kimuli Village in Uganda.

Conclusions

Based on the findings of this study, the following conclusions were made: the change in pre- and post-test plaque scores for this study indicated a strong relationship between a dental hygiene educational intervention and the level of plaque scores in villagers of Kimuli. The findings of this study are concurrent with the findings of previous studies which stressed the importance of educational intervention in order to enlighten and inform a population of the state of their health through the acquisition of education whereby the population may elect to exchange poor health habits for more favorable habits (Janz & Becker, 1984; Nathe, 2011; Richards & Digger, 2011). The development and implementation of better health habits impacts the health of the population and their future generations (Brijlal & Gordon, 2005; Macnab & Kasangaki, 2012; Tapsoba, & Deschamps, 1997).

Implications

When analyzing healthcare literature and disease epidemiology, certain demographics appear to be more susceptible to disease (Berkanovic, Telesky, & Reeder, 1981; Rosenstock, 1966). According to Nield-Gehrig and Willmann (2011), these demographics include age, gender, socioeconomic status and educational level, access to dental treatment and race. It appears that the older a person gets, the more progressive and aggressive periodontal disease may become (Nield-Gehrig & Willmann, 2011; Pappas Queen, Hadden, & Fisher, 1993; Perry et al., 2014; U.S. Department of Health and Human Services [USDHHS], 2007). According to the U.S.

Department of Health and Human Services (2007), adults ranging in age from 20 to 64, 8.52 % have some form of periodontal disease. Approximately 5.08% of adults in the U.S. have a moderate to severe form of periodontal disease. The demographics include older persons, Black and Hispanic adults, smokers, and persons of lower socioeconomic status and lower educational levels. Although the definitive reason for the higher rates of periodontal disease in persons over 60 years old has not been specifically defined, speculation has been made to the possible connection of age with higher rates of exposure to risk factors unhealthy influences such as medications, stress, tobacco use, and sickness. Higher rates of periodontal disease may also be related to a loss of dexterity which may be necessary for effective oral hygiene practices to prevent disease (Nield-Gehrig & Willmann, 2011; USDHHS, 2007). Higher periodontal disease rates in the United States may be found among persons of lower socioeconomic status, especially Black and Hispanic males. Persons of lower income and educational levels in the United States also have higher incidence of periodontal disease (Wells, 2008; Nield-Gehrig & Willmann, 2011; Perry et al., 2014; USDHHS, 2007).

Underdeveloped countries appear to have higher rates of chronic periodontitis (Nield-Gehrig & Willmann, 2011; USDHHS, 2007; Weinberg, et al., 2010). This may be due to the lack of education regarding preventive measures that may be taken to avoid disease (Nield-Gehrig & Willmann, 2011; USDHHS, 2007). Lack of access to dental treatment due to barriers that may be encountered by people may also contribute to the development and progression of periodontal diseases. These barriers may hinder those who need or want dental care (Nield-Gehrig & Willmann, 2011; Nathe, 2011; Perry et al., 2014; USDHHS, 2007). Consistent with the literature, the same barriers such as lack of education, finances, and access to care were reported by the majority of study participants.

Uganda was a different setting to teaching dental hygiene methods and oral/general health education. According to Bishop Vincent Victours, teeth are even utilized in the Kimuli Village in Uganda as self-defense for women. He stressed the importance of women in the Kimuli Village to keep their teeth so that they may defend themselves against an abusive spouse (personal communication, February 13, 2013). This concept was consistent with the literature, as it has been suggested that Ugandan men may be abusive to their wives due to the idea of bride price and ownership. Forty percent of Ugandan women reported having suffered from domestic violence (World Bank, 2005). Some of the participants may have had this motive in mind for wanting to learn about oral hygiene techniques to help preserve the longevity of their own life.

The question and answer sessions were valuable insights into the lives and thought processes of the participants. In the U.S., floss is a common household item and in the researchers 17 years of dental hygiene experience, not one adult has ever asked these type of questions. Some of the questions included “How do you open the floss package?”, “Does one piece do the whole mouth?”, “Do I wash the piece and re-use it?”, “How do I break the piece of floss?”, “How do I get the hard stuff (dental calculus) off?”, and “Do I throw the piece away?” However, some participants asked questions that are quite frequently asked in the U.S. such as, “what do my gums bleeding mean, how do I floss when a tooth is missing, and how do I get the floss to the back teeth?” Some of the participants let the dental hygienists know right away that they preferred the broom straw to the floss. These participants were quickly reassured that they were welcome to use the broom straw as the mechanical action of plaque removal could easily be accomplished with the broom straw. As is consistent with the literature, dental plaque biofilm must be removed mechanically from all surfaces to prevent disease progression (Perry, et al., 2014). Dental plaque biofilm removal was the focus of the majority of the dental hygiene

educational sessions presented in this study and the broom straw could efficiently do the job. Another consideration was the availability of the broom straw. As many of the participants reported using the broom straw, it may be unlikely that they have access to toothbrushes, so as was consistent with the literature, the five characteristics of an innovation which are the relative advantage, the compatibility, the complexity, the trialability, and the ability of the innovation to be observed by the people who are considering it, according to Rogers (1995), must be considered. First, one must consider the relative advantage of the new innovation. When considering the relative advantage of a new idea, one must decide if it is superior to what is being used already. In the case of this study, due to the lack of availability and access to toothbrushes and floss, the likelihood of adoption of the recommended new oral hygiene implements may not be very high. Second, the compatibility of the new innovation must be considered. As far as the compatibility of a new innovation is concerned, he stressed that one must consider how closely it aligns with current practices or beliefs. A large majority of participants reported that teeth should be cleaned and something should be used interproximally to remove dental plaque biofilm. An overwhelming majority of participants were utilizing the oral hygiene implements provided through the dental hygiene educational sessions by the end of the study. The likelihood that the participants will continue utilizing some form of implement to clean their teeth appears to be high. Another research finding that indicated a high level of adoption of the recommended twice per day cleaning of the teeth both brushing and interproximally was the overwhelming correct response to the questions regarding the connection between good oral health and good general health of the body.

Third, the complexity of the new innovation must be considered. If a new innovation presents complications which surpass current practice, the likelihood of adoption may be low.

During the oral health education intervention, dental hygienists lectured and demonstrated in front of the entire group of participants using large typodont sets of plastic teeth, oversized toothbrushes, and various other oral health aids. These aids were also carried by the registered dental hygienists from bench to bench and demonstrated to each participant. The participants were then asked individually to demonstrate the use of the oral hygiene aid on the typodonts. Participants' questions were answered throughout the session as they were presented and their questions. Also, as the plaque index data indicated, the participants were capable of utilizing the oral hygiene implements provided through the study as their plaque scores decreased dramatically by the end of the educational sessions.

Fourth, the trialability, or the ability of the innovation to be experienced on a trial basis, must be considered as well. Since the study lasted only for one week, the trialability will not be able to be tested. If another research study was conducted in Kimuli Village, the participants could be questioned to assess as to the long term rate of adoption of the oral hygiene methods and frequencies taught during the dental hygiene educational sessions.

Last, the ability of the innovation to be observed by the people who are considering adopting or not adopting must be deliberated. Since the study only lasted for one week, the trialability will not be able to be tested. If the research was to perform another study in Kimuli Village, the participants could be questioned to assess as to the long term rate of adoption of the oral hygiene methods and frequencies taught during the dental hygiene educational sessions.

The Health Belief Model theory consists of stages the individual must progress through to adopt healthier behaviors for their lives. The stages are dependent upon each other. The first stage involves the individual's acceptance that they are susceptible to a disease or condition.

Second, the individual must acknowledge the seriousness of a disease or condition. Third, the individual must have confidence in there being an effective intervention for the disease or condition. Finally, the individual must utilize the intervention to overcome any barriers that may be preventing their acceptance of healthier behaviors or lifestyle changes (Harris et al., 2014). As the U.S. Public Health Service utilizes this theory for health interventions, this theory may be applied in an underdeveloped nation to convey oral health education and dental hygiene interventions. According to Nathe (2011), "...when individuals have accurate information, they will make better choices including those pertaining to health" (p. 122).

The four stages of the Theory of the Health Belief Model include susceptibility, serious consequences, benefit, and salience. Adults learn due to a felt need and based upon applicability to their life's situation (Wlodkowski, 1991). It has been determined that one reason the rates of oral disease are high in underdeveloped countries is due to a lack of education (Keenen, 2009; Muhirwe, 2003; Peterson, 2008; WHO, 2003a). According to Muhirwe (2003), if individuals have no prior knowledge, as in the case of Uganda, citizens there may be found at the initial stage of the Theory of the Health Belief Model and be in great need of oral health education and dental hygiene intervention due to the fact that they are not even aware of their personal susceptibility.

As was evidenced through the reported change in pre- and post- scores, the study participants gained knowledge regarding oral hygiene knowledge and beliefs. Prior to the dental hygiene educational intervention, the majority of participants believed that one time per day brushing was enough to clean their teeth. After the dental hygiene educational intervention, the majority correctly indicated that teeth should be brushed twice daily. The data identified that beliefs and practices concerning types of toothbrushes that should be used and the frequency that

the toothbrush should be exchanged changed substantially as a result of the educational intervention. Further, participants' beliefs and practices concerning various aspects of oral hygiene practices changed dramatically between their responses and after the intervention.

According to Wlodkowski (1991), adults may be educated most effectively through the identification of a problem that represents a high level of felt need. Although this study was conducted at the primary level of the dental hygiene continuum of care, the pre-test questionnaire contained an open ended question regarding any discomfort in the study participant's mouth. Some participants (N=40) reported dental pain. The researcher was informed by Bishop Victours that in just a few weeks after the completion of the study, there would be some dentists visiting Kimuli Village and they would possibly perform the tertiary level of treatment needed for some of the dental discomfort that the study's oral hygiene instruction would not help alleviate.

The implications for this study may have long lasting effects on the Kimuli Village study participants and also their families. The participants were instructed as to how to utilize their readily available resources, e.g. broom straw, for plaque disruption. As these resources were easy for participants to acquire and use, they may pass their new knowledge down to family members. There was a certain group of female participants that sat on the front row and who were present for the study early each day. They were active participants, asking many questions and willing to demonstrate the oral hygiene method from the previous day. They were so excited to show the registered dental hygienists their progress and willingness to learn. I have no doubt that those ladies may pass their newfound knowledge down to all of their family members, thus affecting future generations of villagers' oral and systemic health and quality of life as was suggested by Akpabio et al. (2008).

Demographic characteristics such as age, highest grade completed, gender, and approximate monthly income were employed to develop a model of prediction concerning dental plaque scores. There is sufficient literature to support a relationship in America between the above named demographics and poor oral health (Nathe, 2011; Reisine & Psoter, 2001; Wiener, Crout, & Wiener, 2009; Wiener et al., 2012). However, the relationship between these demographic characteristics and dental plaque scores among the villagers of the Kimuli Village in Uganda was not detected in this study.

Possible factors that may have prevented the detection of differences between demographic groups included the fact that villagers were all from the same remote village where dental health had not been promoted. Further, the lack of education and income could have contributed to the homogeneity of this group. Of the participants in this study, 50% had no income and 33.9% had no education. The income reported by participants ranged from 0 to 100,000 shillings, which is still just less than \$50/month, therefore they are all considered poor by U.S. standards. As all of the participants lived in the same remote village in Uganda and had the same educational background, there may not have been enough differences between the wealthier and the poorer villagers to provide a line of demarcation that would reveal differences in dental plaque scores.

Recommendations for Future Practice and Future Research

For future research, this study may be repeated in a more urbanized area of Uganda to compare the results obtained from wealthier and more educated participants to determine if the positive relationships that exist in the United States between demographics and dental health do actually hold true in Uganda. Dental health education is a part of primary school curriculum in Uganda, therefore, a positive relationship between education and dental health would be

reasonable to suspect. As dental care was available in the more urbanized areas of Uganda, it stands to reason that a more urbanized population would have a higher level of dental health.

In the future, this study can be replicated and conducted utilizing a more diverse sample consisting of participants who may come from a more urban setting where residents may have more education and hold a higher socioeconomic status. The present study consisted of homogenous group of participants as far as educational level and socioeconomic status was concerned. A larger sample of the population would also be recommended. As dental health education is a part of primary school curriculum in Uganda, a positive relationship between education and dental health would be reasonable to suspect.

This study may also be repeated in another African village. Research in another African village would allow comparison of oral health frequencies, knowledge, and behaviors of neighboring tribes. A follow-up qualitative study using the researcher's field notes may be recommended to enable insight and further detail into research methods and procedures used for this study and to also help guide future studies.

Dental care was found to be available in the more urbanized areas of Uganda, so it stands to reason that a more urbanized population would have a higher level of dental health, therefore resulting in a less significant change in pre- and post-test plaque scores. A future sample study can include a more educated and wealthier sector of the population and be conducted in an area where there is the availability of electricity for even and consistent lighting and temperature control. The study could also possibly be conducted more smoothly if the building had a room specifically designated for the study instead of an open one-room structure where all villagers

had the freedom to come and go and observe. This open-room concept did allow other villagers to come and hear the educational sessions although they did not participate in the study.

If a future study was to be conducted in the Kimuli Village or other rural remote villages, the study should begin with review of previous oral health methods taught and be expanded to include more nutritional and aseptic aspects which are related to oral and systemic health. If this study is replicated in the Kimuli Village or other remote rural villages, educational sessions could include sessions on asepsis, handwashing, and hygiene in general. As the villagers were asked if they washed their hands, they replied that they did wash their hands after they ate. There was no concept of the importance of washing hands and keeping themselves clean to prevent disease and bacterial transmission.

The response to the educational sessions was a positive experience evidenced by participants' enthusiasm and interest in the subject matter. As a result, plaque scores lowered. The villagers were ready and eager to learn and as the week progressed, the number of attendees grew. Adult educators are needed in rural remote villages. Oral health curriculum is also needed and welcomed. Many of the participants had no education and had never seen a dentist before. The need for dentists and dental hygienists to reach this population is great as oral health education is often omitted from governmental health promotion strategies (Brijlal & Gordon, 2005; Macnab & Kasangaki, 2012; Tapsoba, & Deschamps, 1997). Service learning and faith-based organizations' help and contributions are needed in the rural remote areas, however the use of readily available, sustainable materials should be emphasized to avoid the education from being helpful temporarily (Brijlal & Gordon, 2005).

In summary, the villagers of Kimuli were enthusiastic learners. They were ready and willing to apply the concepts taught. Even though conditions for teaching and learning were not perfect, teaching and learning was accomplished. Rural remote villages are in need of oral health education and the field is wide open for adult educators, service learning organizations, faith-based organizations, dentists, and dental hygienists to work with villagers living there.

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APPENDICES

APPENDIX A

ORAL HEALTH KNOWLEDGE AND PERCEPTIONS PRE-TEST QUESTIONNAIRE

Oral Health Knowledge and Perceptions Pre-Test Questionnaire

Age:

Gender:

Highest grade completed in school:

Approximate monthly household income:

PLEASE CIRCLE OR FILL IN YOUR ANSWERS:

1. Have you ever seen a dentist?

3 times or more in my life 1-2 times in my life Never have seen a dentist

2. If you have, when did you last see a dentist?

3. What type of dental problem did you see the dentist for?

4. Should you clean your teeth? Yes No

5. Do you clean your teeth? Yes No

6. What tools (brush, floss, toothpaste, etc.) do you use to clean your teeth?

7. How often do you brush your teeth?

seldom or never once daily twice daily Other:

8. How often should you brush your teeth?

seldom or never once daily twice daily I don't know

9. Have you always brushed your teeth? Yes No

10. What time of day do you brush your teeth?

morning evening after meals Other:

11. If you use a toothbrush, what type of toothbrush do you use?

big head, hard bristle

big head, soft bristle

I don't know

small head, hard bristle

small head, soft bristle

Other:

12. What type of toothbrush should you use?

hard bristle

soft bristle

I don't know

13. How often should a toothbrush be exchanged for a new one?

1-3 months
know

4-6 months

7-12 months

more than 1 year

I don't

14. What are your reasons for brushing your teeth? (circle all that apply)

clean, bright teeth

prevention of cavities

prevention of bleeding gums

prevention of oral ulcers
others

prevent foul breath

to set a good example to

I do not brush my teeth

Other: _____

15. Why should teeth be brushed? (circle all that apply)

clean, bright teeth

prevention of cavities

prevention of bleeding gums

prevention of oral ulcers
others

prevent foul breath

to set a good example to

All of the above

16. If you do not brush, what are the reasons for not brushing your teeth? (circle all that apply)

My teeth bother me too much
useless

I have no time for brushing

Brushing is

Good teeth are hereditary
family brushes

Gums bleed if I brush

Nobody in my

I have no money for brush and toothpaste
brushing

I don't know of any benefits from

I forget to brush

I don't like the smell or taste of toothpaste

Other: _____

17. Do you use toothpaste? Yes No

18. Should you use something to clean between your teeth? Yes No

19. Do you use floss, toothpicks, or other items to clean between your teeth? Yes No

20. Can bad teeth and gums lead to poor health of the rest of the body? Yes No

21. Can bad teeth and gums be passed from parents to children? Yes No

22. Are baby teeth important to the development of permanent teeth? Yes No

23. Do teeth help you speak? Yes No

24. Should you have sweet foods between meals? Yes No

25. Do you have sweet foods between meals?

1-3 times per day

4-6 times per day

7-10 times per day

I do not have sweet foods between meals

26. Should toothpaste contain fluoride to help prevent cavities?

Yes

No

I do not know what fluoride is

27. If you use toothpaste, does it contain fluoride to help prevent cavities?

Yes

No

I do not know what fluoride is

28. How much time do you spend cleaning your teeth each time you brush?

2 minutes or less

2 minutes or more

29. Where does dental plaque stick?

on the tongue

on the gums

on the teeth

on the tongue, gums, and teeth

I have never heard of dental plaque

30. Are you presently experiencing any discomfort with your mouth? Yes No

31. If so, please describe the discomfort below or on the back of this sheet.

Plaque Index

Tooth #3 B			Tooth #8 F			Tooth #14 B		

Tooth #19 L			Tooth #24 B			Tooth #30 L		

APPENDIX B

ORAL HEALTH KNOWLEDGE AND PERCEPTIONS POST-TEST QUESTIONNAIRE

Oral Health Knowledge and Perceptions Post-Test Questionnaire

PLEASE CIRCLE OR FILL IN YOUR ANSWERS:

1. As a result of the educational sessions, should you clean your teeth? Yes No

2. Have you been using the brush, floss, and toothpaste given to you in the educational sessions?

Yes No

3. How often should you brush your teeth?

seldom or never once daily twice daily I don't know

4. How often do you brush your teeth?

morning evening after meals Other:

5. What type of toothbrush should you use?

hard bristle soft bristle I don't know

6. How often should a toothbrush be exchanged for a new one?

1-3 months 4-6 months 7-12 months more than 1 year I don't know

7. Why should teeth be brushed? (circle all that apply)

clean, bright teeth prevention of cavities prevention of bleeding gums

prevention of oral ulcers prevent foul breath to set a good example to others

All of the above

8. If you do not brush, what are the reasons for not brushing your teeth? (circle all that apply)

My teeth bother me too much I have no time for brushing Brushing is useless

Good teeth are hereditary Gums bleed if I brush Nobody in my family brushes

I have no money for brush and toothpaste
brushing

I don't know of any benefits from

I forget to brush

I don't like the smell or taste of toothpaste

Other: _____

9. Can bad teeth and gums lead to poor health of the rest of the body? Yes No

10. Can bad teeth and gums be passed from parents to children? Yes No

11. Are baby teeth important to the development of permanent teeth? Yes No

12. Do teeth help you speak? Yes No

13. Should you have sweet foods between meals? Yes No

14. Should toothpaste contain fluoride to help prevent cavities?

Yes No I do not know what fluoride is

15. How much time do you spend cleaning your teeth each time you brush?

Less than 2 minutes 2 minutes or more

16. Where does dental plaque stick?

on the tongue on the gums on the teeth

on the tongue, gums, and teeth I have never heard of dental plaque

Plaque Index

Tooth #3 B			Tooth #8 F			Tooth #14 B		

Tooth #19 L			Tooth #24 B			Tooth #30 L		

APPENDIX C

AUBURN UNIVERSITY INSTITUTIONAL REVIEW BOARD PROTOCOL SUBMISSION

AUBURN UNIVERSITY INSTITUTIONAL REVIEW BOARD for RESEARCH INVOLVING HUMAN SUBJECTS
RESEARCH PROTOCOL REVIEW FORM

For Information or help contact **THE OFFICE OF RESEARCH COMPLIANCE**, 115 Ramsay Hall, Auburn University
 Phone: 334-844-5966 e-mail: hsubject@auburn.edu Web Address: <http://www.auburn.edu/research/vpr/ohs/>

Revised 03.26.11 – **DO NOT STAPLE, CLIP TOGETHER ONLY.**

Save a Copy

1. PROPOSED START DATE of STUDY: February 2013

PROPOSED REVIEW CATEGORY (Check one): **FULL BOARD** ☒ **EXPEDITED** ☐ **EXEMPT** ☐

2. PROJECT TITLE: The Evaluation of a Dental Hygiene Education Intervention on the Oral Health Practices and Knowledge of Residents of Kimuli Village, Uganda

3. Kernaly Parr
 PRINCIPAL INVESTIGATOR TITLE EFLT DEPT 423.470.4491 ksp0006@auburn.edu
 580 Lee Road 158 Opelika, AL 36804 MAILING ADDRESS FAX kparr@columbustech.edu
 AU E-MAIL ALTERNATE E-MAIL

4. SOURCE OF FUNDING SUPPORT: ☒ Not Applicable ☐ Internal ☐ External Agency: Pending ☐ Received

5. LIST ANY CONTRACTORS, SUB-CONTRACTORS, OTHER ENTITIES OR IRBs ASSOCIATED WITH THIS PROJECT:

6. GENERAL RESEARCH PROJECT CHARACTERISTICS

6A. Mandatory CITI Training	6B. Research Methodology
<p>Names of key personnel who have completed CITI:</p> <p>Kernaly Parr _____</p> <p>Maria M. Witte _____</p> <p>CITI group completed for this study:</p> <p><input checked="" type="checkbox"/> Social/Behavioral <input type="checkbox"/> Biomedical</p> <p>PLEASE ATTACH TO HARD COPY ALL CITI CERTIFICATES FOR EACH KEY PERSONNEL</p>	<p>Please check all descriptors that best apply to the research methodology.</p> <p>Data Source(s): <input checked="" type="checkbox"/> New Data <input type="checkbox"/> Existing Data</p> <p>Will recorded data directly or indirectly identify participants?</p> <p>Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p> <p>Data collection will involve the use of:</p> <p><input checked="" type="checkbox"/> Educational Tests (cognitive diagnostic, aptitude, etc.)</p> <p><input checked="" type="checkbox"/> Interview / Observation</p> <p><input checked="" type="checkbox"/> Physical / Physiological Measures or Specimens (see Section 6C)</p> <p><input checked="" type="checkbox"/> Surveys / Questionnaires</p> <p><input type="checkbox"/> Internet / Electronic</p> <p><input type="checkbox"/> Audio / Video / Photos</p> <p><input type="checkbox"/> Private records or files</p>
6C. Participant Information	6D. Risks to Participants
<p>Please check all descriptors that apply to the participant population.</p> <p><input checked="" type="checkbox"/> Males <input checked="" type="checkbox"/> Females <input type="checkbox"/> AU students</p> <p>Vulnerable Populations</p> <p><input type="checkbox"/> Pregnant Women/Fetuses <input type="checkbox"/> Prisoners</p> <p><input type="checkbox"/> Children and/or Adolescents (under age 19 in AL)</p> <p>Persons with:</p> <p><input checked="" type="checkbox"/> Economic Disadvantages <input type="checkbox"/> Physical Disabilities</p> <p><input checked="" type="checkbox"/> Educational Disadvantages <input type="checkbox"/> Intellectual Disabilities</p> <p>Do you plan to compensate your participants? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p>	<p>Please identify all risks that participants might encounter in this research.</p> <p><input checked="" type="checkbox"/> Breach of Confidentiality* <input type="checkbox"/> Coercion</p> <p><input checked="" type="checkbox"/> Deception <input type="checkbox"/> Physical</p> <p><input checked="" type="checkbox"/> Psychological <input checked="" type="checkbox"/> Social</p> <p><input type="checkbox"/> None <input type="checkbox"/> Other:</p> <p>*Note that if the investigator is using or accessing confidential or identifiable data, breach of confidentiality is always a risk.</p>
<p>Do you need IBC Approval for this study? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes - BUA # _____ Expiration date _____</p>	

FOR OHSR OFFICE USE ONLY	
DATE RECEIVED IN OHSR: 11/30/12 by 66	PROTOCOL # 12-355 EP 1212
DATE OF IRB REVIEW: 12/4/12 by BRO	APPROVAL CATEGORY: 45 CFR 46.110#7
DATE OF IRB APPROVAL: 12/4/12 by	INTERVAL FOR CONTINUING REVIEW: 1 year
COMMENTS: revisions 11/30, 12/7 and 1/4/13 - OK by BRO + SA original in 10/25/12	

7. PROJECT ASSURANCES

PROJECT TITLE: The Evaluation of a Dental Hygiene Education Intervention on the Oral Health Practices and Knowledge of Residents of Kimuli Village, Uganda

A. PRINCIPAL INVESTIGATOR'S ASSURANCES

1. I certify that all information provided in this application is complete and correct.
2. I understand that, as Principal Investigator, I have ultimate responsibility for the conduct of this study, the ethical performance this project, the protection of the rights and welfare of human subjects, and strict adherence to any stipulations imposed by the Auburn University IRB.
3. I certify that all individuals involved with the conduct of this project are qualified to carry out their specified roles and responsibilities and are in compliance with Auburn University policies regarding the collection and analysis of the research data.
4. I agree to comply with all Auburn policies and procedures, as well as with all applicable federal, state, and local laws regarding the protection of human subjects, including, but not limited to the following:
 - a. Conducting the project by qualified personnel according to the approved protocol
 - b. Implementing no changes in the approved protocol or consent form without prior approval from the Office of Human Subjects Research
 - c. Obtaining the legally effective informed consent from each participant or their legally responsible representative prior to their participation in this project using only the currently approved, stamped consent form
 - d. Promptly reporting significant adverse events and/or effects to the Office of Human Subjects Research in writing within 5 working days of the occurrence.
5. If I will be unavailable to direct this research personally, I will arrange for a co-investigator to assume direct responsibility in my absence. This person has been named as co-investigator in this application, or I will advise OHSR, by letter, in advance of such arrangements.
6. I agree to conduct this study only during the period approved by the Auburn University IRB.
7. I will prepare and submit a renewal request and supply all supporting documents to the Office of Human Subjects Research before the approval period has expired if it is necessary to continue the research project beyond the time period approved by the Auburn University IRB.
8. I will prepare and submit a final report upon completion of this research project.

My signature indicates that I have read, understand and agree to conduct this research project in accordance with the assurances listed above.

Kemaly Parr

Printed name of Principal Investigator


Principal Investigator's Signature
(SIGN IN BLUE INK ONLY)

Aug 12, 2012

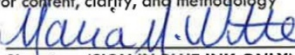
Date

B. FACULTY ADVISOR/SPONSOR'S ASSURANCES

1. By my signature as faculty advisor/sponsor on this research application, I certify that the student or guest investigator is knowledgeable about the regulations and policies governing research with human subjects and has sufficient training and experience to conduct this particular study in accord with the approved protocol.
2. I certify that the project will be performed by qualified personnel according to the approved protocol using conventional or experimental methodology.
3. I agree to meet with the investigator on a regular basis to monitor study progress.
4. Should problems arise during the course of the study, I agree to be available, personally, to supervise the investigator in solving them.
5. I assure that the investigator will promptly report significant adverse events and/or effects to the OHSR in writing within 5 working days of the occurrence.
6. If I will be unavailable, I will arrange for an alternate faculty sponsor to assume responsibility during my absence, and I will advise the OHSR by letter of such arrangements. If the investigator is unable to fulfill requirements for submission of renewals, modifications or the final report, I will assume that responsibility.
7. I have read the protocol submitted for this project for content, clarity, and methodology

Dr. Maria Witte

Printed name of Faculty Advisor / Sponsor


Signature (SIGN IN BLUE INK ONLY)

Oct 18, 2012

Date

C. DEPARTMENT HEAD'S ASSURANCE

By my signature as department head, I certify that I will cooperate with the administration in the application and enforcement of all Auburn University policies and procedures, as well as all applicable federal, state, and local laws regarding the protection and ethical treatment of human participants by researchers in my department.

Sheri Downer

Printed name of Department Head


Signature (SIGN IN BLUE INK ONLY)

10/19/12

Date

8. PROJECT OVERVIEW: Prepare an abstract that includes:

(400 word maximum, in language understandable to someone who is not familiar with your area of study):

I.) A summary of relevant research findings leading to this research proposal:

(Cite sources; include a "Reference List" as Appendix A.)

II.) A brief description of the methodology,

III.) Expected and/or possible outcomes, and,

IV.) A statement regarding the potential significance of this research project.

I.) According to the World Health Organization (WHO), (2003), changes in lifestyles and habits have led to systemic disease and illness in most of the world. Further, many systemic conditions have strong connections to the presence of oral disease. Oral disease not only has devastating effects on the oral cavity, but research suggests that the damages reach much farther into the human body and affect the general or systemic health and quality of life in affected individuals (Ehrlich, 1994; Nathe, 2011; Palmer, 2007; Peterson, 2008). According to Muhirwe (2003), Uganda has no structured oral healthcare system which might possibly allow the citizens to acquire the knowledge and access to the oral healthcare they may be in need. What is more, the Theory of the Health Belief Model (Nathe, 2011) proposes that individuals must be educated regarding the details of possible disease and about their susceptibility to disease.

II.) To evaluate oral health knowledge and perceptions in the Kimuli Village, an oral health questionnaire will be given to consenting participants. The participant will then be asked to chew up a disclosing tablet, thus revealing the level of plaque buildup on the teeth through a minimally invasive examination of their teeth. Over the next four days, the participants will attend four one-hour educational sessions. Following the educational sessions, the questionnaire will be readministered to assess changes in the perceptions and knowledge. Further, following the educational intervention, the participant will once again chew up the disclosing tablets to reassess the plaque levels on their teeth. The pre and post measures will be compared to evaluate the effectiveness of the educational and dental hygiene interventions.

III.) The outcomes include a better understanding of oral hygiene practices in rural Africa and increased education levels concerning oral hygiene. The utilization of evaluation of these interventions will help to better inform the effective methods of adult education in developing countries, especially rural Africa.

IV.) Adults may be educated most effectively through the identification of a problem that represents a high level of felt need. While the Kimuli villagers may not be aware of their susceptibility, they are certainly aware of the discomfort caused by poor oral health. Educational interventions have shown to change individuals' attitudes and influence practice. It stands to reason that an educational intervention in this may result in a change in attitude toward oral health and practices in personal oral health maintenance.

9. PURPOSE.

a. Clearly state all of the objectives, goals, or aims of this project.

The multi-fold purpose of this study is to assess the oral health knowledge, dental health of the oral cavities of the residents of the Kimuli Village in Uganda and to evaluate the effects of a dental hygiene education intervention upon the currently practiced oral health. To accomplish this purpose, the following research questions will guide the study:

1. What means do the villagers employ to maintain their dental hygiene?
2. How often do the villagers visit a dentist?
3. What dental complaints do the villagers hold?
4. What level of plaque biofilm is present upon disclosing the oral cavity of the villagers?
5. What are villagers' perceptions of the need for dental health maintenance?
6. How can an educational intervention affect dental health perceptions and knowledge?

b. How will the results of this project be used? (e.g., Presentation? Publication? Thesis? Dissertation?)

The results of this project will include data that will be utilized to compose a dissertation.

10a. **KEY PERSONNEL.** Describe responsibilities. Include information on research training or certifications related to this project. **CITI is required.** Be as specific as possible. (Attach extra page if needed.) All non AU-affiliated key personnel must attach **CITI certificates of completion.**

Principle Investigator Kemaly Parr Title: Graduate Student E-mail address ksp0006@auburn.edu
 Dept / Affiliation: EFLT

Roles / Responsibilities:

Research design, data collection, data analysis, research report synthesis.

Individual: Dr. Maria Witte Title: Associate Professor E-mail address wittemm@auburn.edu
 Dept / Affiliation: EFLT

Roles / Responsibilities:

Oversee project.

Individual: _____ Title: _____ E-mail address _____
 Dept / Affiliation: _____

Roles / Responsibilities:

Individual: _____ Title: _____ E-mail address _____
 Dept / Affiliation: _____

Roles / Responsibilities:

Individual: _____ Title: _____ E-mail address _____
 Dept / Affiliation: _____

Roles / Responsibilities:

Individual: _____ Title: _____ E-mail address _____
 Dept / Affiliation: _____

Roles / Responsibilities:

11. **LOCATION OF RESEARCH.** List all locations where data collection will take place. (School systems, organizations, businesses, buildings and room numbers, servers for web surveys, etc.) Be as specific as possible. Attach permission letters in Appendix E.
 (See sample letters at <http://www.auburn.edu/research/vpr/ohs/sample.htm>)
 Research will be conducted in the Union Grove Church in Kimuli Village, Uganda.

12. PARTICIPANTS.

a. Describe the participant population you have chosen for this project.

Check here if there is existing data; describe the population from whom data was collected & include the # of data files.
The participant population consists of all adults in the Kimuli Village of Uganda (approximately 100 participants).

b. Describe why is this participant population is appropriate for inclusion in this research project. (Include criteria for selection.)

According to Muhirwe (2003), if individuals have no prior knowledge, as in the case of Kimuli, citizens there may be found at the initial stage of the Theory of the Health Belief Model and be in great need of oral health education and dental hygiene intervention due to the fact that they are not even aware of their personal susceptibility. According to Wlodkowski (1991), adults may be educated most effectively through the identification of a problem that represents a high level of felt need. While the Kimuli villagers may not be aware of their susceptibility, they are certainly aware of the discomfort caused by poor oral health. Educational interventions have shown to change individuals' attitudes and influence practice. It stands to reason that an educational intervention in the Kimuli Village of Uganda may result in a change in attitude toward oral health. The Kimuli village was selected based on previous contact that the researcher has had with leaders in the village. Further, previous research has been conducted in this village by another graduate student in the College of Education concerning educational practices that will complement this research.

c. Describe, step-by-step, all procedures you will use to recruit participants. Include in Appendix B a copy of all e-mails, flyers, advertisements, recruiting scripts, invitations, etc., that will be used to invite people to participate.

(See sample documents at <http://www.auburn.edu/research/vpr/ohs/sample.html>.)

The Union Grove Church Bishop will be contacted to gain approval for conducting the study in the village. Flyers will be provided to hang up around the village to invite participants. Flyers will be hung up approximately two weeks before the study will be conducted. Once the participants arrive for the educational intervention, the informed consent letter will be provided to the participants and the researcher will explain that their participation is purely voluntary. Bishop Vincent Victours serves the village not only as a spiritual leader but also as a village patriarch. By Ugandan tradition, village patriarchs are charged with overseeing much of what happens in their village to ensure that the best interest of the villagers is served. Therefore, Bishop Victours is in a position to grant permission to carry out this study.

What is the minimum number of participants you need to validate the study? ³⁰ _____

Is there a limit on the number of participants you will recruit? ☒ No ☐ Yes – the number is _____

Is there a limit on the number of participants you will include in the study? ☐ No ☒ Yes – the number is ¹⁰⁰ _____

d. Describe the type, amount and method of compensation and/or incentives for participants.

(If no compensation will be given, check here ✓.)

Select the type of compensation: ☐ Monetary ☐ Incentives

☐ Raffle or Drawing incentive (Include the chances of winning.)

☐ Extra Credit (State the value)

☐ Other

Description:

13. PROJECT DESIGN & METHODS.

a. Describe, step-by-step, all procedures and methods that will be used to consent participants.

(☐ Check here if this is "not applicable"; you are using existing data.)

Potential participants will be provided with an informed consent letter that will describe the study and describe that their participation is entirely voluntary. The letter will also state that they may withdraw from participation at any time. Each participant will be asked to read and sign the consent form before they participate. While the English language is predominant in Uganda, a local language specialist will also translate the information to Lugandan for those who lack English skills or need assistance in reading the letter.

b. Describe the procedures you will use in order to address your purpose. Provide a step-by-step description of how you will carry out this research project. Include specific information about the participants' time and effort commitment. (NOTE: Use language that would be understandable to someone who is not familiar with your area of study. Without a complete description of all procedures, the Auburn University IRB will not be able to review this protocol. If additional space is needed for this section, save the information as a .PDF file and insert after page 6 of this form.)

Villagers will be invited to participate in the study via posted flyers(see appendix B). All portions of this study will be conducted in the Union Grove Church building of Kimuli Village. When participants arrive, they will be provided with the informed consent letter. To evaluate oral health knowledge and perceptions in the Kimuli Village, an oral health questionnaire will be given to consenting participants(see appendix C) which they will be asked to complete anonymously. The participant will then be asked to chew up a disclosing tablet, thus revealing the level of plaque buildup on the teeth through a minimally invasive examination of their teeth. Plaque scores will be recorded without any association with names or other identifiable information. Over the next four days, and the participants will attend four one -hour educational sessions. During these sessions, the researcher will provide instruction on proper oral hygiene procedures to the participants. Topics covered in the educational intervention will include, brushing and flossing techniques, the impact of nutrition on oral hygiene, and the impact of oral health on the body. Following the educational sessions, the oral health questionnaire will be readministered to assess changes in the perceptions and knowledge. Further, following the educational intervention, participants will once again chew up the disclosing tablets to reassess the plaque levels on their teeth. The pre and post measures will be compared to evaluate the effectiveness of the educational and dental hygiene interventions.

13c. List all data collection instruments used in this project, in the order they appear in Appendix C.

(e.g., surveys and questionnaires in the format that will be presented to participants, educational tests, data collection sheets, interview questions, audio/video taping methods etc.)

1. Oral health survey
2. Plaque Index

d. Data analysis: Explain how the data will be analyzed.

Demographic data will be collected to compare with the plaque index and the oral health survey results. Frequencies and percentages will be calculated for responses and correlations will be calculated to evaluate relationships in the data. All data will be analyzed via SPSS.

14. RISKS & DISCOMFORTS: List and describe all of the risks that participants might encounter in this research. If you are using deception in this study, please justify the use of deception and be sure to attach a copy of the debriefing form you plan to use in Appendix D. (Examples of possible risks are in section #6D on page 1.)

Participants may encounter social and psychological risks in this research study. Social risks may involve community members being aware of their participation and oral condition. This may result in psychological effects such as varying levels of self-esteem, self-confidence, motivation to improve their oral condition, and content or discontentment with their present oral state. Breach of confidentiality is a risk since personal identifiable data will be collected to match pre-tests with post-tests.

15. **PRECAUTIONS.** Identify and describe all precautions you have taken to eliminate or reduce risks as listed in #14. If the participants can be classified as a "vulnerable" population, please describe additional safeguards that you will use to assure the ethical treatment of these individuals. Provide a copy of any emergency plans/procedures and medical referral lists in Appendix D.
- Participants may encounter social and psychological risks in this research study and precautions will be taken to reduce the possible risks. The possibility of these social and psychological risks may be reduced through the dental hygiene intervention and four educational sessions. Breach of confidentiality will be controlled through careful handling of the code lists that will be generated to identify participants. This list and other identifying documents will be held securely in a locked file box on site and moved to a locked filing cabinet on campus until data has been entered using assigned codes and then the identifying documents will be shredded.

If using the Internet to collect data, what confidentiality or security precautions are in place to protect (or not collect) identifiable data? Include protections used during both the collection and transfer of data.

(These are likely listed on the server's website.)

N/A

16. **BENEFITS.**

- a. List all realistic direct benefits participants can expect by participating in this specific study.

(Do not include "compensation" listed in #12d.) Check here if there are no direct benefits to participants.

The participants may expect an increase in oral health knowledge and improvement in oral health.

- b. List all realistic benefits for the general population that may be generated from this study.

The participants may pass found knowledge onto future generations and those they interact with. Further, this study will help in the understanding of the need for and the effects of dental health education in a remote underdeveloped village.

17. PROTECTION OF DATA.

- a. Will data be collected as anonymous? ☐ Yes ☒ No *If "YES", skip to part "g".*
 ("Anonymous" means that you will not collect any identifiable data.)
- b. Will data be collected as confidential? ☒ Yes ☐ No
 ("Confidential" means that you will collect and protect identifiable data.)
- c. If data are collected as confidential, will the participants' data be coded or linked to identifying information?
☒ Yes (If so, describe how linked.) ☐ No
 Yes, the data will be collected as confidential. The pre and post data collection sheets will be coded to link the participants' oral conditions at the initial baseline examination and after the dental hygiene intervention and four educational sessions.
- d. Justify your need to code participants' data or link the data with identifying information.
 The pre and post data collection sheets will need to be coded to link the participants' oral conditions at baseline and after the dental hygiene intervention and four educational sessions for evidence of effectiveness of the dental hygiene intervention.
- e. Where will code lists be stored? (Building, room number?)
 Code lists and informed consent letters will be stored securely on site in a locked file box. Further, this information will be stored in a locked filing cabinet in Haley Center, Room 4012, Faculty Advisor's office upon return.
- f. Will data collected as "confidential" be recorded and analyzed as "anonymous"? ☒ Yes ☐ No
 (If you will maintain identifiable data, protections should have been described in #15.)
- g. Describe how and where the data will be stored (e.g., hard copy, audio cassette, electronic data, etc.), and how the location where data is stored will be secured in your absence. For electronic data, describe security. If applicable, state specifically where any IRB-approved and participant-signed consent documents will be kept on campus for 3 years after the study ends.
 Code lists and informed consent letters will be stored securely on site in a locked file box. Further, this information will be stored in a locked filing cabinet in Haley Center, Room 4012, Faculty Advisor's office upon return. After data analysis, the code list will be destroyed, therefore no identifying information will be retained, so no data may be connected to participants.
- h. Who will have access to participants' data?
 (The faculty advisor should have full access and be able to produce the data in the case of a federal or institutional audit.)
 The faculty advisor and the principal investigator will have full access to the participants' data.
- i. When is the latest date that confidential data will be retained? (Check here if only anonymous data will be retained. ✓)
- j. How will the confidential data be destroyed? (NOTE: Data recorded and analyzed as "anonymous" may be retained indefinitely.)
 All confidential data (informed consent letters, code list, pre and post exam) will be shredded after data has been entered to prevent connection of anonymous data to participants.



Oral Health Practices and Knowledge Survey Be part of an important oral health research study

Are you between 19 and 35 years of age?

Do you want to learn more about oral health and how to keep your teeth for a lifetime?

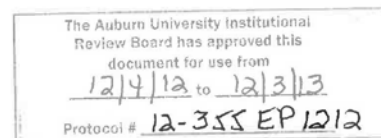
If you answered **YES** to this question, you may be eligible to participate in an oral health research study.

The purpose of this research study is to determine the current level of oral health knowledge and the effectiveness of a dental hygiene intervention. Benefits include an evaluation of current plaque levels and education regarding tooth brushing and flossing to help maintain the mouth.

Adults between 19 and 35 years of age are eligible.

This study is being conducted by Kemaly Parr, RDH of the Educational Foundations, Leadership and Technology Department at Auburn University.

Please contact Kemaly Parr, RDH at **ksp0006@auburn.edu** or **000-1-706-225-0534** or **Bishop Vincent Victours** at **0782824662** for more information.



**(NOTE: DO NOT SIGN THIS DOCUMENT UNLESS AN IRB APPROVAL STAMP WITH
CURRENT DATES HAS BEEN APPLIED TO THIS DOCUMENT.)**

**INFORMED CONSENT
for a Research Study entitled
"The Evaluation of a Dental Hygiene Intervention on the Oral Health Practices and Knowledge
of Residents of Kimuli Village, Uganda"**

You are invited to participate in a research study to The purposes of this study are to assess the oral health knowledge, dental health of the oral cavities of the residents of the Kimuli Village in Uganda. This study will also evaluate the effects of a dental hygiene education intervention upon the currently practiced oral health.. The study is being conducted by Kemaly Parr, under the direction of Dr. Maria Witte, Associate Professor in the Auburn University Department of Educational Foundations, Leadership and Technology. You were selected as a possible participant because you are a resident of the Kimuli Village, Uganda and are age 19 or older.

What will be involved if you participate? If you decide to participate in this research study, you will be asked to fill out a questionnaire, chew up a disclosing tablet, allow examination of your mouth utilizing a pen light and tongue blade, and attend four one hour educational sessions pertaining to oral health education and instruction on proper oral hygiene procedures. Then you will be asked to fill out a questionnaire, chew up a disclosing tablet, allow examination of your mouth utilizing a pen light and tongue blade. Your total time commitment will be approximately 5 hours. The disclosing tablets are chewable tablets composed primarily of sugar that contain a vegetable-based dye that reveals dental plaque. The dye is temporary and will be removed easily by brushing. A translator will be provided if you are not proficient in speaking English.

Are there any risks or discomforts? The risks associated with participating in this study are minimal and include possible social and psychological risks. These risks include possible discontent with your current oral health and social implications from an increased awareness of the importance of oral health.

Are there any benefits to yourself or others? If you participate in this study, you can expect to gain an increase in oral health knowledge and improvement in oral health. We/I cannot promise you that you will receive any or all of the benefits described. Further, your participation will be cost free to you and you will not be paid for your participation. Actual dental therapy (extractions, etc.) will not be performed but recommendations will be made concerning therapy that should be sought.

If you change your mind about participating, you can withdraw at any time during the study. Your participation is completely voluntary. If you choose to withdraw, your data can be withdrawn as long as it is identifiable. Your decision about whether or not to participate or to stop participating will not jeopardize your future relations with Auburn University, the Department of Educational Foundations, Leadership and Technology.

Participant's initials _____

Page 1 of 2

4036 Haley Center, Auburn, AL 36849-5221; Telephone: 334-844-4460; Fax: 334-844-3072

w w w . a u b u r n . e d u

If you have questions about this study, please ask them now or contact Kemaly Parr at ksp0006@auburn.edu or 000-1-706-225-0534 or Bishop Vincent Victours at 0782824662. A copy of this document will be given to you to keep.

If you have questions about your rights as a research participant, you may contact the Auburn University Office of Human Subjects Research or the Institutional Review Board by phone (334)-844-5966 or e-mail at hsubjcc@auburn.edu or IRBChair@auburn.edu.

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE WHETHER OR NOT YOU WISH TO PARTICIPATE IN THIS RESEARCH STUDY. YOUR SIGNATURE INDICATES YOUR WILLINGNESS TO PARTICIPATE.

Participant's signature Date Investigator obtaining consent Date

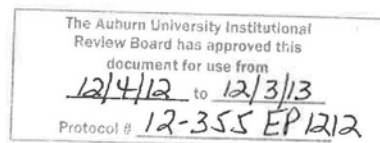
Printed Name

Printed Name

Co-Investigator Date

Printed Name

Page 2 of 2



<p>methodology</p> <p>Institutional Review from 12/3/12</p> <p>Auburn Review 12/4/12</p> <p>Section 609</p> <p>Project # 12-355 EP 12/12</p>	
<p>Received</p> <p>NOV 30</p> <p>Compliance</p> <p>confidential or identifiable data,</p>	
<p>#</p>	

<p>11/30/12</p> <p>12/4/12</p>	<p>46</p> <p>BRO</p>	<p>12 355 EP 12</p> <p>TEGORY: 45 CFR 46.110#7</p>
<p>revisions 130, 12/7 and 1/4/12 K by</p> <p>anal 1251</p>		

APPENDIX D
SITE AUTHORIZATION LETTER

Union Grove Church
Kimuli Village, Uganda

September 16, 2012

Auburn University Institutional Review Board
c/o Office of Human Subjects
307 Samford Hall
Auburn, AL 36849

Please note that Mrs. Kemaly Parr, AU Graduate Student, has the permission of the Union Grove Church to conduct research at our facility for her study, "The Evaluation of a Dental Hygiene Intervention on the Oral Health Practices and Knowledge of Residents of Kimuli Village, Uganda".

Mrs. Parr will contact resident villagers to *recruit* them by posted flyer. Mrs. Parr will evaluate oral health knowledge and perceptions in the Kimuli Village. An oral health questionnaire will be given to consenting participants. The participant will then be asked to chew up a disclosing tablet, thus revealing the level of plaque buildup on the teeth. Plaque scores will be recorded. Further, the participant will be invited to attend four one hour educational sessions where instruction on proper oral hygiene procedures will be presented. Following the educational sessions, the oral health questionnaire will be readministered to assess changes in the perceptions and knowledge. Also, the participants will be asked to chew the disclosing tablets again to reassess the plaque levels on their teeth. Mrs. Parr's on-site research activities will be finished by February 15, 2013.

Mrs. Parr has also agreed to provide to my office a copy of the Auburn University IRB-approved, stamped consent document before she recruits participants at the church, and will also provide a copy of any aggregate results.

If there are any questions, please contact my office.

Signed,

A handwritten signature in black ink, appearing to read "Vincent Victours", followed by a handwritten phone number "0782824662".

Bishop Vincent Victours, Union Grove Church Bishop

APPENDIX E

FLYER



Oral Health Practices and Knowledge Survey Be part of an important oral health research study

Are you between 19 and 35 years of age?

Do you want to learn more about oral health and how to keep your teeth for a lifetime?

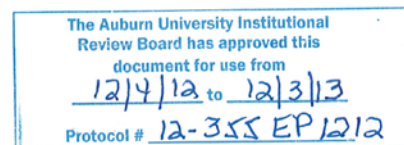
If you answered **YES** to this question, you may be eligible to participate in an oral health research study.

The purpose of this research study is to determine the current level of oral health knowledge and the effectiveness of a dental hygiene intervention. Benefits include an evaluation of current plaque levels and education regarding tooth brushing and flossing to help maintain the mouth.

Adults between 19 and 35 years of age are eligible.

This study is being conducted by Kemaly Parr, RDH of the Educational Foundations, Leadership and Technology Department at Auburn University.

Please contact Kemaly Parr, RDH at ksp0006@auburn.edu or 000-1-706-225-0534 or Bishop Vincent Victours at 0782824662 for more information.



APPENDIX F
INFORMED CONSENT

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INFORMED CONSENT

for a Research Study entitled

**"The Evaluation of a Dental Hygiene Intervention on the Oral Health Practices and Knowledge
of Residents of Kimuli Village, Uganda"**

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Participant's initials _____


Page 1 of 2

4036 Haley Center, Auburn, AL 36849-5221; Telephone: 334-844-4460; Fax: 334-844-3072

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APPENDIX G

WOLTERS KLUWER HEALTH FIGURE USE PERMISSION LETTER

 **Wolters Kluwer**
Health
Two Commerce Square
2001 Market Street
Philadelphia, PA 19103
215 521 6907 tel
www.lww.com

07/29/13

INVOICE AND CONDITIONS

KEMALY PARR
580 LEE ROAD 158
OPELIKA, AL 36804-8642



Invoice # PB3646335 Customer # 000189756745

Dear Requestor:

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Figs 3-2, 3-3, 3-4. Pass-prot site
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APPENDIX H

AMERICAN DENTAL HYGIENISTS ASSOCIATION FIGURE PERMISSION USE EMAIL

Dear Kemaly,

Thank you for continuing research in our field! If your inquiry is regarding the graphic of the roles that is in the "Standards of Clinical Dental Hygiene Practice", we just ask that you cite the reference.

If you have any additional questions, please feel free to reach out.

Sincerely,

Sarah Colomé, M.S.
ADHA Education & Research Specialist
444 N. Michigan Ave
Suite 3400
Chicago, IL 60611
P: 312-440-8930
F: 312-440-6724
sarahc@adha.net
www.adha.org

APPENDIX I

ELSEVIER FIGURE USE PERMISSION EMAIL

Dear Mrs Parr

We hereby grant you permission to reprint the material below at no charge **in your thesis** subject to the following conditions:

1. If any part of the material to be used (for example, figures) has appeared in our publication with credit or acknowledgement to another source, permission must also be sought from that source. If such permission is not obtained then that material may not be included in your publication/copies.
2. Suitable acknowledgment to the source must be made, either as a footnote or in a reference list at the end of your publication, as follows:

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Kind regards

StephNorton :: Rights Associate:: Global Rights ::**ELSEVIER**
T: +44 (0)1865 843325 :: F: +44 (0)1865 853333
E: s.norton@elsevier.com

Please note I am in the office on Tuesdays, Thursdays & Fridays