

ORAL HEALTH DISPARITIES AND HOW MIDLEVEL PROVIDERS CAN IMPROVE
ACCESS TO QUALITY DENTAL CARE

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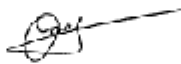
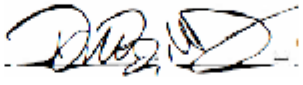
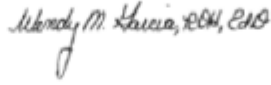
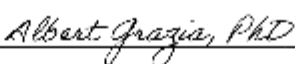
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Sarah O. Ostrander, RDH, MS

Approval of the Dissertation

This Dissertation, by Sarah O. Ostrander has been approved by the committee members below, who recommend it be accepted by the University of Bridgeport, College of Health Sciences in partial fulfillment of requirements for the degree of Doctor of Health Sciences (D.H.Sc.)

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Abstract

Oral disease continues to be a significant issue across the United States and throughout the world. Oral disease is multifactorial and links to general health. Poor oral hygiene is associated with a lack of education and low socioeconomic status. A literature review was conducted to determine the issues related to oral disease, access to quality dental care, and the implementation of a midlevel dental provider being a solution to improve these issues. The research was gathered from peer-reviewed literature. There are no articles used that are older than seven years, except for historical data. The results of the studies support the need for a midlevel dental provider, especially in communities of low socioeconomic status and the uninsured. The limitations include the research completed, populations used in the research studies, statistical testing, and the outcomes of the studies. The populations chosen in the research studies were mainly of the disadvantaged and underserved. These groups of people are associated with low socioeconomic status, lack of education, lack of medical and dental insurance. Based on the findings, this literature review shows the benefit of a midlevel dental provider and how the implementation of this profession across the United States could positively impact oral health care and improve oral health disparities.

Keywords: oral disease, dental disease, access to dental care, dental therapist, midlevel provider, socioeconomic status

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CHAPTER 1: INTRODUCTION

Background

Oral health is an essential aspect of overall health. Dental disease is a significant issue impacting the entire world. Approximately half of the global population is affected by dental disease, and people with low socioeconomic status are affected to a greater extent (Singh, Peres, & Watt, 2019). Lack of access to care and oral health disparities impact not only the health of the oral cavity but also the human body's general health (Dollins, Krust Bray, & Gadbury-Amyot, 2013). In addition to socioeconomic status, other factors that influence oral health include lifestyle, genetics, and environment (Oberoi, Sharma, & Oberoi, 2016).

Impact of Dental Disease

Periodontal disease is the destruction of supporting tissue and bone in the oral cavity. Periodontal disease is characterized by microbially-associated inflammation that results in periodontal ligament attachment loss. The accumulation of biofilm creates inflammation and destroys the oral tissues and, eventually, the bone that supports the tooth structure. Research also shows that active periodontal disease directly correlates with systemic inflammation (Tonetti, Greenwell, & Kornman, 2018). The American Academy of Periodontology recently updated its periodontal classifications. The new classifications focus more on the link to systemic diseases, but especially diabetes mellitus and the use of nicotine and tobacco products. Patients who have uncontrolled diabetes and unstable periodontal disease are at a significantly higher risk for infection (Tonetti, Greenwell, & Kornman, 2018). These direct ties imply that overall health could be improved if the dental and medical professions worked as an interprofessional team.

Access to Dental Care

Access to care has been challenging to obtain due to insurance acceptance, lack of insurance, cost, socioeconomic status, geographic factors, cultural factors, and education. There is currently a shortage of dentists in areas that have been declared a dental health professional shortage area (DHPSA) (Bhagavatula, Xiang, Szabo, Eichmiller, Okunseri, 2016). In 2011, approximately 33.3 million individuals were living in a DHPSA (Institute of Medicine, & National Research Council, 2011). In addition to DHPSAs, there are specific groups of individuals that commonly lack access to oral care. The groups include minorities, children, pregnant women, people with special needs, geriatric populations, underinsured or uninsured, homeless populations, and low socioeconomic status (Institute of Medicine, & National Research Council, 2011).

There are approximately 82 million people who are considered to be of low-income families and therefore are underserved. Of the 82 million, 27.8% are seeing dentists each year. The public health system can see approximately seven to eight million people for dental services each year (American Dental Association, 2011).

The irrefutable fact is that dentistry is not properly serving large segments of our population. The poor, the near-poor, the uninsured, and the elderly, who constitute the greatest number of uninsured, desperately need dental care, but their options are limited. If these underserved groups cannot obtain dental care from traditional providers, other kinds of dental providers will emerge and will almost certainly divide our profession (Seidin, 2013, p. 464).

Different types of dental providers, such as a midlevel dental provider, could be an option to increase access to care and provide services to these specific communities. There will be a greater success if the dental profession can work together as a team to find solutions. Approximately 92% of dentists are practicing in a private practice model, leading to a significant shortage of dentists and dental professionals in the public health sector (Institute of Medicine & National Research Council, 2011). In the dental profession, dental hygienists currently serve as prevention specialists. However, there are limitations in what services they may provide, given the setting. Despite there being set accreditation standards that must be followed for dental hygiene and dental therapy, the level of supervision is still determined by each state. This can prevent clinicians from providing services they have been trained to perform in areas that need it the most. By offering preventive services in underserved areas in addition to implementing a midlevel dental provider, there may be an improvement in access to care in populations that are currently at a disadvantage (Institute of Medicine & National Research Council, 2011).

Midlevel Providers

Midlevel health care providers, such as physician assistants and nurse practitioners, are a growing health profession. This position is advantageous and thriving in the health care world. The implementation of a midlevel provider is a possible solution to the issues with access to dental care around the world.

The American Dental Hygienists' Association has defined a midlevel oral health practitioner as "A licensed dental hygienist who has graduated from an accredited dental hygiene program and who provides primary oral healthcare directly to patients to promote and restore oral health through assessment, diagnosis, treatment, evaluation, and

referral services. The Midlevel Oral Health Practitioner has met the educational requirement to provide services within an expanded scope of care and practices under regulations set forth by the appropriate licensing agency” (American Dental Hygienists’ Association, 2015, pg. 20).

Quite a few states in the United States have adopted this general model. There are currently thirteen states that have implemented a midlevel oral health model. Dentists' opinions have migrated to being more open to the idea of a midlevel provider. However, the view of services a midlevel provider can provide is still subpar, and this is where the nationwide issue of access to care continues (Ly, Schuberg, Lee, Gallaway, Bell, & Coplen (2019)).

The state of Alaska and Minnesota were two of the first to add the midlevel provider model to the practice of dentistry. A midlevel provider model was first passed in Alaska in 2004 with Minnesota following in 2009. Even though the two states' scope of practice is unique, the goals of improving access to care and serving the underserved remain similar (Lenaker, 2017).

Many states have also implemented Registered Dental Hygienists in Alternative Practice (RDHAP) and are considered a direct access state. Even though each state has a different model and scope of practice, the model allows licensed dental hygienists to perform services in alternative practice settings to help the underserved and uninsured without the direct supervision of a dentist (Coppola, Furgeson, Fontana, Kinney, & Gwozdek, 2017). According to Coppola, Furgeson, Fontana, Kinney, & Gwozdek (2017), a direct access state addresses the Institute for Health Care Improvement’s Triple Aim, which includes (a) improving patient experience of care, (b) improving the health of populations, and (c) reducing per capita cost of health care (pg. 16).

Rationale

Oral disease and access to care are significant issues in adults and children in the United States. Dental diseases, such as carious lesions in children, are one of the top diseases' children suffer from each year. Dental disease is related to the quality of life for children and adults, missed school and work hours, and overall general health.

Key Statement

By researching the reasons behind the issues with a lack of access to dental care, solutions may be available to improve oral health.

Research Questions

1. What are the barriers that contribute to oral health disparities?
2. What are the connections related to general health and oral health?
3. Would access to care improve by having a midlevel dental provider?
4. What is the scope of practice for a midlevel dental provider?

Research Objectives

1. Assess the impact of socioeconomic status and oral health.
2. Determine barriers that contribute to oral health disparities.
3. Determine the function of a midlevel dental provider.
4. Discuss insurance issues and the relation to oral health.
5. Discuss links related to general health and oral health.

Definition of Terms:

Advanced Dental Hygiene Practitioner – ADHP

American Dental Hygienists' Association – ADHA

American Dental Association – ADA

American Dental Education Association – ADEA

American Academy of Periodontology – AAP

Center for Disease Control – CDC

Commission on Dental Accreditation - CODA

European Federation of Periodontology – EFP

Federally Qualified Health Center – FQHC

Health Resources and Services Administration – HRSA

Interprofessional Education – IPE

Occupational Safety and Health Association – OSHA

Registered Dental Hygienist – RDH

Registered Dental Hygienist in Alternative Practice – RDHAP

Socioeconomic Status – SES

CHAPTER 2: LITERATURE REVIEW

Oral Disease

Oral disease is one of the most common diseases being treated in adults and children and even more so in those of low socioeconomic status (Oberoi, Sharma, & Oberoi, 2016). Oral health continues to be ignored when examining the body for health or disease. This directly relates to the continued problem of dental disease and access to quality care. Even though oral health has improved over the last century, there are direct links to poor oral hygiene, disease, and low socioeconomic status (Oberoi, Sharma, & Oberoi, 2016). Diseases in the oral cavity are considered an infection and can travel to the rest of the body if left untreated. Dental caries is the most prevalent disease affecting children around the world (Angelopoulou, Beinlich, & Crain, 2019). However, gingivitis and periodontal disease are also oral infections that can cause harm not only to the oral cavity but also to the body. Periodontal disease and its bacteria may affect the cardiovascular system, contribute to diabetes, low birth weight, and bacterial pneumonia. Bacteria in the mouth will also enter the bloodstream, causing potential systemic damage and infection (Li, Kolltveit, Tronstad, & Olsen, 2000).

Gingivitis can develop within 9 – 19 days. If biofilm and food debris accumulate in the oral cavity and go undisturbed, an inflammatory response begins. This is the start of gingivitis. Gingivitis is an infection that includes inflammation, redness, and bleeding. It can become painful when brushing the teeth, flossing the teeth, or even consuming food (Wilkins, Wyche, & Boyd, 2017). Periodontal disease is the destruction of the bone and surrounding tooth surfaces. There are many contributing risk factors involved with periodontal disease. This includes medication usage, immune response, cardiovascular health, adolescence, pregnancy, glucose

control leading to diabetes, and overall current status of oral health. Socioeconomic status and daily routines of cleaning the mouth are directly linked. Those of lower socioeconomic status are less likely to clean their mouth, therefore, more likely to have dental diseases such as dental caries, gingivitis, and periodontal disease (Oberoi, Sharma, & Oberoi, 2016).

Socioeconomic Status

A cross-sectional survey was completed to assess the socioeconomic status of individuals and the relationship to oral health (Oberoi, Sharma, & Oberoi, 2016). The participants were asked questions related to name, age, gender, occupation, and residence. A total of 2,000 people completed the survey. The mean age for participants was 35.32, 58.8% being male, and 41.2% being female. Lower class, upper lower class, lower middle class, and upper-middle-class participated. Of the participants, 42.6% were from the upper lower class, and 38.4% were from the lower middle class. There were 60.2% of the participants who reported visiting the dentist only if there was a problem, and 68.7% were only concerned about pain relief. Even though the majority of participants report cleaning their mouths daily, the survey showed that most participants do not view seeing the dentist as a preventive behavior (Oberoi, Sharma, & Oberoi, 2016).

An additional cross-sectional study was completed on the relationship between income and oral health. There were three different perspectives evaluated that included the following three questions (Singh, Peres, & Watt, 2019);

1. Is low individual/household-level income related to worse oral health outcomes?
2. Is area-level income inequality related to worse oral health outcomes?

3. What is the extent of income-related oral health inequalities within and between countries?

The results show that low socioeconomic status is associated with oral cancer, an increase in dental caries, tooth loss, and traumatic injuries. Also, periodontal disease and poor oral health are more prevalent in low-income families (Singh, Peres, & Watt, 2019).

A study completed in Canada was completed to measure the magnitude of socioeconomic status for four oral health outcomes. Oral health disparity was also measured between genders. The data was collected from 2007 to 2009 through the Canadian Health Measure Survey (CHMS). A total of 4,951 people ages 6 – 79 participated. Among the participants, 2,409 were male, and 2,542 were female (Ravaghi, Quiñonez, & Allison, 2013). The four oral health outcomes included (1) number of decayed teeth, (2) number of missing teeth, (3) number of filled teeth, and (4) oral pain in the past year. Socioeconomic status was measured by household income. Household income was divided into five categories that included lowest income quintile, 2nd quintile, 3rd quintile, 4th quintile, and highest income quintile. The lowest income quintile was a household income of zero, and the highest income quintile was \$100,000 or higher. Statistics were weight-adjusted for a complex study design and standardized for age (Ravaghi, Quiñonez, & Allison, 2013). The data gathered was analyzed using STATA 11.1 and ADePT. Mean outcomes for decayed teeth ranged from 1.1 to 0.35, with the lowest income quintile being the highest and highest income quintile being the lowest. Mean results for missing teeth ranged from 2.15 to 1.57, with the lowest income quintile being the highest and highest income quintile being the lowest. Mean outcomes for filled teeth ranged from 5.05 to 9.18, with the lowest income quintile being the lowest and highest income quintile being the highest. The percentage of dental

pain ranged from 18% to 8%, with the lowest income quintile being the highest and highest income quintile being the lowest. All results except for filled teeth were higher among the lowest income participants. The reasoning behind this may include those of higher socioeconomic status are more likely to visit the dentist for preventive care, therefore more likely to get teeth filled when decay occurs. This study shows significant evidence of socioeconomic status playing a vital role in oral health disparities (Ravaghi, Quiñonez, & Allison, 2013).

Contributing Risk Factors

The risk of dental caries directly links to the consumption of fermentable carbohydrates, as well as sweetened beverages and snacks. Fermentable carbohydrates include cakes, cookies, bread, crackers, chips, and soft drinks. The continuous eating and drinking of sweetened beverages, fermentable carbohydrates, and sugars increase the risk for not only dental disease but also obesity. Since the 1970s, obesity has doubled in children ages 2 to 5 years (Angelopoulou, Beinlich, & Crain, 2019). Fermentable carbohydrates lead to acids accumulating in the oral cavity. If these foods are consumed with water, a washing effect can take place in the mouth. However, frequent snacking and sipping on sweetened foods and beverages cause a continuous cycle of acid attacks in the mouth. When areas in the mouth are left undisturbed, this leads to the breakdown of tooth structure and the formation of carious lesions (Wilkins, Wyche, & Boyd, 2017).

Diet and Lifestyle

High sugar diets are a risk factor for an increase in dental caries. Early childhood caries occurs in many high-risk children. High-risk children include those born into low socioeconomic status. On average, children go to their primary care physician up to 10 times in the first two

years of life (Douglass & Clark, 2015). However, this is not nearly the case for routine dental care. Primary care physicians are also not referring children to see a dentist. By not visiting the dentist within these years, significant damage may occur. Parents and guardians are not being educated on routine oral care at home or in the dental office because they are not going to the dentist. Cariogenic bacteria can transfer from the caregiver or guardian to the child. If children and guardians are not routinely going to the dentist for care, education on the transmission of bacteria will not occur (Douglass, & Clark, 2015). Oral health literacy is low, and creating better access to care at an early age may improve these issues.

An unhealthy lifestyle may also contribute to poor oral health. Additional factors that are linked to dental disease include multiple medications and those suffering from cardiovascular disease and diabetes. Most drugs cause xerostomia, or dry mouth. Saliva acts as a wash cycle for the oral cavity. It helps to self-cleanse the mouth by washing away food debris. When saliva is not being produced, food debris and biofilm tend to sit on the tooth surfaces for long periods. This causes a breakdown of tooth structure, leading to decay and carious lesions (Wilkins, Wyche, & Boyd, 2017). Because oral disease is linked to general health, this association must be explored, so education may not only occur in the dental office but also in primary health care.

Oral Disease in Adults

Poor oral health is associated with quality of life and day to day living (Kelekar & Naavaal, 2018). Oral disease can be preventable, but only if proper resources are available as well as the knowledge of the importance of oral health. Oral health is connected to cardiovascular disease and diabetes mellitus. Those suffering from systemic diseases and have active oral disease are at an increased risk of infection. Poor oral health leads to many missed

work and school hours. A study conducted used data from the Oral Health Supplement to determine work and school hours lost due to planned and unplanned dental visits. Annually, approximately 320.8 million hours were lost just in the United States due to dental care. Of those hours, 92.4 million hours were for emergency dental care (Kelekar & Naavaal, 2018). The data collected from the Kelekar and Naavaal (2018) study determined that the inability to afford proper dental care was associated with additional work hours lost to emergency care. Those with an education beyond high school and with incomes of over \$75,000 lost hours due to planned dental visits when compared to those with less education and lower socioeconomic status. Planned visits consist of preventive or cosmetic care. The results show that a lower socioeconomic status is more likely to lead to unplanned or emergency dental care because preventive care is not occurring on a routine basis. Participants with lower education and income lost more unplanned hours when compared to those with higher education and income (Kelekar & Naavaal, 2018). This study shows that there is a significant amount of missed work related to unplanned or emergency dental care.

Much of the general population of the United States and around the globe are uneducated concerning the importance of oral health, and services are not easily accessible. Many adults are choosing not to go to the dentist, even if they are educated. This is because of the cost associated with treatment. Price is the most common reason people do not receive dental treatment (Kelekar & Naavaal, 2018).

The United States Ranked in Cost, Care, Midlevel Provider, and Direct Access

Each state in the United States was recently evaluated for best and worst dental health and highest and lowest cost for dental treatment. This was determined by 26 key indicators

related to oral health and habits. Each indicator was weighted individually for a total of 100 points (McCann, 2020). The results lead to a connection between dental treatment cost, socioeconomic status, and the use of midlevel dental providers.

The cost of dental treatment is an essential factor when considering care. States vary significantly in the price of treatment. The following five states are ranked as the lowest cost in dental treatment in the United States (Garrity, 2019).

1. Alabama
2. Kentucky
3. Mississippi
4. Tennessee
5. Texas

Unfortunately, of the states that are considered to have the lowest cost in dental treatment, many of these states also have the worst dental care. This correlation can be related to low socioeconomic status among the states. All five states with the most economical cost of dental care appear in the bottom 11 states (including the District of Columbia) with the worst dental care. Also, of the 11 states that are listed below, only the state of Alaska has implemented a midlevel provider, and three of the states are not considered a direct access state, in which a registered dental hygienist can work in alternative practice to serve the uninsured and underserved.

The following states are ranked the top 11 states with the worst dental care (McCann, 2020).

1. Tennessee
2. Florida
3. Kentucky
4. Alaska
5. Texas
6. Alabama

7. Louisiana
8. Montana
9. West Virginia
10. Arkansas
11. Mississippi

Of these 11 states, three do not have Registered Dental Hygienist in Alternative Practice. The states that do not participate in an RDHAP are Alabama, Louisiana, and Mississippi (American Dental Hygienists' Association, 2019). Many states with the worst dental care are also considered to have the lowest cost of dental care. This includes Alabama, Kentucky, Mississippi, Tennessee, and Texas (Garrity, 2019).

The following top 10 states are considered to have the best dental care (McCann, 2020).

1. Wisconsin
2. Illinois
3. Minnesota
4. District of Columbia
5. Connecticut
6. North Dakota
7. Michigan
8. Massachusetts
9. Idaho
10. Iowa

Of these states, Minnesota, Massachusetts, Connecticut, and Idaho have midlevel providers, and Wisconsin and North Dakota are currently pursuing the midlevel provider model. North Dakota is the only state of the top 10 ranked that does not have a Registered Dental Hygienist in Alternative Practice in place (American Dental Hygienists' Association, 2020). The following five states have the highest cost of dental treatment in the United States (Garrity, 2019). Of these states, Connecticut, Massachusetts, and Maine have a dental therapist model (American Dental Hygienists' Association, 2020).

1. Connecticut
2. Maine

3. Massachusetts
4. New Hampshire
5. Rhode Island

Oral Disease in Children

Children are routinely suffering from early childhood caries and dental disease. Dental caries is the most common chronic health problem in children worldwide (Angelopoulou, Beinlich, & Crain, 2019). Dental disease is preventable if proper oral hygiene and regular dental visits occur. Gingivitis is the body's defensive response to existing biofilm from poor oral health. When biofilm and bacteria are not disrupted, the inflammatory response begins to act in the oral cavity. Gingivitis can occur in anyone, including children, adolescents, and adults (Tomazoni, Vettore, Zanatta, Tuchtenhagen, Moreira, & Ardenghi, 2017).

A study completed by Fernanda, et al. (2016) discusses the associations between gingival bleeding in children and adolescents. A cross-sectional study was completed with 1,134 12-year-old children in Santa Maria, Brazil. Parents of the children completed a questionnaire regarding education, gender, race, household income, parent's perception of oral health, and religiosity (Tomazoni et al., 2017). Of all of the children who participated, 96.21% presented with at least one area of gingival bleeding, and 26.28% showed gingival bleeding in 15% or more of the total sites. Those who had higher percentages of gingival bleeding and overall poor oral hygiene were associated with fathers with limited education and those with lower attendance to religious meetings, which can be linked to low socioeconomic status (Tomazoni et al., 2017). Conclusions show that socioeconomic status plays a role in oral health as parents do not have the education of proper oral hygiene to teach their children.

According to the Guideline of Infant Oral Health Care (2015), it is recommended that infants should receive an oral health risk assessment by six months of age. By age 1, a dental home should be established. Even though it is recommended that children should see a dentist by age 1, this is not occurring. The percentage of children between the age of 3 to 5 years who do see a dentist is also deficient (Kuthy, Jones, Kavand, Momany, Askelson, Chi, Wehby, & Damiano, 2014). A retrospective cohort study by Kuthy, et al. (2014) was conducted to evaluate the time until the first carious lesion is identified at five FQHCs in Iowa. A total of 200 children, 40 children at each facility were followed for 36 months. The ages of the children ranged from 4 months to 5 years. Results show that over 50% of children presented with caries during the time of the study. Dental caries began to develop more frequently at age 2. Children who went longer between regular recall appointments were more likely to have carious lesions. Recall intervals should occur every six months for children, and dental professionals must stress the importance of this as it can be a preventive measure for decay forming in children (Kuthy, et al., 2014).

Research shows that age, socioeconomic status, fluoride exposure, gender, and family lifestyle can play a part in early childhood caries (Sharna, Ramakrishnan, Samuel, Ravikumar, Cheenglembi, & Anil, 2019). Sharna, et al. (2019) conducted a study on 200 children who ranged from 3 to 5 years of age showed that 83.5% are suffering from early childhood caries. Parents also reported three significant impacts on the child's quality of life that included dental pain, difficulty eating, and difficulty drinking. These issues are impacting the quality of life in a child who has no control over what food they are provided and if they will receive dental treatment. This also leads to children having a fear of visiting the dental office.

It is reported that dental phobia occurs in 5 – 20% of children among many countries (Pratiwi, Akbar, Pasiga, Samad, Anwar, Djameluddin, & Aprilia, 2018). A cross-sectional study was completed among 278 children who were 8 – 10 years of age. An assessment of dental fear was conducted using the Children’s Fear Survey Schedule-Dental Subscale (CFSS-DS). The survey included 15 total questions related to types of dental treatment. All of the questions were rated using a score range. The range is as follows, 1 = not afraid, 2 = a little afraid, 3 = fairly, 4 – quite afraid, and 5 = very afraid, for a total score of 15 to 75. The results showed that 48.9% were afraid of dental treatment, and 51.1% were not fearful of dental treatment (Pratiwi et al., 2018, pg. 972). The result of dental fear leads to uncooperative behavior and children trying to avoid treatment. If children are uncooperative, this makes it more difficult for a dental office to perform the necessary services. Dental disease is impacting the quality of life in children and increasing their fear of visiting the dentist. Due to this phobia, many children continue to go untreated. This fear continues into the child’s adulthood, and issues continue to arise due to not regularly visiting the dentist for treatment and preventive services. It is recommended that children are introduced to oral hygiene remedies at home in addition to seeing a dentist beginning at age 1 to prevent dental fear from occurring (Pratiwi, et al., 2018). This study provides quality data using a survey that directly links to the predictions. Many children are afraid of dental treatment, which leads to incomplete treatment and an impact on the quality of life that may lead to adulthood (Pratiwi, et al., 2018).

Oral hygiene and disease have been linked to socioeconomic status. A cross-sectional study was completed to assess the link between socioeconomic status and oral health (Oberoi, Sharma, & Oberoi, 2016). The study occurred between June 2014 to October 2014. Low,

middle- and high-class populations were surveyed by questionnaire about gender, age, as well as the frequency of cleaning teeth, replacing toothbrush, rinsing with water, rinsing with a mouth rinse, and tongue cleaning. The socioeconomic status of the population was evaluated using the Kuppuswamy scale, which is based on per capita income per month, education status, and occupational status (Oberoi, Sharma, & Oberoi, 2016). The results showed that 68.7% of those surveyed were focused solely on oral pain relief (Oberoi, Sharma, & Oberoi, 2016). The association between the Kuppuswamy SES scale and cleaning the teeth were significant. The results showed that 99% – 100% of lower middle class and upper-middle-class reported cleaning their teeth. When compared to the lower class, only 62.5% and 86.9% of the upper lower class reported cleaning their teeth (Oberoi, Sharma, & Oberoi, 2016).

Oral Disease Linked to Systemic Diseases

According to Li, Kolltveit, Tronstad, & Olsen (2000), teeth are the only nonshedding surfaces in the body, and bacteria levels can reach more than 10^{11} microorganisms per milligram of dental plaque (pg. 547). Bacteremia may occur after dental procedures, including extractions, scaling and root planing, endodontic treatment, and periodontal surgery. Due to the high levels of bacteria, the bacteria may enter into the bloodstream systemically. Genetic and environmental factors, such as smoking, diet, and socioeconomic status, take up one-half to two-thirds of incidence for cardiovascular disease. The remaining factors include chronic infection and inflammation that may be associated with periodontal disease. The bacteria in periodontal disease consists of gram-negative rods and proinflammatory cytokines (Li, Kolltveit, Tronstad, & Olsen, 2000, pg. 549).

Periodontitis is an infection and is considered a risk factor to cardiovascular disease (CVD), respiratory disease, and type 2 diabetes (Oberoi, Harish, Hiremath, & Puranik, 2016). A cross-sectional study was conducted by Oberoi, Harish, Hiremath, & Puranik (2016) to determine the periodontal status in those suffering from cardiovascular disease, diabetes, or respiratory disease. There were 220 patients surveyed between the age of 30 and 79 years. All participants confirmed they had one of the following conditions: cardiovascular disease, respiratory disease, or type 2 diabetes. A control group was also formed that consisted of 340 patients to act as a comparison. The control group participants did not present with cardiovascular disease, type 2 diabetes, or respiratory disease. The index used was the community periodontal index of treatment needs (CPITN) with a World Health Organization (WHO) periodontal screening probe. Patients were assigned codes 0 – 4 based on the CPITN findings. Code 0 indicates healthy and progresses to code 4, indicating significant periodontal disease. Results showed that those with diabetes and cardiovascular disease had an increase in periodontal disease. Links between respiratory disease and periodontal disease were not found. The connection between periodontal disease and systemic diseases such as CVD and diabetes work together like a two-way street. All conditions need to be maintained and controlled for stability to occur (Oberoi, Harish, Hiremath, & Puranik, 2016).

Congenital heart disease is one of the most common conditions among infants and children and is related to oral health status (Koerdt, Hartz, Hollatz, Frohwitter, Kesting, Ewert, Oberhoffer, & Deppe, 2018). Oral hygiene can play a massive part in the overall health of children, and medical providers are not addressing it. Parents with children who have congenital heart disease are reporting they have limited knowledge between oral health and heart disease.

Children with congenital heart disease are at a higher risk for infection, bacteremia, and endocarditis (Koerdt, et al., 2018). Due to these risks, proper oral hygiene must be maintained to prevent additional issues. A study conducted regarding the education between congenital heart disease and oral health took place surveying 147 patients. Seventy-three percent of the participants with congenital heart disease were not educated on the importance of oral health from their treating heart specialist (Koerdt, et al., 2018). Children with congenital heart disease are more likely to be hospitalized for long periods and miss routine dental visits. General dental offices may be hesitant to treat children with congenital heart disease due to the complexity of the condition (Koerdt, et al., 2018). Medical providers should educate patients and guardians on the importance of oral health. Unfortunately, oral health is a topic that is not addressed or viewed as unimportant. According to the Koerdt, et al. (2018) study, 14% of children participating in the survey reported brushing their teeth only once per day. This study shows that significant issues exist between medical and dental professions, and there is a lack of interprofessional education.

Interprofessional Education in the Dental Profession

The United States health system has been described as an industry working in parallel rather than together, creating communication barriers and possible patient safety issues (Nagelkerk, Thompson, Bouthillier, Tompkins, Baer, Trytko, Booth, Stevens, & Groeneveld, 2018). Nagelkerk, et al. (2018) conducted a study that used sequential mixed methods design, and its purpose was to include staff, students, and patients in a Federally Qualified Health Center (FQHC) to determine the benefit of interprofessional collaborative practice (IPCP). There was a total of 292 participants, including 20 staff, 22 students, and 250 patients. Results showed an improvement of access to care by the number of patients being treated during the year of the

study and the preceding year. By implementing interprofessional collaborative practice (IPCP), an improvement of health and access to care may occur, in addition to a decrease in cost (Nagelkerk, et al., 2018).

Interprofessional Collaboration and Education

Interprofessional collaborative practice shows positive results for improving access to care among different medical professions. Interprofessional care in the dental profession is also shown to improve access to care. A non-experimental comparative design study, plus a retrospective pre-test and post-test were completed regarding the perceptions of interprofessional education among dental and dental hygiene students (McGregor, Lanning, & Lockeman, 2018). A total of 300 students participated from Schools of Allied Health Professions, Dentistry, Nursing, and Pharmacy. A group of faculty members designed a one-hour, thirteen session course that was required for all students. The course content included three significant subjects of interprofessional education, including Roles and Responsibilities, Teams and Teamwork, and Interprofessional Communication. The results show that dental hygiene students had the most considerable change in attitudes towards interprofessional education (IPE) when compared to the other professions that participated (McGregor, Lanning, & Lockeman, 2018). However, the dental students' attitudes did not change significantly. Interprofessional education is one step that may lead to an improvement in access to care. Advancement of access to care comes from the collaboration of providers being knowledgeable on prevention, systemic connections related to oral health, and knowing when to refer appropriately. When providers collaborate and direct patients in the proper direction, resources are more readily available (McGregor, Lanning, & Lockeman, 2018). The Commission on Dental Accreditation has deemed interprofessional

education a requirement within its standards. As schools continue to increase interprofessional education in its curriculums, students will become more educated on the importance of IPE and its link to improving access to dental care (McGregor, Lanning, & Lockeman, 2018).

If health care disciplines work collaboratively in preventive care, positive patient outcomes may increase. According to Palatta, Cook, Anderson, & Valachovic (2015), the Institute of Medicine called for interprofessional education to be adopted by health professions as a pedagogical approach to educating future practitioners for practice in multidisciplinary teams beginning in 2003 (pg. 982). The goal of interprofessional education is to provide more effective and efficient health care, as well as reduce expenses. The American Dental Education Association (ADEA) has made this a priority as dentistry was one of the last to catch on to IPE. Dentistry has been viewed as an isolated profession, which has led to the division of medical and dental care. Within the past decade, the 2010 Patient Protection and Affordable Care Act, in conjunction with an expansion from Medicaid, has made way for IPE and its importance within health care communities (Palatta, Cook, Anderson, & Valachovic, 2015). A survey was sent to all 63 dental schools across the United States to gain additional knowledge on five main components. These include (1) learn the percentage of schools that have initiated an IPE program, (2) determine where IPE is situated in the curriculum, (3) identify other professions with which dental schools collaborate, (4) determine which professional topics provide ample collaborative opportunities, and (5) learn how IPE programs are delivered and assessed.

Interprofessional education is vital to health care and improving access and understanding preventive care. However, of the total dental schools in the United States, only 69.6% require IPE as part of their curriculum (Palatta, Cook, Anderson, & Valachovic, 2015).

The research shows with improved IPE, patients will have greater access to care, enhanced coordination of care being received, and better connections to resources within their communities (McGregor, Lanning, & Lockeman, 2018).

Access to Dental Care

There is a large portion of dentists who retire each year and not enough graduating to replace them, leading to a shortage of dentists.

There are more than 100 million Americans who lack dental insurance and are unable to pay for services provided in the predominantly private, fee-for-service dental practice setting call into question the effectiveness of our current oral health care delivery model in the United States. For adults and children who are able to obtain dental coverage under Medicaid, Pew Research Center found that only one-third to one-half of dentists are even treating Medicaid patients. This is assumed to be due to the perceived high-cost and low-reimbursement rates when treating these patients. As a result, dental needs become more severe as less treatment is performed (Dollins, Bray, & Gadbury-Amyot, 2013, p. 276).

The thought of an alternative workforce model is being proposed throughout the United States with the support of the American Dental Hygienists' Association. The American Dental Hygienists' Association Policy Manual (2020) defines *direct access* as the ability of a dental hygienist to initiate treatment based on their assessment of a patient's needs without the specific authorization of a dentist, treat the patient without the presence of a dentist, and maintain a provider-patient relationship (pg. 32). There are currently 43 states that are considered a direct access state apart from Alabama, Delaware, Hawaii, Louisiana, Mississippi, North Carolina, and North Dakota (American Dental Hygienists' Association, 2020). Direct access states provide

options for dental hygienists to perform their licensed tasks in alternative settings to improve access to care.

A qualitative study was completed from August 2007 to May 2009 to determine the process of legislation relating to the alternative workforce model leading to the implementation of a dental therapist (Dollins, Bray, & Gadbury-Amyot, 2013). According to the research, access to dental care is sparse, with less than 50% of dentists participating in public insurance plans. Because of this, many seek treatment in hospital settings. For one year, 10,325 dental-related emergency room visits occurred and resulted in a cost of \$4,743,519, which breaks down to approximately \$525 per visit. Within the year, 20% of patients returned 2 to 11 times for additional dental pain. This is because the emergency room is not able to treat the issue but provide temporary relief. Since access to care is an established issue, this study was conducted to determine if an alternative workforce model with the implementation of dental therapists would improve the current issues (Dollins, Bray, & Gadbury-Amyot, 2013). To maintain consistency during the study, the sources were divided into three sections: (1) interviews with key stakeholders, (2) documents, and (3) research participant field notes (Dollins, Bray, & Gadbury-Amyot, 2013). The following four questions were developed for the interviews:

1. What was the process that lead up to the act of pursuing legislation regarding the dental therapist and advanced dental therapist?
2. What groups or stakeholders were most involved or influential in the process, what portions of the process were they most involved in and how did they work together?
3. What was the level of stakeholder influence on the workgroup that was assigned the role of scrutinizing the details of the bill and how did it fit into the process?

4. How was the adoption process handled in the end? Who were the primary influential members and how were the final decisions negotiated between parties prior to being presented to the legislature for a vote? (Dollins, Bray, & Gadbury-Amyot, 2013, pg. 277).

The research was kept at the state level, despite the issues in the United States and around the world. The research showed that there is a need for a workforce model that includes a dental therapist to increase access to dental care. Results showed that the group is unable to make significant improvements by standing alone. Safety net organizations, in conjunction with local, state, and national dental hygienists' associations, will have a bigger impact when working collaboratively. A simulation study showed that a general practice dental office that employs a dental therapist and accepts publicly insured patients would increase profits by 28%. The legislation was ultimately passed in this state, and the research is useful as additional states begin to advocate for a similar workforce model (Dollins, Bray, & Gadbury-Amyot, 2013).

Dental Delivery Systems

There are two main types of delivery systems for dental care. This consists of the private delivery system and the oral health safety net (Institute of Medicine & National Research Council, 2011). With the majority of dentists practicing in the private delivery setting, this causes an issue for those who are uninsured and underserved. Data shows that less than 50% of dentists participate in public dental insurance, such as Medicaid plans, and more than 100 million Americans lack insurance (Dollins, Bray, & Gadbury-Amyot, 2013). Dentists who do accept public insurance limit the number of patients to be treated. This leads to people seeking emergency room treatment in place of the dental office. Of those uninsured or with limited insurance, children are thought to take precedence in being provided with public insurance.

However, coverage is still limited. The issues with access to dental care have resulted in a loss of 164 million work hours and 51 million school hours per year in the United States (Dollins, Bray, & Gadbury-Amyot, 2013).

Private Delivery of Dental Service

Approximately 92% of dentists are practicing in the private practice model. Of this percentage, it is estimated that 60% of private practice dentists are solo dentists, 13% are employees, and 3% function as independent contractors (Institute of Medicine & National Research Council, 2011). Private practice offices are more likely to be in areas where populations meet the needs of the dental office. Therefore, more offices are located in urban areas when compared to rural areas. Dental offices are more likely to be in higher-income areas when compared to lower-income areas (Institute of Medicine & National Research Council, 2011).

On average, a dental office will staff 4.8 employees per dentist. This includes 1.3 dental hygienists and 1.8 chairside dental assistants. Some offices will also employ office managers, financial coordinators, and laboratory technicians, but these tasks are also expected to be completed by the chairside dental assistants (Institute of Medicine & National Research Council, 2011).

Private dental offices report having approximately 1,871 active patients and see their patients 3.3 times per year. Payment is collected through fees for service and private insurance. Direct payment occurs in 39% of patients, and 44% occurs through private insurance. Also, only 6% of payment comes through public insurance. In total, approximately two-thirds (63.3%) of all

independent dentists do not have any patients insured by public insurance (Institute of Medicine & National Research Council, 2011).

There are significant disparities in oral health care, especially when comparing the public sector to the private sector. In 2004, public government programs paid a total of \$4.9 billion in dental services. To compare, \$81.5 billion was spent on dental services through private expenditures, third parties, and private insurances. These drastic differences lead to an awareness of dental procedure reimbursement and its flaws (Academy of General Dentistry, 2008).

Oral Health Safety Net

The term safety net has been given to the organizations and providers that are committed to serving public sector populations. However, they are very limited, especially when compared to the private sector. Federally Qualified Health Centers, community health centers, and school-based clinics are the safety net for those in need. An FQHC must be located in an area of need and plan to provide care to the underserved population (Institute of Medicine & National Research Council, 2011). FQHCs offer medical and dental services to the underserved populations. Federal qualified health centers are governed by the Health Resources and Services Administration (HRSA). Grant money is provided by HRSA to maintain financial stability (Grisanti, Boyd, & Rainchuso, 2015). These facilities accept Medicaid and Medicaid insurances with an increased reimbursement rate because of the grants received under Section 330 Public Health Service Act (PHS). To receive the grants, FQHCs regularly submit data to HRSA's Universal Data System (Grisanti, Boyd, & Rainchuso, 2015). From 2001 to 2010, HRSA has provided \$55 million in grants to expand oral health services (Institute of Medicine & National Research Council, 2011). In addition to accepting Medicaid and Medicare, FQHCs offer sliding

scale options for those without insurance. Sliding scale fees are based on family income and the total number of people living in the household (Grisanti, Boyd, & Rainchuso, 2015). In 2009, 71% of patients served in a Federally Qualified Health Center had a family income that fell 100% below the federal poverty level, and 93% fell 200% below the federal poverty level (Institute of Medicine & National Research Council, 2011). FQHCs allows the underserved to seek dental treatment when it can be difficult to find elsewhere. Less than 50% of dentists accept public insurance, leading to a restriction for those with Medicaid and low socioeconomic status. Private practice dentists do not see patients with public insurance due to low reimbursement rates. Due to this reason, emergency dental pain is many times treated in the emergency department rather than in a dental office (Dollins, Bray, & Gadbury-Amyot, 2013).

There are approximately 82 million people who are of low-income families and therefore are underserved. Of the 82 million, 27.8% are seeing dentists each year. The public health system can see approximately seven to eight million people for dental services each year. Even with improvements, there is an estimated capacity of an additional 10 million people. This does not reach anywhere near the numbers of those considered low income and underserved. As additional options are introduced, such as the dental therapist, the American Dental Association sees far larger issues in the health care system that must be addressed before adding a new dental professional role (American Dental Association, 2011).

Public insurances provide very limited services that are covered with insurance. In Pennsylvania, Medical Assistance services are limited. This includes one partial or full denture per lifetime. This means if a person is provided a partial denture at age 50 and needs a full denture later in life, it will not be covered (Pennsylvania Health Law Project, 2019). Medical

Assistance insurance does not cover scaling and root planing, crowns, or root canals unless a benefit limit exception (BLE) is submitted. If the provider submits a benefit limit exception, insurance will only approve the services if (a) the person's life is in danger, (b) the person's health would get much worse, or (c) the person would need additional expensive services. Orthodontics are not covered for any adults, regardless of aesthetic or medical needs (Pennsylvania Health Law Project, 2019). While there are requirements for children's dental coverage through Medicaid, there are no minimum requirements for adult dental coverage nationwide. Currently, less than 50% of states provide comprehensive dental services to adults (Centers for Medicare & Medicaid Services, n.d.)

A report looked at one FQHC in Dubuque, Iowa. A total of 6,000 were served, 3,403 for medical services, and 3,497 for dental services. Twenty-three percent had Medicaid insurance, 42% were uninsured, and 815 were of the homeless population (Grisanti, Boyd, & Rainchuso, 2015). The report reviewed oral health indicators established by Healthy People 2020, HRSA, Maternal Health, National Quality Forum, and Crescent Community to improve oral health. One of the proposed goals related to reducing restorative procedures and extractions in children ages 3 to 5 years. This goal was met by dental hygienists performing services, who specialize in prevention. Between 2007 – 2011, preventive services increased from 60% to 63%, restorative services ranged from 12% to 14% over the five years, and extractions reduced from 4% in 2007 to 1% in 2011 (Grisanti, Boyd, & Rainchuso, 2015).

Insurance

When reviewing the United States, some states are more likely to have higher percentages for uninsured residents. If dividing the United States into the North, South, East, and

West, the South tends to have people with lower socioeconomic status. In 2018, the United States reported health insurance coverage rates by state (Berchick, Barnett, & Upton, 2019). Texas, Oklahoma, Mississippi, Georgia, and Florida have 12% of their populations without insurance. Many other states trend closely behind with 9% – 11.9% uninsured. These states include North Carolina, South Carolina, Tennessee, Alabama, Missouri, New Mexico, Arizona, Utah, Nevada, Wyoming, Idaho, and South Dakota (Berchick, Barnett, & Upton, 2019).

Medicaid funding has continually decreased across the United States, which is a culprit in this issue. Some states have shown an increase in oral health when funding increases. However, it is difficult for dentists to take Medicaid insurances because reimbursement rates are so low. The American Dental Association believes that the country's oral health care system will continue to suffer until more resources are placed in prevention programs such as a community fluoridation, sealant programs, school programs, visiting a dentist by age 1, and overall oral health awareness (American Dental Association, 2012).

Areas that are considered dental health professional shortage areas (DHPSAs) have a disadvantage in receiving dental care. These areas are determined by the Health Resources and Services Administration (HRSA). A study was conducted to compare the utilization of dental procedures with children enrolled in Wisconsin Medicaid and Delta Dental insurance plans (Bhagavatula, Xiang, Szabo, Eichmiller, & Okunseri, 2016). The children in this study must have one of the insurance plans for at least six months during a calendar year and were divided into four groups. The four groups included Delta Dental – DHPSA, Delta Dental non – DHPSA, Medicaid – DHPSA, and Medicaid non – DHPSA (Bhagavatula, et al., 2016).

The results showed that both Medicaid groups had fewer preventive and diagnostic procedures completed but more therapeutic procedures when compared to the Delta Dental groups. Therapeutic procedures include restorative, endodontic, and tooth extraction procedures. Children in the Delta Dental non – DHSPA group had 172.7 diagnostic and 189 preventive procedures. To compare, Medicaid – DHPSA had 127 diagnostic and 110.3 preventive procedures and Medicaid non – DHSPA had 121.1 diagnostic and 98.2 preventive procedures (Bhagavatula, et al., 2016). Medicaid – DHPSA had a total of 97.6 therapeutic procedures, Medicaid non – DHPSA had 89.1 therapeutic procedures, and Delta Dental non – DHPSA had 61.5 therapeutic procedures. Overall, these results show major differences between public and private insurance plans and the type of care and procedures children are receiving due to insurance and residential areas (Bhagavatula, et al., 2016).

Federally Qualified Health Centers (FQHCs)

FQHCs are one of the most important safety nets in reducing significant oral health disparities (Maxey, Norwood, O’Connell, & Ziyue Liu, 2017). Data from 2009 shows that 71% of patients served at an FQHC fell 100% below the poverty level, 93% fell 200% below the poverty level, 38% were uninsured, and 37% were insured by Medicaid (Institute of Medicine & National Research Council, 2011). Safety net programs have continued to grow but are still not able to support all of the people in need. By law, Federally Qualified Health Centers are required to provide certain services, such as preventive services. However, this does not mean comprehensive services are being covered. Approximately 75% of FQHCs are providing comprehensive dental care, leaving 25% only providing preventive services (Institute of Medicine & National Research Council, 2011).

Research shows that a combination of oral health safety net organizations, such as an FQHC and dental hygienists' organizations may lead to an alternative workforce to improve access to care. The midlevel dental provider model shows improvement in access as well as profitability (Dollins, Bray, & Gadbury-Amyot, 2013). Dental therapists and midlevel providers are continuing to be explored through research and its association with the improvement of access to dental care.

What is a Midlevel Dental Provider?

Two main models have been reviewed regarding the implementation of a midlevel provider. This consists of a dental therapist and an advanced dental hygiene practitioner.

The American Dental Hygienists' Association defined a Midlevel Oral Health Practitioner as a licensed dental hygienist who has graduated from an accredited dental hygiene program and who provided primary oral health care directly to patients to promote and restore oral health through assessment, diagnosis, treatment, evaluation, and referral services. The Midlevel Oral Health Practitioner has met the educational requirements to provide services within an expanded scope of care, and practices under regulations set forth by the appropriate licensing agency (American Dental Hygienists' Association, 2015, pg. 20).

Registered Dental Hygienist in Alternative Practice (RDHAP)

Most states are now considered a direct access state, which allows a registered dental hygienist to work in public health settings under the general supervision of a dentist. Many states require additional certification. Each state has a slightly different direct access model, which is determined by state legislation. The following cross-sectional study surveys RDHAPs in

California to determine economic sustainability factors (Coppola, Furgeson, Fontana, Kinney, & Gwozdek, 2017). A survey that consisted of 38 questions was mailed to 540 RDHAPs in the state of California, and 98 responses were received. Of the participants, 59% have a bachelor's degree, and 20.5% have a master's degree. The results showed that 44% of RDHAPS reported employment in traditional private practice, but if the opportunity presented, 61% of the respondents would practice only as an RDHAP. Thirty-one percent of participants felt that dentists lack knowledge of an RDHAP, and 25% indicated dentists are resistant to this workforce model (Coppola, Furgeson, Fontana, Kinney, & Gwozdek, 2017). The study was able to determine five challenges faced in economic sustainability based on survey responses. This included practice expense, insurance reimbursement, patient flow, RDHAP visibility, and issues with the dentist. Despite the challenges, there is still positivity related to the RDHAP nationwide (Coppola, Furgeson, Fontana, Kinney, & Gwozdek, 2017).

States that Currently Use Midlevel Providers in Dentistry

Midlevel dental provider models are continuing to gain popularity. There are many states that have passed legislation or are currently working on a midlevel provider model. However, the models differ significantly, and many do not address the advocacy needed for a midlevel provider. The model was designed to offer an opportunity to provide care to the underserved, uninsured, and those in geographic locations where dental offices currently do not exist. Some midlevel provider models still require the direct supervision of a dentist. This does not solve the issue. Many populations are not being served because a dental office does not accept public insurance or offer a sliding scale option for those of low income. Midlevel providers need the

option to work independently or at least work under the general supervision of a dentist to provide necessary services to all populations, regardless of socioeconomic status.

States that currently have midlevel provider models include Minnesota, Alaska, Maine, and Vermont. States that have pending legislation include Ohio, Kansas, Connecticut, Massachusetts, Michigan, and North Dakota (Smallidge, Boyd, Rainchuso, Giblin-Scanlon, & LoPresti, 2018). Since this research, additional states have passed legislation to make a dental therapist possible. New Mexico, Idaho, Connecticut, Montana, and Nevada are very recent, as these states passed dental therapy into law in 2019 (American Dental Hygienists' Association, 2019). Dental therapy is gaining popularity across the country as there are now a total of 13 states that have passed legislation for dental therapy. Within the last two years, six of the 13 states have been passed into law. Six additional states are also currently pursuing dental therapy to improve access to dental care (American Dental Hygienists' Association, 2019).

The following lists the state and year that legislation was passed to implement a midlevel provider (dental therapist) that requires additional education for licensure (American Dental Hygienists' Association, 2020).

1. Alaska (Tribal Community); 2004
2. Minnesota; 2009
3. Maine; 2014
4. Oregon; 2016
5. Vermont; 2016
6. Washington (Tribal Community); 2017
7. Massachusetts; 2017
8. Arizona; 2018
9. New Mexico; 2019
10. Idaho; 2019
11. Connecticut; 2019
12. Montana; 2019
13. Nevada; 2019

The following states are currently pursuing midlevel dental providers (dental therapists) (American Dental Hygienists' Association, 2020).

1. Florida
2. Washington
3. Kansas
4. North Dakota
5. Wisconsin

Scope of Practice – Alaska

The state of Alaska utilizes and accepts the services provided by a midlevel dental provider. The model in Alaska is different from other states, but Alaska is given credit for beginning this trend in the United States. Adopted from New Zealand, the Alaska Native Tribal Health Consortium developed the Dental Health Aide Therapist (DHAT) in 2004. The Alaska Native community has a large shortage of dental providers and a major epidemic in oral health. The American Indian and Alaska Native population's oral health is worse than all of the United States when compared. A survey conducted in 1999 by the Indian Health Service found that children and adolescents age 2-19 years that are American Indian and Alaska Native are more likely to suffer from dental disease and untreated disease when compared to the entire nation. Children in these communities age 2-5 years are five times more likely to have dental disease than other children in the United States (Institute of Medicine & National Research Council, 2011).

The implementation of a Dental Health Aide Therapist has helped address these issues tremendously. Dental Health Aide Therapists specifically work in the Alaska Native villages. The profession requires two years of education. Students attend Ilisagvik College as they are in partnership with the Alaska Dental Therapy Education Program. As a Dental Health Aide Therapist, the scope of practice allows the DHAT to provide community-based oral health

preventative care, education, basic restorations, cleanings, and non-surgical extractions under the general supervision of a dentist (DHAT Certification and Scope of Practice, Alaska Native Tribal Health Consortium, 2019).

This model also differs because students attending the program do not need to already be in the dental field. Students are recruited from their villages, and all education is provided during the two years of schooling. This model is very successful but does differ from other states that have implemented a midlevel dental provider. However, due to Alaska adopting this model from New Zealand, a trend has started that will hopefully continue to travel across the United States through legislation.

Alaska Native continues to work diligently to reduce emergency care and provide more preventive care services to its villages. As legislation passed in 2004, the first graduating class began practicing in 2006. The Yukon Delta village began utilizing a team-approach and incorporated DHATs into the dental setting. Between 2006 and 2013, the focus was to reduce emergency treatment and provide more preventive services to reduce disease. Since then, the village has seen significant changes in the type of care that is being provided (Lenaker, 2017). In 2009, 38% of the care being provided was for emergency reasons. In 2014, this number decreased to 24%. Preventive services made up 24% of care in 2009 and have since increased to over 40% in 2014 (Lenaker, 2017). The implementation of a Dental Health Aide Therapist has been a successful model for the Alaska Native, where so much of the population is unable to receive care due to geographic location and socioeconomic status. There are so many other areas of the United States that continue to have similar issues in providing care, and this research shows this model could be very successful.

Scope of Practice – Minnesota

Minnesota was the first state to implement a midlevel dental provider for the entire state. Even though Alaska already had a similar model in place, it is strictly for Alaska Native villages, rather than the entire state. This did not occur in Minnesota until 2009 and was a significant accomplishment for the state and dental professionals. The state of Minnesota developed two midlevel positions for the dental profession. They include the Dental Therapist (DT) and Advanced Dental Therapist (ADT). According to the Minnesota Department of Health (2019), the goal of the two roles is to serve those who are underserved, uninsured, and of low socioeconomic status to reduce emergency room visits for dental care.

The main difference between the two professions is the level of supervision that is needed to practice. Advanced dental therapists do not need to have a dentist on-site, nor do they need the dentist to see the patient before treatment. Advanced dental therapists are still considered to work under the general supervision of the dentist, allowing them to provide needed services in public health centers and areas where there is a shortage of providers. Both providers can perform similar services, but the level of supervision differs. To compare, dental therapists are performing similar services but must work under the direct or indirect supervision of a dentist. According to Minnesota 2009 Session Laws, Chapter 95, Article 3, Subd. 4, a dental therapist may perform the following under general supervision (Minnesota Dental Therapy Association, 2019):

- Oral health instruction
- Radiographs
- Polishing
- Application of topical fluoride
- Pit and fissure sealants
- Pulp vitality testing

- Fabrication of mouthguards and soft occlusal guards
- Atraumatic restorative therapy
- Dressing changes
- Tooth reimplantation
- Administration of local anesthesia
- Administration of nitrous oxide

A dental therapist may perform the following under indirect supervision (Minnesota Dental Therapy Association, 2019):

- Emergency palliative treatment of pain
- Placement and removal of space maintainers
- Cavity preparation
- Restoration of primary and permanent teeth
- Placement of temporary crowns
- Preparation and placement of preformed crowns
- Pulpotomies on primary teeth
- Extractions of primary teeth
- Suture removal
- Brush biopsies
- Repair of defective prosthetic devices
- Recommending permanent crowns

Minnesota has implemented a clear and concise scope of practice for dental therapists and advanced dental therapists to be successful. There are programs offered for students to complete dual enrollment, completing programs that will lead to becoming a dental hygienist and a dental therapist.

Scope of Practice – Maine

A quantitative cross-sectional study was completed to assess the awareness of the midlevel provider model in dental hygienists licensed in the state of Maine (Smallidge, Boyd, Rainchuso, Giblin-Scanlon, & LoPresti, 2018). A survey was utilized to collect data with a total of nineteen items. The study was sent to 1,284 dental hygienists. There was a response rate of 21% for a total of 268 who participated in the survey. After collecting the data, 65% of

participants expressed interest in enrolling in a dental hygiene therapy program. Of those interested, 51.8% were interested in the program on a part-time basis, and 47.4% would prefer the education modality to be web-based. Results of the study show that there is a significant interest in dental hygienists becoming dental therapists but have some hesitation concerning cost and education modality (Smallidge, Boyd, Rainchuso, Giblin-Scanlon, & LoPresti, 2018).

The state of Maine now offers a midlevel dental hygiene therapist (DHT) model, as well as several direct access models. All of the models require different education and the scope of practice differs among the professions. Those interested are required to be a practicing dental hygienist in the state of Maine and hold a bachelor's degree. The education requires four additional semesters from a CODA-accredited institution for licensure eligibility (Smallidge, Boyd, Rainchuso, Giblin-Scanlon, & LoPresti, 2018).

Support of Midlevel Providers from Dentists

Midlevel providers offer a solution to vulnerable populations, such as the uninsured and underserved. According to a recent study by Ly, Schuberg, Lee, Gallaway, Bell, & Coplen (2019), research suggests that dentists are becoming more accepting of the implementation of a midlevel dental provider. However, the opinions on the scope of practice, supervision, and education differed when surveying dental hygienists. The survey questioned dentists and dental hygienists working in the Pacific Northwest. Respondents came from Oregon, Washington, and Idaho. There were 13 items for dental hygienists and 14 items for dentists to answer. A total of 271 dental professionals participated. Of this total number, 84 were dentists, and 187 were dental hygienists. Results showed that 82% of dental hygienists indicated "Strongly Agree" or "Agree"

that a dental therapist should be an integral part of the dental team. When compared to the survey results of the dentists, only 51% indicated a dental therapist should be part of the dental team.

The only area where the participating dental hygienists and dentists reported agreement was the level of education. Thirty-eight percent of dentists and 36% of dental hygienists believe that a bachelor's degree should be required for a midlevel provider. Thirty-five percent of dentists and 24% of dental hygienists believe that a master's degree should be required for a midlevel provider (Ly, et al., 2019). Agreement between professions differed when being surveyed regarding the scope of practice. This led to the most significant difference in opinion, which was the levels of supervision for dental therapists. Forty-eight percent of dentists believe that a dental therapist should have the direct supervision of a dentist when practicing. To compare, only 11% of dental hygienists reported direct supervision would be necessary for a dental therapist. Even though dentists are becoming more open to the idea of a midlevel provider, the research clearly shows that there is a long way to go between the opinions of dental hygienists and dentists. If direct supervision continues to be required, solutions will be limited to serving those without insurance and of low socioeconomic status (Ly, et al., 2019).

The dental hygiene community understands the importance of obtaining the appropriate amount of education to become a dental therapist. The Commission on Dental Accreditation is the accrediting body for dental, dental therapy, dental hygiene, and dental assisting programs. For dental hygienists and dentists, education must occur within an institution that is fully accredited by the Commission on Dental Accreditation to be eligible for licensure. It would be the same scenario for a dental therapist. The Commission on Dental Accreditation developed standards for dental therapy programs in 2015. The standards are nationally accepted, but the

scope of practice remains in the hands of each state that pursues this opportunity (Commission on Dental Accreditation, 2016). Current dental hygienists who are interested in becoming a midlevel provider are more than willing to obtain the appropriate level of education to provide services. Dental hygiene and dental therapy communities are interested in serving the public to the best of their ability with proper education (Ly, et al., 2019).

Dentists are skeptical that implementing midlevel providers will provide a solution to the shortage in dentists and access to care issues (Ly, et al., 2019). Fifty-three million people are living in the United States in areas that are considered to have shortages of dental professionals. By expanding the scope of a dental hygienist, these populations may be able to be better served (Ly, et al., 2019). Dentists' opinions have migrated to being more open to the idea of a midlevel provider. However, the view of services a midlevel provider can provide is still subpar, and this is where the nationwide issue of access to care continues (Ly, et al., 2019).

Skepticism from the American Dental Association and American Association of Oral and Maxillofacial Surgeons

The American Dental Association has made it well-known in the last two decades that the organization does not support a midlevel dental provider. The dentists who stand behind this believe no provider who is not a trained dentist should be legally able to provide irreversible or surgical procedures. The American Dental Association believes there are far more issues with the health care system, and increasing providers is not the solution. The ADA does not find there to be fundamental research and statistics to show a midlevel provider is improving oral health (American Dental Association, 2011).

A concern of the American Association of Oral and Maxillofacial Surgeons (AAOMS) is the amount of training and education that midlevel dental providers are receiving. The claim is a nurse practitioner, or physician assistant completes approximately six years of post-high school education. However, some dental therapists receive two years of schooling post-high school and are completing irreversible procedures (American Association of Oral and Maxillofacial Surgeons, 2017). However, the American Dental Hygienists' Association proposed a master's degree level for a midlevel dental provider model. Dental therapy programs do range in length, but most programs require more than two years of post-high school education. Dental therapy programs that are CODA-accredited must follow the standards set for the profession.

Many countries have been using a midlevel dental provider for decades. Still, according to the ADA, of the 54 countries that have implemented a dental therapist, less than half have reported data that shows effectiveness. Many countries are relying on verbal reports (American Dental Association, 2012). Dental therapists within the United States and other countries all abide by slightly different laws, the scope of practice, and the level of required supervision. This makes it challenging to demonstrate efficacy due to the significant differences.

The American Dental Association presented a report in 2013 regarding the effectiveness of dental therapists in communities. A search was conducted through 13 databases and finding over 7,000 articles. After reviewing the inclusion criteria, 18 studies met the requirements. The studies ranged from the 1950s as the oldest and current articles within the past five years. Of the 18 reviews, bias was determined based on a low, moderate, and high scale with 12 considered to be high, five is moderate, and one is low risk. The report indicates that no differences were found in decayed, missing, and filled teeth for populations treated by dental therapists and only

dentists. Even though more carious lesions are being treated, the ADA does not believe that implementing a dental therapist reduces the number of decayed areas occurring in populations (American Dental Association, 2013).

CHAPTER 3: METHODOLOGY

Methods

A comprehensive review of the literature on the implications of oral health disparities and access to quality dental care was conducted. Independent search histories were conducted to determine disparities with oral health and access to dental care as well as solutions to improve these issues. The first search completed was to determine primary studies and background research explicitly related to the topic. The first search consisted of identifying the problems associated with oral disease and access to care. The articles were searched and found on the following databases: EBSCOhost; Dentistry and Oral Sciences Source, EBSCOhost; Academic Search Complete, Google Scholar, and web addresses with direct associations to the American Dental Hygienist's Association, Center for Disease Control, American Academy of Periodontology, American Dental Association, Pennsylvania Dental Hygienists' Association, Minnesota Dental Hygienists' Association, The National Academies Press – Improving Access to Oral Health Care for Vulnerable and Unserved Populations, and Oral Health Workforce Research Center.

The second search consisted of solutions to the issues with access to quality dental care. The search included solutions that have been implemented in different states in the United States but cannot be utilized everywhere due to state laws and jurisdiction. Articles were searched and found on the following databases: EBSCOhost; Dentistry and Oral Sciences Source, EBSCOhost; Academic Search Complete, and web addresses with direct associations to Federally Qualified Health Centers, public insurances, states utilizing a midlevel dental provider

or dental therapist, services being provided by midlevel dental providers or dental therapists, and states utilizing practitioner certificates.

All articles were available in full-text versions to review the entire article. Studies were not excluded based on the findings, results, and conclusions to reduce bias.

Search Engines

The keywords and search terms used when searching the EBSCOhost Dentistry and Oral Science Source database included: dental therapist, access to dental care, oral disease in children, dental therapist in Maine, socioeconomic status, dental care, ADA against midlevel providers, public health sector, federally qualified health centers, caries infectious disease, dental care and socioeconomic status, oral disease and cardiovascular disease, dental disease, dental disease in children, periodontal disease, American Academy of Periodontology classifications, early childhood caries, dental cost, dental insurance, lack of education, and recommendations for pediatric health care. The keywords used when searching the Academic Search Complete database included: use of physician assistant, oral disease, and cardiovascular disease.

Significant literature has been reviewed. Only sources from the last seven years have been considered for the inclusion of this review of the literature. Pertinent historical articles were also considered.

Reference Selection

When using the keywords and search terms, hundreds to thousands of articles were populated. To narrow the results and research, approximately 65 articles were utilized for this research. The research consisted of scholarly journal articles, including qualitative and cross-sectional studies.

Inclusion Criteria

There are four inclusion criteria. Inclusion criteria included (a) literature published since 2013, except historical sources; (b) English-language text; (c) peer-reviewed articles; and (d) web addresses related to the following:

1. Oral health/oral disease impacting adults and children
2. Dental hygienists/Dental midlevel providers
3. Dental therapy/dental therapist/ Dental Health Aide Therapist (DHAT)
4. Specific services provided by public insurance
5. Access to dental care and federally qualified health centers (FQHCs)
6. High-risk populations (race, education level, socioeconomic status)
7. State and national dental/dental hygiene associations
8. Associations related to oral health, periodontology, and infection control safety

Exclusion Criteria

There are four exclusion criteria. The exclusion criteria included (a) literature published before 2013, except historical sources, (b) text not published in the English language; (c) articles that are not peer-reviewed, and (d) web addresses not related to the following:

1. Oral health/oral disease impacting adults and children
2. Dental hygienists/Dental midlevel providers
3. Dental therapy/dental therapist/ Dental Health Aide Therapist (DHAT)
4. Specific services provided by state-governed insurance
5. Access to dental care and federally qualified health centers (FQHCs)
6. High-risk populations (race, education level, socioeconomic status)
7. State and national dental/dental hygiene associations

8. Associations related to oral health, periodontology, and infection control safety

Ethical Disclosure

This dissertation discusses oral health disparities and possible solutions for access to quality dental care around the world but particularly in the United States. Data was collected from existing resources and summarized. There was no new research conducted for this dissertation. This dissertation is not original research and does not use human subjects; therefore, it did not need approval from the Institutional Review Board (IRB).

CHAPTER 4: RESULTS

The following chapter provides an overview and key findings from studies that were presented in Chapter 2. This chapter will highlight the research results. Additional details on each review are found in Chapter 2.

Socioeconomic Status Study #1. A cross-sectional survey completed by Oberoi, Sharma, & Oberoi (2016) to assess the effect of socioeconomic status and its relationship to oral health (Table 1 and Table 2).

Table 1
Socioeconomic Status Study #1: Overview

Element	Description
Study Design	Cross-sectional
Occurrence	June 2014 – October 2014
Participants	2,000
Mean age of participants	35.32
Percentage of male and female participants	58.8% male, 41.2% female

Table 2
Socioeconomic Status Study #1: Key Findings

Study Criteria	Study Results
Kuppuswamy socioeconomic status (SES) scale	Lower class: 3.2% Upper lower class: 40.2% Lower middle class: 40.8% Upper middle class: 15.8%
Percentage of participants who report visiting the dentist only when there is a problem	60.2%
Percentage of participants who report visiting the dentist only when concerned about pain	68.7%
Percentage (Kuppuswamy SES scale) of those who report regularly cleaning teeth/mouth at home	Lower class: 62.5% Upper lower class: 86.9% Lower middle class: 99.0% Upper middle class: 100.0%
Percentage (Kuppuswamy SES scale) of those who use toothbrush and toothpaste for cleaning	Lower class: 62.5% Upper lower class: 68.1% Lower middle class: 84.4% Upper middle class: 100.0%

Even though most of the participants report cleaning their mouths daily, the survey shows that the majority of participants do not view seeing the dentist as a preventive behavior.

Oral Health Inequalities in Canada Study #2. A study in Canada was completed by (Ravaghi, Quiñonez, & Allison (2013) to measure the magnitude of socioeconomic status for four oral health outcomes. This study shows significant evidence of socioeconomic status playing a role in oral health disparities (Table 3 and Table 4).

Table 3
Oral Health Inequalities in Canada Study #2: Overview

Element	Description
Study Design	National health survey (Canadian Health Measure Survey – CHMS)
Sample Size	4,951 Canadians
Age Range	6 - 79
Gender	Male: 2,409 Female: 2,542
Oral health indicators utilized	(1) number of decay teeth, (2) number of missing teeth, (3) number of filled teeth and (4) oral pain in the past year
Socioeconomic status utilized by household income (five categories)	Lowest income quintile, 2 nd quintile, 3 rd quintile, 4 th quintile, and highest income quintile

Table 4
Oral Health Inequalities in Canada Study #2: Key Findings

Study Criteria	Study Results
Mean outcomes for decayed teeth	Lowest income quintile: 1.10 2 nd quintile: 0.52 3 rd quintile: 0.39 4 th quintile: 0.21 Highest income quintile: 0.35
Mean outcomes for missing teeth	Lowest income quintile: 2.15 2 nd quintile: 1.83 3 rd quintile: 1.64 4 th quintile: 1.30 Highest income quintile: 1.57
Mean outcomes for filled teeth	Lowest income quintile: 5.05 2 nd quintile: 6.01 3 rd quintile: 6.36 4 th quintile: 6.70 Highest income quintile: 9.18
The percentage for dental pain	Lowest income quintile: 18% 2 nd quintile: 12% 3 rd quintile: 9% 4 th quintile: 12% Highest income quintile: 8%

The results show that all populations have decayed, missing, and filled teeth and dental pain. However, percentages increase for decayed and missing teeth and dental pain in those of low socioeconomic status.

Hours Lost to Planned and Unplanned Dental Visits Study #3. This study was conducted through the Centers for Disease Control and Prevention by Kelekar and Naavaal (2018) to evaluate the number of lost work and school hours due to planned and unplanned dental visits in the United States (Table 5 and Table 6).

Table 5
Hours Lost to Planned and Unplanned Dental Visits Study #3: Overview

Element	Description
Study Design	Cross-sectional study, random sample
Data Collection	2008 National Health Interview Survey (NHIS) – Oral Health Supplement
Sample Size	8,716 Adults in the United States who indicated they visited the dentist in the past six months
Age	18 years or older
Gender	Men: 45% Women: 55%

Table 6
Hours Lost to Planned and Unplanned Dental Visits Study #3: Key Findings

Study Criteria	Study Results
Total Hours Lost (Annually)	320.8 million hours
Unplanned Hours (Emergency)	92.4 million hours
Planned Hours (Routine)	159.8 million hours
Planned Hours (Cosmetic)	68.6 million hours

Even though the planned hours exceed the unplanned hours, the results show that participants are not receiving routine dental care, which leads to the many hours of unscheduled, emergency treatment.

Socioeconomic Status and Gingival Bleeding Study #4. A study was completed in Brazil by Tomazoni, Vettore, Zanatta, Tuchtenhagen, Moreira, & Ardenghi (2017) to assess gingival bleeding in schoolchildren and its association with socioeconomic status (Table 7 and Table 8).

Table 7
Socioeconomic Status and Gingival Bleeding Study #4: Overview

Element	Description
Study Design	Cross-sectional study, random sample
Sample Size	1,134 schoolchildren
Location	Santa Maria, Brazil
Age Range	12
Gender	Male: 523 Female: 611
Race	White: 77.93% Non-white: 22.07%

Table 8

Socioeconomic Status and Gingival Bleeding Study #4: Key Findings

Study Criteria	Study Results
Percentage of parent's perception of a child's oral health	Excellent/good: 65.47% Fair/poor: 34.53%
Percentage of children with untreated caries	42.33%
Percentage of children with greater than 15% of tooth surfaces with dental plaque	29.37%
Percentage of participants with one site of gingival bleeding	96.21%
Percentage of participants with 15% of gingival bleeding sites or more	26.28%

First Dental Caries Study #5. A study conducted by Kuthy, Jones, Kavand, Momany, Askelson, Chi, Wehby, & Damiano (2014) was completed to assess when initial dental caries appear in children at five Federally Qualified Health Centers (FQHCs) (Table 9 and Table 10).

Table 9

First Dental Caries Study #5: Overview

Element	Description
Study Design	Retrospective cohort study
Sample Size	200 children
Location	Five Federally Qualified Health Centers (FQHCs) in Iowa (40 children from each facility)
Age Range	Four months – 5 years

Table 10
First Dental Caries Study #5: Key Findings

Study Criteria	Study Results
Percentage of children with caries by age 2	Over 50%
Number of children who had dental caries by the first dental visit	21 (by 40.1 months of age)
Number of children who developed caries during the study	80
Number of children without caries	99

Even though dental caries are preventable, the results indicate that over 50% of participants had either existing dental caries or developed dental caries during the time of the study.

Early Childhood Caries Study #6. This study was completed by Sharna, Ramakrishnan, Samuel, Ravikumar, Cheenglembi, & Anil (2019) to determine if early childhood caries can impact the quality of life using the Early Childhood Oral Health Impact Scale (ECOHIS) (Table 11 and Table 12).

Table 11
Early Childhood Caries Study #6: Overview

Element	Description
Study Design	Cross-sectional study
Sample Size	238 children
Age Range	Six – 72 months
Gender	Male: 128 Female: 110

Table 12
Early Childhood Caries Study #6: Key Findings

Study Criteria	Study Results
ECHOIS score	Mean \pm SD, 14.12 \pm 6.62 with an observed range of 0 – 32
Children with pufa score of > 0	Significantly lower quality of life
Children with pufa score = 0	Significantly higher quality of life

The results of this study indicate that children show a lower quality of life when early childhood caries occur, as this can result in dental pain and future issues.

Children and Dental Fear Study #7. Pratiwi, Akbar, Pasiga, Samad, Anwar, Djamaluddin, & Aprilia (2018) completed a study to assess dental fear in children and its effect on the quality of life using the Children’s Fear Survey-Dental subscale and Child Perceptions Questionnaire (Table 13 and Table 14).

Table 13
Children and Dental Fear Study #7: Overview

Element	Description
Study Design	Cross-sectional study
Sample Size	278 children
Age Range	Eight – 10 years
Gender	Male: 48.6% Female: 51.4%

Table 14

Children and Dental Fear Study #7: Key Findings

Study Criteria	Study Results
Experience Fear of Dentist	48.9%
Does Not Experience Fear of Dentist	51.1%

The results of this study indicate that nearly half of the participants experience a fear of the dentist. Children who fear the dentist are more likely to avoid treatment. The results suggest that the negative mentality of visiting the dentist impacts the quality of life.

Periodontal Status and Poor Health Study #8. Oberoi, Harish, Hiremath, & Puranik (2016) completed a study to determine the relationship between the severity of periodontal disease in patients suffering from cardiovascular disease, respiratory disease and type 2 diabetes using the Community Periodontal Index of Treatment Needs (CPITN) coding (Table 15 and Table 16).

Table 15

Periodontal Status and Poor Health Study #8: Overview

Element	Description
Study Design	Cross-sectional study
Sample Size	220 participants with cardiovascular disease, type 2 diabetes or respiratory disease
Control Group Size	340 participants without cardiovascular disease, type 2 diabetes or respiratory disease
Age Range	30 – 79 years
Conditions Reviewed	Cardiovascular disease, respiratory disease, type 2 diabetes

Table 16
Periodontal Status and Poor Health Study #8: Key Findings

Study Criteria	Study Results
Percentage of diabetes participants with CPITN Code 3 or Code 4 (indicating periodontal disease)	78.18% (Code 3 – 31.82%, Code 4 – 46.36%)
Percentage of cardiovascular disease participants with CPITN Code 3 or Code 4	72.73% (Code 3 – 34.55%, Code 4 – 38.18%)
Percentage of respiratory disease participants with CPITN Code 3 or Code 4 (indicating periodontal disease)	78.64% (Code 3 – 24.09%, Code 4 – 54.55%)
Percentage of control group participants with CPITN Code 3 or Code 4 (indicating periodontal disease)	53.53% (Code 3 – 47.35%, Code 4 – 6.18%)

The results of this study show evidence that those with existing systemic conditions are more likely to have uncontrolled periodontal disease.

Congenital Heart Disease in Children Study #9. The study completed by Koerdt, Hartz, Hollatz, Frohwitter, Kesting, Ewert, Oberhoffer, & Deppe (2018) was to evaluate parents with children who have congenital heart disease and their awareness of oral disease and its systemic connection to cardiovascular disease (Table 17 and Table 18).

Table 17
Congenital Heart Disease in Children Study #9: Overview

Element	Description
Study Design	Cross-sectional study
Sample Size	150 children with congenital heart disease
Location	Munich, Germany
Age Range	Three – 17 years
Gender	Male: 55.3% Female: 44.7%

Table 18
Congenital Heart Disease in Children Study #9: Key Findings

Study Criteria	Study Results
Percentage of patients not educated on oral health by cardiologist	73%
Percentage who were unaware of the relationship between cardiovascular disease and oral health	33.3%
Percentage of patients who brush teeth once daily	14%
Percentage of patients who brush teeth twice daily	78.7%
Percentage of patients who see a dentist every six months	32%
Percentage of parents who have never checked the oral health of their child	26%
Percentage of parents who stated oral health was not important for their child	48%
Percentage of parents of children with congenital heart disease do not know the term <i>endocarditis</i>	40.7%

The results of this study indicate the need for a team approach to treating patients with cardiovascular disease properly. The need for maintaining proper oral health is especially crucial in those suffering from cardiovascular disease.

Delta Dental and Medicaid Study #10. The study completed by Bhagavatula, Xiang, Szabo, Eichmiller, Okunseri (2016) discussed the differences in children and the use of dental services for those who have Medicaid insurance and Delta Dental insurance in areas where shortages of dental providers exist and do not exist (Table 19 and Table 20).

Table 19
Delta Dental and Medicaid Study #10: Overview

Element	Description
Study Design	Descriptive
Sample Size	Children with Medicaid or Delta Dental in Wisconsin
Timeframe	Insurance claims from 2002 – 2008
Age Range	Newborn – 18 years

Table 20
Delta Dental and Medicaid Study #10: Key Findings

Study Criteria	Study Results
Delta Dental Insurance – DHSPA	161.5 diagnostic procedures 174.7 preventive procedures
Delta Dental Insurance non – DHSPA	172.7 diagnostic procedures 189 preventive procedures
Medicaid Insurance – DHSPA	127 diagnostic procedures 110.3 preventive procedures
Medicaid Insurance non – DHSPA	121.1 diagnostic procedures 98.2 preventive procedures

Even though some participants were living in areas considered to be non – DHSPA, participants with Medicaid insurance still had less diagnostic and preventive procedures. The research suggests that children with Medicaid insurance are at a disadvantage in receiving routine dental care.

Registered Dental Hygienist in Alternative Practice Study #11. The completed study by Coppola, Furgeson, Fontana, Kinney, & Gwozdek (2017) discusses economic sustainability in Registered Dental Hygienist in Alternative Practice (Table 21 and Table 22).

Table 21
Registered Dental Hygienist in Alternative Practice Study #11: Overview

Element	Description
Study Design	Cross-sectional descriptive survey
Sample Size	98
Survey Size	38 questions
Percentage of participants who are members of ADHA	87%
Percentage of participants who are working as RDHAP	63%

Table 22

Registered Dental Hygienist in Alternative Practice Study #11: Key Findings

Study Criteria	Study Results
Participants education level	Bachelor’s degree: 59% Master’s degree: 20.5%
Percentage of participants who work in a traditional dental office	44%
Percentage of participants who would practice solely as RDHAP if given the opportunity	61%
Percentage of participants who indicated dentists are resistant to the idea of RDHAP workforce model	25%

Even though many licensed dental hygienists would enjoy practicing as an RDHAP, there is hesitancy due to the resistance from dentists and their lack of knowledge of the role.

Interest in Dental Hygiene Therapy Study #12. The study completed by Smallidge, Boyd, Rainchuso, Giblin-Scanlon, & LoPresti (2018) surveyed dental hygienists and their perception of dental hygiene therapy and interest levels (Table 23 and Table 24).

Table 23
Interest in Dental Hygiene Therapy Study #12: Overview

Element	Description
Study Design	Quantitative cross-sectional study
Number of Surveys Sent	1,284
Response Rate	21%
Sample Size	268
Location	Maine
Gender	Female: 97.7% Male: 2.2%
Level of Education of Participants	Associates degree: 51.9% Bachelor's degree: 31.7% Master's degree: 5.2% Other: 3.7%

Table 24
Interest in Dental Hygiene Therapy Study #12: Key Findings

Study Criteria	Study Results
Percentage of participants interested in enrolling in a dental therapy (midlevel provider) program	65%
Percentage of those participants interested in completing the program part-time	51.8%
Percentage of those participants interested in completing the program in a web-based education modality	47.4%

Even though many licensed dental hygienists are interested in continuing their education to become a dental therapist, some stipulations would make the program more sustainable for those who are currently working in the field of dentistry.

Opinion on Dental Therapists Study #13. The study completed by Ly, Schuberg, Lee, Gallaway, Bell, & Coplen (2019) surveyed dentists and dental hygienists on their perception of dental therapy, the level of education, and level of supervision (Table 25 and Table 26).

Table 25
Opinion on Dental Therapists Study #13: Overview

Element	Description
Study Design	Cross-sectional study
Participants	Dentists and dental hygienists
Sample Size	271 dentists and dental hygienists 220 surveys sent – 38% of dentists participated 187 surveys sent – 46% of dental hygienists participated
Location	Pacific Northwest of the United States

Table 26
Opinion on Dental Therapists Study #13: Key Findings

Study Criteria	Study Results
Percentage of participants indicated “Strongly Agree” or “Agree” that a dental therapist (midlevel provider) should be an integral part of the dental team	Dental Hygienists: 82% Dentists: 51%
Percentage of participants who believe a bachelor’s degree should be required if a midlevel dental provider	Dental Hygienists: 36% Dentists: 38%
Percentage of participants who believe a master’s degree should be required if a midlevel dental provider	Dental Hygienists: 24% Dentists: 35%
Percentage of participants indicating they believe that a dental therapist (midlevel provider) needs to have the direct supervision of a dentist when practicing	Dental Hygienists: 11% Dentists: 48%

The results of the study show that there are apparent differences in opinion on the level of supervision of a dental therapist when surveying dentists and dental hygienists.

Obesity and Early Childhood Caries Study #14. A study completed by Angelopoulou, Beinlich, & Carin (2019) discusses the association between weight and early childhood caries (Table 27 and Table 28).

Table 27
Obesity and Early Childhood Caries #14: Overview

Element	Description
Study Design	Systematic review and Meta-analysis
Sample Size	55 literature review articles
Date of Articles	1982 – 2017
Median Sample Size from Articles	355 (100 – 500 children)

Table 28
Obesity and Early Childhood Caries #14: Key Findings

Study Criteria	Study Results
Statistically significance	Children who had a higher body mass index (BMI) were at greater risk for having early childhood caries

This systematic review suggests that children who suffer from obesity are more likely to have early childhood caries than children with healthy weight or below average weight.

Perceptions of Interprofessional Education Study #15. The study completed by McGregor, Lanning, & Lockeman (2015) discussed the attitudes of including interprofessional education within the curriculums of dental and dental hygiene schools (Table 29 and Table 30).

Table 29
Perceptions of Interprofessional Education #15: Overview

Element	Description
Study Design	Non-experimental comparative design with retrospective pre- and post-test
Sample Size	300 students from six programs
Percentage of dental and dental hygiene students	21% (47 dental students and 16 dental hygiene students)

Table 30
Perceptions of Interprofessional Education #15: Key Findings

Study Criteria	Study Results
Pre- and post-test response rate	62%
Highest attendance rate	Dental hygiene students
Lowest attendance rate	Dental students

Even though all students were required to attend the sessions to gain information regarding interprofessional education, dental students had the lowest attendance rate of the six professions. Due to dental hygiene students having the highest percentage, the results suggest this may be why the students had the most considerable attitude change related to the importance of interprofessional education.

CHAPTER 5: CONCLUSION

Oral Disease

Oral disease is one of the most common diseases being treated in adults and children. The prevalence is even higher in populations of low socioeconomic status. (Oberoi, Sharma, & Oberoi, 2016). Oral health continues to be ignored when examining the body for health or disease. This directly relates to the continued problem of dental disease and access to care. As health care professionals, the oral cavity examination is entirely separate from the examination of the body, yet it is all connected. If there is an infection in the mouth, an inflammatory response initiates, just like any other inflammatory process throughout the body. With approximately half of the global population being affected by dental disease, it is evident that the implementation of a universal midlevel dental provider could be very beneficial (Singh, Peres, & Watt, 2019).

Lack of Insurance

Research shows that less than half of practicing dentists participate in public dental insurance, such as Medicaid plans, and over 100 million Americans simply do not have insurance (Dollins, Bray, & Gadbury-Amyot, 2013). Ninety-two percent of dentists are currently practicing in the private practice model rather than in the public health sector. This alone leads to the difficulty of obtaining regular dental visits, especially for those of low socioeconomic status and those who lack insurance.

The midlevel dental provider creates dental care opportunities for populations who are underserved and uninsured in environments outside of the private practice model. This includes the oral safety net sector, as well as the potential for midlevel providers to open practices for specialized treatment.

The Implementation of a Midlevel Provider

The implementation of a universal midlevel dental provider is one solution that could improve the issues that the United States faces with a lack of access to proper dental care.

The American Dental Hygienists' Association defined a Midlevel Oral Health Practitioner as a licensed dental hygienist who has graduated from an accredited dental hygiene program and who provided primary oral health care directly to patients to promote and restore oral health through assessment, diagnosis, treatment, evaluation, and referral services. The Midlevel Oral Health Practitioner has met the educational requirements to provide services within an expanded scope of care, and practices under regulations set forth by the appropriate licensing agency (American Dental Hygienists' Association, 2015, pg. 20).

Utilizing a Physician Assistant

Midlevel providers in medicine are commonly used in today's health care industry. Physician assistants were introduced to the United States in the 1960s. The model was created to provide care since there were not enough medical doctors (Hooker & Everett, 2012). According to Morgan, Shah, Kaufman, & Albanese (2008), the physician assistant profession has grown from 20,000 practicing in 1991 to over 68,000 practicing in 2008 (pg. 1906). By 2011, there were over 75,000 practicing physician assistants in the United States, and the profession is continuing to grow globally. Countries such as Australia, Canada, and Germany are getting on board with the model as it shows great benefit to the health care profession and society (Hooker & Everett, 2012). The profession of physician assistants and nurse practitioners continues to grow. As the professions continue to become a more popular option, there is some speculation.

Questions arise regarding the productivity, cost, and overall quality of care. These questions are reasonable, and research continues to show that the utilization of physician assistants and nurse practitioners are reducing cost and improving efficiency (Morgan, Shah, Kaufman, & Albanese, 2008).

If the utilization of midlevel providers has been such a success and continues in that direction, it seems that this health care model would also improve the dental profession. When medical insurance and dental insurance are compared, it is much more common to have medical insurance. By utilizing a midlevel provider in dentistry, similar benefits would occur regarding cost and efficiency (Blue & Kaylor, 2016).

Dental Therapy Approved by the Commission on Dental Accreditation

Dental Therapy has been approved through the Commission on Dental Accreditation (CODA) and has its own set of standards that accredited schools must comply with to maintain good standing with the accrediting agency. The Commission on Dental Accreditation (CODA) is the leading accrediting agency for dental, dental hygiene, and dental assisting programs. Accreditation status is critical for obtaining licensure throughout the country. If colleges and universities are being held to the same standards as dental programs, this is an indication that the programs with dental therapy are following the guidelines provided to have a reliable program that produces competent clinicians. If graduates from a CODA-accredited dental therapy program could be utilized throughout the United States, access to care issues may be more thoroughly addressed. The universal midlevel dental provider would need to be reviewed and approved by the State Board of Dentistry from all states.

The Opinion of the American Dental Association

Research suggests that dentists are not fully supportive of the midlevel provider model. There is hesitation in the support for several reasons that continue to be refuted from the American Dental Hygienist's Association. The American Dental Hygienists' Association believes that a midlevel provider must be properly educated to perform such duties and work to improve the oral health of high-risk populations. The American Dental Association believes there are far more issues with the health care system, and increasing providers is not the solution. The ADA does not believe there are fundamental research and statistics to show a midlevel provider is improving oral health (American Dental Association, 2011). As states continue to pass legislation for midlevel dental providers, dentists may realize that implementation within specific communities could provide more benefits than risk. Midlevel dental providers will be serving specific populations, such as low income, underserved, and uninsured. Proper training and education will occur by schools that have a CODA-accredited dental therapy program, in addition to the successful completion of licensure examinations. Midlevel dental providers will work under the general supervision of a dentist and consult the dentist as needed. Finally, the intent of the midlevel dental provider is not to take business away from practicing dentists. The goal is to provide care to the underserved populations who cannot go to a general dentist due to cost, location, and lack of insurance.

A survey completed shows that 58% of dentists who participated are open to the idea of dental therapy, but 48% believe that direct supervision is still necessary (Ly, et al., 2019). If direct supervision would need to occur, the purpose of the dental therapist is somewhat defeated.

The goal of a dental therapist is to improve access to care in those who are underserved and uninsured while performing services that are within the scope of practice.

Recent Updates

Alaska was the first state in the United States to implement a midlevel provider model in 2004 with Minnesota shortly behind with a similar model in 2009. This model was replicated based on a model in New Zealand. Since 2004, the midlevel provider model has grown significantly with a large jump in the past year. Within the past year, many states have passed legislation to implement a dental therapist or midlevel dental provider. These states include New Mexico, Idaho, Connecticut, Montana, and Nevada (American Dental Hygienists' Association, 2019). These changes may lead to the improvement of oral health for all communities, regardless of socioeconomic status.

Minnesota has the most established dental therapy profession, as it was the first state to utilize dental therapy. Minnesota's dental therapy program has shown success with the improvement of access to dental care. In 2018, the Minnesota Department of Health, with the help of the Minnesota State Board of Dentistry, reported that dental therapists improve access to care in underserved populations. The findings show a decrease in patient wait time and an increase in patient volume at public health clinics in rural areas of Minnesota. Also, the Apple Tree Dental reported \$52,000 in savings at a Veteran's home, and Midwest Dental reported a \$10,042 increase in revenue (Minnesota Department of Health, 2018).

Future Studies

As more states continue to implement the dental therapy model, additional research should continue to be conducted on efficacy and access to improved care. Future research studies

should focus on the following: the rationale for the increase in states passing legislation in 2019, the effectiveness of a midlevel dental provider serving the uninsured and underserved populations, and comparisons of access to care in states that utilize midlevel dental providers to those who do not utilize midlevel providers. Positive movements are occurring, but each state that passes legislation creates a scope of practice. A universal midlevel dental provider would increase access to care and potentially improve oral health. The design of a nationally accepted curriculum would lead to achieving and unifying the educational pursuits of a midlevel dental provider.

Dental Therapy Curriculum Proposal

The midlevel dental provider is intended to serve distressed areas and populations that are underserved. Those living in rural areas have difficulty receiving dental care due to a lack of providers and transportation. There are only 100 dental therapists in the United States, and all primarily reside and practice in Minnesota. Dental therapy programs are currently small. Many states that have passed legislation for dental therapy have not opened a dental therapy program. This is due to the time and effort involved in developing a curriculum (Mantel, 2019). Despite the positive energies of legislation passing for dental therapy, every State Board of Dentistry has different guidelines, which creates a barrier for existing dental therapists to practice in distressed areas across the country. Each State Board of Dentistry would need to review and accept the proposed dental therapy program before it could be implemented. These efforts would be introduced at the state level by the state and nationwide dental hygienists' associations. The established research related to the effectiveness of dental therapy would be presented to show how this model would improve access to care.

The curriculum proposed is intended for the clinician to work in the public health sector to serve populations in need. The midlevel dental provider would be an asset to the dental team to improve access to care. Midlevel dental providers may provide preventive and therapeutic services and increase the provider to patient ratio. Education for midlevel dental providers is not as expensive or as lengthy when compared to dental school. The following discusses a proposed curriculum and scope of practice for a universal midlevel dental provider within the United States.

This program would require clinicians who are interested in becoming a dental therapist to be a licensed dental hygienist who graduated from an accredited dental hygiene program with at least an associate degree. The prospective licensed dental hygienist must practice dental hygiene a minimum of 2,000 hours before being considered for the dental therapy program. The degree to become a dental therapist would be a Bachelor of Science in Dental Therapy. The program would be two years in length and five full-time semesters. The program would begin in the fall and include one summer session between the first and second program years. Students would be required to complete 48 college credits, in addition to the credits transferred from the accredited dental hygiene program. Students would be required to maintain a 3.0-grade point average for the duration of the program. The dental therapy program would undergo initial accreditation by the Commission on Dental Accreditation under dental therapy standards.

The design of this program would allow clinicians to work in any state that has dental therapy, regardless of which state they received their education. Licensed dental hygienists would already have clinical background knowledge before entering the dental therapy program.

Dentists, dental therapists, and dental hygienists would work collaboratively to provide optimum care for individuals in need.

The proposed curriculum is as follows:

- Dental Therapy Preclinic and Theory: 5 credits

Course Description: This introductory course will provide the necessary skills for dental therapy. Restorative and surgical procedures are introduced during this course.

- Communications in Dentistry: 2 credits

Course Description: This course discusses interprofessional education and communicating with patients in the dental setting. At least one clinical enrichment site is attended for interprofessional education during this course.

- Patient Assessment: 3 credits

Course Description: This course provides knowledge of appropriately diagnosing and assessing findings for the dental therapist.

- Dental Research I: 3 credits

Course Description: This course provides skillsets in evidence-based decision making and determining valid research and research types. Students begin to develop a literature review during this course and complete the literature review in Dental Research II.

- Dental Research II: 3 credits

Course Description: This course is a continuation of Dental Research I. Students will complete a literature review during this course. This course emphasizes evidence-based research and hypothesis development.

- Introduction to Orthodontics: 2 credits

Course Description: This course will provide knowledge and skills for providing dental therapy services to patients with orthodontic appliances.

- Introduction to Geriatrics: 2 credits

Course Description: This course will provide knowledge and skills for providing dental therapy services to the geriatric population.

- Introduction to Pediatrics: 2 credits

Course Description: This course will provide knowledge and skills for providing dental therapy services to the pediatric population.

- Dental Public Health: 3 credits

Course Description: This course provides education on various community health care settings. Emphasis is placed on assessment, planning, implementation, and evaluation in the public health sector.

- Pain Control and Pharmacology: 2 credits

Course Description: This course discusses the theory and clinical knowledge of the effective administration of anesthetic agents and the pharmacologic effect of anesthetics and medications. The course focuses on the administration of local anesthetic agents for all patient types and prescribing appropriate drugs to patients for pain management and infection.

- Dental Therapy Treatment Planning: 3 credits

Course Description: This course provides knowledge and skills on proper treatment planning and appointment sequence for the dental therapist.

- Dental Therapy Theory II: 3 credits

Course Description: This course discusses necessary information on prevention, dental therapy, and medical history conditions for all patients.

- Dental Therapy Clinical Experience II: 3 credits

Course Description: This course provides experiences with preventive and therapeutic clinical skills on all patient types. Emphasis is placed on the development of clinical skills in preventive and restorative procedures.

- Dental Therapy Theory III: 3 credits

Course Description: This course discusses therapeutic treatment for patients with special needs and specific conditions.

- Dental Therapy Clinical Experience III: 3 credits

Course Description: This course builds from Dental Therapy Clinical Experience II. This course provides emphasis on the refinement of clinical skills in preventive and restorative procedures, in addition to developing skills of surgical procedures on all patient types.

- Dental Therapy Theory IV: 3 credits

Course Description: This course discusses the professional role of a dental therapist within the dental team. Insurance, provider credentials, and licensure are discussed in detail.

- Dental Therapy Clinical Experience IV: 3 credits

Course Description: This course builds from Dental Therapy Clinical Experience III. All clinical skills are refined.

Scope of Practice – Dental Therapist

Upon graduation from a CODA-accredited dental therapy program, clinicians may perform dental hygiene services within the state they are currently practicing. Clinicians who graduate from an accredited dental therapy program may practice in any state that has dental therapy and receive reciprocity from the State Board of Dentistry. In addition to the dental hygiene scope of practice, dental therapists may perform the following services under the general supervision of a dentist:

- Administration of local anesthesia
- Emergency treatment of pain
- Prescribe medications (Prescribing medications are limited to therapeutic agents and anti-infective agents. Prescribing opioids are prohibited.)
- Preparation of cavities
- Restorations on primary and permanent teeth
- Pulpotomies on primary teeth
- Placement of temporary crowns
- Placement of space maintainers
- Extractions of primary teeth
- Brush biopsies

Dental therapists would be required to complete 30 continuing education hours within each license renewal cycle. License renewals occur every two years in January. Half of the required continuing education credits must be live or in-person education. Of the 30 continuing education credits, three credits must be related to local anesthesia, five credits must be related to public

health, two credits must be related to restorative dentistry, and two credits must be related to recognizing and reporting child abuse as a healthcare provider.

Conclusions

General supervision of a midlevel provider is key to the success of this model, so underserved and uninsured populations receive dental care. Access to dental services is limited to those of low socioeconomic status due to the cost and acceptance of public dental insurance. By implementing midlevel dental providers in the public health sector, populations will be able to be treated with a wide range of dental services.

The design of the proposed program provides the opportunity for the improvement of access to dental care by having a midlevel dental provider available to work throughout the United States. This model would be carefully designed so that clinicians interested in the dental therapy program are competent clinicians before transitioning to the dental therapy program. The dental therapy program would provide strong emphasis and training on preventive and therapeutic services, so one provider may serve patients on a wide variety of services. This program would be unique in that prospective clinicians must be a licensed dental hygienist, and dental therapy licensure may be obtained in states that pass legislation through reciprocity. Licensure that can be widely used across the country is crucial to improving oral health disparities and serving populations in need. As technology, delivery of education, and health care continues to evolve, all health care professionals must continue to remember the goal of the profession, and that is to serve the communities and improve overall health. The implementation of a midlevel dental provider is a powerful solution to improve access to quality dental care and serve all populations, regardless of socioeconomic status.

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