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Oral Health Behaviors, Attitudes, and Dental Diseases in Native American/Alaskan Native School-Age Children

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Walden University
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MPH, Grand Canyon University, 2013

BSN, Oklahoma City University, 1994

Doctoral Study Submitted in Partial Fulfillment

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Abstract

Dental disease is a highly preventable pediatric disease, and 70% of Native American/Alaskan Native (NA/AN) preschool children have a history of dental caries, which is 3.5 times higher than in the general population. This study aimed to conduct a meta-analysis examining the impact of oral health behaviors and attitudes of NA/AN parents and guardians on dental disease in NA/AN school-age children. The impact of frequency of flossing and brushing, consumption of sugary foods, dental visits, dental attendance reason, sealants, fluoride treatment, and oral health education by NA/AN parents and guardians on children's caries and periodontal diseases status was explored. Additionally, the effect of gender, age, education, and income on the oral health behaviors/attitudes and dental disease in NA/AN school-aged children and their parents or guardians were investigated. The health belief model was the theoretical framework. Four studies met the criteria to be included in this meta-analysis and the effects of group type on outcomes were examined to determine the overall effect size. Heterogeneity between studies was evaluated by Q and I^2 tests. Meta-analysis revealed an overall statistically significant effect of optimal oral health behaviors and attitudes on dental disease in NA/AN school-aged children ($p < .001$). Also, higher education and income levels were significantly associated with better oral health status in NA/AN school-aged children ($p < .001$). The positive social change implications and recommendations are to inform public health authorities about the behavioral and sociodemographic factors affecting oral health in NA/AN school-aged children, to develop customized oral health promotion and prevention programs.

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Section 1: Foundation of the Study and Literature Review

Oral health is an essential construct in general health and well-being, yet many individuals fail to realize the oral health component when assessing health (Honkavuo, 2019). Americans' realization of the importance of oral health is often predicated on beliefs and/or behaviors modeled by their parents and/or guardians (Puri et al., 2019). A child's health is a direct outcome of the parental rearing practices children receive in childhood and often extended into adulthood (Stewart-Brown et al., 2005). Early childhood caries (ECC) is among the most frequent and preventable chronic diseases in children (Horowitz et al., 2017). Economic hardships, accessibility to care, and insufficient oral health literacy (OHL) result in preventive and restorative dental needs of children (Assari & Hani, 2018). There is also a general perception that dental care and dental needs do not need to be addressed with the same urgency as health care.

Dental disease in American children has higher dominance in minority groups as compared to their White counterparts (Fischer et al., 2017; Reda et al., 2018), but no minority group is more greatly impacted with dental disease than the Native American (NA)/Alaskan Native (AN) communities (Murphy & Larson, 2017). According to the Health Resources and Services Administration, by the year 2025, every state in the United States is projected to face a shortage in dental care, inferring the utilization of preventive care will persist at low rates (Cao et al., 2017). The availability of dental providers is scarcer in the NA community. Barriers that continue to limit the number of dental providers are geographic location, racial and economic disparities, and the history

of inadequate care (Cladoosby, 2017). Parents and guardians are not seeking preventive oral health needs of their children at the rate they seek out health care.

Researchers have argued that dental caries in primary and permanent teeth in NA and AN cohort, and utilization of dental resources for emergent needs may have a correlation to OHL (Batliner, 2016; Bersell, 2017; Cladoosby, 2017; Lee et al., 2012; Parker & Hernandez; 2012). Researchers have also argued that the oral health behaviors and beliefs of parents and guardians directly impact the oral health of children (Wilson et al., 2016; Kumar, Zimmer-Gembeck, Kroon, et al., 2017; Vozza, Campasso, Marrese, et al., 2017). Limited research is available examining the oral health behaviors and practices of NA parents and the relationship it has on the dental disease of school-aged children.

The United States is home to nearly 4 million NAs and ANs, to which the Indian Health Services (IHS) provides medical, dental, and behavioral services for more than five hundred federally recognized tribes (Warne et al., 2012). The goal of the enactment of the Indian Health Care Improvement Act in 1976, which is considered the legal authority for the provision of care to the NA/AN (U.S. Commission on Civil Rights, 2003), was to limit health disparities in this community, and at least mirror that of the general population. In spite of efforts to improve upon the care in this community, the IHS is underfunded in its attempt to address the inequalities. Individuals with IHS coverage are less likely to have employer-sponsored insurance and more likely to be uninsured relative to those without IHS coverage (Bhaskar & O'Hara, 2017).

According to NA/AN alone (Norris et al., 2010). ANs are people indigenous to Alaska, defined by the region, tribal affiliation, and language. Indigenous people have

pursued recognition of their identities, way of life, and right to traditional land without the external interference throughout history. Indigenous people residing in Canada and other countries, such as Australia, are referred to as Aboriginals (Romaniuk and Trovato, 2014). Similar to NAs, and ANs, the Aboriginals are the first Natives of the land before European colonization. The European colonization, in the United States, Canada, and Australia, brought change in culture to the first Natives, change in their beliefs and practices as coercion existed to adopt European lifestyle. ANs have the highest percentage of indigenous people, and the sixth largest population compared to other States in the union (Barnhardt, 2001). For this study, NA/AN will be used interchangeably to reflect indigenous people in Canada and U.S. Territories.

In Alaska, studies have shown that a positive impact dental therapist has on the prevention and treatment of tooth decay because the limited availability of dentists in the rural areas makes it difficult to obtain and maintain dental providers (Wahowiak, 2016). Dental therapists are people who have extensive training that allows them to provide fluoride treatment, excavating cavities, performing fillings, and simple extractions while under supervision of the dentist (Yang, Chen, & Wanchek, 2017). Similar to Alaska, other states such as Minnesota and Tennessee have mentioned the positive impact on employing dental therapists to serve rural regions (Mehta & Erwin, 2018). Dental therapists are filling the void of the dearth of general dentistry to serve the underserved and in the rural regions. Although this concept is not new, it is becoming accepted in areas where there is a limited number of dentists, such as rural areas and Indian Reservations (Cladoosby, 2017; Batliner, 2016; Koppelman, Singer-Cohen, 2017).

Recent literature published the positive effect of oral health parental education and its relationship to preventive services and associated factors such as income and service providers in the NA community (Batliner, 2016; Brega et al., 2016; Khoadadai et al., 2016). Increasing public awareness about oral health promotion, dental caries prevention, and how oral health impact on systemic health is a pivotal point to increasing efficacy in oral health interventions. Prior to implementing public service announcements on awareness, however, understanding NA/AN beliefs and attitudes toward dental hygiene is beneficial. Batliner et al. (2014) examined motivational interviewing to NA women to decrease childhood caries and promote dental sealants. A mother's behavior and attitude toward dental hygiene can impact children's permanent teeth (Ivana, Indiarti, & Budiarjo, 2018). In this community, ECC begins soon after primary teeth eject and can cause difficulty with sleeping, eating, and learning (U.S. Department of Health and Human Services [HHS], 2000). The chronic infectious disease of ECC originates from bacteria that can be transmitted from mother to child (Heaton et al., 2018). The prevalence of ECC can lead to untreated disease in permanent teeth. It is essential for public health providers to act now addressing the formative years of children and their parents, soliciting behaviors that model good oral health outcomes.

Similar to the social justice issues that frame health equity to generate policies and legislation to assure resources are available to all, oral health equity has a similar frame addressing the inequalities within populations. Oral health equity includes literacy, access, income, and education. Often, education is considered the first and last defense with programs created to implement change in behavior. Similar to health literacy, OHL

involves the capacity to obtain, process, and act upon, all of which are mediated by socioeconomic factors. The socioeconomic factors can be the influence or lack of family involvement, educational level, income, and/or cultural beliefs and practices. The belief in practices regarding dental hygiene begins early in a child's development and often is mirrored by the beliefs and practices of their parents, and/or guardians. Baskaradoss (2018) argued that people with limited health literacy have poor oral health in which dental attendance is not on an annual basis, and the main reason for dental visits is pain issues, not prevention. There are multifaceted approaches in addressing the socioeconomic barriers that may impede one's decision to prevent dental disease. But one barrier that is relatively easily attainable is OHL. Unfortunately, tools to measure OHL in the NA/AN communities are nonexistent at this time. However, before education is received, processed, and applied, perceptions and attitude concerning the concept are weighed.

Similar to OHL, oral health attitudes and behaviors of parents and caregivers may impact dental disease and caries in NA/AN children. In addition, the parents or caregivers' attitudes and behaviors concerning oral health may transcend to the children, and the NA/AN children will adopt learned behaviors and attitudes that may have a relationship with dental disease. Several factors influence the capacity of receiving oral health promotion information, such as education, socioeconomics, and attitudes and behaviors relating to oral health. Similar to the socioeconomic barriers that obstruct access to dental care, the beliefs and behaviors concerning dental health are considered an obstacle as well. A long history of distrust between NA and government about health

practices, and the possible impedance to cultural beliefs is acceptance of recommended change in behaviors. Green (2014) addressed how the urbanization of the NA after World War II has shifted or devalued the traditionalist NA, and argued if people have multiple identities, they identify with the identity that yields the most economically. However, since economic prosperity of the casino, many NAs may not be residing on the reservation but aligning their beliefs and attitudes with forefathers (Green, 2014).

Eliminating challenges to oral health equity in the NA community is a concern (Cladoosby, 2017). Behaviors and attitudes of oral health of the parents are influential for the child. Children are nearly eight times more likely to engage in regular tooth brushing when the parent advocates a belief of importance (Hiratsuka et al.; 2019). For an attitude of oral health practices to be deemed as necessary, and a behavior to act upon the attitude, measure of literacy concerning oral health is established. Beliefs and attitudes of parents affect the oral health outcome of NA children. Attitudes are orientations based upon knowledge received from external sources such as community, culture, and/or environment. Behaviors are actions based upon knowledge or an attitude, and for this study, behaviors are defined as biannual dental visits; fluoride treatment; sealants, treated decay, and brushing and flossing teeth daily, and/or supervised brushing and flossing of the child's teeth. Caregivers who believed in placing an importance on dental health, had children with significantly less tooth decay (Schroth, Harrison, & Moffatt; 2009).

OHL refers to the capacity of a person to source, process, comprehend and act upon information received to make decisions concerning oral health services (Dickson-Swift et al., 2014). Bersell (2017) argued that the insufficiency in OHL had a correlation

with the decrease in the utilization of dental services and thus constitutes a barrier to optimum dental health. The utilization of dental services consists of timely treatment of decay or diseased teeth, which may lead to filling, extraction, or other dental procedures, and prevention and maintenance which consist of bi-annual exams, cleaning, and sealants (Braun et al., 2014). Also, optimum dental health includes the consumption of a proper diet, and Chi (2013) evaluated dental disease and sweet beverage consumption and confirmed its contribution to tooth erosion from sugar substances leading to decay.

Again, the utilization of dental services for prevention and intervention has shown a relationship to quantifiable OHL and the perceptions and behaviors argued by Hongal et al. (2013), Bress (2013), and Burgette et al., (2016). Lee et al. (2012) and Smith (2015) reported that low self-efficacy and OHL can have a negative impact on oral health. Before the promotion of oral health practices, the thorough understanding of the culture and beliefs needs to be investigated to eliminate the potential barriers. Gaps in the literature exist addressing the NA community and how oral health behaviors and perceptions of parents relate to the prevalence of the dental disease in school-aged children. The implications of this study for social change can be having school-aged children learning the significance of good oral health behavior and transcending the practices learned into adulthood. Besides, viewing oral health as part of the general health may cross over to the medical, and merging dental and health providers for diagnostic and examinations eliminating the necessity to choose.

Problem Statement

The maintenance of health is impacted by several factors, such as access to care, education, cultural influence, and socioeconomics that may generate barriers (Cladoosby, 2017; Flood et al., 2017; Vozza et al., 2017; and Hayes, Wallace, and Coxon, 2016). Similar to the factors affecting overall health, oral health is impeded by various obstacles (Batliner, 2016; Cladoosby, 2017). In the United States, minority groups are disproportionally affected, none more so than the NA community, facing challenges of inequity, socioeconomics, and access to health care (Batliner, 2016).

Home to 4 million NA/AN, the United States provides medical care and services for more than 500 federally recognized tribes (Warne et al., 2012) through services rendered by the IHS. Through treaties established long ago, the United States entered into agreement with American Indians, now referred to as the Native Americans, to provide inclusive health services (Bhaskar & O'Hara, 2017). Prior to being inclusive to health services rendered by IHS, beginning in the 1970s (Barnhardt, 2001), the AN community consisted of small villages, often pressured by the European Americans to decentralize its community and political self-control (Marenin, 1994). Present day, the AN Tribes are federally recognized to receive health services from IHS.

Recent literature suggests the need of programs to prioritize access to preventive and restorative dental care, to positively impact the oral health of NA and AN children (Phipps & Ricks; 2017). The association between oral health behaviors and attitudes and dental disease (Brega et al., 2019; Hiratsuka et al., 2019) is evident, but a gap in the literature exists examining oral health behaviors and attitudes and the outcomes of NA

children (Yazdani et al., 2018) and their parents or caregivers. Parents and guardians are pivotal participants for the outcome of their children's oral health needs. Children with ECC are three times more likely to develop caries in their permanent teeth (Phipps et al., 2012). Khodadadi et al. (2016) reported a cross-sectional study revealing that 95% of parents with inadequate OHL had children with dental caries, whereas 99% of parents with adequate OHL have accessed dental services for their children as evident by dental fillings and/or sealants. Interestingly, behaviors and attitudes may have relations with the inability to acquire OHL, therefore negatively impacting dental disease in NA children. As stated before, quantifiable data on OHL involving this population is unavailable, so in this study I examined the behavior and attitude of this population to see if they negatively or positively impact the oral health of NA children.

Optimum oral health is essential for both adults and children, requiring a minimum of bi-annual maintenance and treatment as necessary (Braun et al., 2014). Rugg-Gunn (2013) reported that dental disease is considered the most preventable pediatric illness. Access to dental care for exams, cleanings, sealants, daily brushing, and flossing aid in the prevention or oral illnesses. Dental disease encompasses chronic gingivitis, periodontal disease, and dental caries (Saini et al., 2009). Studying behaviors and attitudes about oral health status and prevention of oral diseases is essential to the promotion of oral health. Through the adaption or modification of behavior, there is the potential to increase OHL, and promoting OHL can raise awareness of what constitutes dental disease and what actions are required to relieve or alleviate them.

The prevention of oral disease is also significant because numerous studies show a relationship between periodontal disease and systemic conditions including endocrine disorders and cardiovascular disease (Critchlow, 2017; Gurenlian, 2009; Nash et al., 2018). Cardiac disease and endocrine disorders consume a significant percentage of inpatient hospitalizations. Deficient diet consumption is a prominent risk factor for cardiometabolic disease (CMD) in the United States, which translates into $50.4 billion in cost for the population (Jardim et al., 2019). The dental needs are often unmet in the preoperative setting, attributing to individuals harboring potent odontogenic infection (Yasny and Herlich, 2012), which may lengthen hospitalization or increase mortality and disability rate. The absence of oral health negatively impacts social and development facets, causing social withdrawal, lack of confidence, and a decrease of self-esteem. Guarnizo-Herreño and Wehby (2012) reported that poor dental health impeded children's growth development and academic performance. Further, a gap in the literature exists examining oral health behaviors and attitudes and oral health outcomes in the NA children (Braun et al., 2016; Hiratsuka et al., 2019). Hence, this research can fill this gap by focusing on the association between oral health behaviors and attitudes and dental disease in this community, with future studies to assess the OHL in the NA/AN community and how perceptions, culture, and behaviors can be impactful to obtaining optimum OHL.

Purpose of the Study

This study's aim was to conduct a meta-analysis on published data examining the impact of oral health behaviors and attitudes of NA/AN parents and guardians on dental

disease in NA/AN school-age children. I also investigated how the dependent variables of oral health behaviors, attitudes, dental disease correlate with independent demographic variables such as gender, age, education, and income in NA/AN community. Dental disease is the most highly preventable pediatric disease (Brega et al., 2016), and 70% of NA preschool children have a history of dental caries which is 3.5 higher than the general population (Batliner, 2016). The IHS, which is underfunded, provides 90% of basic dental services and emergency care services, with preventive and restorative care primarily provided for children (Batliner, 2016). NA adults are often denied services such as crowns, endodontics, dentures, and bridges; and often left with extractions. The perception and behavior relating to dental hygiene are often shared or demonstrated with the rearing of the children. The reason this population group (parents and guardians) was selected is that research shows positive impact to change poor behaviors in children transcends to behaviors promoting oral health in adult hood.

Research Questions and Hypotheses

RQ1: What is the effect of oral health behaviors and attitudes (optimal vs. not optimal) on dental disease (dental caries, periodontal status) in NA/AN school-aged children and their parents or guardians?

$H_0$1: There is no significant effect of oral health behaviors and attitudes on dental disease in NA/AN school-aged children and their parents or guardians.

H_a1. There is a significant effect of oral health behaviors and attitudes on dental disease in NA/AN school-aged children and their parents or guardians.

Independent variables: Oral health behavior, which includes frequency of dental flossing and brushing (supervised and non-supervised) and consumption of sugary foods, and attitude, which is identified as how the parents or guardians value dental hygiene and oral health for themselves or for their children, for example dental visits and reason for dental attendance, dental sealants, fluoride treatment, and what education, if any, is instructed to the child in the home by the parent or guardian. Examples of optimal oral health behaviors and attitudes are brushing and flossing frequency at least twice per day, low consumption of sugary foods, etc.

Dependent variable: Dental disease, which includes of dental caries treated or untreated, gingivitis, and missing permanent teeth (tooth loss).

RQ2: What is the effect of social demographic factors (e.g., gender, age, education, and income) and oral health behaviors/attitudes on dental disease (dental caries, periodontal status) in NA/AN school-aged children and their parents or guardians?

$H_0$2: There is no significant effect of social demographic factors (e.g. gender, age, education, and income) on oral health behaviors/attitudes and dental disease in NA/AN school-aged children and their parents or guardians.

H_a2: There is a significant effect of social demographic factors (e.g. gender, age, education, and income) on oral health behaviors/attitudes and dental disease in NA/AN school-aged children and their parents or guardians.

Independent variables: Social demographic factors (e.g. gender, age, education, and income).

Dependent variables: Oral health behaviors/attitudes and dental disease in NA/AN school-aged children and their parents or guardians, as described for RQ1.

Theoretical Framework

The theoretical framework used in this study was the HBM (Health Belief Model), which originated in the 1950s to describe the failure nationwide of people not participating in programs geared toward health promotion and disease prevention (Hochbaum, 1958; Rosnestock, 1960). The HBM consists of several constructs that predict why people act on information received to control or prevent illnesses (Glanz et al., 2015). Glanz et al. (2015) discussed the concepts of the HBM, which are perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy. It is proposed that, when people receive knowledge, an action will ensue based upon the knowledge they have received. There is abundant literature self-identifying people as ignorant of the correlation between systemic health and oral health (Lee et al., 2012). Improving OHL can decrease the number of NA/AN children with oral diseases (dental caries and periodontal diseases). The modification of behavior and beliefs involves identifying the barriers that exist to implement oral health knowledge and improve the outcome of oral disease in the NA community. The present culture must be receptive of information to assure success in improving the OHL of NA/AN. The HBM contributed to this study by promoting the awareness of the relationship dental caries has with systemic disease, and by showing the susceptibility and the severity of dental caries in the NA/AN community. RQ1 explores the relationship between oral health behaviors/attitudes and dental disease in NA/AN community in children and the

parents/caregivers. The HBM Components and Linkages identifies knowledge as "a modifiable factor, that can impact the perceived susceptibility to the disease and the severity of the disease, and the perceived threat, which may bring about cues to action from the individual behaviors" (Glanz et al., 2008, p.38). This theory is also appropriate as it addresses RQ2, the social demographic factors that contribute to oral health behaviors/attitudes as it relates to dental disease in the NA/AN community. The HBM Components and Linkages list the modifying factors as socioeconomics, and using this theory, can show a relationship demonstrating an increase or cause a dearth in OHL (Glanz et al., 2008, p.38). The challenges to using the HBM for this study included that the relationship between risk and severity in establishing threat is not always translucent (Glanz et al., 2008). The HBM is more of a cognitive approach allowing individuals to weigh the benefits to oral health prevention and promotion (Bakan & Erci, 2018).

Nature of the Study

The study was a meta-analysis of published data to address the aforementioned research questions by investigating oral health behaviors and attitudes of the NA/AN population and examining oral health behaviors and attitudes of parents/guardians to see if there is a relationship with the dental disease of NA/AN school-aged children. The details on the data analysis plan are provided in Section 2. For the aims of this study, two types of effect size (odds ratios and standardized mean differences) per each independent variable (please see above the independent variables per RQ) were estimated for each study, and a summary effect size was calculated and reported. The meta-analysis population was NA/AN individuals residing in Canada and the United States Territories.

The study examined relationships between social demographics factors and oral health behaviors and attitudes and dental disease in NA/AN school-aged children and their parents or guardians. In this meta-analysis, I examined previous studies, systematic reviews and published data on oral health behaviors and perceptions of NA/AN and dental disease in their school-aged children.

Literature Search Strategy

I used four search engines (ProQuest Central, Google Scholar, MEDLINE, and Thoreau) and the Walden library to examine scholarly review articles. The key words used in the literature search are *oral health behaviors*, *oral health attitudes*, *Native American oral health*, *Alaskan American dental health*, *Dental health in Native American children*, *First Natives*, *Aboriginals and dental disease*, *and dental disease in the Native American community*. A compelling predictor of an individual's health behavior and health outcomes is health literacy (Berkman, Davis, & McCormack, 2010; Berkman et al., 2011). Just as health literacy may negatively impact health behaviors and outcomes, oral health behaviors and attitudes may contribute to practices and adverse oral health outcomes.

Literature Review

Oral Health Behaviors and Attitudes

OHL has shown success in the promotion of healthy behaviors and decreasing the disparities found in oral health (Horowitz & Kleinman, 2012). In the NA/AN community, the acceptance and application of knowledge come with great reservation, due to the historical injustices by non-Indigenous people (Mooradian et al.; 2006; Pember, 2011).

The colonization by Europeans left many NA/AN hesitant with public health leaders in relation to public health policy for NA/AN (Kunitz, 1996). Public health providers need to interface cultural competence before the implementation of programs designed to increase knowledge of oral health practices. As such, Heaton et al. (2018) used story development to incorporate good oral health behaviors among NA/AN children. Using characters known in NA storytelling, like the Coyote, and the association of the Coyote being one to deceive, used the character to illustrate the importance of eating proper foods and brushing teeth (Heaton et al., 2018). The inclusion of cultural practices and beliefs are essential before any community education. The Commission of Dental Accreditation decrees that dental schools in the United States offer cultural competency training to students and studies as to how the practice can assist to decrease disparities in this community (Behar-Horenstein et al., 2017). Cultural competence is knowing the behavior that exists in a subset of a population that is ethnically similar or geographically located. Dental and health care providers who have expertise in culture can identify barriers that exist to obtaining optimum oral health knowledge and the attitudes, beliefs, and actions surrounding oral health. Brega et al. (2019) examined the ethnic identity of the Navajo nation and the relationship to oral health behavior, using a randomized control trial to measure the parental oral health knowledge, parental oral health attitudes, parental oral health behavior, and the oral health outcome of parents, predominantly female. The study conducted in the Navajo area is in a Head Start Program, which is a program sponsored by the government for low-income families, allowing children of underserved communities a head start of education. The median age of the parents was 32 years, and

that of the children was 3.6 years, with 51% being female. Approximately 96% were enrolled a member of the Navajo Nation. Similar to previous studies that show a positive relationship between income and education as it impacts the oral health of children, participants with higher income and education believed the benefits in connection to their ethnic identity and had better oral health knowledge and outcomes in their children. The study demonstrated that a strong ethnic identity in NA parents is linked with positive health-related attitudes, behaviors, and outcomes. The connection to ethnicity involves practicing the customs of previous generations, using the language, residing on the reservations, and practicing in ceremonial rituals.

Quissell et al. (2014) addressed dental disease in the Navajo community at a Navajo Nation Head Start, which has strong reach in the underserved communities. The study, cluster-randomized trial, originated by the Center for Native Research with members of the Navajo Nation to contrast outcomes between oral health intervention by trained researchers from the Center for Native Research and usual care in the community. The study sample was based on data from IHS oral health survey. The analysis was assessing the differences between the intervention from usual care, and intervention from the group of oral health professionals. Since many of the NA children received fluoride varnish through services offered at IHS, the usual or community-based care refers to behaviors and/or attitudes given in the community setting. The benefits of adding community-based participatory research methods to the randomized control studies outweigh the barriers and constraints. The community-based intervention approach promises to be effective in eliminating disparities in the NA community.

Baskaradoss (2018) examined the relationship between oral health status and OHL from a patient from the School of Dental Medicine at Case Western Reserve University, Ohio, from February through April of 2015. The study included African Americans and White; education consisted of high school graduate or less, some college, and/or professional degree; payment type was public/private insurance and/or out of pocket; socioeconomic tatus used the Federal Poverty Level, below or above the level. The finalized sample consisted of 150 respondents, of whom 74% were above the poverty level, 26% had finished high school, only 10.7% had a professional degree, 60% were Caucasian, and the majority of the sample (55.3%) were female (Baskaradoss, 2018). In this study, a higher percentage of African Americans and individuals with low education had limited OHL levels ($p < .05$); the mean decayed, missing, and filled teeth (DMFT) score for this population was higher, and people with limited OHL had severe periodontitis as compared with those with adequate OHL ($p = .04$). The disparities in OHL relating to race/ethnicity, social, economic status, and education levels is well documented (Jones, Lee, & Rozier, 2007), but gaps in the literature exist about how behavior and perception on OHL in the NA/AN community and the relationship with oral disease and social demographics.

Cultural Influence on Oral Health Behavior

Culture influences the health, belief, and practices of many individuals. Bogen and Goldstein (2009) defined culture as the integrated pattern of human knowledge, belief, and behavior that depends upon man's capacity for learning and transmitting knowledge to succeeding generations. Gampa et al. (2017) addressed the importance of

cultural factors to the doctor–patient relationship, and for community health workers to understand the cultural community to which they serve will assist and eliminating barriers in the Native community. Behar-Horenstein et al.'s (2017) study examined the oral health disparities in the United States among different ethnicities, and not only understanding the culture but having a cultural competence will eliminate the obstacles that may impede one adoption of oral health behaviors. Formicola (2003) defined cultural competence oral health providers have the capacity and delivery system to unite the oral health needs of the underserved in the framework of their cultural belief, values, languages, practice, and health behaviors. Heaton et al. (2018) understood the cultures of ANs and used storytelling to increase the oral health knowledge of the parents and the school-aged children. The intervention is useful as it builds respect of beliefs and practices, of the NA culture, but to increase the cultural competence of individuals, the need for a diversity in the oral health profession. Diversity in the workforce has been described as a critical first step in reducing oral health disparities in underserved communities (Behar-Horenstein et al., 2017).

Systemic Health and Oral Health

In recent years, the association between general and oral health has been validated, and the benefits of medical and dental providers working together for optimum health has been established. As advances in technology increase, more baby boomers are retaining their natural teeth (MacDougall et al., 2018), and as such, are vulnerable to dental caries and the causations such as dry mouth, gum recession and build of biofilm (Thompson, Bucher, & Bell, 2017). Studies have shown the relationship oral health has

to systemic health, in reference to cardiovascular diseases, systemic lupus, diabetes, and other endocrine disorders (Giacaman, 2017; Gurenlian, 2009; Thompson et al., 2017). Studies have revealed the relationship between periodontitis, a chronic immune inflammatory disease in which there is a disruption in the balance of the tooth and the microbial interactions, and systemic diseases such as Type 2 diabetes (Alvarez et al., 2018). Because of the high occurrence of Type 2 diabetes in the NA/AN population and the morbidity and mortality rates associated (Anderson et al., 2016), the significance of increasing the OHL in this community is needed. There are gaps in the literature addressing the relation of oral health and systemic health in this community, and this study was an attempt to bring this topic at the forehand.

OHL in the NA/AN community

Health literacy is an issue that has gained attention in public health throughout the years. While it is true that poor health literacy is associated with impoverished countries, it is also true low health literacy in the United States is related to people with decreased educational level, people who live below the poverty level, and ethnic minorities (McDonald & Shenkman, 2018). It is also true that an individual can be highly qualified in a field of study but may not understand the language in another area of research, and/or beliefs and practices in the community dismisses the acceptance of new information. Rasu et al. (2015) discussed the cost of health expenditures associated with people who have below, or basic health literacy endures more visits, prescription medications, and utilizes more emergent resources in comparison with those with adequate health literacy.

Just as inadequate health literacy leads to poor health outcomes, inadequate OHL leads to poor results in oral health. Also, poor OHL may lead to poor systemic health.

Brega et al. (2016) and Van et al. (2010) addressed OHL in the NA community putting emphasis on parents of preschoolers and the impact limited OHL have on the adopted behavior of children transcending to adulthood. In these articles, the value of parental influence can positively impact behaviors of preschool NA children. Nouri and Rudd (2015) examined the influence on health care outcomes from oral communication taking place between the patients and health care providers. The authors argued that despite the potential influence, health literacy in this field of health care has been under implementation for a short period of time. In light of the systematic literature review conducted in this area, Nouri and Rudd revealed discrepancies between the literacy levels of providers and the patients. Furthermore, demands for higher literacy can be associated with reduction in the learning of patients. The findings of this study have useful implications for the development of community programs aiming at servicing the economically challenged, uneducated and the minorities. A complex relationship between literacy levels is revealed in the light of past studies showing the levels may vary among various individuals and groups that implicate the need for further studies in this area to facilitate literacy programs for this population (Nouri & Rudd, 2015). The relationship between oral health and systemic health is relevant, and programs involved in educating future providers in medical and dentistry schools are needed to fulfill the gaps in OHL.

Chi (2017) did a qualitative study to address the method of motivational interviewing and how it can be influential in the improvement of general oral health.

Using the patterns of consistency in the existing studies on this topic, positive results in term of oral health care is shown illustrating how effective the method can be. The study also showed that improving the results of oral health for individuals in the dental practice setting and the techniques of motivational interviewing can be helpful if definition of specific components was shared. A review of the interventions revealed similarities with counseling approaches that aim at positive changed in the behavior of individuals. Chi argued that significant oral health behavioral improvements in terms of plaques levels, tooth brushing, and other important habits can be observed with the aid of using these intervention tools. For the NA population, community-based approaches are effective, as they may reiterate the importance of information received from their primary provider, family members, and educators. However, gaps exist in the studies when it comes to the evaluation of frequency or timing for which these intervention strategies are applied or can prove to be successful in terms of the outcomes produced.

For the oral health of children, a vital role is associated with the early preventive dental sessions. It is reportedly found that most of the registered Medicaid children are not receiving these important visits. Askelson et al. (2015) aimed at revealing the significant aspects that may serve as motivation factors for children to pay attention to their oral health and the necessity of these visits for them. The model used by the authors referred it as “The extended parallel process model” which suggested that actions of people are motivated by the presentation of certain threats and potential dangers posed to them. Also, the effectiveness and responsiveness are driven by these motivational aspects. The parents of children subjected to this study have been categorized into four

using the method of Witte for carrying out such categorization. These four categories are combination of threats and efficacy levels. Using logistic regression, it was found that parents under high threat/high efficacy and low threat/high efficacy have 2.5 times more likelihood of completing their children's preventive early dental visits as compared to the parents from other groups. Hence, the study proved that understudied aspects of self-efficacy require incorporation in the intervention aiming at higher rates of young children going for preventive dental visits. The study showed that some level of association exists between the preventive dental health care receipt and status of oral health. From the study of perceptions influencing decision of parents to conduct the visit, a vague connection can be drawn that health care literacy concerning oral health was a motivational factor for the parents taking their children for preventive dental care visits. In a nutshell, the association between OHL and outcomes is presented while efficiency of using behavioral health model in this field of research (Askelson et al., 2015).

Dickson-Swift (2014) created mapping measuring tools for OHL. Rapid Estimate of Adult Literacy in Medicine (REALM) (Dickson-Swift, 2014) was found to be the most commonly utilized OHL tool used in literature for explorations in this field of research. The Test of Functional Health Literacy in Adults (ToFHLA; Tadakamadla et al., 2014) was found to be another existing tool. This tool has proven to have good internal reliability while possessing potential of discriminating between health care literacy in general and OHL in particular. Various adaptations of OHL were also listed in this research such as REALM-D, REALD-20, REALD-30 and REALD-99. For the terms related to American dental association REALD tools are being utilized for extraction.

Finally, the authors concluded that the ToFHLA and REALM are the most widely used tools for measuring OHL across literature. It can be argued that service utilization and behaviors must be taken among the aspects determining the effectiveness of these tools for measuring OHL. The validity of these tools must have an association with the incorporation of these factors (Dickson-Swift et al., 2014).

The OHL and awareness among the baby boomer is explored by the study of MacDougall et al. (2018). Association between the chronic diseases resulting in the higher death rate and oral health of this population is used as a motivational rationale for initiating this study. It is indicated that as compared to the previous generations, baby boomers tend to have better oral health care outcomes due to their awareness of keeping the natural teeth for longer life spans. In the light of these facts, it is argued that the population of older adults requires greater level of knowledge and awareness about oral health in order to achieve similar health care goals. MacDougall et al.'s study was descriptive in nature and explored oral health and oral literacy levels among the population of baby boomers regarding the relationship that exists between the chronic diseases and oral health. The authors argued that regardless of the growing literature on OHL, there is not much done in the exploration of connection between the OHL and oral health knowledge. The findings of their study showed existence of lower yet positive relation between the knowledge scores and literacy of participants. A positive correlation was found between the oral knowledge scores and oral health care. Also, a relationship of the literacy level and socioeconomics has been discovered. Furthermore, the role of gender on the OHL is discussed as women tend to show higher level of OHL. In light of

this study, it can be argued that overall attainment of education can play its part in increasing the OHL levels among the target population. The role of effective communication is also found to be important in inducing higher level of literacy about oral health among the older population. The findings of the study may have useful implications for the client education about oral health (MacDougall et al., 2018).

The effectiveness of oral health promotion was explored by Braun et al. (2016) for community-based program. The study was conducted by developing Oral health promotion intervention program targeting the children of Navajo. The program was delivered by the Navajo workers who have been trained for this program.

The idea that health care awareness programs conducted by the members of community under professional supervision can result in the extension of health care services to Indian communities is accepted and implemented in this study. The measuring aspects for outcomes of the study were filled surfaces, missing, decayed and other commonly encountered oral health issues at the early age. The results of this study showed that for American Indian children, baseline caries is extremely high. Even if the children participated in the study in high numbers, lack of participation was shown by the caregivers in the program. The population subjected to intervention program for Oral health awareness showed higher level of knowledge on oral health and improved oral behaviors. Previous reports on the health issues of this population's children raise awareness on the need for introducing preventive Oral health services for this population. The success of this program developed and implemented for Indian Americans showed that by engaging the community members and training them for delivering programs may

help in achieving higher goals of Oral health care among communities of minority groups (Braun et al., 2016).

Socioeconomic Factors

There is a consistent and strong association between low socioeconomic status and OH behaviors. Several studies have shown that the prevalence of oral diseases such as dental caries, periodontitis, gingivitis, and OH behaviors influenced by socioeconomic and demographic factors (Peres, Peres, Barros, & Victoria, 2007; White, 2012). Prevalence of caries is higher in individuals with lower levels of education and in those who have greater difficulty in accessing information and health services. Low socioeconomic conditions also prevent the existence of a healthy diet leading to an increase in the consumption of sweetening foods. Studies have also shown individuals living below the poverty level, have only primary education, no dental insurance, and no primary physician have a low OHL (Henderson et al., 2018). Also, the utilization of dental services or low, in contrast, the usage for emergency services are high being seen for oral pain and emergent dental needs (Henderson et al., 2018; Reda et al., 2018). Individuals who are socially and economically challenged, limit access to health services by preventing the adoption of habits such as the daily brushing teeth with fluoride and flossing. These challenges significantly increase the risk of oral diseases. Many have argued IHS should fill the gaps seen in the community in terms of oral health and oral disease seen in NA/AN children. As stated earlier, IHS is underfunded and poorly managed to meet the needs of the community. The IHS offers medical, dental, and vision; but the facility and tribal officials identifies several factors affecting the access to the

services, such as travel distance, lack of transportation, and wait times between scheduling appointments (GAO, 2005).

Definitions

According to *Dorland's Medical Dictionary* (Anderson, 1989), terms used in this study are defined as follows:

- *Periodontitis* is inflammation of the periodontium.
- *Caries* is defined as the destructive process causing decalcification of the tooth enamel and leading to continued destruction of enamel and dentin, and cavitation of the tooth.
- *Periodontium* is the tissues investing and supporting the teeth, including the cementum, gingiva, and alveolar bone.
- *Gingivitis* is inflammation of the gums.
- *Dental disease*: caries (treated and untreated) and periodontal diseases (gingivitis, periodontitis). Caries will be measured by the continuous variable of DMFT index (decayed, missing, and filled tooth surfaces) (WHO, 1977) and periodontal status will be mostly evaluated by the nominal variable of Community Periodontal Index (CPI; WHO, 1997).
- *Oral health literacy (OHL)* is the ability to receive information, process the information, and act upon it seeking care for the treatment and prevention of oral disease (Lee, Divaris, Baker, Rozier, & Vann; 2012).
- *NA/AN Community* consist of indigenous people whose identity, language and customs are preserved and practiced.

- *Early childhood caries (ECC)* is the presence of any smooth-surface carious lesion in a child under three years of age; in ages three to five, it is defined as one or more cavitated, or missing due to caries (Alanazi, Pain, & Alkabbaz; 2018).
- *Oral health behavior* includes frequency of dental flossing and brushing (supervised and non-supervised), and consumption of sugary foods.
- *Oral health attitude* is identified as how the parents or guardians value dental hygiene and oral health for themselves or for their children, for example dental visits and reason for dental attendance, dental sealants, fluoride treatment, and what education, if any, is instructed to the child in the home by the parent or guardian (Brega et al., 2019)
- *Age* is defined numerically, and preschool (2-5 years); and school age (6-9) (Braun et al., 2016).
- *Education for parent and/or guardian*, defined as less than high school graduate; High school graduate/GED; some college/vocational; college degree or more (Brega et al., 2019).
- *Income* is defined as <$10,000; $10,000 to < $20,000; $20,000 to < $30,000; $30,000 to $40,000; > or = to $40,000 (Brega et al., 2019).

Assumptions

One assumption of this study is NA/AN who receive IHS services in combination with Medicaid, have behaviors and beliefs that utilize preventive interventions for their children, and therefore have a higher level of OHL and have better oral health in their

NA/AN children than NA/AN who receive only IHS services. Another assumption is services offered at IHS facilities are only funded for prevention (sealants) and/or extractions, not for restorations. For the NA/AN adult, this can be taxing due to oral pain that may lead to extractions only and may decrease the self-confidence in a young adult. Finally, I assume that the secondary data and studies I used to conduct the meta-analysis were adequately valid and reliable.

Scope and Delimitations

The specific aspect of the problem is defining the relationship between oral health behaviors/attitudes and socio-demographic factors and dental disease in the NA/AN community, and what impact can have a parent or caregiver OHL on children's oral health. The population under study is NA/AN residing in the United States and Canada. Specific criteria to select studies and data to be included in the meta-analysis will be described in detail in Section 2.

Significance, Summary, and Conclusions

The contribution of this study is revealing the behavioral and socio-demographic factors affecting oral health in NA/AN school-aged children and advancing the knowledge that oral health and general health are interlinked. The medicinal and dentistry discipline can augment OHL to the curriculum, therefore placing practitioners in the community that will convey the importance of increasing OHL in the NA/AN community. This study exposed the main health source for many NA/AN is underfunded in the area and revealing the increased risk of NA/AN children have with dental decay and caries may increase yearly funding. As Phipps and Ricks (2015) illustrated 76% of

NA/AN children are affected by dental caries by the age of 5. As such, preventive measures to modify behaviors that impede the oral health of this community are essential. Just as health care policies are critical in support of services and resources to prevent disease and maintain optimum health, health care policies should include dentistry for the health care beneficiaries. As studies reveal the connection between general health and oral health; and how oral health can exacerbate and often trigger systemic health concerns (Donoff, McDonough, and Riedy; 2014). For the NA/AN community, studies addressing oral health and the impact it has on general health can assist U.S. Congress to increase the budget for IHS and promote social change in this risk population group. In the implementation of the curriculum to health practitioners conveying the merger of dentistry and systemic health, practitioners can examine and evaluate the body as a whole with aims on prevention and holistic health promotion.

Section 2: Research Design and Data Collection

In Section 1 of this study, the significance of oral health was discussed especially in relation to systemic diseases. Joseph et al. (2016) illustrated the association between oral and general health, and also identified the correlation between medical disorders and dental infections. Also, minorities have dental diseases to a higher degree compared with the general population, with a greater incidence of dental diseases in the NA/AN community, children included (Murphy & Larsson, 2017). NA/AN children are 2 to 4 times more likely to have caries and untreated primary tooth decay (Schroth et al., 2009). NA/AN who experience poor oral health in childhood are more likely to endure this situation throughout adult life (Batliner, 2016; Jamieson et al. 2010).

In Section 1, it was identified that although there are numerous variables to explain why dental diseases are prevalent in this community, there are compounding variables that may impact the decision of individuals in this community to seek oral health care for their children and themselves. These compounding variables can complex social determinants that include poverty, social exclusion, cultural eradication, government guidelines of assimilation, historical consequences of colonialism, and institutional racism (Durie, 2004). Studies have shown culture influences health behavior (Rochelle, 2019; Swierad et al., 2017). For the NA/AN, with the history of government skepticism to provide health services as agreed upon (Kunitz, 1996), culture can be a significant predictor factor for health. NA/AN culture identifies how societal demands affect how people from the NA/AN community think about cultural beliefs and values (Stewart et al., 2017) influencing the decision to seek for health services and treatment.

In this section, I examine the relationship between oral health behaviors and attitudes in NA/AN parents and/or guardians in relation to the oral health diseases in children. Additionally, I discuss the impact of sociodemographic factors, such as gender, income, and education, on these beliefs and attitudes among NA/AN. A discussion of the research design and rationale, the methodology, search strategy, selection, and the data extraction will be provided.

Research Design and Rationale

Parents and guardians who have poor health child-rearing practices are more likely to also have poor health-related behaviors overall, and children with deficient oral health behaviors are susceptible to higher prevalence of oral diseases (Kumar et al., 2017). In this research, the population under study was NA/AN and their children, for whom secondary data are not easily accessible especially as far as the variables under study are concerned (oral health attitudes, behaviors and oral diseases). Therefore, for this doctoral study, the research design of choice is meta-analysis, which is "the statistical analysis of a large collection of analysis results from individual studies for the purpose of integrating the finding" (Glass, 1976, p. 3). Prior to performing the meta-analysis, I conducted a systematic review of the relevant literature was conducted to provide a comprehensive literature search with predefined eligibility criteria (see also Liberati et al. 2009). The main advantages of systematic review and meta-analysis are the following: first an exhaustive systematic review ensures that the search strategies are replicable (Aytug et al. 2012), and although systematic reviews may not be able to address potential problems in the primary studies, a well-performed systematic review can allow future

researchers to replicate the results of their literature review and probably in meta-analysis (Cooper et al. 2008). Second, in a meta-analysis, the researchers do not focus on the statistically significant results of each individual study, but on the combined magnitude of the effect derived from all studies included in the meta-analysis (Cheung & Vijayakumar, 2016). Also, a researcher can estimate the heterogenicity of the effects, which evaluates if the effect is consistent across studies (Cheung& Vijayakumar, 2016). Finally, some study – level characteristics can be used as moderators, to explain more objectively some of the variation in the detected effect sizes across individual studies (Cheung & Vijayakumar, 2016). This study reviewed the published literature of NA/AN parents, guardians, and their children and examined whether there is a relationship between their oral health behaviors and attitudes and dental diseases in children.

Methodology

Population

The target populations were individuals who identify as either NA/AN or Aboriginals or First Citizens who reside in Canada. The identification of NA/AN included bi-racial, not specified but inclusive of First Citizens or NA/AN who are of mixed heritage (i.e., Anglo-Saxon, African American, Asian, Latin). The parents and/or guardians of school-aged children used to determine the relationship, if any, between the parent/guardian's behavior and attitude and oral health of the school-aged children. To increase the number of articles included, the age of children was not specified; rather, it was generalized to school-aged children. This population was chosen because of the alarming disparities seen in oral health of this population compared to other minorities

(Murphy & Larsson, 2017). Further, children with ECC are 3 times more likely to develop caries in their permanent teeth (Li & Wang, 2002). Many of the over 500 federally recognized tribes are eligible to access services provided by IHS, which includes but is not limited to health, dental, and mental health (Phipps & Ricks, 2017). Although many NA/AN are eligible to receive service, many do not access dental services for preventative and oral health promotion. Historically, descendants of an indigenous population have various barriers when implementing health recommendations sponsored by Westernized practitioners (Garcia de Moura et al. 2010). The NA/AN distrust in government stems from fractured promises perceived as exploitation relating to the care and services of the NA/AN people (Stivers, 2017). This population experiences meagre oral health in childhood that continues during the life course (Batliner, 2016; Jamieson et al. 2010).

Sampling Procedure

All the articles/studies that meet the inclusion criteria above were examined in this meta-analysis based on the target population, and keywords such as *oral health*, *behaviors*, *attitudes*, *Native American*, *American Indian*, *dental disease*, *Native American children*, *Alaskan Native*, *First Nationals*, and *dental caries*. I used Walden University Library's Thoreau, which is a multidatabase search tool, Medline Plus, Cochrane Database for systematic reviews, CINAL, and government search engines such as Centers for Disease Control and Prevention (CDC) and HHS.

Articles with qualitative findings (e.g., semistructured interviews) were eliminated due to the quantitative approach of this study. Some examples of studies that

are relevant to my topic but were excluded for several reasons are the following: A recent study by Heaton et al. (2018) identified concerns of oral health in children, but the participants were limited to women with the annual household of less than or equal to $20,000 annually. Naidu et al. (2014) addressed oral health practices in the Algonquin community of Quebec. Using semistructured interviews, Naidu et al. identified three main themes for analysis: A gap existed between oral health knowledge and verbal health behaviors; challenges for oral health promotion included attitudes and beliefs, access, and priorities; and parents needed to be further integrated into health promotion strategies. Although the article was excluded from this study, as it did not identify a quantitative dependent variable of dental disease in children, the findings demonstrated systemic connections to oral health that may impede an individual from engaging, such as geographically isolation and food deserts (Naidu et al., 2014). Naidu et al. also demonstrated that children could actively engage with oral health promotions along with their parents, and initiatives to help in this area are needed.

After further review of the abstracts, I excluded seven articles from this study, as some focused on the attitude/behavior of medical student providers, who are NA/AN, and if their attitude/behavior of oral health have bearing on how they will practice. The included articles had a sample size of a 100 or more to have as representative a sample of the NA/AN population as possible. Many of the articles included dyads of both parent/guardian and their children, however, a few of the articles selected included preschool age children only, and one of the articles included NA/AN mothers and newborns.

Research Questions and Variables Under Study

RQ1: What is the effect of oral health behaviors and attitudes (optimal vs. not optimal) on dental disease in NA/AN school-aged children and their parents or guardians?

$H_0$1: There is no significant effect of oral health behaviors and attitudes on dental disease in NA/AN school-aged children and their parents or guardians

H_a1: There is a significant effect of oral health behaviors and attitudes on dental disease in NA/AN school-aged children and their parents or guardians .

Independent variables: Oral health behavior, which includes frequency of dental flossing and brushing (supervised and non-supervised), and consumption of sugary foods. Attitude is another independent variable, identified as how the parents or guardians value dental hygiene and oral health for themselves or for their children, for example, dental visits and reason for dental attendance, dental sealants, fluoride treatment, and what education, if any, is instructed to the child in the home by the parent or guardian. Examples of optimal oral health behaviors and attitudes are brushing and flossing frequency at least twice per day, low consumption of sugary foods.

Dependent variable: Dental disease, which includes of dental caries treated or untreated, gingivitis, and missing permanent teeth (tooth loss).

RQ2: What is the effect of social demographic factors (e.g. gender, age, education, and income) on oral health behaviors/attitudes and dental disease in NA/AN school-aged children and their parents or guardians?

$H_0$2: There is no significant effect of social demographic factors (e.g. gender, age, education, and income) on oral health behaviors/attitudes and dental disease in NA/AN school-aged children and their parents or guardians.

H_a2: There is a significant effect of social demographic factors (e.g. gender, age, education, and income) on oral health behaviors/attitudes and dental disease in NA/AN school-aged children and their parents or guardians.

Independent variables: Social demographic factors (e.g. gender, age, education, and income).

Dependent variables: Oral health behaviors/attitudes and dental disease in NA/AN school-aged children and their parents or guardians, as described for RQ1.

Inclusion Criteria for Articles

The meta-analysis inclusion criteria involve published articles dated from 2014 through 2021 with the following data/population; first descendants of North American, which include residents in the United States (NA/AN) Canada (Aboriginals). There was no preference for tribal affiliation, although Navajo tribe was used frequently. Other inclusion criteria included studies involving school-age children and studies measuring the oral health behavior and/or attitude of parents/children, and how that, if any, impacts the oral health of the child (dental disease). Some of the potential limitations of this study include variance in how data have been collected, from randomize controlled trials (RCT), self-reported surveys, and community-based participatory research. Also, the possible influx of being bi-racial, and how that may affect the influence of behavior, depending on the ethnic identity is established. However, all participants in the studies

have identified as NA/AN or Aboriginal. The type of research involved RCT, cross-sections surveys, cluster RCT, and community based participatory research. When all the studies were collected, publication date, sample size, and effect sizes (e.g., odds ratio) were reported for each study.

Exclusion Criteria

Studies excluded in this study are qualitative studies. Also, secondary studies were excluded, as were meta-analysis, systematic, and studies published in non-English. Studies of populations other that NA/AN were excluded as well. The sampling procedure did not include articles pending publication, non-published articles, essays, or editorials. No historical or legal documents were used as sources of data.

Data Analysis Plan

For this study, a meta-analysis of the data was carried out using the Comprehensive Meta-Analysis (CMA, Version 3) statistical software, developed by Biostat, Inc. in the United States. Of the two programs considered to analyze data, RevMan (Version 5) and CMA, the CMA program offers data entry of individualize studies and allows entry of treatment effect in one or more formats. This component is essential, as studies chosen for this meta-analysis have varied treatment effects and measuring or variables differ. For RQs 1 and 2, the primary outcome in the studies included dental caries treated or untreated, mostly measured by the continuous variable of DMFT index (WHO, 1977), and periodontal status, measured for example by the nominal variable of the CPI (WHO, 1997). For RQ2, an additional outcome was the oral health behaviors and attitudes of the populations (nominal/ordinal variables). In order to

meta-analyze data by the independent variables concerning the outcome variables recorded in the studies, Mantel–Haenszel and continuous outcomes methods were used (Mamai-Homata et al., 2016; Higgins & Green, 2011). More specifically, two types of effect size were examined depending on the level of measurement of the outcome variable as used in the included studies: (a) odds ratio (OR) and 95% CI: a summary OR and 95% CI of each independent variable (e.g., for RQ2 gender, education level) on the outcome nominal/ordinal variable (e.g., brushing frequency) were calculated and reported using Mantel– Haenszel method; and (b) a summary standardized mean difference (SMD) and 95% CI of each independent variable (e.g., for RQ1 brushing frequency) on the outcome continuous variable (e.g., dental caries/DMFT score) was calculated and reported using continuous outcomes method. If needed, the Bonferroni-adjusted *P* value was used for more valid results (Mamai-Homata et al., 2016). In this study, there is no intervention/treatment to be evaluated; therefore, there are no actual "treatment" and "control" groups, but the effect of the independent variables was estimated between the levels/groups of these variables; for example, for RQ1, the treatment group can be considered the ones who demonstrate optimal oral health behaviors and attitudes (e.g., brushing at least twice per day, reason for dental attendance is prevention) and the control group may be considered those who do not demonstrate optimal oral health behaviors and attitudes (e.g. brushing once per day or less).

Meta-analysis can play a significant role in offering synthesized reports for the development of new questions

Threats for Validity

Frankfort-Nachmias and Nachmias (2008) define validity as the degree an instrument measure what it is supposed to measure. The articles included in the analysis for this study have a variance of instruments used when measuring the secondary outcome of behavior and attitude. Many of the items used a form of questionnaire to assess attitude and behavior, of which a multitude were identified. The lack of uniformity defined in the questions asked to the sample participants about the sense of perspective about oral health relates to face validity. No internal threats to validity discovered after an in-depth review of articles utilized for this study. The content validity is confirmed since all attributes are covered in measuring the intended outcome to answer the research questions. Although the population is NA/AN and First Nationals from Canada in all studies, because of the diversities of tribal affiliation, with the USA having over 600 federally recognized tribes, the sampling validity may be of the question since the majority studies reflect sampling from the Navajo tribe.

Ethical Procedures

Many of the articles used for this study specified they have obtained written consent from the parents and children participated in these studies. The IHS and IRB approved the studies for intent to decrease dental disease in NA/AN children. In the Batliner et al. (2014) study, the participants and the trial conducted on the Pine Ridge Reservation of the Oglala Sioux Tribe (OST), and although the dental clinics are on the reservation, permission for the study supported by tribal leaders and IHS IRB panel. No ethical concerns identified relating to how participants recruited and/or retained for the

study. The Albino et al. (2016), secondary baseline data used in obtaining information from the Navajo Nation Head Start, to which parents consented and approved by the Navajo Nation Human Research Review Board. For this study, I received Walden's IRB approval (#06-16-20-0488076) and no significant ethical issues were anticipated, since I used secondary data from already published studies to conduct my meta-analysis.

Summary

For this study, the research questions address the attitudes and behaviors of NA/AN parents and/or guardians and dental disease in school age children. The methodology of this study uses meta-analysis to synthesize empirical studies to yield findings that have a high possibility of providing statistical significance to address research questions more precisely. Section three will reveal narrative review of data from studies chosen and the statistical results of the conducted meta-analysis.

Section 3: Presentation of the Results and Findings

The purpose of this study was to conduct a meta-analysis on published data examining the impact of oral health behaviors and attitudes of NA/AN parents and guardians on dental disease in NA/AN school-age children. Also, the study investigated how the dependent variables of oral health behaviors, attitudes, dental disease correlate with independent demographic variables such as gender, age, education, and income in NA/AN community.

The following research questions and hypotheses were addressed:

RQ1: What is the effect of oral health behaviors and attitudes (optimal vs. not optimal) on dental disease in NA/AN school-aged children and their parents or guardians?

$H_0$1: There is no significant effect of oral health behaviors and attitudes on dental disease in NA/AN school-aged children and their parents or guardians.

H_a1: There is a significant effect of oral health behaviors and attitudes on dental disease in NA/AN school-aged children and their parents or guardians.

RQ2: What is the effect of social demographic factors (gender, age, education, and income) on oral health behaviors/attitudes and dental disease in NA/AN school-aged children and their parents or guardians?

$H_0$2: There is no significant effect of social demographic factors (gender, age, education, and income) on oral health behaviors/attitudes and dental disease in NA/AN school-aged children and their parents or guardians.

H_a2: There is a significant effect of social demographic factors (gender, age, education, and income) on oral health behaviors/attitudes and dental disease in NA/AN school-aged children and their parents or guardians.

This section includes a discussion of the data collection process involved in the analysis and the results of the meta-analysis, which are summarized in tables and charts. Finally, a summary of the chapter will be provided.

Data Collection of Secondary Data Set

Using four search engines (ProQuest Central, Google Scholar, MEDLINE, and Thoreau), and the Walden library, I examined scholarly review articles published between 2015 to 2021. The key words used in the literature search were *oral health behaviors*, *oral health attitudes*, *Native American oral health*, *Alaskan American dental health*, *dental health in Native American children*, *First Natives*, *Aboriginals and dental disease*, and *dental disease in the Native American community*. Research articles included the variables oral health behavior, attitude of parents or guardians towards the values of dental hygiene and oral health for themselves or for their children, social demographic factors (e.g., gender, age, education, and income), and dental disease.

Out of the nine research studies that were originally considered for the meta-analysis, only seven were deemed appropriate and included in the analysis. The two excluded studies are the following: Brega et al. (2019) discussed associations between tribal identity and oral health and behaviors of NA/AN's. Using a cluster randomized trial, associations were drawn with sociodemographic with ethnic identity, tribal language with oral health, and the importance of maintaining tribal identity with oral health. No

analysis on associations between oral health and behaviors were examined. Batliner et al. (2014) discussed a proposed motivational interviewing trial to AI/NA mothers to prevent childhood caries. Batliner et al. study would have captured components related to the research question, but no results were reported, and no further investigations were located involving this subject matter.

What follows is a summarization of each study article included in this meta-analysis research.

- *Validation and Impact of Caregivers' Oral Health Knowledge and Behavior on Children's Oral Health Status* (Wilson et al., 2016). Wilson et al. (2016) set out to validate the oral health knowledge and behavior measures from the Basic Research Factors Questionnaire, developed to capture specific themes contributing to children's oral health outcomes and influence of caregivers. Data were collected as part of a randomized clinical trial (n = 992) aimed at reducing dental caries in young children. Participants were NA/AN caregivers with a child aged 3 to 5 years enrolled in a Navajo Nation Head Start Center. Oral health knowledge and behavior outcomes were compared with measures of participants' sociodemographic characteristics, oral health behaviors and attitudes, and oral health status. The main results of the Wilson et al.'s study was that caregiver's oral health knowledge was significantly associated with education, income, oral health behavior, and all but one of the oral health attitude measures. As the behavior score improved, DMFS declined, child/caregiver overall oral health status improved, and children's oral health

quality of life improved. The results of this study were included in the meta-analysis for Research Questions 1 and 2.

- *Validation of Psychosocial Measures Assessing American Indian Parental Beliefs Related to Control over Their Children's Oral Health* (Wilson et al., 2020). Wilson et al. (2020) set out to validate questionnaire items NA parental beliefs regarding control over their children's oral health within the context of psychosocial measures and children's oral health status. Data were collected as part of a randomized controlled trial (n = 1016) addressing ECC. Participants were AI parents with preschool-age children in the Navajo Nation Head Start program. Questionnaire items assessed parental oral health locus of control (OHLOC) and agreement with beliefs indicating that they were in control of their children's oral health (internal), the dentist was in control (external powerful others), or children's oral health was a matter of chance (external chance). Parents of higher education ($p < .0001$) and income ($p = .001$) had higher scores for internal OHLOC. Significant associations were not found for OHLOC beliefs and children's oral health status. This article was included in the meta-analysis for Research Question 2.
- *A Cluster-Randomized, Community- Based, Tribally Delivered Oral Health Promotion Trial in Navajo Head Start Children* (Braun et al., 2016). Braun et al. (2016) tested the effectiveness of a community-based, tribally delivered oral health promotion (OHP) intervention (INT) at reducing caries increment in Navajo children attending Head Start. The authors enrolled 1,016 caregiver-

child dyads. After 3 years, DMFS increased in both the intervention (INT) and usual care (UC) groups (+12.9 INT vs. +10.8 UC; $p < .216$), as did caries prevalence (86.5% to 96.6% INT vs. 90.1% to 98.2% UC; $p < .808$) in a modified intention-to-treat analysis of 897 caregiver-child dyads receiving 1 year of INT. Caregiver oral health knowledge scores improved in both groups (75.1% to 81.2% INT vs. 73.6% to 79.5% UC; $p = .369$). Caregiver oral health behavior scores improved more rapidly in the INT group versus the UC group ($p < .006$). The DMFS increment was smaller among adherent INT children (+8.9) than among UC children (+10.8; $p < .028$). This article was included in the meta-analysis for Research Question 1.

- *Oral Health Beliefs and Oral Hygiene Behaviours Among Parents of Urban Alaska Native Children* (Hiratsuka et al., 2019). Hiratsuka et al. (2019) set out to explore constructs of the HBM informing oral health beliefs and oral hygiene behaviors of parents of AI/AN children ages 0–6 years. The study aimed to determine the tooth brushing behavior in parents of AI/AN children and the relationship between parent oral health beliefs and tooth brushing frequency. A cross-sectional survey which included the Oral Hygiene Scale, Oral Health Belief Questionnaire and the Early Childhood Oral Health Impact Scale was administered to a convenience sample of parents of NA/AN children 71 months or younger attending outpatient pediatric primary care appointments ($n = 100$). Analyses were conducted to determine parent tooth brushing, demographics, and the relationship between parent health beliefs

and child tooth brushing. The odds of regular child tooth brushing were 49.10 times higher when the parent brushed their own teeth regularly (CI = 11.46–188.14; $p < .001$). Parental tooth brushing had a strong positive association with the belief that oral health is as important as physical health. This article was included in the meta-analysis for Research Question 2.

- *Oral Health Beliefs of Alaska Native Dental Patients* (Adams, 2017). Adams (2017) studied oral health beliefs and oral health behavior based by demographics of ANs who remained on the Pacific coast and resided in the remote region of Northwest Alaska. The researcher collected survey data from patients Maniilaq of Association Dental Clinic, a subsidiary of the Northwest Alaska Native Association (NANA). On average, women reported oral health to be more important than men did. Regarding age, the older the participant, the more serious oral health is. The strongest positive relationship was between perceived seriousness of dental problems and perceived importance of dental health ($r = 0.547$, $p < .001$). "Importance" was also strongly, positively related with both "benefits" ($r = 0.485$, $p < .001$) and "efficacy of dentists" ($r = 0.466$, $p < .001$).
- *Oral Health Knowledge and the Utilization of Dental Services: A Survey of Urban Native Americans* (Byrappagari et al., 2017). Byrappagari et al. (2017) investigated oral health knowledge among the NA patients of American Indian Health and Family Services and how it affected the utilization of dental care. About 91% of participants reported that good oral health was very

important to them, and about half of them reported having good to very good oral health. A large percentage of the respondents did not practice good oral hygiene and sought dental care when needed even though they scored high on the knowledge questions. Byrappagari et al. investigated the relationship between the importance of oral health knowledge and the frequency of the time they had a dental problem. Of those that stated that oral health knowledge was important, 51.3% had a dental problem and 23.1% did not. Out of those that stated that oral health knowledge was not important, 7.7% had a dental problem and 17.9% did not. The results of the study indicated that good oral health knowledge alone does not translate to better utilization of dental services, and there are other barriers to seeking care.

- *The Oral Health of American Indian and Alaska Adult Dental Patients: Results of the 2015 IHS Oral health Survey* (Phipps et al., 2016). The IHS collected data from 11,462 American Indian and Alaskan dental patients ranging in age from 35 to 103 years (Phipps et al., 2016). This data brief focused on the oral health of adult dental patients and presented information on the prevalence of dental caries, severe periodontal disease, and tooth loss, and assesses trends over time. There were five key findings of this brief:
    - NA/AN adult dental patients suffer disproportionately from untreated dental caries, with twice the prevalence of untreated caries as the general U.S. population and more than any other racial/ethnic group.

- AI/AN adult dental patients are more likely to have severe periodontal disease than the general U.S. population.
- Compared to the general U.S. population, NA/AN adult dental patients are more likely to have missing teeth.
- Compared to the general U.S. population, NA/AN adult dental patients are more likely to report poor oral health, oral pain, and food avoidance because of oral problems.
- Since 1999, the oral health of AI/AN adult dental patients has improved. Fewer have untreated decay, the prevalence of severe periodontal disease has decreased, and more adults are keeping their teeth into older age.

Results

Meta-analysis is an analytical approach utilized for the purpose of synthesizing quantitative data from multiple different studies to determine the degree of effect of the independent variable on the dependent variable. It uses statistical results from individual quantitative studies as the units of measurement in an overall study. These results are summarized by indices of effect size or mean difference that "may then be averaged to obtain an overall estimate of effect magnitude" (Hedges & Becker, 1986, p. 15). The strength of the meta-analysis derives from the fact that the indices of effect magnitude are scale-free. The use of a scale-free index of effect magnitude makes it possible to combine the results of studies that measure the same construct. The meta-analysis was performed using the latest edition of CMA (Version 3.0).

In this study, the effects of group type on outcomes, as indicated by the results of individual studies, were examined to determine the size of the overall effect. Heterogeneity between studies was evaluated by Q and I^2 tests. Q is considered a classical measure of heterogeneity, called Cochran's Q, which is calculated as the weighted sum of squared differences between individual study effects and the pooled effect across studies, with the weights being those used in the pooling method (Greenland & O'Rourke, 2008). The I^2 statistic describes the percentage of variation across studies that is due to heterogeneity rather than chance. Heterogeneity is considered significant when $p < .05$ in Q statistics and $I^2 > 40\%$. (Graziani, 2014). The results of the meta-analysis will be presented as weighted mean difference and 95% confidence interval, with a significance level $\alpha = 0.05$. The data of each study and meta-analysis will be summarized with Forest plots. There were different measures of effect sizes reported in each of the studies included in the meta-analysis. Effects of means and proportions were often reported. In order to use both types of measurements, weights were assigned to each study based on the inverse of the overall study error variance (Rosenblad, 2009). This provided a generic approach to meta-analysis that was used to combine estimates of a large variety of metrics, including standardized mean differences, means differences, correlation coefficients, regression coefficients, odds ratios and simple means or proportions (Rosenblad, 2009).

Research Question 1

RQ1: What is the effect of oral health behaviors and attitudes (optimal vs. not optimal) on dental disease (dental caries, periodontal status) in NA/AN school-aged children and their parents or guardians?

$H_0$1: There is no significant effect of oral health behaviors and attitudes on dental disease in NA/AN school-aged children and their parents or guardians.

H_a1: There is a significant effect of oral health behaviors and attitudes on dental disease in NA/AN school-aged children and their parents or guardians.

Braun et al. (2016), Wilson et al. (2016), and Byrappagari et al. (2017) were included in the meta-analysis in order to address this first research question and corresponding hypotheses (see Table 1).

Description of the independent and dependent variables included in the meta-analysis was as follows: Braun et al. (2016) tested the effectiveness of a community-based, tribally delivered oral health promotion (OHP) intervention (INT) at reducing caries increment in Navajo children attending Head Start. To address RQ1 without the bias of the effect of the oral health promotion and caries prevention programs used in this study, we used the data at the baseline and prior the intervention; The first group of caregivers (intervention group) had a higher oral health knowledge score ($M = 75.1$, $SD = 0.8$) than that of the second group (usual care group; $M = 73.6$, $SD = 0.6$). Since the first group had a higher oral health knowledge score (independent variable), I considered this score as optimal and the score of the second group as not optimal according to RQ1. Regarding the dependent variable of RQ1 (dental diseases), the level of oral health status

of the children (as reported by caregiver: 1 = *excellent*; 2 = *very good*; 3 = *good*; 4 = *fair*; 5 = *poor*) in the first group was a little better ($M = 2.9$, $SD = 0.1$) than in the second group ($M = 3.00$, $SD = 0.10$), $p = .395$.

In the study by Wilson et al. (2016), the impact of optimal versus not optimal oral health behavior (independent variable) on oral health status/dental disease (dependent variable) was assessed. Participants who demonstrated optimal oral health behavior ($M = 58.7$, $SD = 18.10$) had children with good oral health status on average ($M = 2$, $SD = 0.2$, where 1 = *excellent*; 2 = *very good*; 3 = *good*; 4 = *fair*; 5 = *poor*) and those who were classified as not optimal oral health behaviors ($M = 48.30$, $SD = 18.40$) had children with fair/poor oral health status in average ($M = 4.5$, $SD = 0.2$), $p < .001$.

Braun et al. (2017) collected post intervention data in three consecutive years. As such, the findings reported by Braun et al. have been placed into three sub-groups based on the post-intervention year on which data were collected. To measure tooth decay, the researchers simply counted the number of tooth surfaces with decayed, missing, or filled surfaces (DMFS). Similarly, Wilson et al. (2016) used the DMFS index to measure tooth decay. Consequently, the two studies had comparable measures of tooth decay hence meta-analysis could be conducted. Table 1 indicates the descriptive statistics of data reported by both Wilson et al. and Braun et al. Specifically, the dataset consists of two groups of participants: those with optimal knowledge and those without optimal knowledge on oral health.

Table 1

Descriptive Statistics by Study for RQ 1

Study name	Subgroup within study	Group 1[1]			Group 2[1]		
		M	*SD*	*n*	*M*	*SD*	*n*
Braun et al. (2017a)	Follow-up year 1*	1.73	1.64	217	1.85	1.67	231
Braun et al. (2017b)	Follow-up year 2*	1.89	1.66	238	1.98	1.67	229
Braun et al. (2017c)	Follow-up year 3*	2.03	1.69	118	2.05	1.58	111
Wilson et al. (2016)	Not optimal oral health behaviors*	1.32	1.03	668	1.70	1.03	315

[1] Group 1: optimal behaviors and attitudes, Group 2: not optimal behaviors and attitudes.
* These values were converted from a 0-128 to 1-5 scale using the transformation New = 0.03125*Old + 1.
** These values were converted from a 0-100 to 1-5 scale using the transformation New = -,04*Old + 5.

A meta-analysis was conducted to find out whether oral health promotion has a significant impact on dental carries. A random effect model was chosen because of evidence of heterogeneity based on the significant test for heterogeneity ($Q = 1746.25$, $p < .001$, $I^2 = 99.82\%$).

The meta-analysis found an overall statistically significant effect of optimal oral health behaviors and attitudes on dental disease in NA/AN school-aged children ($p < .001$), thus the null hypothesis for RQ1 should be rejected. Table 2 depicts the results of the meta-analysis.

Table 2

Results of Meta-Analysis for RQ 1

Study name	Subgroup within study	Statistics for each study: Std Paired Difference	*SE*	Variance	Lower limit	Upper limit	*p*
Braun et al. (2017a)	Follow-up year 1	-0.18117	9.47E-02	8.97E-03	-0.36684	4.50E-03	5.58E-02
Braun et al. (2017b)	Follow-up year 2	-0.12737	9.27E-02	8.59E-03	-0.30898	5.42E-02	0.169261
Braun et al. (2017c)	Follow up year 3	-3.89E-02	0.132238	1.75E-02	-0.29804	0.220328317	0.7689
Wilson et al. (2016b)	Not optimal oral health behaviors	-12.5	0.290082	8.41E-02	-13.0686	-11.93144927	0
Random		-3.1929	1.486121	2.208556	-6.10564	-0.280153501	3.17E-02

Research Question 2

RQ2: What is the effect of social demographic factors (gender, age, education, and income) and oral health behaviors/attitudes on dental disease (dental caries, periodontal status) in NA/AN school-aged children and their parents or guardians?

H^0 2: There is no significant effect of social demographic factors (e.g. gender, age, education, and income) on oral health behaviors/attitudes and dental disease in NA/AN school-aged children and their parents or guardians.

H^0 2: There is a significant effect of social demographic factors (e.g. gender, age, education, and income) on oral health behaviors/attitudes and dental disease in NA/AN school-aged children and their parents or guardians.

Wilson et al. (2016) and Wilson et al. (2020) were included in the meta-analysis to address RQ2 and the corresponding hypotheses. In the sections below, I describe the independent and dependent variables included in the meta-analysis.

Gender

Wilson et al. (2020) and Wilson et al. (2016) included gender as a control variable while addressing the impact of oral health behaviors and attitudes on dental caries However, the data originally reported by Wilson et al. (2020) and Wilson et al. (2016) regarding oral health status were not comparable. Specifically, Wilson et al. (2020) used a five-point likert-scale to measure and report oral health status while Wilson et al. (2016) used percentages to report oral health status. Consequently, transforming the percentages into a range of values between 0 and 5 was necessary. As such, the researcher transformed the percentages into values ranging between 0 and 5 by simply dividing each percentage value by 20 (see Table 3).

Table 3

Effect of Gender of Caregivers on Oral Health Behaviors and Attitudes

Study name	Male			Female		
	M	*SD*	*n*	*M*	*SD*	*n*
Results not standardized						
Wilson et al. (2020a)	4.1	0.9	162	4	1	841
Wilson et al. (2020b)	2.3	1.1	162	2.5	1.1	841
Wilson et al. (2020c)	2.5	1.1	162	2.2	1.1	841
Wilson et al. (2016a)	70	14.3	161	75.4	12.8	831
Wilson et al. (2016b)	51.1	19.1	161	56	18.7	831
Results standardized						
Wilson et al. (2020a)	4.1	0.9	162	4	1	841
Wilson et al. (2020b)	2.3	1.1	162	2.5	1.1	841
Wilson et al. (2020c)	2.5	1.1	162	2.2	1.1	841
Wilson et al. (2016a)	3.5	0.715	161	3.77	0.64	831
Wilson et al. (2016b)	2.555	0.955	161	2.8	0.935	831

A random effect model was chosen because of evidence of heterogeneity based on a significant test for heterogeneity, Q =41.78, p <0.01, I^2 = 90.43%.

As per the results of the meta-analysis, there were no statistically significant differences between males and females in terms of their oral health status (Mdiff = -0.09635, $p < 0.44$, $SE = 0.12$; see Table 4). Consequently, these results suggest that gender was not a significant determinant of oral health status of children.

Table 4

Results of Meta-Analysis for RQ 2 Concerning Gender

Study name	Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Wilson (2020a)	0.101564	8.58E-02	0.007367	-6.67E-02	0.269791	1.183294	0.236692
Wilson (2020b)	-0.18182	8.59E-02	7.38E-03	-0.35017	-1.35E-02	-2.11669	3.43E-02
Wilson (2020c)	0.272727	8.60E-02	7.40E-03	0.104136	0.441318	3.170609	1.52E-03
Wilson (2016a)	-0.41366	8.66E-02	7.50E-03	-0.58341	-0.24392	-4.77631	1.79E-06
Wilson (2016b)	-0.26112	8.63E-02	7.45E-03	-0.43028	-9.20E-02	-3.02549	2.48E-03
Random	-0.09635	0.124496	1.55E-02	-0.34035	0.147662	-0.77389	0.438997

Age

Regarding age, Wilson et al. (2020) was the only study that directly investigated the relationship between oral health behaviors and attitudes and age of the caregivers, therefore I was able to conduct a meta-analysis regarding this variable. Wilson et al. (2020) found that mean overall oral health was greater in the 31-36 age category compared to any others ($M = 4.2$, $SD = 0.9$). The 19-25 and 26-30 age categories had equal mean oral health ($M = 4.0$, $SD = 1$). The 37-99 age category was the least ($M = 3.9$, $SD = 1$). Table 5 depicts this information. While Wilson et al. (2020) had reported several age categories, only two age categories were included in the current study; below or equal to 36 years and above 36 years. As such, to obtain comparable data for the category

'below or equal to 36 years,' the researcher averaged the means and standard deviations of the originally reported age categories (1) 19-25, (2) 26-30, and (3) 31- 36. Similarly, to obtain comparable data for the age category 'above 36 years,' the researcher averaged the means and standard deviations for the age category 37–99 years.

Table 5

Results of Analysis conducted by Wilson et al. (2020) concerning the Effect of Age on Oral Health Habits

Study name	Age < 36 Mean	Age < 36 Std-Dev	Age < 36 Sample size	Age >= 36 Mean	Age >= 36 Std-Dev	Age >= 36 Sample size
Wilson et al. (2020a)	4.066667	0.933333	767	3.9	1	236
Wilson et al. (2020b)	2.466667	1.1	767	2.5	1.2	236
Wilson et al. (2020c)	2.233333	1.066667	767	2.3	1.1	236

A random effect model was chosen because of evidence of heterogeneity based on a significant test for heterogeneity, $Q = 5.98$, $p < .001$, $I^2 = 66.56\%$. The meta-analysis found no statistically significant effect of age on oral health behaviors/habits on dental disease in NA/AN school-aged children ($p = .71$). Table 6 depicts the results of the meta-analysis.

Table 6

Results of Meta-Analysis for RQ 2 Concerning Age

Study name	Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Wilson et al. (2020a)	0.175549	7.45E-02	5.56E-03	0.0294499	0.321647	2.355045	1.85E-02
Wilson et al. (2020b)	-2.96E-02	0.074441	5.54E-03	-0.175551	0.116254	-0.39828	0.690421
Wilson et al. (2020c)	-6.20E-02	7.45E-02	5.54E-03	-0.207961	0.083882	-0.83329	0.404681
Fixed	2.78E-02	4.30E-02	1.85E-03	-5.64E-02	0.112107	0.647193	0.517507
Random	2.79E-02	7.44E-02	5.53E-03	-0.117823	0.173647	0.375381	0.707377

Educational Level

Regarding education level, Wilson et al. (2016) found that parents with more than a high school education had a higher mean score of oral health behavior [$M = 56.5$, $SD = 19.1$ or $M = 2.8$, $SD = 0.9$ to be comparable with Wilson et al. (2020) measures] compared to HS/GED [$M = 54.2$, $SD = 18.5$ or $M = 2.7$, $SD = 0.9$ to be comparable with Wilson et al. (2020) measures], $p = .067$. In addition, Wilson et al. (2020) concluded that parents with more than a high school education had better oral health behavior score ($M = 4.2$, $SD = 0.9$) compared to HS/GED ($M = 4.0$, $SD = 1.0$), $p < .001$. However, Wilson et al. (2020) reported different education level categories. In the current study, I only included two education level categories: college or beyond, and below college level (see Table 7). To obtain comparable for the category 'below college level,' I averaged the means and standard deviations for HS/GED. Similarly, comparable data for the second category was obtained by averaging the means and standard deviations for the categories college and beyond.

Table 7

Effect of Education Level of Caregivers on Oral Health Behaviors and Attitudes

Study name	Not-College Mean	Not-College Std-Dev	Not-College Sample size	College Mean	College Std-Dev	College Sample size
Wilson et al. (2020a)	3.9	1.05	527	4.2	0.9	471
Wilson et al. (2020b)	2.75	1.15	527	2.15	0.9	471
Wilson et al. (2020c)	2.45	1.1	527	1.95	0.9	471

A random effect model was chosen because of evidence of heterogeneity based on a significant test for heterogeneity, $Q = 115.88$, $p < .001$, $I^2 = 98.27\%$. The meta-analysis found a significant effect of education level on oral health status in NA/AN school-aged children ($p < .01$). Table 8 depicts the results of the meta-analysis.

Table 8

Results of Meta-Analysis for RQ 2 Concerning Education Level

Study name	Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Wilson et al. (2020a)	-0.30548	6.38E-02	4.07E-03	-0.43047	-0.18048	-4.78979	1.67E-06
Wilson et al. (2020b)	0.577175	6.47E-02	4.19E-03	0.450342	0.704007	8.9192	0
Wilson et al. (2020c)	0.494772	6.44E-02	4.14E-03	0.368612	0.620932	7.686538	1.51E-14
Random	0.250881	3.71E-02	1.38E-03	0.17814	0.323621	6.75987	1.38E-11

Income Level

Regarding income level, Wilson et al. (2016) found that the caregivers with the higher income had a higher mean score of oral health behavior [$M = 57.7$, $SD = 17.7$ or $M = 2.9$, $SD = 0.9$ to be comparable with Wilson et al. (2020) measures] compared to the ones with the less income [$M = 54.9$, $SD = 18.5$ or $M = 2.7$, $SD = 0.9$ to be comparable

with Wilson et al. (2020) measures], $p = .441$. Similarly, Wilson et al. (2020) found that parents of the higher income level had better oral health behavior score ($M = 4.3$, $SD = 0.7$) compared to the ones of the lowest income category ($M = 3.9$, $SD = 1.0$), $p < .001$. On the other hand, Hiratsuka et al. (2019) found that parents of high income (above 30k) had children with average oral scores ($M = 60.7\%$, $n = 56$) that were almost equal to those of children of low-income parents ($M = 61\%$, $n = 41$). However, Hiratsuka et al. (2019) data were not comparable to that of Wilson et al. (2020). Since Hiratsuka's et al. (2019) data were in form of percentages, it was necessary that they be converted to the 0-5 likert scale. This conversion was achieved by dividing each Hiratsuka et al. (2019) data by 20. Table 9 provides this information.

Table 9

Effect of Income Level of Caregivers on Oral Health Behaviors and Attitudes

Study name	Below 30k Mean	Below 30k Std-Dev	Below 30k Sample size	Above 30k Mean	Above 30k Std-Dev	Above 30k Sample size
Wilson et al. (2020a)	4.1	0.9	689	4.2	0.8	130
Wilson et al. (2020b)	2.233333	1	689	2.05	2.05	130
Wilson et al. (2020c)	2.166667	0.966667	689	1.95	0.95	130
Hiratsuka	3.05	1	41	3.035	1	56

A fixed effect model was chosen because of evidence of heterogeneity based on a significant test for heterogeneity, $Q = 6.98$, $p < 0.01$ .001, $I^2 = 57.01\%$.

The meta-analysis did find a significant effect of income level on oral health status in NA/AN school-aged children ($p < .001$). Table 10 depicts the results of the meta-analysis.

Table 10

Results of Meta-Analysis for RQ 2 Concerning Income Level

Study name	Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Wilson et al. (202a)	-0.113	9.57E-02	9.15E-03	-0.3005	7.45E-02	-1.18122	0.237517
Wilson et al. (2020b)	0.14941	9.57E-02	9.16E-03	-3.81E-02	0.336966	1.561328	0.118446
Wilson et al. (2020c)	0.224745	0.095784	9.17E-03	3.70E-02	0.412478	2.346383	1.90E-02
Hiratsuka et al. (2019)	1.50E-02	0.205545	4.22E-02	-0.38786	0.41786	7.30E-02	0.941825
Fixed	8.21E-02	0.053365	2.85E-03	-2.25E-02	0.186669	1.537986	0.124052

Therefore, the null hypothesis for RQ 2 was rejected since educational and income level of parents/guardians of NA/AN school-aged children significantly affected their oral health behaviors and attitudes.

Summary

This study included a meta-analysis on published data examining for RQ1, the impact of oral health behaviors and attitudes of NA/AN parents and guardians on dental disease in NA/AN school-age children. Also, for RQ2, the study investigated how the dependent variables of oral health behaviors, attitudes, dental disease correlate with independent demographic variables of gender, age, education, and income in NA/AN community. There was a total of four studies that were included in the meta-analysis that provided insight to the relationship s between the study variables. Results of the meta-analysis found an overall statistically significant effect of optimal oral health behaviors and attitudes on dental disease in NA/AN school-aged children ($p < .001$). Additionally, the meta-analysis found a significant effect of educational and income level on oral

health status in NA/AN school-aged children ($p < .001$). Higher education and income levels were associated with better oral health status.

Section 4: Application to Professional Practice and Implications for Social Change

The purpose of this study was to explore the impact of oral health behaviors and attitudes of NA/AN parents and guardians have on dental disease in NA/AN school-age children. Dental disease is a common and preventable chronic childhood disease, that can negatively affect the mental and physical development of the child (Lim et al., 2015). The NA/AN children are nearly three times higher than their non-Native counterparts, to have untreated dental disease (Batliner, 2016). Studies have documented the connection between oral health and systemic health, and how thorough oral examinations can detect systemic disease, immune disorders, and nutritional deficits (McCormick, 2019). The maintenance of optimal oral health is paramount in the prevention of oral health diseases. Neglecting the preventive measures to sustain optimal oral health, has been shown to have an adverse effect on the systemic health, often exacerbating many chronic diseases (Martin et al., 2020).

The findings of the present study illustrate how optimal oral health behaviors and attitudes, such as routine cleaning and screening, have a significant effect on dental disease in NA/AN school-aged children. The study results also indicated that children whose parents and/or guardians who were educated, had attitudes and behaviors (e.g., recommended biannual exams, routine brushing and flossing) that yielded optimal oral health outcomes for their children. In addition to the educated, parents and/or guardians who have higher annual salary were less likely to have untreated dental disease and more likely to have children who exhibit optimal oral health behaviors. Previous studies have identified the socioeconomic status and parental education level determine the oral health

behaviors for children of color (Musselman, 2020), but there is a dearth in the literature involving the same variables and how they impact the NA/AN communities.

Interpretation of the Findings

The findings from this study suggest NA/AN parents and guardians' behaviors and attitudes of oral health is a contributory factor on dental disease in the NA/AN children. Dental caries is the most preventable chronic disease in children (Shitie et al., 2021), and children's behaviors and attitudes can negatively impact the mental, physical, and social health of the child that may transcend to adult hood (Sullivan, 2017) The finding from the current meta-analysis indicated the statistical significance ($p < .001$) of how the attitudes and behaviors of parents migrate to their children. To clarify, if parents and/or guardians' behaviors, attitudes, and actions does not reflect a pro-oral health stance in which displays regular visits to the dentists and habits of brushing and flossing the teeth, the children will mirror the attitudes, behaviors, and actions of their parents and/or guardians.

The results also indicated the significant role of socioeconomic status in the oral health status of the children; NA/AN children with parents or guardian of lower educational or/and income background the NA/AN children are more likely to have poor oral care status and are more likely to have untreated dental disease and this also confirmed by the literature (Friedman & Mathu-Muju, 2014; Riedy, 2010; Warren, 2016). Literature suggests there are opportunities to investigate OHL in this subset population as well. Bridges (2014) defined *oral health literacy* as "the degree to which individuals have the capacity to obtain, process and understand basic oral health

information and services needed to make appropriate health decisions." The American Academy of Pediatrics recommends children are seen by a pediatrician provider for 14 well-childcare visits within the child's first five years of life and then annually (Committee on Practice and Ambulatory Medicine, 2007). The well-childcare visits monitor the growth and development of the child. During the physical examination, immunizations, screenings, and significant health information is shared to promote healthy behaviors so these behaviors can be adopted at an early age (Moreno, 2017).

As health literacy is paramount to the overall health of an individual, OHL plays a vital part in maintaining optimal oral health outcomes of the individual. According to HHS (2020), in the fourth quarter of 2019, in adults 18 and over, 85% had a doctor visit in the past 12 months, compared to 64% seeing a dentist in the past 12 months (CDC, 2020). The literature infers attitudes and behaviors of the adult or guardian is often emulated by the child. Although the American Academy of Pediatric Dentistry (2021), recommends children be evaluated by a dentist with the first tooth eruption and no later than 12 months of age, the first visit to the dentist for many children is at the age of three (Suresh, et al., 2020). The opportunities exist to share oral health knowledge with other disciplines that often see children at an early age, such as speech therapist, and occupational therapy (Denman et al., 2021). Primary care providers can educate their parents and guardians of children on the behaviors that promote optimal oral health. Also, literature confirms findings that children's oral health behavior, attitudes, and actions, are largely predicated on the behaviors, attitudes, and actions of the parent or guardian living in the household (Puri et al., 2019), and unfortunately the predominant reason for a

child's first visit to the dentist is often for treatment of dental caries and/or pain (Kannan & Mathew, 2019). Hence, opportunities exist to extend oral health knowledge to medicine and primary care, so the OHL of the parents will increase therefore decreasing the prevalence of untreated tooth decay in children.

The interpretation of the findings suggests how the education and income of parents and guardians affect the oral health status of NA/AN children. An individual with higher income and education can better understand the importance of oral health better and often has additional dental insurance other than IHS. There are not sufficient data about whether NA/ANs assimilated in urban areas and not accessing oral health services on the reservations have a better understanding of preventive and restorative oral health needs. However, this study revealed that NA/AN who have private insurance, higher incomes, and educated, are 3 times less likely to have children with caries and this is in accordance with the literature (Albino et al., 2016; Phipps, 2016; Warren, 2016).

NAs who are on the reservation have a higher probability of unemployment because of the lack of access to jobs; NA/ANs usually remain unemployed longer because of the refusal to accept a lower wage than relocate where economic opportunity is abundant (Axelrad et al., 2017). Economic opportunity is significant since it is associated with better general health insurance benefits and other resources such as dental insurance and dentist availability.

Axelrad et al. (2017) suggested that familiarity contributes to NA/AN remaining in the rural areas. The results of this study indicated that NA/AN who have higher income and educated beyond primary academia (especially a Master degree and above) are less

likely to have children with untreated caries and more likely to visit the dentist regularly than NA/AN with low income and limited education (Schroeder et al., 2019; Warren, 2016). OHL competency is essential and impactful on the oral health care needs of the NA/AN children. Understanding the impacts of disparities in NA/AN communities will aid in improving health equity.

Current literature supports the positive effect of oral health parental education and its relationship to preventive services and associated factors such as income and service providers in the NA community (Batliner, 2016; Brega et al., 2016; Khoadadai et al., 2016). The IHS provides dental services to the tribal members, but the dentist to population ratio of 32.3 per 100,000 is at the lowest level nationally (Batliner et al., 2014). Access to the dentist and the availability of dentist are not the prominent factors associated with dental disease in children in the NA community. Brega et al. (2019) showed that 41% of the sample in their study had annual income of $10,000 a year or less, and nearly half of the sample had some college or vocational training.

In terms of the theoretical framework, I used the HBM, as this model best addresses the potential for application and efficacy with compliance. The results of this study illustrate how NA/AN behaviors and attitudes on oral health impact the oral health of their children. The constructs of the HBM such as perceived susceptibility, perceived severity, and perceived benefits gives a convergent relationship with RQ1, and reiterates the importance of OHL, and the plausibility if increasing OHL will ensue a change in behavior. In the NA/AN community, some of the same barriers exist in the general population, such as access, income, and OHL (Wilson et al., 2020). Under the

preconceived notion that if people had in-depth knowledge on oral health as it relates to systemic health, people would change their belief and attitudes and a behavior change will ensue. As demonstrated by the RQ1 results, when NA/AN parents and/or guardians of children do not demonstrate optimal oral health behaviors, the children are more likely to not have optimal oral health behaviors, thus leading to oral health disease such as untreated caries and periodontal disease. The HBM constructs that relate to the RQ1 are the perceived susceptibility and severity of the disease. Perceived susceptibility refers to the beliefs about the plausibility of acquiring the disease or condition (Glanz et al., 2008). The environment in which people live often formulates the belief system that they practice. As listening and surveillance are standard characteristics of NAs, watching and learning have an added significance (Jennings, 2017). Increasing the OHL in the NA/AN community is an opportunity to educate the community, sharing their susceptibility to oral disease and the severity of which oral disease may increase the body's inflammatory response (Sabharwal et al., 2021) may change their beliefs and practices.

Similarly, RQ2 results indicate that higher education and income level and increased education and income are associated with optimal oral health outcomes, consistent with constructs for the HBM. Sociodemographic variables such as income and education may moderate relationships between health beliefs and health behavior (Glanz et al., 2015). The constructs of perceived benefits may register with a paramount preeminence in someone with higher education and substantial financial means, as they may weigh the cost–benefit of preventive measures of oral health and can sustain compliance in those measures. When people are intrigued about their risks of dental

disease and the benefit of prevention, they are highly likely to minimize the threats, become self-efficient, and take cues to activate those resources to retain behavior that yields optimal outcomes (Ashoori et al., 2020). Multiple studies have illustrated that optimal health, in general, are often associated with educated and/or people with above middle-class incomes (Beraldo et al., 2009; d'Udekem, 2018). The HBM constructs of perceived benefits, self-efficacy, and cues to action demonstrate how education and finances impact beliefs and attitudes when referencing oral health.

Limitations of the Study

This meta-analysis included four studies due to the limited number of studies addressing the oral health behaviors and attitudes of NA/AN population and how it relates to dental disease in NA/AN children; therefore, an opportunity exists to study this further. In addition, since there are over 600 federally recognized tribes in the United States (Batliner, 2016), opportunities exist to study as many as tribes as possible to see if behaviors and attitudes are similar to the Navajo nation which are the majority subset population in this study. Since a significant number in the study are below the poverty line, which may increase their potential for State Aid programs, the studies did not address the allocation of funding from the State programs as compared to the IHS facilities. IHS is under HHS, to which the Congressional Budget Act of 1974 classified the funding as discretionary as opposed to mandatory (Kavanagh, 2016). The IHS is funded at 60% of nearly a third of what is allocated for the Veterans Affair Health System (Empey et al., 2021). This limits the study as IHS is a provider and State Aid

programs is an insurance company which services and access are broader than IHS. IHS is underfunded and understaffed, which limits the availability of resources.

Recommendations

Opportunities exist for further studies in OHL in NA/AN population. Section 1 identifies there is a dearth of information assessing the OHL of the NA/AN population. Educating parents on the benefits of oral hygiene and how it connects to systemic health will help change the perspective that many parents have viewing the curative aspect of the dentist and will improve compliance for parents, thus decreasing dental disease in the children (Kannan & Mathew, 2019). Improving the OHL in the NA/AN population may increase the utilization of dental services for preventive measures as opposed to curative and pain. Although there are many barriers existing in the general and in the NA/AN community, the education component is cost affective when comparison to the treatment for dental disease. Studies have highlighted the importance of educating parents on how oral health is connected to general health, and how education along with routine dental treatment is cost effective and reduces inflammation in the body which, thus affecting general health (Almabadi et al., 2021).

Implications for Professional Practice and Social Change

The implications for professional practice are for medicine and dentistry to combine efforts in the education of both general and OHL. The advancements in OHL continue to evolve but a significant area of interest remains to identify a comprehensive tool to measure the OHL with emphasis on understanding the role of culture for the NA/AN community (Sun et al., 2021; Albino et al., 2016). The disparity in health equity

in minority communities is evident; a study by Byrappagari (2017), evaluating the oral health knowledge among NA families in southeastern Michigan, revealed 61% of NAs reported not having a routine dentist for dental care, and revealed that 59% reported having an untreated dental problem for greater than a year. The IHS oversees 45 hospitals and 617 health centers and clinics across the nation, with 2.2 million federally recognized to receive 100% coverage for health care and services, to include oral health (Herman, 2016). An opportunity exists in IHS to increase the OHL in the health settings, extending knowledge to NA/AN children when they are seen by their primary health care provider. In a study by Lewis et al. (2009), it was revealed the over 90% of pediatrician believe they should educate the parent and child about oral health, but only 50% admit to educating the parent and child about the benefits of oral health, and this study highlights the importance of oral health education of parents/guardians.

The implication for social change can be extended in general population settings where many rely on Medicaid or State funded programs for health and dental care. The dental coverage under Medicaid is mandated for children, but among adults aged 19 to 64, 7.4% have Medicaid dental benefits, and 33.6% have not dental insurance benefits (American Dental Association, 2020). This study and previous studies have shown parents and/or guardians who do not have optimal oral health habits, are less likely to ensure their children have optimal oral health habits. Unfortunately, the barriers continue to exist with access to care and OHL. Among dentists in the United States, only 39% participate in the Medicaid or Children Health Insurance Program (CHIP) for dental services per the ADA Health Policy Institute The dentist to population ratio has created a

concern in the low-income areas (McKernan et al., 2015), intensifying the immediacy for advancing policy for Medicaid and State programs.

In the NA/AN community the dentist-to-patient ratio is low and lacks access to children's dental needs (Phipps & Ricks, 2014). To recruit and retain dentist to service the remote reservation is challenging. Twenty percent of dentist positions consistently remain vacant within IHS (Warren, 2016). In addition, according to the U.S. Census Bureau (2012), in 2013, nearly 27% of 5.2 million NA/AN lacked health insurance coverage. As barriers exist in the general population, the barriers are magnified in the NA/AN community.

Despite creating the Affordable Care Act, in 2017, nearly 15 % of NA/AN had no insurance coverage (Berchick, Hood, & Barnett; 2018). While children may qualify for state-funded programs, IHS utilization does not qualify as a medical home, and less than half of NA/AN had a medical home (Empey et al., 2021). Entrusted to fulfill the obligation to provide health care, IHS servers nearly 2.7 million NA/AN who belong to the federally recognized tribes (Empey et al., 2021); the comprehensive care differs from tribes, and IHS operates as a direct provider of services and is not an insurance provider (Kavanagh, 2016). Therefore, if specialized oral surgery is needed to preserve or prevent further disease, the parent would have to seek a provider type outside of the reservation and pay out-of-pocket costs. Social implications increase OHL and synergize how oral and health care services are delivered on the reservation. This initiative will change the culture and an invested effort to maximize the benefits and share knowledge.

Conclusion

Dental disease in children is chronic yet 100% preventable disease. Better oral health knowledge and attitudes of parents and guardians can significantly affect the oral health of their children, and according to the results of this study, this is extremely important for parents of lower educational and financial background. This can contribute to increase the utilization for preventive dental services in the NA/AN community, and to decrease resources used for acute treatment, and therefore to eventually improve oral health and quality of life of NA/AN children

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