PROVIDER PERSPECTIVES ON CULTURAL ADAPTATION OF ORAL HEALTH INTERVENTIONS AND THE IMPACT OF COVID-19 ON ORAL CARE AMONG AMERICAN INDIAN CHILDREN

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ABSTRACT

CULTURAL ADAPTATION OF ORAL HEALTH INTERVENTIONS AND THE IMPACT OF COVID-19 ON PREVENTING EARLY CHILDHOOD CARIES AMONG AMERICAN INDIAN CHILDREN

HEATHER R. THOMAS

Early childhood caries (ECC) is a chronic childhood disease that is most prevalent among American Indian and Alaska Native (AI/AN) populations. Despite recent declines in ECC rates nationally and among other high-risk groups, the rates of ECC among AI/AN populations persist at greater levels. The implications of ECC are far-reaching, affecting the overall physical and mental wellbeing, social and functional development of the individual, as well as contributing to economic loss. Interventions utilizing a variety of approaches to address ECC among AI/AN populations have shown mixed results, but few have explored the possibility of creative cultural adaptation of oral health education materials to improve the oral health of AI/AN children. The use of Entertainment Education (E-E) and specific cultural adaptation of intervention materials have shown success in improving health behaviors of minority and disadvantaged populations and may be successfully utilized to reduce ECC in AI/AN populations. Access to oral care has been a longstanding barrier for AI/AN populations which has recently worsened due to the effects of COVID-19. This dissertation had three Specific Aims: 1. Develop an entertaining and culturally and contextually adapted children's book with infused oral health education that is perceived by Tribal members and local oral health care providers as acceptable, understandable, and culturally relevant. 2. Assess the differences of access to and quality of dental care for young AI children before and during COVID-19. 3. Determine perceived barriers to oral healthcare for young AI children and the strategies dental professionals recommend to overcome them.

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I want to thank and acknowledge the American Indian Tribe and individual members who worked with me on this project. Their kindness and generosity in sharing their history and culture with me afforded valuable insight into the hearts of their people, whose beauty and peace I hold in the highest regard. I seek to honor and serve you and hope the outcomes of this research will contribute to ongoing efforts to achieve social justice and health equity.

I would also like to thank my family, to whom I have dedicated this work. I would not be here without you.

TABLE OF CONTENTS

LIST OF TABLES

DEDICATION

I would like to dedicate this dissertation to my family, who have been patient and loving during the demands of this long and arduous process. My brilliant wife, Emily, is a pillar of strength and source of encouragement, giving me honest feedback and supporting my wildest dreams. My children, Zoie, Holly, and Tucker are my heart and world. They amaze and inspire me every day to view life as the miracle it is, to make the most of the time we are given, and to cherish the ones we love. I would also like to thank my dad, Tom, my sister, Heidi, and my mom, Debbie, who passed away during this project. Tom is an incredibly talented musician and one of the most empathetic and selfless people I know. Thank you for helping to instill these qualities in me. Heidi is a caring confidant and an exceptionally creative and heartfelt individual. Thank you for being my lifelong best friend and partner in crime. My mom was a charismatic, generous person who always looked at the bright side of life and made people feel special and loved. She was my rock and my compass. Mom, thank you for giving me such a wonderful life, I would not be the woman I am today without your love, support, and guidance. My desire to help others stemmed from your example and the life lessons you taught me. You showed me how to look for the good in people and the adventure in life. Thank you for always being my biggest fan. I love and miss you.

PREFACE

Chapters 2, 3, and 4 of this dissertation were written to appear as articles in specific journals and as a result, there may be some redundancy resulting from combining these articles within the university formatting requirements. Chapter 1 provides a general review of the literature pertaining to the prevalence, risk factors, and strategies to address Early Childhood Caries in American Indian populations, to explain the context in which these three studies were conducted. Specific methods, materials and analytic plans are listed in each of articles and not in a separate chapter to reduce redundancy for the reader.

CHAPTER 1: Overall Introduction and Comprehensive Literature Review

Introduction/ Background and Significance

Early childhood caries (ECC), or the presence of one or more decayed, missing, or filled teeth (dmft) in children age 5 or younger, is the most chronic childhood disease though it is largely preventable.[1] Children from diverse ethnic backgrounds and those with low socioeconomic standing (SES) have up to twice the risk for developing ECC than their white, affluent counterparts.[2,3] However, ECC is most prevalent among American Indian and Alaska Native (AI/AN) children, who suffer 4 times the disease rate with nearly 60% experiencing decay by the age of 3, and over 75% by the age of 5.[2–5]

Oral health is a significant indicator of overall well-being, health, and quality of life, and can have grave impacts on children and their families when disease is not addressed. Dental decay in primary (baby) teeth can cause pain, damage to the permanent teeth, infection of the head and neck, and difficulty chewing.[6,7] Severe decay can interfere with intellectual and social development, cause poor speech articulation, embarrassment, low self-esteem, missed days at school, and social isolation.[2–4,6,8,9] In addition to the physical, psychosocial, and developmental toll on children and their families, treatment for ECC is costly, particularly when hospitalization and general anesthesia are required. Cases of Severe ECC (S-ECC), defined by the presence of smooth surface caries on children under age 3 or one or more decayed, missing, or filled smooth surfaces (dmfs) in the maxillary anterior teeth of children ages 3-5, often require extensive restorative treatment or emergency care.[10] Surgical or Emergency Department (ED) treatment for a single child can cost $10,000-$25,000 depending on the severity of disease[61] and about 6% of AI/AN children (approximately 8,500) between ages 1-5 experience extreme pain or a serious infection requiring urgent dental care.[3] Additionally, every year approximately 34 million hours

of school are missed and over $45 billion dollars are lost in production from missed work due to dental disease.[61] Thus, untreated oral disease leads to profound economic impacts on individual, family, community, state, and federal resources.

Because ECC is preventable and can progress quickly, early intervention is a key strategy in reducing its prevalence, particularly in high risk populations. It is estimated that for every $1 spent on preventative dental care in the U.S., between $8-$50 could be saved in emergency and restorative dental treatment.[11] The etiology and treatment of ECC is complex, involving numerous factors including individual biological/behavioral, family, organizational/community, and health system/policy-level factors.[9,12] Recently, the effects of COVID-19 have created additional barriers and factors affecting oral health.

Individual biologic/behavioral factors

Caries (tooth decay), is caused by the demineralization and destruction of enamel by acid produced from bacteria in oral plaque biofilms digesting fermentable carbohydrates, or free sugars.[5,12–16] The length of time teeth are exposed to an acidic environment positively correlates with the amount and severity of decay, making chronic sugar intake and poor oral self-care two of the leading risk factors for ECC.[12,17,18] Other individual/biologic risk factors include eating processed foods, a susceptible tooth surface such as enamel hypoplasia, active caries, prolonged nocturnal breastfeeding, gender (male), not brushing with fluoride toothpaste, not brushing at least once a day, not having professional fluoride treatments, having visible plaque present, using a bottle after 12 months of age, early tooth eruption, and early exposure to and elevated levels of cariogenic (decay-causing) bacteria (particularly Mutans streptococci [MS]), which may be transmitted from a parent or caregiver to child or from another child through shared salivary contact such as food/utensil sharing or the pre-chewing of food for infants.[19–25]

Family-level factors

Family-level risk factors include maternal dental anxiety, parental education level and job status[26], low SES, low annual household income, parental oral health status, parental oral health behaviors[27], daily brushing not initiated in children until after 18 months[28], lack of parental monitoring of children's behavior[24], and poor maternal mental health.[29,30] Some studies on AI/AN communities have identified additional risk factors for ECC to include greater household size, younger maternal age, and higher maternal caries levels.[22] Research has shown a lack of parental knowledge, and negative attitudes, beliefs, behaviors, and perceptions about their level of control over their oral health and/or that of their child (locus of control) are also predictors for oral disease.[31,32]

Organizational/community level factors

Several social determinants of health (SDOH) have been linked to increased risk for oral diseases such as residing in a poor community, being part of a racial/ethnic minority group, living in a dentally underserved area, lack of family and social/community support or oral health education, lack of access to care, lack of access to healthy food and water, low levels of economic security, and lack of environmental safety and freedom from fear.[14,27,33] These more distal determinants are often less obvious than the individual/biologic etiologies largely implicated and targeted in ECC studies. However, they have a direct impact on the systems and social supports on which individual/family factors are cultivated. Likewise, the SDOH are heavily influenced or, in many cases, directly imposed by greater sociopolitical and health system policies.

Health System/Policy Level Factors

Upstream policy factors driving ECC risk factors include those that predicate accessibility of services, education, local economics, healthcare, and transportation, such as lack of community

water fluoridation, lack of sustainable oral health prevention and promotion programs, lack of community/parental support, underfunded IHS programs, dental professional shortage areas, and food insecurity.[14,17,34] Systemic factors at the state and federal level dictate provisions and standards for oral care and allocations of funds for healthcare programs which often exclude oral health. Lack of fiscal support or policy structures that facilitate oral healthcare perpetuates the private sector dental care model wherein dental care is treated as a commodity rather than a human right. This lack of support became particularly evident during the COVID-19 pandemic where systemic failure led to further marginalization of high-risk and vulnerable populations such as AI/AN communities.[35,36]

COVID-19 Factors

In most countries, early risk mitigation strategies in dentistry included limiting operations to emergency care only or ceasing operations entirely for a time.[9,37] Recommendations from the U.S. Centers for Disease Control and Prevention (CDC), the Occupational Safety and Health Administration (OSHA), and the American Dental Association (ADA) fluctuated throughout the course of the pandemic, including precautions such as patient/provider screening procedures, additional personal protective equipment (PPE), air ventilation and other engineering controls, patient triage and scheduling management, and suspension of non-emergent care.[38–41] While the intent was to reduce the spread of COVID-19, protect at-risk populations, and contain public outbreaks, there was an inadvertent effect of reduced access to oral care, particularly in minority communities already facing multiple barriers to care.[9,35,42]

As global and national efforts have arisen to examine policies and procedures to better prepare state and national systems to deal with potential future pandemic events, it is important

to explore feasible avenues to increase access to dental care that would likewise withstand adverse events and prove sustainable in the most underserved communities.

ECC Prevention and Intervention: Significance and Knowledge Gaps

Current best practices for the prevention and treatment of ECC address the multifactorial etiology at every level of social and economic influence. Prevention strategies include educating parents on oral health, improving maternal oral health, brushing with fluoridated toothpaste twice daily by the time the first tooth erupts, applying fluoride varnish (FLV), not putting babies to bed with a bottle or allowing prolonged night feeding, avoiding frequent intake of liquids and/or solid foods containing sugar, eliminating baby bottle use after 12 months, establishing a dental home within six months of the first tooth eruption and no later than 1 year of age, and reducing transmission of cariogenic bacteria.[10,19,33] While the emphasis of managing ECC is on the prevention and arrest of disease,[9,35] current standards of care dictate that cavitated lesions should be treated immediately with as minimally invasive restoration techniques as possible such as Atraumatic Restorative Treatment (ART), Silver Diamine Fluoride (SDF), and Interim Therapeutic Restorations (ITR).[18] Sometimes, however, surgery and/or the use of general anesthesia is unavoidable in order to treat severe ECC, particularly in emergency situations.

In 2019, the World Health Organization (WHO) published an updated implementation manual with recommendations on ending childhood dental caries which, in addition to the above practices, include integrating ECC prevention and control interventions into primary care, community, and maternal health programs; creating supportive environments for families; implementing population-based fluoride programs; using sealants; health education and community engagement; and building framework for the integration of oral health promotion and ECC prevention into health initiatives and policies.[14]

ECC Among AI/AN Populations

The focus on oral health has increased through the turn of the century resulting in a myriad of state, national, and global oral health initiatives. These have contributed to a decrease in the national prevalence of ECC in recent years, yet among AI/AN populations the prevalence remains high.[3,22] Though standard treatment and strategies for the prevention of ECC are well-established, there remains a lack of understanding as to why these problems persist at such high rates in AI/AN communities.[22,43,44] This may be explained, in part, by the amalgamation of risk factors ubiquitous to this population.

AI/AN populations suffer from numerous social and systemic health inequities, including various barriers to care such as lack of knowledge or access to education about prevention and oral health, language obstacles, living in dental professional shortage areas, limited dental office hours, lack of fluoride exposure, geographic isolation, and lack of transportation or inability to take off work.[6,33] There is a significant relationship between individuals reporting a high number of barriers and poor oral health behaviors.[45] Though a variety of research and interventions have targeted ECC in AI/AN communities, results have been mixed, warranting further investigation into the cause of AI/AN oral health disparities.

Current literature on the prevention and treatment of ECC in AI/AN and other minority or disadvantaged populations was reviewed for evidence of effectiveness. Searches were performed using PubMed (Medline), Scopus, Cochrane Library, Wiley Online Library, Northern Arizona University Cline Library, and Google Scholar electronic databases for peer-reviewed articles written in English, published since 2005. Several themes emerged regarding the types of interventions, and/or approaches used that were central to study outcomes and were categorized as follows: interventions targeting knowledge, attitudes, beliefs, and behaviors of AI/AN

parents/families; interventions utilizing other/existing public health initiatives/ interdisciplinary collaboration; interventions utilizing motivational interviewing (MI); culturally and contextually adapted interventions; interventions with a community engaged and/or community-based participatory research (CBPR) approach; and interventions utilizing multiple or combined approaches.

Interventions Targeting Knowledge, Attitudes, Behaviors of AI/AN Parents/Families

ECC studies focusing on changing knowledge, attitudes, beliefs, and behaviors for improved health outcomes among AI/AN communities have resulted in varying degrees of success. Some studies have shown increases in health literacy[46] and child oral home care,[47] and a lower incidence of ECC.[48,49] In many cases, however, even significant gains in knowledge, attitudes, or beliefs did not translate into behavior change or ECC reduction.[45,50–53] In a review of behavioral research to reduce ECC, Albino and Tiwari (2016) evaluated 18 studies between 2011 and 2015, finding that results varied even between similar intervention types.[54] The authors of another community-based oral health education program concluded that greater social environmental support is crucial to overcoming such barriers in oral health interventions.[50] These results indicate a need to intervene early on parents/ caregivers' oral health and knowledge, attitudes, and behaviors, but also to maintain or reinforce those efforts through greater social support.

Interventions Utilizing other Public Health Initiatives/Interdisciplinary Collaboration

Many initiatives have incorporated oral health interventions into existing public health entities such as Head Start, Women Infants and Children (WIC), and federally qualified health centers to utilize ongoing efforts at improved community health outcomes.[12,55] Such collaborations have been instrumental in assisting the reduction of ECC. In a scoping review of the integration of oral health into primary healthcare, researchers found that integrated approaches focusing on

Indigenous culture were efficient and relevant in improving oral health.[56] Other public health initiatives such as public water fluoridation and fluoride varnish (FLV) programs have proven safe and effective for reducing ECC in minority and low SES populations,[14,18,57,58] and are recommended by the WHO, the CDC, and the American Academy of Pediatric Dentistry (AAPD).[1,6,14,34] Expanding the ability to deliver FLV to include primary care physicians, community health workers, and other providers in interprofessional collaboration is particularly promising. The expansion of dental healthcare includes the creation of midlevel dental providers such as dental therapists (DTs) or dental health aid therapists (DHATs) to increase the number of dental professionals that work in rural and undertreated areas. Several studies have shown decreases in ECC with this approach.[55,57,59] The DT/DHAT model varies in scope and practice depending on the state and/or tribal governance, but it has seen success in AI/AN communities.[60,61]

Interventions Utilizing Motivational Interviewing

Motivational interviewing (MI) is a behavior change approach originally designed to mitigate substance abuse but that has also proven instrumental in managing other health behavior changes such as tobacco cessation.[51] MI has been used in oral health interventions among minority and disadvantaged populations with varying degrees of success. Several studies have found it successful in either significantly reducing ECC rates or the severity of disease,[49,62–68] while others did not identify a significant effect of MI.[51,69–71] In their randomized trial of MI to prevent ECC in AI children, Batliner et al. found that it increased maternal knowledge but did not affect oral health behaviors or the rate of ECC.[51] A 2020 systematic review and meta-analysis of the impact of MI on ECC further illustrated these mixed results.[72] One note made by several authors in the literature was that MI implemented in the case of ECC varies from traditional MI structure

in that it is delivered to the parent on behalf of the child rather than to the individuals themselves, which may affect longitudinal outcomes.[51,72] With such varied results across different populations it is reasonable to deduce that some cultural barriers may be preventing MI from reaching its full protentional as an ECC prevention strategy. Batliner et al. (2018) postulated that more culturally holistic approaches may be necessary to address social factors and that the basic needs of high-risk populations need to be met before sociobehavioral strategies may be effective.[51]

Culturally and Contextually Adapted Oral Health Interventions

The adaptation of intervention materials to specific cultural norms is not a new approach to health behavior change, but literature on its application in oral health to reduce ECC is limited. Cultural adaptation of evidence-based interventions to the specific cultural, linguistic, and socioeconomic context of a community increases relevance, acceptance, effectiveness and sustainability of behavioral health interventions.[73,74] There is a strong foundation of empirical evidence to support its use in healthcare as applications have demonstrated improvement in patient outcomes for behaviors related to diabetes, HIV/AIDS, mammography use, psychosocial/mental health, nutrition, and exercise.[74–80] Bolstering cultural pride and ethnic identity has also resulted in a positive relationship with health attitudes and beliefs, suggesting the restoration of cultural reverence, tribal autonomy, and involvement of the community may be important elements of a successful intervention.[53] Cultural adaptations of oral health intervention materials have been implemented primarily in community-based interventions, an approach recommended by many researchers in the field.[12,58,71,81,82]

In their community-based oral health promotion trial with Navajo Head Start children, Braun et al. (2016) stressed the importance of highly personalized approaches sensitive to social

determinants of health and created with cultural perspectives in mind. In a study exploring traditional medicine and teachings while integrating MI, FLV, and dental care to expectant mothers, researchers emphasized the importance of understanding cultural health traditions in order to gain acceptance of interventions.[83,84] Other studies have echoed these results with improved oral health outcomes by utilizing culturally adapted materials.[83,85–87] One of the more innovative applications of cultural adaptation is through the use of Entertainment-Education (E-E), or the use of entertaining media formats to deliver a persuasive health message using storylines and characters that are relatable to their intended audience.[88,89]

E-E has been used in public health campaigns to influence community knowledge, attitudes, and health behaviors across a variety of disciplines,[90] though it has been relatively untapped in field of oral health. Typically E-E is applied to large scale projects, though the theory can be applied at different levels. Some creative oral health interventions have used a combination of entertainment and cultural adaptation of the oral health message to decrease ECC risk. Heaton et al. utilized a culturally tailored traditional storytelling technique to improve oral health knowledge, beliefs and behaviors among self-identified AI/AN pregnant women and mothers.[86] Similarly, O'Malley, et al.[87] used a storybook and DVD targeting parental attitudes, intention, and self-efficacy to successfully increase child toothbrushing behaviors in a deprived area of England. In another visually interactive intervention, Lumsden et al. (2019) utilized an iPad-based program to reduce ECC risk behavior.[91] Using entertainment and cultural adaptation can increase the appeal and utilization of oral health interventions and speak to individuals of all ages and education levels.

Interventions Utilizing a Community Engaged or CBPR Approach

Community based participatory research (CBPR) is an approach to research that involves cultural immersion, bringing the community into the research team and the research team into the community. As equal partners, they design, refine, and implement research that engages the local people, utilizes existing strengths, addresses real community needs, and builds sustainable programs.[92] Health programs utilizing a CBPR approach increase local capacity and raise oral health awareness often through the use of Community Health Representatives (CHRs) or Community Health Workers (CHWs) who have expert knowledge of their culture, values, local perspectives, and are trained to implement health interventions within their community.[93] Several oral health interventions have utilized this approach with some degree of successful outcome.[58,71,85,94,95] There are several strengths and advantages innate to CBPR including building lasting, equitable partnerships, building capacity and sustainable programs, and drawing on the resilience, strength, knowledge, and resources within the community.[92,96,97] One of the biggest limitations of CBPR is the immense time dedication required to launch a successful research or health intervention campaign which often leads to unexpected strains on research budgets, personnel, and other resources.

Combined/Multifaceted Intervention Approaches

The most successful interventions appear to be those that utilize multiple elements and approaches simultaneously.[14,17,29,43,98] Some of the more consistent predictors of improved oral health behaviors and decreased ECC incidence were early prenatal intervention with mothers, increased oral self-care practices of parents/caregivers, MI techniques or personalized approaches, and improved locus of control over oral health.[45,54,99] Several studies and systematic reviews of trials with a multifaceted approach that included providing oral health care to expectant mothers/parents resulted in reduced ECC. [48,65,100,101] In reflecting on their work with

the Navajo Nation, Braun et al. (2018) postulated that successful intervention approaches must be built around holistic cultural understanding and perspectives to fully understand and address social determinants of oral health. The importance of taking time to develop new and innovative strategies that align with cultural perspectives, are relevant to the community, and build a trusting relationship cannot be overstated by those in the field who have seen both success and failure.[17,98,99,102,103] Whatever the approach, ECC interventions should be effective, culturally acceptable, and economically sustainable.[6,12,43]

COVID-19 and Access to Dental Care

Decades of data show the need for effective and sustainable oral health interventions in AI/AN communities, yet oral disease persists at disproportionate rates.[35,71] Limited access to care and structural deficits were amplified in these communities during the height of the COVID-19 pandemic. Because the literature strongly supports involvement of Indigenous communities in the research and intervention process, more qualitative research is indicated to better understand the individual factors and lived experiences of the people within these populations and the providers who serve them. Preliminary studies show some dissonance between provider perceptions of barriers/solutions to achieving oral health in Indigenous populations and those from within the community.[104] While some degree of disconnect may be universally present between providers and patients due to differing levels of understanding, educational backgrounds, and training in health sciences, there are perhaps specific issues that may be uncovered through individual feedback. This study seeks to add qualitative research to the limited body of knowledge in this subject to better understand community and oral healthcare provider insights into specific communities and how these insights can contribute to finding sustainable and feasible solutions to the ECC oral health epidemic in AI/AN communities.

Supporting Models/Theories

Psychosocial theories and models have developed around health behavior change on individual, community, and national scales. The Social Cognitive Theory (SCT) views behavior as a result of a combination of personal, behavioral, and environmental expectancies and incentives which is better fitted to the interpersonal level of the SEM.[105] The main constructs of SCT that can be applied in oral health interventions are personal knowledge, observational learning, self-efficacy, interceding on expectations to guide behavior change, such as addressing social norms and cultural/community understanding of oral health and its benefit to individuals' overall health.[106] A limitation of the SCT is that community and cultural beliefs or expectations about health can be deeply embedded and difficult to modify.

E-E Theory uses the influential impact of entertainment and narratives to convey messages to entire societies or cultures. Wang, et al. define E-E as: "A theory-based communication process for purposefully embedding educational and social issues in the creation, production, processing and dissemination process of an entertainment program, in order to achieve desired individual, community, institutional, and societal changes among the intended media user population."[88] While early utilization of E-E focused on mass media productions such as television and radio, it can also be successfully deployed at the individual, community, and institutional levels.[88,107,108] Successful examples of utilizing E-E for disease prevention and health promotion are seen in the advent of telenovelas in Latin America to promote adult literacy, family planning issue, and attitudes toward the use of home care services,[108,109] and in other public health campaigns such as videos to reduce substance abuse in 7th graders,[90] diabetes management,[89] condom use,[108] or stories to improve dietary and oral health behaviors.[86,87] Because storytelling and oral narratives are integral to AI/AN culture,[110,111] utilizing E-E in

culturally adapted interventions could reach several generations and individuals within an AI/AN community.

Current Study

The long-term goal of this research was to identify effective interdisciplinary and culturally relevant strategies to reduce the incidence of ECC among AI/AN children. The following three aims set specific objectives for investigating different elements affecting access to care, and recommendations for applications to address the issues.

Aim 1. To develop an entertaining and culturally and contextually adapted children's book with infused oral health education that is perceived by Tribal members and local oral health care providers as acceptable, understandable, and culturally relevant. This aim was achieved through an iterative process reviewing educational materials with Tribal members over the course of 2-3 years. The partnership of Tribe members provided specific beliefs, customs, imagery, and local context to the oral health message. Interviews were conducted with local providers to assess the perceived utility, dental messages, acceptability, and tribal and cultural relevance of the materials vs. a standard pamphlet from the NIH designed for AI/AN parents. These data were coded and analyzed for common themes.

Aim 2. To assess the differences in access to and quality of dental care for young AI children before and during COVID-19. This aim was achieved by comparing formative assessment data from the Healthy Native Smiles R56/U01 project (prior to COVID-19) to interview data of oral health care providers (collected during COVID-19) to determine access to and quality of dental care for young AI children. These data were coded and analyzed to compare and contrast common themes.

Aim 3. Determine perceived barriers to oral healthcare for young AI children and the strategies dental professionals recommend to overcome them. This aim was achieved by analyzing data from oral health care provider interviews (during COVID-19) that address two specific questions: 1. How do the dental professionals' perceived barriers and ideas of improving oral health care for young AI children align with the current literature? 2. Has COVID-19 changed or influenced the recommendations for improved oral healthcare for AI/AN children? If so, in what ways?

For Aim 1, elements of the Social Cognitive Theory (SCT),[106] Education Entertainment Theory (E-E),[108] and Behavior Change Technique (BCT) Taxonomy[112] guided the development of the intervention to engage AI children and parents or caregivers of children less than six years of age in the prevention of ECC. This study applied several elements of successful intervention approaches by taking an interdisciplinary approach through the use of arts and mixed media to culturally and contextually adapt an oral health message into a children's book. For Aims 2 and 3, a social determinants of health framework[113] and Grounded Theory (GT)[114] approach were utilized in assessing the thematic content of the interviews.

These Aims were approached as three different studies and the materials, methods, analysis, results, and conclusions for each are presented in journal-format in chapters 2-4. A summary of results and conclusions for all three studies is presented in chapter 5.

CHAPTER 2: Provider Perspectives on Cultural Adaptation of an Oral Health Entertainment-Education Intervention to Prevent Early Childhood Caries Among American Indian Children

Introduction

Early childhood caries (ECC), or the presence of one or more decayed, missing, or filled teeth (dmft) in children age 5 or younger, is the most chronic childhood disease though it is largely preventable.[1] Children from diverse ethnic backgrounds and those with low socioeconomic standing (SES) have up to twice the risk for developing ECC as their white, affluent counterparts.[2,3] However, ECC is most prevalent among American Indian and Alaska Native (AI/AN) children, who suffer 4 times the disease rate, with nearly 60% experiencing decay by the age of 3, and over 75% by the age of 5.[2–5]

Oral health is a significant indicator of overall well-being, health, and quality of life, and can have grave impacts on children and their families when disease is not addressed. Dental decay in primary (baby) teeth can cause pain, damage to the permanent teeth, infection of the head and neck, and difficulty chewing.[6,7] Severe decay can interfere with intellectual and social development, cause poor speech articulation, embarrassment, low self-esteem, missed days at school, and social isolation.[2–4,6,8,9]

Because ECC is preventable and can progress quickly, early intervention is a key strategy in reducing its prevalence, particularly in high risk populations. Interventions using a combination of cultural adaptation and Entertainment Education (E-E) have produced positive results in health-related behavior change, though literature on their application in oral health to reduce

ECC in specific populations is limited. Cultural adaptation of evidence-based interventions to the specific cultural, linguistic, and socioeconomic context of a community increases relevance, acceptance, effectiveness and sustainability of behavioral health interventions.[73,74] There is a strong foundation of empirical evidence to support its use in healthcare, as applications have demonstrated improvement in patient outcomes for behaviors related to diabetes, HIV/AIDS, mammography use, psychosocial/mental health, nutrition, and exercise.[74–80] Strengthening cultural pride and ethnic identity has also resulted in a positive relationship with health attitudes and beliefs, suggesting the inclusion of cultural reverence, tribal autonomy, and involvement of the community may be important elements of a successful intervention.[53] Cultural adaptations of oral health intervention materials have been implemented primarily in community-based interventions, an approach recommended by many researchers in the field.[12,58,71,81,82]

E-E has been used in public health campaigns to influence community knowledge, attitudes, and health behaviors across a variety of disciplines,[90] though it has been relatively untapped in field of oral health. Typically E-E is applied to large scale projects, though the theory can be applied at different levels. Some creative oral health interventions have used a combination of entertainment and cultural adaptation of the oral health message to decrease ECC risk. Heaton et al. utilized a culturally tailored traditional storytelling technique to improve oral health knowledge, beliefs and behaviors among self-identified AI/AN pregnant women and mothers.[86] Similarly, O'Malley, et al. used a storybook and DVD targeting parental attitudes, intention, and self-efficacy to successfully increase child toothbrushing behaviors in a deprived area of England.[87] In another visually interactive intervention, Lumsden et al. (2019) utilized an iPad-based program to reduce ECC risk behavior.[91] Using entertainment and cultural adaptation can

increase the appeal and utilization of oral health interventions and speak to individuals of all ages and education levels.

The long-term goal of this research is to add to the body of knowledge identifying effective interdisciplinary and culturally relevant strategies to reduce the incidence of ECC among AI/AN children. The aim of this study was to develop an entertaining and culturally and contextually adapted children's book with infused oral health education that is perceived by Tribal members and local oral health care providers as acceptable, understandable, and culturally relevant. This aim was achieved through an iterative creation process of reviewing educational materials for the book with Tribal members over the course of 2-3 years. The partnership of Tribal members provided specific beliefs, customs, imagery, and local context to the oral health message. Interviews were then conducted with local providers to assess the perceived utility, dental messages, acceptability, and tribal and cultural relevance of the materials versus a standard pamphlet from the NIH designed for AI/AN parents.[115] These data were coded and analyzed for common themes using a constructivist, Grounded Theory approach.[114]

Materials and Methods

A qualitative approach was selected for this study to capture the unique perspectives of dental professionals who treat the target population and to elicit a deeper understanding of their perspectives pertaining to the developed educational book. This approach facilitated assessment of dental providers' experiences and viewpoints in working with a southwest American Indian Tribe. A Grounded Theory constructivist approach was utilized to glean information from individual experience and to interpret it through the creation of common themes that emerged

from interviews with the providers. This approach was appropriate given the Aim of the study as it seeks to build theoretical ideas from qualitative data.[114]

The first part of Aim 1 involved the creation of a children's book with an infused oral health message that was culturally adapted to the specific values, beliefs, imagery, and local context of a southwest American Indian Tribe. The script was developed by the project PI, a dental professional and university educator, and reviewed in an iterative process using formative assessment data from an ongoing trial, the Healthy Native Smiles R56/U01 project,[104] including interviews conducted with Native health care providers; Women, Infants and Children (WIC), Head Start, dental clinic staff; mothers/caregivers of young children; and meetings conducted with a Community Advisory Board (CAB) from the tribe. The methods for the formative assessment interviews are described elsewhere.[104] The Northern Arizona University Institutional Review Board approved the study for the formative assessment on April 11th, 2019 (IRB #1396150). Informed consent was obtained by all interview participants and community advisory board (CAB) members. Contributing tribal members vetted the script, translation, imagery, and overall content of the book. This feedback was used to inform the layout, formatting, and final edits, so that the information, visual content, tone, and style were locally and culturally relevant and meaningful to the target audience. To create culturally appropriate images, illustrations were designed by a local artist from the Tribe. All data from the formative assessment were considered during the final stages of culturally tailoring the book. After completing the book design, it was printed, and a website was created to house the electronic version that can be accessed by smartphone or internet and has an audio narration option by a native speaker as well as a pdf version of the book for e-readers.

The second part of Aim 1 consisted of semi-structured interviews conducted with oral health providers (dentists and dental hygienists) who work with the target population to assess the providers' perceived utility, opinions on dental messages, acceptability, and tribal and cultural relevance of the materials versus a standard pamphlet from the NIH designed for AI/AN parents. Local dental providers were recruited through professional connections using both purposeful and snowball sampling techniques. Inclusion criteria for providers included: (a) being 18 years or older, (b) being a dental professional who works with the target audience, and (c) not living on Tribal land. All participants were required to sign a written Informed Consent document to agree to participate in the group and to be audio recorded. Study data were collected and managed using REDCap electronic data capture tools hosted at Northern Arizona University.[116,117] After informed consent was obtained, providers completed a brief demographic survey online about their work as dental professionals, and were sent electronic versions of both the baby book and the NIH pamphlet with instructions to review them prior to their scheduled interviews. The same oral health topics were covered in both the book and the pamphlet, but only the baby book was culturally tailored specifically to the Tribe. The book is 16 pages long, with vivid illustrations on each page that incorporate specific Tribal elements and customs into the storyline along with the oral health message. The book welcomes the baby into their family, community, and Tribe, and celebrates the Tribal culture. There is a page in the book for children to write their name, so they become a part of the story. Images of the book are not included in this report to protect the identity of the participating tribe. The pamphlet includes imagery of AI/AN people and follows a conversation between two sisters who are discussing how to care for their baby's teeth.

Key oral health topics covered in both the book and the pamphlet include the following: using fluoride to protect teeth, checking and cleaning children's teeth, eating healthy foods, not putting babies to bed with a bottle, and taking children to the dentist by the age of 1. Semi-structured interviews lasting approximately 30 minutes were completed via the online platform Zoom,[118] and the audio recordings were transcribed and saved to a secure, password protected server. All participants were sent a 'thank you' email and a $25 gift card. The interview questions assessed providers' work history with the population; reflections on the baby book and pamphlet regarding their utility in combatting ECC and as a chairside educational tool; preferred media types; interpretation of cultural adaptation; support for tribal values and practices; value of the integration of the native language; main takeaway messages; most valuable elements; and areas for suggestions/improvement.

These studies were judged to have little-to-no risk to participants. Steps taken to minimize risk included housing consent forms and surveys in Research Electronic Data Capture (REDCap) software designed to securely transfer research data to statistical analysis software. REDCap was used to collect all consent forms and survey data, including participants' contact information for receiving study materials and incentive payments, to assure confidentiality of patient responses. Jefferson REDCap is locally supported by NAU Information Technology Services and data are stored on NAU secure servers. Only participants who screened into the study by fulfilling the entry criteria and were enrolled had their data collected and kept. All enrollments were done electronically. Data obtained was accessible only to the researchers and no subject, including the specific participating Tribe, will be identified in any report of the project. Interviews were audio recorded only and housed on the secure NAU server ADAMS. ADAMS is a Dell PowerEdge

R740 server with a directly attached data storage array. The server is configured as a remote desktop server with a full set of applications installed so that sensitive data can be analyzed in a secure environment. Users are required to register for access and accept strict conditions for handling and analyzing the data. Once transcripts of the recording were made, the recordings were destroyed/deleted.

This study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Northern Arizona University Institutional Review Board on December 20th, 2022 (IRB #1989388-1).

Analysis

Interview data with providers were coded and analyzed for common themes using NVivo qualitative data analysis software 12[119] on a secured server. All interviews were audio recorded and transcribed using Zoom software and edited for accuracy by the PI. Interview transcripts were analyzed using an inductive, open coding approach guided by a Grounded Theory framework,[114] to capture recurring themes and summarize the main ideas and nuances expressed by participants.

For the provider interviews about the baby book and pamphlet, the PI developed an initial codebook and established definitions for each code based on the focus of the research questions and as themes emerged. The following questions were asked in the analysis of data: 1.What are the providers' professional roles and work histories with the population? 2. Do providers believe the book would be useful in combatting ECC compared to the pamphlet? 3. Do they believe the

book will be useful as a chairside educational tool? Are certain media types preferred over others (book, pamphlet, e-book, audio narration), 4. What are providers' interpretation of the cultural adaptation and support for tribal values and practices? 5. Do providers think there is value in integrating the Tribe's native language? 6. What are providers' interpretation of the main takeaway messages? 7. What do providers consider the most valuable content in the book and/or pamphlet, and 8. Are there areas that providers recommend for suggestions/improvement?

Results

Several different themes emerged in examining the providers' perspectives on the baby book and pamphlet. This paper discusses the providers' background, experience, and the following themes: utility of the materials; media types; tribal and cultural relevance and acceptability; dental educational elements and messages; and mentions of the state of children's oral health and contributing factors such as parental/caregiver knowledge and community factors.

Provider characteristics

The study sample (n = 4) included three dental hygienists and one dentist. Providers' characteristics and professional experience are listed in Table 2. Participants had an average of 22.75 years and a collective sum of 91 years of experience as dental providers, and an average of 12.6 years and a collective sum of 50.5 years working with the target population. The amount of experience in the field and working with the population is significant in terms of developing professional and cultural insights. Providers worked in a variety of facilities and settings including rural, urban, private practice, and public health centers/Indian Health Services (IHS). Seventy-five percent of providers also mentioned working in secondary education, adding

validity to their perspectives on the pedagogical development and implementation of educational materials.

Table 1. Provider characteristics and professional experience

Characteristics		***n***	**(%)**
Age	Mean 48.3 (±17.3) years	4	(100%)
Race/Ethnicity	White	3	(75%)
	Hispanic or Latino	1	(25%)
Gender	Female	4	(100%)
Degree/License	RDH	3	(75%)
	DDS/DMD	1	(25%)
Years of practice	Ave. 22.75 (±25), Sum 91 years	4	(100%)
Years treating target population	Ave. 12.6 (±18.4), Sum 50.5 years	4	(100%)
Primary practice type/facility	Community/Public Health Center/IHS	2	(50%)
	Private Dental Practice	2	(50%)
Primary practice setting	Rural	1	(25%)
	Urban	1	(25%)
	Both Rural and Urban	1	(25%)
	Don't know	1	(25%)
Insurances accepted by practice	Patients with no insurance	2	(50%)
	Private health insurance	2	(50%)
	Medicaid/CHIP	2	(50%)
	Alaska Native, IHS, Tribal Health Services	1	(25%)
	Unsure	2	(50%)

Note. RDH, Registered Dental Hygienist; DDS/DMD, Doctor of Dental Surgery/Doctor of Medicine in Dentistry; IHS, Indian Health Services.

Utility of the Materials

When asked about the utility of the materials, all participants responded that they thought the book could be useful in a variety of ways. The most commonly cited uses for the book were to educate parents, to educate children, to use chairside in an office setting, and to educate other types of providers/educators or in alternative settings. The majority of commentary centered around the education of the parents.

"I think that [the book] is fantastic because most of the information I think we need to get

out there is really to educate the parents. And so, if we got this book in, like, every [Tribal member's] home, and they read it to their kids on a regular basis, or you know, even looked at it, I think that it, it would be informative, and I think it could make a difference, because the I think that most of the lack of education is coming from the parents. The parents are bringing their kids into the clinic because they just don't understand the need for it. I hear a lot like, 'It was just a baby tooth, so it doesn't matter'." (Provider)

"I like the book more so. Yeah, I do, especially when we're really trying to target that population, because you know, their decay rate is very, very high, and so if we can leave them with something that is as colorful as that and culturally based, I, I think it would just help the teachers and the parents. And it would be kind of nice, too… for, like each parent to have the book." (Provider)

Other comments combined the utility of the book for chairside, child, and parental education.

"Well I don't think it's a, a lengthy book. I like that. It's short and concise, and so I it's something that you know, while waiting for the dentist to come do an exam. We could flip through it, and it also entertains the child, and, you know, gives the parent information at the same time, so I think it could be useful to go through it with the illustrations and have it more specific to their culture. I think that that's, that's great. It makes it very useful." (Provider)

"You know, because then the child reads the book, and looks at the pictures, and you know, and it and it could be a book that the parents read, like I read The Giving Tree to my kids every night and even though they couldn't read, they knew what each picture meant and it was almost like, you know…I think leaving it in the home and the kids can see it, I think, you know, it would be more impactful." (Provider)

Suggestions for using the book to educate other providers or in alternative settings included incorporating it into programs such as WIC, Head Start, and Healthy Families, and using it in various outreach programs to schools, to the hospital, and directly into people's homes. Two providers also suggested that the book be distributed to pregnant women and in the pre-natal ward at the hospital for prevention of ECC. Discussions included using the book to educate both the providers who work in these settings and the parents and children they serve.

"I think it is especially for the educators. I personally went and did an instructional seminar for the Head Start teachers, and anything that they can use is very beneficial, and I always tell them that sometimes material may be overwhelming. But what we give you is, you know, like science-based, it's evidence based. And you can pick what you think is useful for your population, and they're very receptive. They were very receptive at first. I was a little nervous when I was talking to them about, you know, articles to use, but they're very open minded." (Provider)

"And I'd like to see them, too, also with Healthy Families, because I would do home visits…and you know we have a great Native American population here…so I would go

with them to their homes, and I would, you know, check their teeth and show them pictures so they can really see firsthand like, you know, early childhood carries, and the reasons why [they occur]."(Provider)

"I would like to leave the books with [WIC], so that [the] WIC specialists would have that on hand…I would go with WIC to their appointments in [various communities around the state], and then I would set up in their lobby, because, you know, WIC provides services for all groups and all nationalities. So we would actually be able to, you know, provide services to the population that you're targeting." (Provider)

When asked about the utility of the oral health pamphlet and its support of Tribal values and practices, providers expressed that the pamphlet could be useful but less so than the book because of its lack of cultural adaptation and entertainment value. One provider cited the materials being in written form as a possible advantage over just repeating the information orally at visits. Two providers talked about having pamphlets that are accessible but hardly ever read or thrown away shortly after.

"I think the physical book [is preferable], and because pamphlets, I think we give patients pamphlets all the time, and they don't read them. I mean, I don't know where they end up, probably the trash eventually." (Provider)

One provider talked about using the book and the pamphlet together, rather than just using one or the other. One of the positive elements of the pamphlet that a provider pointed out was its portrayal of family members working together and sharing oral health knowledge.

> *"I think they're both helpful. I like them both. and I liked that they were different, like there was a pamphlet that hopefully that you know adult would look at, and then a book that even though you're reading it to the baby is really for the adult as well."* (Provider)

> *"The pamphlet did say like, as soon as you know what you need to be prepared to take care of [your child's teeth], and this is how easy it can be, and even kind of gives the idea of, like, you should share this information with your family and your, you know, your sisters and things like that."* (Provider)

> *"I think that most valuable in the pamphlet was just the, the tips about the prevention, honestly."* (Provider)

One provider noted distrust of the government as a possible deterrent from using the pamphlet and as a positive element of the book.

> *"I prefer the book over the pamphlet. Cause the pamphlet, to me, the pamphlet is like it's coming from the State Health service, or Maternal Child Health. It's like they're really, I mean you're trying to change behavior, too, but you're not doing it like government. You*

know what I'm saying? Because what I have learned working with the population in the last 30 years is a lot of them don't like government, and so when you, as an individual person, as a hygienist, is like, you want to make it impact your difference, I think they can sense that. So yeah, I yeah, I, I'm sorry, I can't say enough how much I love the book." (Provider)

While three providers said the pamphlet had some degree of utility, they were unanimous in their preference for the book over the pamphlet. This stemmed from different perspectives about the elements that make educational materials attractive, interesting, and culturally sensitive.

"When I look at the pamphlet it's all about the baby, and what can the parent do for the baby, but the picture book, I like it because it was more colorful, and the pictures stood out. And…it's like you did like a play by play. You know the baby, the mother being pregnant. And then you know the dad, and then you know the caressing of the baby like you, you highlighted all the important factors, whether, whatever our nationality is, you know this is very loving and it's like we're not trying to teach them how to nurture. We're just trying to, not embellish, but just enhance what they are already doing, and by these pictures, even if even if they didn't read the words, and you look at the pictures. I, I could tell what you're trying to say. And I, I love the book." (Provider)

Media Types

When asked about the different types of materials and multi-media options such as the E-book, the online video with narration, the hardcopy of the book, and the pamphlet, the overwhelming

preference was for the hardcopy of the book. Providers cited several reasons for this, including having something tangible, being portable and accessible at any age, having something the child can put their name on, and something that parents or caregivers can easily read together with their children.

> *"I actually like when something is tangible. So I'd like the hard back book."*(Provider)

> *"I like the book a lot. I, I don't think that there's anything that I would really change with that. Yeah, I like that you can make it personalized, you know. Like by writing your name in it. It's like your book, and you can, you know, carry it with you where you go and so I don't know that there's anything I would change with the book. I like that. It has it the illustrations about the cavities that you know about the sugary foods, and those are all very important things."* (Provider)

> *"I think most homes have books. You know, when I go to my nieces and nephews homes, they always bring me a book to read. So I'm assuming most homes have books, and so this would be fantastic way to get more information out there."* (Provider)

While multi-media platforms are ubiquitously used for entertainment and increasingly to distribute health information, only a few mentions were made about the usefulness of the multi-media options. One of the limitations for this particular population cited by two of the providers was their lack of access to internet connectivity and/or the technology to use it.

"I think that my preference would be for the, the physical book only because it'll be actually, you know, read and read again where online, you have to actually make an effort to go on and, and listen to it. And you know, click on something or have internet access or have the technology to do it, which you know, there could be issues with that as well." (Provider)

Some positive elements of the electronic media were mentioned, such as having the video narrate the book in both languages and having the E-book version that could be used asynchronously.

"I did click on the online version, and I thought it was cool that it hooks up to that YouTube video. So I think if I had to pick one of the 2, probably the book would be a good way to go, because you can hand it out as a book. You can also reference like, okay, watch this video with it. And we all know kids love their screens and stuff so I could see a parent sitting and looking at that with someone." (Provider)

"I thought it was really cool, and I liked how the video had reading both [languages] cool." (Provider)

"If I would have had this book during COVID, I would have been using this book on my Zoom, because even though you know, we couldn't be in person, I was still doing Zoom presentations with some of the populations on the reservation." (Provider)

Illustrations were mentioned in some form (pictures, images, graphics, visuals, art) more than 30 times in the interviews. There was general consensus that the illustrations were the most important element of the book. Reasons cited included attracting the reader, being memorable, enhancing the cultural identity, and for pedagogical purposes, to help remember the messages delivered.

> *"I honestly think about the graphics about the, the sugar and the drinks and the sweets turning the sugar into acid. I like that graphic, and I think that that could be really helpful. And then also the part about the, the bottle. I'm not giving them a bottle at night and only water in the bottle. I think that that's a really important point to make."* (Provider)

> *"I think what I found most valuable in the book was honestly the illustrations. I, I think that, you know, having a visual for kids is important, and they can, you know they always point to things, and you know, can kind of see themselves in in the images. So that's something that I thought was really, really helpful."* (Provider)

> *"I really liked how that the illustrations were, were good, and then also some of the references, like when you were reading the part about like our ancestors did, and things like that like that reference values that are important in the culture."* (Provider)

> *"Well, for me, I'm a visual person, so I think it would be very beneficial, because sometimes, when you are relaying a message to a person, if you're not repeating it like 3*

times, they're not gonna really comprehend, and it's not going to stay in the brain. But if you visualize, and you show them something, that one picture can resonate in their brain to help them, you know, correlate, or remember what your message was. So I'm all about visual." (Provider)

"…You have the picture of, like the mom caressing the baby and brushing with the baby, you know, like I said, if you didn't have any verbiage in it, and I just saw pictures, I would know like oh, I should be brushing my teeth with my baby, and brushing is fun, you know?" (Provider)

Tribal and Cultural Relevance, Acceptability, and Accessibility

The most essential aspect of creating the book in tandem with Tribal members was addressing the tribal and cultural relevance, and presenting every element (the script, illustrations, the native language, narration, etc.) in a way that celebrated their culture and was acceptable to the Tribe. When asked about these elements, all of the providers responded positively that they thought the book was written and or presented in a way that supports tribal values and practices.

"Yes, you use their language. You honored them with art and using, you know, an artist from [their] tribe." (Provider)

"I, I love that you did a cooperation with, you know, some people to do illustrations and translate it and everything like. I think that this is fantastic. I love the illustrations. They're very cute. They did a great job with those, and then it's. It's just very

straightforward information. But I like that, you know, even with like the mom doing dishes with like the baby wrapped around her like very traditional things, and I, I think that it will be useful that they have something that's very specific to their culture. I think that's great." (Provider)

"It's very nice and thoughtful on your part because you put some of those traditions in there, because, like if it was my population and you, you went to great lengths to include that, you would make me feel like you really cared, like you're really trying to make a difference." (Provider)

"I do. Because you made it more cultural based, and you brought in some of their traditions which I think is going to resonate." (Provider)

A couple of providers expressed that they were unsure about certain aspects of the cultural adaptation, such as not being completely familiar with specific traditions presented in the book.

"Well, as I was reading over it I, I wish I was more familiar with some of the [Tribal] traditions and customs that they do, because I do know that they have [specific ceremonies], and I assume that you consulted with somebody who has this knowledge before you made the book. So, I, I think that it's fantastic."

"Yes, I think it…talks about their traditions, it talks about, you know, the things that they do as well their ancestors. I think it talks about things that they value, and so they'll

probably feel like it's more—I don't know that they've ever had something that's geared so specific to [their] people—so I think that that's great. Yeah, I, I don't see any anything that, well, from my perspective…that would be offensive. I think asking a [member of the Tribe] specifically would probably be better. Like I said, I'm familiar with some of the things they do…but I, I, I know that they have very specific things that they do when they have a baby. So, yeah." (Provider)

When asked about whether or not they thought the integration of the native language was valuable, the providers were affirming, though one provider noted that they were unsure how much the language was actually spoken at home.

"I do [think it's valuable], because in my experience it's even those patients who aren't like fluent in [their] language do appreciate like at least phrases and things like that, and it brings in that cultural relevance, and like the pulling in from, we're not trying to get rid of the old or anything like that, we're trying to just incorporate everything. So I, I thought it was really cool, and I liked how the video had reading both." (Provider)

"Oh, I love, I love it. I love the time that you took to make it about them, so that they found that this was that, you know, like we're not just encompassing them into a vulnerable group. You know that we are trying to establish a good relationship with that population and make them the priority." (Provider)

> *"I think it is valuable, because, like, for a couple of different reasons. One is, I think, because you took the time to make it in their language, so that you are, you are focusing on them, and because some of the elders don't read English, and they may read [the native language] that you're making the extra effort to accommodate both the English and the [Tribe's] language."* (Provider)

Another element that was discussed was the inclusion of different family members and honoring the familial social structure where caregiving and raising the child is a shared responsibility among entire families.

> *"I like that it includes the father. Yeah, because what I learned working with the population is that children are not always raised by their mother, and sometimes not even by their father. It's by the elders."* (Provider)

Dental Educational Elements and Messages

Providers were asked about the educational element of the messages, such as the specific dental content, what they thought was most valuable, what the main takeaway message was, and whether they thought there was any content that should have been included. The consensus on the main takeaway message was prevention and what parents and caregivers can do to promote oral health in their children. There was some variation in responses to what was considered most valuable about the book, including the illustrations, the QR code on the book to access the online resources, and the prevention message. Although best practices were not specifically asked about, they were alluded to in comments about the efficacy and pedagogical elements and

strategies in putting together the materials. Among those mentioned were the inclusion of vibrant artwork (imagery), retaining evidence-based content in a concise, culturally supportive way, the length and readability of the text, and the portability of the book and inclusion of multi-media resources.

> *"It was easy [to read], because, you know, I think we always try to hear everything at what, like a eighth grade level? And not too wordy."* (Provider)

> *"I try to give them basic things that are not too wordy where it's going to take a lot of memory to, you know, just to remember everything that we said, and we told them."* (Provider)

> *"I like it, it's not overwhelming, and it's, it's kind of to the point, but in a nice way. You know it's not like you're forcing them to have this behavioral change. You know it's making it fun inviting and cultural based."* (Provider)

When asked about whether providers would change anything about the book or if there were topics that they would have liked included, only a few items were mentioned. Recommended topics included professionally applied fluoride varnish, more on nutrition, healthy foods, and that carbohydrates turn into sugar, stressing not going to bed with a bottle, and explaining that breast milk still contains sugar. It was acknowledged by the provider that the latter topic can be difficult to broach because we do not want to seem as though we are not promoting breastfeeding, which is best, but just educating the parents about caring for the teeth, and that the chronic exposure

from staying latched all night (for pacification rather than feeding) can cause ECC just like a bottle with milk or formula in it.

Other Contributing Factors to the State of Children's Oral Health

Some of the lower frequency items expressed in the interviews were not directly part of the study but salient mentions as they add to provider's perspective on some of the barriers to achieving oral health in this particular population. The high prevalence of ECC in the community was referenced regarding the need for effective interventions. Three of the four providers stressed the impact of diet on oral health and how access to nutritious foods is limited in the community due to geographic isolation along with a prevalence of convenience foods that are often acidic and high in sugars. One provider noted that it is a topic that needs to be handled with care because of the structural systemic limitations.

> *"It didn't seem to be quite as geared…you know, in the in the sugary stuff...the food it the formula juice, that sort of thing. I think that that's relevant because I think a lot of them do struggle to have access to those kinds of things on the reservation. You know they, they have convenience store essentially, and so I think they do sell formula there."* (Provider)

Elements of the Tribe's focus on community and family support were recognized as a source of strength within the population.

"I feel like especially since it had, like, the sisters kind of talking to each other in it. That's you know, family is a big thing." (Provider)

Discussion

The aim of this study was to develop an entertaining and culturally and contextually adapted children's book with infused oral health education that is perceived by Tribal members and local oral health care providers as acceptable, understandable, and culturally relevant. In this qualitative assessment, local dental providers were asked to review a book that was co-created and approved by Tribal members and compare it to a standard pamphlet from the NIH written for AI/AN parents/caregivers. The overall feedback from the providers was favorable toward the book. Providers noted the importance of the cultural adaptation and the innate entertainment value of a book with multi-media options compared to the pamphlet. Providers felt positively about the messages conveyed, the presentation of the materials, and that it could make an impact on ECC rates in the community if it were made widely available.

Although it is a children's book, it was interesting that providers focused more on the impact the book could have on parents, caregivers, and other educators or in alternative outreach settings than necessarily how it would improve children's oral health knowledge or behaviors. This is likely because the target group for prevention of ECC are ages 5 and below and are dependent on the help they receive from parents to care for their oral health, not being old enough to efficiently care for themselves. This is particularly true as ECC can form as soon as a tooth erupts, when a child is only approximately 6 months old.

It was surprising that the multi-media features (the E-book and online narration video) that are accessible by smart phone, were not a focus of much enthusiasm because of the prominence of portable media devices, however, it is understandable given the limited access of the community to the internet and for many, the technology to use it. Although these applications were not commented on much in this inquiry, it would be beneficial to utilize the same approach in other communities that may not have the same technological barriers.

Individually, cultural adaptation of health education materials, SCT, E-E theory, and community engagement have shown to be successful in guiding interventions to improve health behaviors but projects combining them for improved dental public health have been limited. The results of this project have potential to impact the field of dental public health, rural health education and cultural adaptation through creative endeavors and the use of emerging technologies to improve oral health equity. The same methodology could be applied in other contexts and cultures, and such materials could be made available at IHS dental and medical clinics, WIC sites, and other outreach entities for distribution among parents and caregivers.

Strengths and Limitations

Strengths of the study include access to formative assessment data from the Healthy Native Smiles R56/U01 project, and pre-established relationships with Tribal CAB members to aid in the cultural adaptation of materials. The use of qualitative data is a strength in that the public health assessments of these communities do not often include in-depth interviews with Tribal members or the providers who care for them. This is an important element in assessing individual needs of the community and identifying avenues to reduce ECC. The tight-knit nature

of the Tribal and the dental communities in the area was a strength in that the PI was able to utilize pre-existing relationships and professional networking to gain access to the individuals who assisted in creating the book and the providers who treat this population. It was also a limitation, however, because the size of the community and the number of providers working directly with them was a small pool from whom to draw participants. In addition to the small sample size, other limitations of this study include the lack of field testing for the book, which would be implicated for future research. Additionally, the specificity of cultural tailoring and other possible confounding factors may limit generalizability of study results.

Conclusions

The high rates of ECC among Indigenous communities make it imperative that alterative and sustainable interventions are employed to combat community-specific barriers to achieving oral health. The use of E-E and cultural adaptation of educational materials may prove a feasible avenue for successfully improving oral health knowledge and effecting oral health habits through repeated exposure to the health messages embedded in entertainment media. Collaboration with the community is imperative to ensure their equitable involvement in the creation of materials and in the research process. The current study found that dental providers who serve a specific Tribal community approved of the materials designed in partnership with the tribe, and were supportive of the distribution of those materials throughout the region. The process of this research requires a significant amount of time and resources, particularly when access to community members is limited logistically (geographically, technologically, etc.). However, further research on the implementation of the book in the community is warranted to support this dedication of resources.

CHAPTER 3: Differences in Access to and Quality of Dental Care for Young American Indian Children Before and During COVID-19, a Qualitative Study

Introduction

Early childhood caries (ECC), or the presence of one or more decayed, missing, or filled teeth (dmft) in children age 5 or younger, is the most chronic childhood disease.[1] Children from diverse ethnic backgrounds and those with low socioeconomic standing (SES) have up to twice the risk for developing ECC, however, it is most prevalent among American Indian and Alaska Native (AI/AN) children, who have up to 4 times the disease rate, with nearly 60% experiencing decay by the age of 3, and over 75% by the age of 5.[2–5]

Oral health has a substantial impact on overall health and untreated disease can cause, pain, reduced quality of life, difficulty eating and speaking, low self-esteem, social isolation, missed days at school, and in extreme cases, even death.[2–4,6,8,9] Severe cases of ECC can incur significant cost to families and put strain on the healthcare system, particularly when hospitalization and general anesthesia are required.[10] ECC also accounts for approximately 34 million hours of missed school each year due to dental disease.[61]

ECC is primarily preventable and can progress quickly, making early intervention a key strategy in reducing its prevalence, particularly in high risk populations. For this reason, it is important to gather population-specific data targeting pregnant mothers, parents/caregivers of young children, and the providers who serve them. While other minority populations have seen a decrease in ECC, the prevalence remains disproportionately high in AI/AN populations.[9,12] The effects of

COVID-19 have created additional barriers and factors affecting oral health of young children in these communities.

While there are data on oral disease status and various interventions that have been implemented to reduce ECC, the literature is lacking in substantial qualitative data that might provide additional insights as to why previous efforts have not resulted in significant declines in ECC in the AI/AN population. This study aimed to understand and assess the differences in access to and quality of dental care for young AI children before and during COVID-19 for a southwest tribe. This aim was achieved by analyzing formative assessment data from the Healthy Native Smiles project (an R56/U01-funded project) gathered prior to COVID-19, and comparing it to interview data from oral health care providers collected three years later, during COVID-19, to determine access to and quality of dental care for young AI children in the community. These data were coded and analyzed to compare and contrast common themes.

Methods

A qualitative approach was selected for this study to draw a deeper understanding of the unique perspectives of dental professionals who treat the target population in the context of barriers to care before and during COVID-19. Qualitative data is essential in gathering a holistic understanding of the issue because it elicits specific feedback about individual experiences or perceptions that may not be represented in quantitative survey data.[120] The qualitative approach taken for this study facilitated assessment of dental providers' experiences and viewpoints in working with a southwest American Indian Tribe.

A Grounded Theory constructivist approach was utilized to glean information from individual experience and interpret it through the construction of common themes that emerged from interviews with providers. This approach was appropriate given the aims of the study which sought to build theoretical ideas from qualitative data.[114] A social determinants of health framework[113] was used to code interviews to better understand the social context for access to and quality of oral health for the target population.

To assess the differences in access to and quality of dental care for young AI children before and during COVID-19, data were compared and contrasted between the Healthy Native Smiles R56/U01 project formative assessment (collected pre-COVID-19), and interviews of oral health care providers collected three years later (during the later phases of the pandemic). For the Healthy Native Smiles R56/U01 project, the research team conducted in-depth, semi-structured interviews (n=5) with dental providers in the target AI community. Interview questions assessed providers' practices and identified potential barriers and facilitators to successful implementation of the intervention. Interviews were conducted until thematic saturation was reached. Detailed methods for the formative assessment interviews are described elsewhere.[104]

The semi-structured interviews conducted during COVID-19 were with oral health care providers to identify barriers to and facilitators of oral health care availability before, during, and after the height of COVID-19. Local dental providers were recruited through professional connections and suggestions from community partners using both purposeful and snowball sampling techniques. Inclusion criteria for the oral health care providers included: (a) employed in an agency that serves pregnant women at the study site; and (b) work in a capacity that

includes interaction with pregnant women, mothers, and/or young children as a dentist, dental hygienist, or dental assistant. Exclusion criteria for dental care providers were limited to lack of willingness to participate in a qualitative interview. The study sample (n = 7) included four dental hygienists and three dentists. All participants were required to sign a written Informed Consent document in Jefferson Redcap to agree to participate in the group and to be audio recorded. Jefferson REDCap is locally supported by NAU Information Technology Services and data are stored on NAU secure servers. Participants were given an orientation to the project including study risks and benefits and compensation information. After informed consent was obtained, providers were scheduled for interviews. Semi-structured interviews were completed via the online platform Zoom[118], and the audio recordings were transcribed using a web based service, Trint.com. Transcripts were deidentified, using the subject IDs only and saved to a secure, password protected server. All participants were sent a 'thank you' email and a $25 gift card for their participation.

Interview questions assessed providers' work history with the population; descriptions of the oral health status of the target population; contributing factors for those health conditions; steps taken to address ECC in the target population and effectiveness of those efforts; barriers to oral care in the community; interactions with parents/caregivers regarding how to care for their children's teeth/oral health; the effects of COVID-19 on access and utilization of care; factors that might have facilitated positive oral health during COVID-19; and areas for suggestions/improvement. These data were coded and analyzed to compare and contrast common themes.

These studies were conducted according to the guidelines of the Declaration of Helsinki and all researchers were certified by the Collaborative Institutional Training Initiative (CITI Program) through Northern Arizona University. The Northern Arizona University Institutional Review Board approved the Healthy Native Smiles R56/U01 study on April 11th, 2019 (IRB #1396150). The Northern Arizona University Institutional Review Board approved the study for the COVID-19 provider interviews on June 5th, 2022 (IRB #1920796-6).

Analysis

Interview data with providers were coded and analyzed for common themes using NVivo qualitative data analysis software 12[119] on a secured server. All interviews were audio recorded and transcribed. Transcriptions for the Healthy Native Smiles R56/U01 study were outsourced to an external transcription company (Rev.com, accessed on 17 September 2021). The COVID-19 interviews with providers were transcribed using Trint.com. Interview transcripts were analyzed using an inductive, open coding approach guided by a Grounded Theory framework[114] to identify recurring themes and summarize the main thoughts and subtleties expressed by participants.

For the Healthy Smiles R56/U01 study, an iterative process of interviewing and thematic coding was used to guide the analysis. The research team first developed an initial codebook and three members met frequently to establish definitions of each code before coding the remaining data. [104] This method was used to improve interrater reliability while still accommodating the incorporation of emergent themes.[104] The transcripts were then coded with the NVivo qualitative data analysis software 12[119] on a secured server using an applied thematic analysis technique to determine the most common barriers and supports to care in the community.[104] The following

questions were asked in the analysis of the formative data (collected pre-COVID-19): 1.What do caregivers know about the relationship between oral health and dietary practices? 2. What do caregivers think about oral health in young children? 3. Is oral health a priority for new mothers in these communities? 3. What are the major barriers to accessing oral health care for children at the individual, provider, community, and clinic levels? 4. What are the major social and structural issues caregivers face which can prevent positive oral health in children? 5. What are the major supports for promoting oral health care for children at the individual, community, and clinic levels?[104]

For the provider interviews during COVID-19, an iterative process of interviewing and thematic coding was used to guide the analysis. Two members of the research team (CK and SB) initially used the final codebook developed in the Healthy Native Smiles analysis and added thematic codes pertaining to COVID-19 as they emerged. The two members met frequently and established working definitions of each code before coding the remaining data. This method was used to increase interrater reliability while still allowing for the incorporation of emergent themes. Interrater reliability tests were performed for internal validity. The transcripts were then coded with the NVivo qualitative data analysis software 12[119] on a secured server using an applied thematic analysis technique.

The following questions were asked in the analysis of data: 1.What are the providers' professional roles and work histories with the population? 2. How would providers describe the status of oral health in young children and pregnant women and/or mothers/caregivers in the target population? 3. What do providers identify as contributing factors to that status? 4. What

steps have been taken to address ECC in the community and how have they been effective or could be improved? 5. What resources would be needed to do this? 6. Have those efforts changed since the beginning of COVID-19? 7. What do providers see as the major barriers to accessing oral health care for children at the individual, provider, community, and clinic levels? 8. How many patients did providers see each week during 2021-22 and what were the reasons for the visits? 9. What do providers see as the major social and structural issues caregivers face which can prevent positive oral health in children? 10. What do providers anticipate oral health will look like in this population post-pandemic? 11. What factors within the community might have facilitated positive oral health during the COVID-19 pandemic? 12. Are there any programs that providers think could help improve oral health during a pandemic and what would they look like?

Results

Similar themes arose between the two sets of interviews before and during COVID. This paper will discuss the providers' characteristics and the following themes surrounding access to and quality of dental care for young AI children before and during COVID-19: limitations in oral health education; limitations in dental services/ quality of care; structural factors; social/community factors; follow-up to care; and prenatal healthcare. The interviews conducted during COVID also included additional thematic factors related to COVID-19.

Provider characteristics

The study sample, (n = 12), included five provider interviews before COVID-19, and seven during COVID-19. The sample consisted of four dental hygienists and eight dentists. A

comparison of providers' characteristics and professional experience are listed in Table 2. Participants had an average of 9.3 years and a collective sum of 104 years working with the target population. The amount of experience in the field and working with the population is significant in terms of developing professional judgement and cultural insight.

Table 2. Provider characteristics

Characteristics	Pre-COVID-19 Interviews	During COVID-19 Interviews	*n*	(%)
Dates of Interviews	Feb.-May 2019	July-Oct. 2022		
Type of Provider:			12	(100%)
RDH	0	4	4	(33%)
DDS/DMD	5	3	8	(67%)
Years treating target population:				
Average	5.8	10.7	9.3	
Total	29	75	104	

Note. RDH, Registered Dental Hygienist; DDS/DMD, Doctor of Dental Surgery/Doctor of Medicine in Dentistry; IHS, Indian Health Services.

Access to and Quality of Dental Care for Young AI Children Before and During COVID-19

Common themes and the number of times they were referenced in context for each set of interviews are shown in Table 3.

Table 3. Common themes in access to and quality of dental care

Theme	Pre-COVID Interviews		During COVID Interviews		Total # of References
	# of References	*n* (%)	# of References	*n* (%)	
Limitations in Oral Health Education	**25**	**5 (100%)**	**29**	**6 (86%)**	**54**
Caregiver Knowledge	19	5 (100%)	14	6 (86%)	33
Community Education and Outreach	4	3 (50%)	14	6 (86%)	18
Cultural Communication Gap	2	2 (40%)	1	1 (14%)	3
Limitations in Dental Services/ Quality of Care	**16**	**5 (100%)**	**30**	**6 (86%)**	**46**
No pediatric dentist/ hygienist/ other specialist	7	5 (100%)	20	5 (71%)	27

Portable dental equipment or lack of technology	6	3 (50%)	1	1 (14%)	7
Lack of follow up after referrals	3	3 (50%)	2	2 (29%)	5
Structural Factors	**15**	**5 (100%)**	**20**	**4 (57%)**	**35**
Transportation	7	4 (80%)	8	3 (43%)	15
Higher Level Structural	8	3 (50%)	12	4 (57%)	20
Social/Community Factors	**20**	**5 (100%)**	**12**	**6 (86%)**	**32**
Caregiver Structure	8	5 (100%)	8	5 (71%)	16
Community Factors	12	5 (100%)	4	3 (43%)	16
Prioritizing Oral Health	**15**	**5 (100%)**	**14**	**6 (86%)**	**29**
Prenatal Health Care	**9**	**5 (100%)**	**6**	**4 (57%)**	**15**
COVID-19 Factors	**N/A**	**N/A**	**45**	**7 (100%)**	**45**

Limitations in Oral Health Education

The greatest number of references identifying barriers to care (54) had to do with oral health education. Nearly all of the providers (92%) commented on the impact of parents/caregiver's oral health knowledge, limitations in community education and outreach, and/or limitations in education due to cultural/communication barriers. Responses were similar between the Pre-COVID Providers and those interviewed during COVID, though the latter included some cross-references to the effects of COVID-19 closures.

Caregiver knowledge

Providers' perceptions of parents'/caregivers' knowledge as barriers included not understanding the importance of caring for deciduous (baby) teeth or how to do so, not fully understanding the oral-systemic link, the connection between mother's oral health and that of the baby's, and the complex processes involved in caries formation.

"A lot of people don't know certain things. For example, cavities come from bacteria. So a lot of people don't really understand that process. The bacteria eats sugar and then put acid on your teeth, it eats your teeth away. So when you explain it to people, sometimes they're like "wow I've never heard that before, didn't know it, didn't know the fluoride in the toothpaste helps fix that damage." So we start talking about...a lot of people don't know that adult teeth start to erupt at six years old. You have a kid at eight and they say "oh well he'll get his adult teeth," he's already got half his adult teeth and they're halfway decayed already. Building those habits, trying to explain to people "hey, five years old they need to be brushing their teeth twice a day at least." If not, their adult teeth are going to be affected." (Pre-COVID Provider)

"The importance of primary teeth, a lot of people think "ah they're just baby teeth," but they're important teeth for growth and development. Speech, growth, development, also guiding the adult teeth into place. There's a lot of reasons why it's important to have primary teeth. The bones are forming, and the way that the speech patterns are developed has to do with teeth. So the tongue thrusting against the bones helps grow. If you have a two or three year old that loses all their teeth, eating is affected, self-confidence, it could even affect skeletal growth and things like that." (Pre-COVID Provider)

"I just want to try to educate them that even though we can fix the baby teeth, they're still problems because they were damaged in the first place. Totally preventable. It's just hard it's a hard call to hard to get that education across." (During COVID Provider)

"I think the biggest factor is the lack of education surrounding it. So I don't think that they have a firm understanding or a firm belief that their overall health is affecting their oral health. " (During COVID Provider)

Because early intervention is crucial in preventing ECC, there was particular emphasis on needing to educate pregnant mothers and parents/caregivers about the importance of oral health in babies and very young children.

"I guess more guidance for the parent, early on, like when they're pregnant. You know, just tell 'em what to expect and try to keep track, have a set protocol, so at certain times of the pregnancy they know how to take care of themselves, and then as they get closer to their ... their baby gets older, there's set times that we may contact the parents, and we'll educate them. I guess that's something we can do." (Pre-COVID Provider)

"We don't have any type of health education thing specifically for pregnant patients…At least not at the dental clinic." (Pre-COVID Provider)

"Many of [the pregnant women] didn't feel that it was safe to have oral health services while they're pregnant. But we shared with them that it's very important for pregnant women to receive oral health services. One is so that we can reduce the chances of a preterm labor and a low weight baby. And we specifically say maybe the mid trimester would be safe for mom and baby. But I think a lot of them, it's just the lack of education." (During COVID Provider)

"I know that there have been a lot of programs and a lot of things tried. I think there's been a lot of education that's been attempted, but I'm not sure how to reach everybody, how to reach the parents, to educate them, because that's really where it begins. The children obviously don't know any better. And if you can somehow get through to the parents, the importance of, of the preventing the early, early childhood carries and the good oral hygiene habits early on." (During COVID Provider)

Community Education and Outreach

Seventy-five percent (*n*=9) of providers interviewed cited a lack of resources or support for community education and outreach as major barriers to care.

"It doesn't help now that in our clinic situation we don't have a pediatric dentist any longer. You know we've been missing one for a year and a half. And now we don't have a hygienist either. So there's no more community education." (Pre-COVID Provider)

Cultural/Communication Gaps

Not as frequently cited, but pertinent to the aims of this study were references to gaps in communication due to cultural and language differences.

"What I'm hoping is that if we have a culturally-sensitive person involved in the field, maybe they get something different than what they get from me… And so, I don't know, I

think there's certainly that chasm that exists between culture and languages." (Pre-COVID Provider)

"Get [the caregivers] involved, just like when we do health education for the pregnant parent. Any caregiver that may be involved, have them attend the session. Of course, usually grandma or grandpa, sometimes they don't speak English that well, so maybe we'll need a translator." (Pre-COVID Provider)

"…[the parents] have to find a way to brush [their children's] teeth, even if they don't like it. So I think maybe that might be a cultural thing too, though. So it's sometimes hard to cross over that cultural barrier to say, I'm sorry, we're going to have to force it, you know, because that that may be something that they're not comfortable with." (During COVID Provider)

Though oral health education received the most mentions in regard to barriers to care, it is interesting to note that 43% (*n*=3) of the providers interviewed during COVID-19 also expressed frustration at the lack of progress in decreasing ECC, even after years of effort in promoting oral health education. There was an air of disconnect between delivering oral health education and seeing changes in oral health status to reflect it that predated the effects of COVID-19.

"Well, they're usually very, very open to hearing about things. And honestly, they're very kind and very what's the word I want to say? I think mostly just open to learning about it and understanding it better. So I've never reached anybody that's just like absolutely

resistant to hearing what we have to say. But I think implementing it at home is a whole nother battle. So we can do what we can in the clinic by lecturing them, by showing them visual aids and things, but taking it home and actually implementing it is a whole nother battle. So that's one thing. I mean, we always struggle with as healthcare providers is motivating the patient or motivating the parents enough to be able to do it in their own environment. " (During COVID Provider)

"If we came out and gave oral health education to them at a fair, health fair, that'd be great. But we do it in our office every time they come, so they know they hear it all the time. I don't know that answering that question is really difficult to answer. I don't know what kind of programs we can do because I feel like I talk myself blue in the face and I almost get mad that I'm lecturing them, but I'm doing it in a very positive way. But sometimes it's perceived as lecturing. I'm trying to help them. I really am from a good place in my heart to get their children back to health." (During COVID Provider)

"It also seems that there might be a, you know, a communication problem in the educational part of the deal with them because, you know, you, you spend quite a bit of time in the preventive education aspect of their care, but yet they come back time after time with the same type of presentation with regard to their dental care. So something is missing in the translation, you know what I mean? Right. So that was a frustrating part of their care is to see, see improvement just didn't happen as quickly as you might hope…overall doesn't quite make it home. And we had you know, got handouts, videos.

You know, face to face talks but. You know, over the decades, it just hasn't made much difference. " (During COVID Provider)

Limitations in Dental Services/ Quality of Care

Limitations in dental services was the second most frequently cited barrier to care (46), and included a lack of certain services, dental providers/specialists such as a dental hygienist, pediatric dentist, oral surgeon, or periodontist; ineffective recall and referral systems; travel distance; using portable equipment for remote locations that do not provide the ability to deliver comprehensive care/limit treatment capabilities; or parents not returning consent forms for school or other oral health programs. Again, interviews before and during COVID were not remarkably different in the specific context of limitations, though mentions were made of there being a complete shutdown of the IHS clinic for about two years during the height of COVID.

Lack of Specialty Care

"They know to come here. And then we tell them that we can't see them here because we don't have a pediatric specialist here. And then we refer them to [other locations]. And then as far as we can go, and it's up to them to check on their insurance or to access, try to get their ... change over so they can go to a private office in [another town], but usually [the office] has a long waiting list, and they're at the point where they don't want referrals because they're so backed up." (Pre-COVID Provider)

"It was five years that we went without a pediatric dentist and as a result, we had to make referrals to private practitioners in [another town], which is another hour and a half away." (During COVID Provider)

"Well, one of my biggest pet peeves, you know, in my tenure there was not having specialty care. And in dentistry, you know, gosh, you need you need orthodontics, you need periodontics, you need pedodontists, you need oral surgery. All of these are, are common issues with regard to the patients that we see. And so because of our location, general dentist were asked to do a lot of specialty care, which is a problem. We're not trained as oral surgeons." (During COVID Provider)

"I hope they can get back on track. I think I alluded to it before. To get a full time pediatric dentist in there would be huge. Huge to get full time staff two dentists can't do what all of us were doing before and they're very short staffed right now. So very limited care when you have half your professionals out of there. So I think a lot of good things can happen once everybody is up and running and fully staffed. " (During COVID Provider)

"Having a full-time pediatric dentist would have been a great help." (During COVID Provider)

"I've wanted a full time Hygienist. I was able to experience that a couple of times there at [the reservation] in 14 years, but it was never long term." (During COVID Provider

"I think that the biggest thing is just the lack of availability of appointments at the [specific Tribe's] Health Care Center. Obviously, during COVID, it was completely halted unless you had a toothache. But without having a preventive specialist out there like a dental hygienist, the new [university] students are only providing services during those select months of the semester they were able to rotate out there. So if they had a person that was hired out there full time, that would help significantly." (During COVID Provider)

Limitations in Equipment and/or Technology

Equipment and/or technology issues were mentioned more often in pre-COVID interviews than during COVID-19 interviews (3:1). During COVID-19 the limitations centered around the additional equipment and technologies required as engineering controls to help prevent the spread of aerosols.

"…Treatment's really the thing that they need. Unfortunately, we lost our pediatric dentist up here, so it's hard. We don't always have the tools necessary to treat children as far as sedation and time and expertise." (Pre-COVID Provider)

"They know to come here. And then we tell them that we can't see them here because we don't have a pediatric specialist here. And then we refer them to [other locations]. And then as far as we can go, and it's up to them to check on their insurance or to access, try to get their ... change over so they can go to a private office in [another town], but

usually [the office] has a long waiting list, and they're at the point where they don't want referrals because they're so backed up." (Pre-COVID Provider)

"The other issue is lugging this portable dental equipment from where it is here to the existing location that we're going to. And so, the hygienist that takes that role has to be physically capable of lifting a 50-pound sack, okay? And so, there are those that can do it, and there are those that have struggles, struggle with that. So we're fortunate, I think, in a lot of ways that we never had a situation where we've suffered an injury from lugging our stuff. And once we get it there, usually we can find a room, okay, where that will be set up. But it doesn't deliver the quality of care that we could deliver here at the clinic, clearly. I mean, portable stuff just doesn't cut it. It's hard to do. You don't have good lighting, you don't have ... You've got an aspirator, but it's sometimes not so effective. It's hard to do dentistry in the modern technological era with portable equipment. And we've been doing it that way for at least since I've been here." (Pre-COVID Provider)

"One of the biggest problems we had in dentistry was…you create aerosols every time the mouth is open, and you do a dental procedure. I mean, you squirt water and somebody's mouth, and it creates an aerosol, let alone use a high speed hand piece on someone. So plus, coupled with the fact that we only had three isolation rooms out of 14, so we were really hands and cuffed when it came to providing the type of dentistry that we were used to doing. The pandemic created havoc with regard to that." (During COVID-19 Provider)

Ineffective Recall and Referral Systems and Geographic Distance

Lack of follow-up after referral was cited five times by 58% of providers (n=7) as another barrier to care because patients might not return, may become frustrated with the referral system and/or meet additional financing barriers when referred outside of the IHS system.

> *"[Patients] get lost, 'cause they get put on waiting lists, and then the parents just kinda ... either they forget, or they give up...Frustrated, maybe. I guess we can do a better job tracking those patients, that have been referred. Follow up after few weeks, see where they are on the waiting list, see if they made any progress toward making an appointment in [another town]."* (Pre-COVID Provider)

> *"…The third problem was providers with regard to children. It was five years that we went without a pediatric dentist and, as a result, we had to make referrals. To private practitioners in [another town], which is another hour and a half away. That referral process was hit and miss in many instances. 50% of the time they wouldn't show up for their appointment, and that was due to either forgetting or having to take busses to wherever they're going, not getting there on time, having cancelations. So those are serious issues to the delivery of pediatric care."* (During COVID Provider)

> *"You know, you've got to be there on time. The other the other aspect of being in a remote area like that, sometimes we had to refer to all the way down to [another city] and that's a, that's a two day thing for these people to, to manage that. Very difficult to do."* (During COVID Provider)

COVID-19 Closures and Travel Distance

The IHS facility was closed except for emergency care for roughly two years during the height of COVID, so the providers interviewed immediately after that time mentioned that outside referral/traveling to dental offices/clinics outside of the reservation was the only option for preventive oral care.

> *"When the pandemic happened, all of [the community education and preventive care] stopped and we couldn't go out and do presentations. There was no school to go into anymore. Everything stopped. And so we wondered what's going to happen to the kids? And we knew what was going to happen. I anticipated. And yeah, we only saw kids when it was emergency. "* (During COVID Provider)

> *I'm seeing all these kids getting referred out over and over and over again. So that was a hardship on parents because how are they going to get there? Is AHCCCS going to cover their, their covered charges for, for driving? And I heard that that was cut out of AHCCCS, that they didn't do that anymore. So at first it was available to them that they would call AHCCCS to the ride, would pick them up at their house, take them right to their appointment and bring them right home, at some point in time during COVID, that was not available anymore. "* (During COVID Provider)

Structural factors

Structural factors were the third most frequently cited barrier to oral care (35 references) by 75% of providers. Of these factors, transportation and other higher level structural barriers were specifically mentioned.

> *"[Transportation is] a huge issue, yes. The cars, running cars that really run. Not just, you turn a corner and the engine falls out. 'What happened to your car?' 'Oh, I lost your engine back there.' 'What are you talking about?' 'They forgot to put the bolts on when they did the ... whatever.' It's just nothing surprises me."* (Pre-COVID Provider)

> *"Transportation was a big, big barrier. A lot of people simply do not have the means to get to the [facility]. And there are lots of situations where, where we would have patients that were scheduled at, you know, 9:00 or 10:00 in the morning and not get there till 3:00 pm because they walked 20 miles. Well, so we tried to accommodate them, obviously, whenever they showed up. But having a meaningful schedule was very challenging on a daily basis as well. So transportation was a big problem."* (During COVID Provider)

> *"It could be transportation issues. I get a lot of broken appointments, and patients tell me it's that they couldn't get here."* (Pre-COVID Provider)

> *"I would say the biggest barrier would be transportation. Even though even though they have several opportunities to, to get there, transportation is, is paramount because they*

just don't have cars. They just don't have the means to get there. So they rely on grandma. They rely on, you know, neighbors to, to get them to their appointments. There is no, you know, designated help transit system that goes around from village to village at 7:00 in the morning to pick them up and bring them to all the health care center." (During COVID Provider)

Some providers expressed that they did not believe access to care was really a barrier (in that care was not available), but that transportation was the biggest barrier.

"They talk about access to care, and that's always the drum beat about access to care, access to care. It's really kind of a fallacy. It's more access to transportation. There's plenty of access to care, every kid up here has AHCCCS for the most part, probably over 90%. Medicaid. That means all those kids can just go down to [another town] and have their dental treatment done. No charge. So there's no access to care problem, they can come here, they can go to [another town], they can go to [another town], they can go to any pediatric dentist in the state." (Pre-COVID Provider)

"You know, the other thing that is always looked at is the access to care. The issue of access to care…there are seven clinics within 25 square miles of us. And so, access to a facility, I think, is not so much a problem. The problem is transportation to the available facilities, and so, if you don't have that, then they might as well not have access…There's

no reason that the population shouldn't be given access. It's getting them to get there that I think, for many people, is a big problem." (Pre-COVID Provider)

Providers interviewed during COVID commented on the detrimental effects of the pandemic on the already challenging geographic isolation of the population.

"Transportation was very poor before the pandemic and nonexistent during the pandemic, because they were the transporters were afraid of contracting COVID." (During COVID Provider)

"And I we've seen a few of the [Native American] patients [in a nearby town] that I used to see at the [IHS] clinic come into the [local] dental hygiene clinic, which was very, I was very happy to see that because we offered affordable treatment options for people. But it is a bit of a nuisance obviously for them to come all the way, all that way, 4 hours roundtrip is quite significant for, for them to come for an appointment." (During COVID Provider)

Higher level structural factors mentioned included SES, organizational, or policy factors affecting children's oral health, such as poverty, basic needs not being met, lack of access to nutritious foods, no community water fluoridation, patients not being able to navigate the system or not knowing how to address the issue on a higher level, and difficulties with AHCCCS/Medicaid reimbursement.

SES Factors—Lack of Transportation or Inability to Take off Work

"I don't know, you could try to tell a parent to be more involved, but they might be too busy. Maybe the poverty level comes into play as well because maybe they have a job that they need to go to. They're trying to arrange rides, trying to get the other kids to school. So dentistry becomes less important." (Pre-COVID Provider)

Difficulty with AHCCCS/Medicaid Reimbursement

"Historically, all these service units have struggled to meet AHCCCS because of the crazy way that they determine this number that you're supposed to meet. It's based on the number of people that utilize the clinic. But we also don't get credit for the people that are not in our service unit that we treat. In our particular situation, literally, I don't have the exact figures, but I can tell you that 35 to 40% of the people we treat are not [affiliated with this Tribe]. So they live in service units that are out of our service unit, and for that reason, we don't get credit for seeing them." (Pre-COVID Provider)

"So, the other part of the equation when it comes to our community outreach programs is that because they were operated by hygienists, we could not submit [for reimbursement], they could not be billed. These services could not be billed for. So we were missing out on a significant revenue stream as a result of that." (Pre-COVID Provider)

SES Factors—Poverty, Lack of Basic Needs or Utilities Available (Water, Electricity)

"Maybe education. Or you can also say maybe education, lack of education. That might relate to poverty level and everything else." (Pre-COVID Provider)

"And they also there's lack of, of water supply out there as well and also electricity. So oftentimes will recommend something like, say, an electric toothbrush to a patient out there and they'll say, well, I don't have electricity, so I can't do that." (During COVID Provider)

"I think some of it is just knowing somebody cares. Sometimes there's so much going on with the family dynamics, there's not time for them just to get up and get the bus. They don't wash their face or even have anything in their tummy to go to school. They're just getting up and hitting the bus…Some people will say, well, we don't have running water, so we don't brush our teeth." (During COVID Provider)

I was part of the customer service team there at Hopi for a while and a lot of different communities I was on the struggle with all that is people don't have electricity in some of the community or have Internet. They don't have computers, they don't have cell phones that we're calling limited time. So it is constant struggle, and constant struggle with something like that. (During COVID Provider)

Lack of Nutritious Food Available

"One [strategy] that didn't work I think often would be nutritional counseling because it's very difficult for them to have access to proper healthy foods, you know, fresh foods and vegetables." (During COVID Provider)

"A contributing factor is poor diet, primarily in that [population]. There's not a lot of nutritious foods available on the rez. And so. You know, they resort to a lot of fast food types of things, packaged foods, high carbohydrate foods, which leads to, of course, problems with regard to their dental care…" (During COVID Provider)

Social/Community Factors

Social/community factors were mentioned 32 times in interviews by 92% of providers. The most thematic of these references involved caregiver structure in the households and other community-level factors outside of the individual caregiver that affect children's oral health.

Caregiver structure

Caregiver structure was mentioned by 34% of providers (*n*=4) as a barrier to care when someone other than the parent or multiple people were serving as caregivers and were unfamiliar with the medical or dental history of the child.

"There's a lot of children that live with their grandparents or an aunt or uncle and so a lot of times what I'll hear is "hey, I don't know, we just got him. I guess they weren't taking care of his teeth," kind of thing. So sometimes people are really concerned and they're like "we just got him with us, we didn't know it was that bad." (Pre-COVID Provider)

"I would say, off the top of my head, education, [is] always important. The fact that a lot of children are not with their parents is definitely something to address. Almost like a

new child packet, like you're a grandparent, you haven't had a child in 30 years, now you've got a two year old, what do I do? You just don't automatically know." (Pre-COVID Provider)

"If I tell the parent, the parent will go home and, and hopefully, you know, do some behavioral changes or implement maybe another oral health strategy for their family. Or if the grandparent says, oh, yeah, let me tell my, you know, my daughter or my son, because this and that. And then a lot of the elders on the reservation are raising their grandchildren. And because, you know, are elders, they don't know that information. So bringing it to them now is has been new, but it's something that we hope that they will take home and actually change some of the habits at home." (During COVID Provider)

"…there's a lot of males that are raising their children, you know, and they don't have that, that knowledge because they didn't go through the pregnancy where they went to prenatal appointments. So it's so important that we not only reach the prenatal moms, but we need to reach the dads, all the caregivers. And like I said on the reservation, a lot of the elders end up raising their grandchildren." (During COVID Provider)

"…maybe they're home tending to multiple children or even other family members children, or maybe the children are living with the grandparents because the parents aren't present. I see that quite a bit. The grandparents are bringing the grandchildren and not the parents…" (During COVID Provider)

Interestingly, two providers mentioned that they observed better oral health in the children brought by grandparents.

> *"I still think that I've seen that some of the younger generation not as good about getting their kids into medical care, dental care. I've seen the grandparents are pretty strong and pretty good about it."* (During COVID Provider)

Community Factors

Frequently cited community factors included lack of access to healthy foods, frequent turnover of Tribal officials, community beliefs/attitudes toward oral health, and difficulty getting programs out into the community.

> *"If after 10 years of seeing the kid before that first tooth comes in, we still don't have a handle on it, then I don't know what to do, you know? I just don't know what the problem is. Diet, of course, enters into this as you know. And so a healthy diet is one that can really foil our efforts. With as much education as we can give them, if they can't get the right diet on board, we are gonna be frustrated with the results. And here, as you guys know, the only game in town really is [one town] where they have a little grocery store and then Circle K in on the other side down here, which has some groceries. But the healthy alternatives certainly aren't there. It's not a Whole Foods environment. And so, because of that and because of economic circumstances, the diet is high in carbohydrates, fast food."* (Pre-COVID Provider)

"Evaluating the oral cavities is wonderful and being able to apply that fluoride varnish. We know that, statistically, it has a benefit for those kids. And then now we're taking the statistic a lot more statistical data and who we're able to reach and what we're able to do. The tricky part is data collection, paperwork, getting the children registered into our system so that we can legally and collect that data that's a lot of paperwork, administrative work on top of the clinical piece. So that's the challenge." (During COVID Provider)

"…Tribal governments they change hands every couple years, so maybe if someone is, maybe you might look at it as elected official gets in there and maybe the tribal members don't like them they get pushed out. So they could be on the cutting edge. They could say, "Hey, we're going to mandate this." Or, "I really care about you guys and I want you to do this." That might be too pushy for people. Next two years they're out of there and they start again…and you can't have an overall plan for a couple of just say five years or a decade or two decades if you keep on having turnover and everyone has their own viewpoint. You just reinvent the wheel. So I think the tribal perspective is really important." (Pre-COVID Provider)

"The parent's experience, the parent's parent, it's pervasive. It's a cultural thing. They heard something, an uncle, aunt, way long time ago. You see how when you walk through the community, it doesn't bother them now [not] to have teeth. I had a conversation with a gentleman last night who said, "I'm not vain. I don't need this." I said, "Well you're talking to the wrong person. Your smiles everything," I said, "So I definitely don't feel the

same way you do." He goes, "Well I'm not vain, I don't have to do that—have teeth and my front teeth to say who I am." I thought that was interesting." (Pre-COVID Provider)

"…One of the frustrations that we've had, not so much personally, but I know that my hygienists have had to endure, is in getting out to those communities and getting into those schools. First, there's sometimes a roadblock with administrators of the school. They don't want us in there for...not because they don't believe in dentistry or something like that, but our presence interrupts...their daily routine, and I can understand that." (Pre-COVID Provider)

One provider interviewed during COVID also noted that because it was such a tight-knit community, that the lack of anonymity had been a deterrent for people coming to the clinic and seeking care.

"A lot of the HIPPA stuff was a big issue with [the people]. We all know each other, and relatives work at the hospital and, and things get back to the village before the patient even gets back to the village of everybody knowing what's wrong with them, because somebody said something inappropriate and people were getting dismissed and losing their jobs over stuff like that, and rightfully so. I mean, just learning how to keep your mouth shut. This is nobody's business and it's not a newspaper. The hospital is not the newspaper. And I think it's a whole education on that part to keep it private." (During COVID Provider)

Prioritizing Oral Health

Provider's perceptions of dental care not being a caregiver priority or not as high of a priority as others was referenced by 92% of providers (*n*=11). Mentions included parents not returning consent forms for school visits, not looking at child's teeth on a regular basis or not knowing that they have active disease. Prioritizing oral health had nearly the same number of references for the pre-and during-COVID groups (15 and 14, respectively).

> *"Um...they don't think it's important to bring their child in, like at six months, one year...they just don't. By the time we see them, they're already three or older and they already have problems."* (Pre-COVID Provider)

> *"[The consent form] kind of gets lost in the backpack and the parents don't look for it. I know some of the programs we're having like a homework folder, so the parents had to read it and sign it. So that's where we try to say, okay, please make sure the consent is in the homework folder so that the parents can read it and sign it"* (During COVID Provider)

> *"I don't think they have value for why it's important not to have the baby teeth ruined…But it really does cause implications down the road with early loss of primary teeth causing all kinds of problems. So it's hard. Try to educate all the time."* (During COVID Provider)

"...I don't know why it doesn't get integrated into the holistic nature of taking care of yourself, your family, being the person who can take care of yourself. Because I can tell you, I saw patients that were 90 years old that still had a lot of their teeth and some that were five years old that lost every tooth in their mouth. So yeah, it's a very, very much a disparity there. And, and it saddens me." (During COVID Provider)

Prenatal Health Care

As an early intervention opportunity, the importance of prenatal care and being able to intervene with pregnant mothers was mentioned by 75% of providers. Barriers to achieving this included discussion of women's prenatal health needs; establishing a medical/dental 'home' for care, talk about how mothers should take care of themselves during pregnancy; and oral health practices for the mother and baby.

"Well, one of the things that is not working for us here is that we don't have the specialty care for the pregnant patient to receive all of her services here in [this Tribe], so she goes into the city or she goes elsewhere where she can get that care. They're trying to implement that again. At one point, when I first got here, they were doing that. And I know in the hospital that I was working at [in another state], of course they had all sorts of residencies, OB-GYN was one of them, and one of the big programs that they had was they would have a prenatal class that the pregnant parents would come, every week, to become educated on issues, both medical and dental. So I'd be the one that gave the talk on how to prevent carries, how to prevent nursing bottle syndrome, and all those things.

And it was pretty gratifying to do that, but we don't have that program here." (Pre-COVID Provider)

"[Prenatal oral health education] would be key. They don't realize, things are going on inside the baby with their teeth and how nutritious mom stays healthy, that, that affects the baby's bones and teeth, and just all those things. You've got to take care of yourself to take care of your baby. Those kinds of programs, that I definitely see would be sustainable that have never, I don't see have ever even been started here…" (Pre-COVID Provider)

"They had a midwife, they had all of that. And I think when, when a facility takes care of mom, when she first comes in her first trimester all the way through, there's an ownership of that facility that they feel like, wow, they're going to take care of me. This is my home and this is who I want to take care of me. This is how I want my baby to, you know, be taken care of because they took such good care of me. And when there's that kind of ownership with that kind of care, they can continue on, for their babies to want to come here and their children to want to come here. That was all broken. [This healthcare center] will not get a OB/GY/U wing open again. That's closing for good there. They're redirecting that whole room to other facilities and it really breaks my heart." (During COVID Provider)

"I think the pregnant female in my mind, if they go to [anther city] for their health care, they're going to go to [there] for their dental care. So it was far in between that I saw any

pregnant women there. It's like, where are they? I know they're out there. Where are they going? And it's because. We're not delivering them. So they don't want to come here. They're taking their health care somewhere else. So I could count. I mean, that would have been a good figure, because I was so excited when I see somebody pregnant. I can tell you it just wasn't very often…I couldn't even say once a month, I would love to say once a month that I don't even think it was that often. That's how seldom it was. before the pandemic was probably once one a month, maybe. And then during the pandemic? Very rarely. And then. And then. I never saw a post because WIC was closed down too. I mean, it was. We were just shut down. Our hands were tied. Where do they all go? So they come in for their, their WIC supplies. And I don't know what the conversation was with WIC because there was so much turnover in the WIC department." (During COVID Provider)

COVID-19 Factors

One of the goals of this research was to understand the impact of COVID-19 on the quality and access to dental care for a southwest AI tribe. The interviews during COVID-19 captured some of the most common grievances incurred by the pandemic, the greatest of which was the complete closure of the IHS facility. These codes were intended to be co-occurring and several previous references to other themes included some of these effects. Following, are some of the additional quotes that express the extent to which COVID impacted quality of and access to care. Several providers discussed how treatment came to a halt with the increase in COVID cases and the closure of the clinic and how it might affect already poor oral conditions.

"The oral health of the 0 to 3 year old is very poor and we had a difficult situation obviously with COVID in the clinic. Went from seeing 50 patients a day to emergency care only. And that spanned a period of 18 months or something like that. While I was still there. So clearly the impact of COVID on oral health was detrimental to all [the Tribe's] community residents, but in particular the 0 to 3 age group. " (During COVID Provider)

"Prior to the COVID pandemic, the typical pattern was advanced gingivitis and multiple carious lesions in our moms. So we tried to address their needs, trying to provide preventive education to them, let them know what to expect with the advent of the child. And so we worked as hard as we could with that group…During the COVID crisis, of course, everything else went to hell in a handbag, so to speak, with regard to those types of programs. And our focus was only on emergency care." (During COVID Provider)

"And so pre-COVID, we would screen, we would educate, we would apply fluoride varnish during COVID. Of course, the reservation was on lockdown and was not receiving services." (During COVID Provider)

Some of the providers who had either worked on the reservation prior to COVID or worked in nearby towns commented on not being able to enter the reservation during the lock down, and not knowing what the conditions were like during that time.

"Well, you know, it was difficult for the last maybe two years because of COVID. So we were not permitted to go on the reservation to provide services. So hopefully there are getting some type of direct services and education on the reservation until we're permitted to enter the reservation and provide services." (During COVID Provider)

"…We didn't go out in 2021 and I can't remember in 2020, because I think that's when things were really high on the radar where we were not going and providing direct services, not even in the [city outside the] area. I mean, I know at that point in time, even dental offices were closed until we implemented some different protocols. But I've always trusted the dental profession, so and I'm not sure if that's why people weren't coming to the dentist, especially from the reservation, because of not knowing. It's kind of like the unknown. " (During COVID Provider)

"…I don't know what's been happening in these last two years, but hopefully, you know, we'll be back out on the reservation so that we can make a difference. " (During COVID Provider)

Several providers mentioned the fear and risk of contracting COVID as mitigating factors for community members traveling outside of the reservation for routine care.

"I'm sure that was a barrier too, they, they pretty much were really scared because they had a lot of, a high incidence, a high level of COVID outbreaks on the reservation. So I'm

sure a lot of them stayed in place a lot longer than other people who weren't on the reservation just because of the fear. " (During COVID Provider)

"They had barriers even within their reservation. They had curfews where they had to be back at in in the confines of the reservation by sundown. So they had barriers put in place by their own people, their own whatever the rules are. So a lot of them didn't come and we're just now seeing them after two years of not coming" (During COVID Provider)

"[Preventive dental care] was put on hold during COVID because they weren't seeing any patients out there at all. They were seeing emergency patients only, and they didn't want to have any aerosol producing, producing procedures. And also, as you know, they're very high risk population as far as their susceptibility to contracting COVID, so they weren't welcoming any volunteers out at that time. " (During COVID Provider)

Providers either expected a decrease in oral health status, or confirmed that they were already seeing those results as patients were gradually starting to return for preventative care.

"Seeing them after they haven't had any kind of care for the last two and a half years, I imagine there's going to be a high prevalence of periodontal disease, high prevalence of tooth decay and, and a lot of buildup that's accumulated on their teeth since it's been so long. We had a lot of patients that we would see every three months, every four months. And because they haven't had that care, I'm a little bit concerned for that. But I'm also excited to get out there and be able to help them with that and be able to start re treating

them in that environment. So I don't know that it'll change a whole lot from before COVID, except for the PPE that we're wearing." (During COVID Provider)

"In my experience working with the children, when I was working at the pediatric office, when they finally opened it up and patients were coming from the reservation, to be honest, I don't know if they brushed in two years. It was not a pretty sight in there. The tissues were so inflamed. There was so much buildup… I think with the pandemic, people just kind of put those priority things on a lower priority. " (During COVID Provider)

When asked about the oral condition of young children before and after COVID, one provider inferred that the problem was already so bad to begin with that it is hard to tell a difference afterward.

"*I couldn't make that big of a difference just thinking the overall their oral health care or dental disease prevalence, the amount of cavities they might have had I feel like was obvious. And so to make that difference between five or eight cavities…I wouldn't be able to differentiate if it was worse. "* (During COVID Provider)

When asked what providers thought could be done differently in the future to mitigate the possible effects of another pandemic, two providers mentioned solutions involving restructuring of clinics to reduce aerosol transmission and preparing oral health kits to distribute in the event that the clinic closed again.

"Gosh, I mean, this pandemic was so different than anything we've ever experienced. So it's hard to say what we might do differently next time. I mean, we were so scared of the slightest possibility of an aerosol that could, could transfer COVID. So oral health care is a very difficult thing to speak to as far as it goes because it was a high risk environment to be in. You can't have your patient wear a mask when you're working on them, so. Yeah. So, I don't know. I mean, I wish I could imagine something that that would help. But maybe just handing out oral health kits or something like that may have helped people in the emergency room or something to that effect. " (During COVID Provider)

"I would say that the issue of improved care is going to be a gradual one. It will require reinvestment in the redesign of clinics so that in the future, pandemics can be addressed without shutting down. We had to during this last one again all of our pretty much all IHS Dental facilities that have been around for years have all had open, open bays. And those are contradictory to any type of pandemic with regard to inner respiratory virus. So when we remake our clinics, we're going to go back into a I'm sure a closed room, you know, type of facility. So the facility design led to, you know, major problems in dentistry." (During COVID Provider)

I Don't Know

Interestingly, 14 times during the interviews 100% of providers answered "I don't know" in the context of why these problems have persisted and what should be done about them. Although all of the themes presented here emerged as possible explanations and solutions, the more seasoned

providers were the most apt to share their disappointment at not making a bigger difference in the long-term prevalence of the disease despite their passion for serving the community. There was a common thread of needing to do something entirely different to elicit impactful results in the future.

> *"I went to a conference about probably a year and a half ago…They are trying to have a new structure. They got some budgeting that allowed for these monies. And so they were trying to think about what they were going to do with the money and one of the things that they talked about was ECC. I would say some of the dentist leaders extraordinaire, they've been around for 20 years at least, maybe 30 even. They didn't really seem to have new solutions. I mean because they're trying to research it. I mean ECC has been, from my last five years, has been pretty much emphasized every year and I didn't know but prior to that as well…I mean if you look at it, IHS has thrown a lot of money at it through the clinic and other programs, yet we're still at the same spot as where we were historically."* (Pre-COVID Provider)

> *"But the frustrating part of what I see over the years is that we're not making a dent in the problem. And so, you have to ask yourself, "What are we doing that's not working?" And so, just recently we've been trying to answer those questions and maybe approach the situation a little bit differently and just as you understand the problem and you're going out trying to educate the population in question, we feel that the educational aspect of it is where we're probably not doing it. And if we can't prevent the problem, there is no way that we can restore and fix, if you will, the problem. So we've turned our focus now,*

[here], to trying to get to the patient before the first tooth comes in the mouth. " (Pre-COVID Provider)

"Because the ECC studies have all shown that in spite of all the things that we've done, it's still...70% of the kids, before two, have a problem. Or at two, at least 70% have carries. It's just not acceptable and it's not changing. It's not going down, it's not. Even with all the sealants and things that we've done, you'd expect that eventually, you're gonna get those teeth sealed, you know? With all the kids getting sealants every year, you'd expect, eventually, to have adults that don't have problems…Because fixing things is not the strategy that I want to adopt. It's so much easier to prevent it. It's so much less costly to prevent these issues." (Pre-COVID Provider)

"Well, historically, as you might already know, IHS is focused on early childhood caries. And this goes back to you know, this goes back 30 years. And we were always, always trying to make a difference in the carries rate. And for 20 years at least, that there was no progress, there was just no progress being made. And I would say in the last ten years, there has been some improvement, I've got to say, based on the participation of studies that we were involved in. And it seemed like every year we had to look at the 0 to 3, the 3 to 6, you know, the 6 to 18 group. I mean, those types of programs are always ongoing and we're always trying to conceive of ways that we can get to, to those groups. But again, early childhood carries has been a focus forever, and it just never seemed to take, to get to the point where we could say, wow, we've really made a difference." (During COVID Provider)

There was an air of frustration and heartbreak for many of the providers who had spent years of their personal and professional lives working in these communities to make a difference, but felt thwarted in their efforts.

> *"The early, early childhood carries, it's a problem that has been with us forever. And my experience after 14 years of dealing with it is that it will always be with us. And that's, and that's sad. Everybody's looked at ways to try to, to reduce this this incidence. But it's been a long uphill battle."* (During COVID Provider)

> *"It was really hard for me to leave [there] because I did love that community and I know there was so much work to be done…[I am] retired and close to 70 years old. It's time for somebody else. I, I did the best I could. Gave my whole heart. So I'm ready to say, you know, it's time for somebody else to make a difference. I always wanted to make a difference, so I hope I did that after the pandemic."* (During COVID Provider)

Discussion

ECC has been a persistent health issue for AI communities and has only worsened with COVID-19. The aim of this research was to understand and assess providers' perceptions of the differences in access to and quality of dental care for young AI children before and during COVID-19 for a southwest tribe. The most common themes that emerged during both sets of interviews were limitations in oral health education, limitations in dental services/quality of care, structural factors, social/community factors, prioritizing oral health, and prenatal care. Individual

solutions suggested by providers included different forms of education, school and community programs to promote oral health education and screenings, access to prenatal care that includes comprehensive dental care, and programs such as WIC to help care for pregnant mothers and prepare them to care for the oral health of their babies. Other recommendations addressed transportation issues through funding traveling dental busses with portable equipment to bring dental care into the communities, providing on-call transportation, and flexible appointment times.

Although mandatary barriers to care erupted with the explosion of COVID cases in the form of community lockdowns and closure of the IHS dental facility to emergent care only, what was most remarkable was that these barriers were not centralized by providers in their discussion of lack of access affecting ECC. Though sudden and strict, COVID constraints were presented by providers more as temporal obstructions…speed bumps in the already rocky terrain of care utilization. As one provider pointed out, when the problem is already as severe as it is in this community, determining the effects of COVID—from 5 cavities to 8—is difficult, if not impossible. As detrimental as they have been, the effects of the global pandemic on ECC in the AI community were, and are, appearing more surmountable than the root cause.

While COVID has certainly contributed to making a serious situation worse, those barriers have slowly been removed with the re-opening of clinics and lifting of lockdown mandates. Providers expressed that the sheer latitude of the ECC problem far predated COVID and will long outlast it. Conditions may return to status quo, but in AI communities suffering from high prevalence of ECC, it is a return to status woe. While providers identified individual elements that could be

improved upon, there was no single factor that arose above the rest as the source or solution to the problem. Just as there are a myriad of contributing factors at work on the individual, community, and systemic levels, there remains a need for a multifaceted, multi-level solution to nullify them.

Though providers did not use the terms 'social determinants of health' or 'systemic change' they alluded to them in their references to poverty, lack of transportation, prenatal care, and access to nutritious food. They outlined the need for policy change in their recall of years filled with various programming that may have helped individual people, but did not ultimately affect the bottom line. Their expression of dissonance with caring so deeply for the community but not being able to fully incite lasting change was palpable. As providers who are trained in diagnosing and treating the individual patient, perhaps it is expected that specific systems level thinking is beyond our scope of reflexive thought. We look for signs and symptoms but cannot always identify the underlying cause. However, in the absence of a single obvious truth, another emerged. The common thread was that there was no common thread. All of these different initiatives operating as single serve movements, one-off grant provisions, and efforts that only last as long as the individuals who started them are never going to do more than damage control if the problems cannot be resolved at a higher level. There is something lacking at the systems level to contain the various spokes and sustain their forward movement. Legislation, policies, and funding must be revised to include oral care. Examples of possible steps to integrate a more preventive, oral health focused system that provides care equitably would be the expansion of Medicare to include dental coverage, having affordable marketplace dental insurance that is integrated with medical insurance, reimbursing providers for care at a fair wage compensation

level, and providing public oral health programs that include screenings, education, and prevention measures for all. These are no small tasks, and the issue requires further research, interdisciplinary fusion of minds, and different perspectives that can fill in the pieces of the puzzle and add clarity to the bigger picture. Strategic planning of government and IHS funds and care models is imperative. Changes may be necessary at every level, but they must be facilitated in a collective, organized, sustainable way, starting from the top down in the form of policy and structural provisions for care.

Strengths and Limitations

Strengths of the study include access to a variety of dental providers who have served the target community for many years. The use of qualitative data is a strength in that the public health assessments of these communities do not often include in-depth interviews with the providers who care for them. This is an important element in assessing individual needs of the community and identifying possible avenues to reduce ECC. The tight-knit nature of the dental community in the area was a strength in that the PI was able to utilize pre-existing relationships and professional networking to gain access to the providers who treat this population. However, the small size of the community was also a limitation, because the number of providers working directly with the target audience constituted a small pool from which to draw participants. In addition to the small sample size, other limitations of this study included the unique characteristics of the community that limit generalizability of study results.

Conclusions

The reduction in access to care resulting from COVID closures and restrictions had a negative impact on the already disproportionately high prevalence of ECC in this southwest AI community. Seasoned dental providers who have served the community offered insights into the history of ECC and various interventions that have aimed at reducing it. While COVID made things worse, the problem has persisted at such high levels for so long, that the difference was less polar than might be observed in more affluent communities. Themes surrounding possible solutions were multifaceted and accompanied by providers acknowledging that they did not know how to ultimately and significantly affect the prevalence of ECC in this community. Responses point to the need for further research and strategic change that comes from the top down and is integrated into government and IHS policy and funding.

CHAPTER 4: Perceived Barriers to Oral Healthcare for Young American Indian Children and the Strategies Dental Professionals Recommend to Overcome Them

Introduction

Early childhood caries (ECC), or the presence of one or more decayed, missing, or filled teeth (dmft) in children age 5 or younger, is the most chronic childhood disease though it is largely preventable.[1] ECC disproportionately affects children from diverse ethnic backgrounds and those with low socioeconomic standing (SES),[2,3] and is most prevalent among American Indian and Alaska Native (AI/AN) children who suffer 4 times the disease rate with nearly 60% experiencing decay by the age of 3, and over 75% by the age of 5.[2–5]

The effects of untreated ECC are far reaching and can negatively impact children, their families, and the healthcare system. ECC can cause pain, damage to the permanent teeth, infection of the head and neck, difficulty chewing,[6,7] and can interfere with intellectual and social development, cause poor speech articulation, embarrassment, low self-esteem, missed days at school, and social isolation.[2–4,6,8,9] Treating severe ECC is costly, particularly when hospitalization and general anesthesia are required.[10] Surgical or Emergency Department (ED) treatment for a single child can cost $10,000-$25,000 depending on the severity of disease[61] and about 6% of AI/AN children (approximately 8,500) between ages 1-5 experience extreme pain or a serious infection requiring urgent dental care.[3] Additionally, every year approximately 34 million hours of school are missed and over $45 billion dollars are lost in production from missed work due to dental disease.[61]. The impacts of ECC on AI/AN communities have worsened with the effects of COVID-19, creating additional barriers and factors affecting oral health.

The aim of this study was to determine perceived barriers to oral healthcare for young AI children in a southwest tribe and the strategies dental professionals recommend to overcome them. This aim was achieved by analyzing data from oral health care provider interviews during COVID-19 that address two specific questions: 1. How do the dental professionals' perceived barriers and ideas of improving oral health care for young AI children align with the current literature? 2. Has COVID-19 changed or influenced the recommendations for improved oral healthcare for AI/AN children? If so, in what ways?

Methods

This study utilized a qualitative approach to gain a deeper understanding of the unique perspectives of dental professionals who treat the target population in the context of barriers to care and solutions to overcome them. Qualitative data is an essential component of data collection because it elicits specific feedback about individual experiences or perceptions that may not be represented in quantitative survey data.[120] The qualitative approach taken for this study facilitated assessment of dental providers' experiences and viewpoints in working with a southwest American Indian Tribe.

A Grounded Theory constructivist approach was utilized to glean information from individual experience and to interpret it through the creation of common themes that emerged from interviews with providers. This approach was selected because the Aims of the study seek to build theoretical ideas from qualitative data.[114] A social determinants of health framework[113] was used to code interviews to better understand the social context for access to and quality of oral health for the target population.

To determine perceived barriers to oral healthcare for young AI children and the strategies dental professionals recommend to overcome them, semi-structured interviews were conducted with oral health care providers to identify barriers to and facilitators of oral health care utilization and service availability before and during COVID-19. Local dental providers were recruited through professional connections and suggestions from community partners using both purposeful and snowball sampling techniques. Inclusion criteria for the oral health care providers included: (a) employed in an agency that serves pregnant women at the study site; and (b) work in a capacity that includes interaction with pregnant women, mothers, and/or young children as a dentist, dental hygienist, or dental assistant. Exclusion criteria for dental care providers were limited to lack of willingness to participate in a qualitative interview. The study sample (n = 7) included four dental hygienists and three dentists. All participants were required to sign a written Informed Consent document in Jefferson Redcap to agree to participate in the group and to be audio recorded. Participants were given an orientation to the project including study risks and benefits and compensation information. After informed consent was obtained, providers were scheduled for interviews. Semi-structured interviews were completed via the online platform Zoom[118], and the audio recordings were transcribed using a web based service, Trint.com. Transcripts were deidentified, using the subject IDs only and saved to a secure, password protected server. All participants were sent a 'thank you' email and a $25 gift card for their participation.

Interview questions assessed providers' work history with the population; descriptions of the oral health status of the target population; contributing factors for those conditions; steps taken to

address ECC in the target population and effectiveness of those efforts; barriers to oral care in the community; interactions with parents/caregivers regarding how to care for their children's teeth/oral health; the effects of COVID-19 on access and utilization of care; factors that might have facilitated positive oral health during COVID-19; and areas for suggestions/improvement. These data were coded and analyzed to identify common themes. A review of current literature was performed to identify current recommendations and best practices to address ECC in high risk communities, particularly Indigenous populations. Suggestions from providers were compared and contrasted to those identified in current literature.

Current literature on strategies for prevention and reduction of ECC in AI/AN and other minority, disadvantaged, or Indigenous populations were reviewed to determine recommendations for change. Searches were performed using PubMed (Medline), Scopus, Cochrane Library, Wiley Online Library, Northern Arizona University Cline Library, and Google Scholar electronic databases for peer-reviewed articles written in English, published from 2014 to present. Keyword searches included the terms: ECC, early childhood caries, dental caries, dental decay, American Indian/Alaska Native, Native American, Indigenous, vulnerable populations, minority, deciduous teeth, child, public oral health, disparity, intervention, Medicaid, WIC, mobile units, teledentistry, school programs, sealants, fluoride, silver diamine fluoride. Criteria for inclusion were as follows: literature published in 2014 and later, English language, systematic reviews, meta-analysis, clinical and controlled trials, peer reviewed, randomized controlled trials, position papers, reports, op eds, and full text available. Papers were included from other countries when the target audience included minority, vulnerable, or Indigenous communities and the findings were relevant to this study. Exclusion criteria

eliminated literature published before 2014, not peer reviewed, did not address focus of this review, language other than English, and no full text available. Some duplicates or overlap of sources are accounted for in included systemic reviews on the specific topic or intervention. Several themes emerged regarding the types of interventions, and/or approaches used that were central to study outcomes and were coded for common themes.

This study was conducted according to the guidelines of the Declaration of Helsinki and all researchers were certified by the Collaborative Institutional Training Initiative (CITI Program) through Northern Arizona University. The Northern Arizona University Institutional Review Board approved the study for the COVID-19 provider interviews on June 5th, 2022 (IRB #1920796-6).

Analysis

Interview data with providers were coded and analyzed for common themes using NVivo qualitative data analysis software 12[119] on a secure server. All interviews were audio recorded and transcribed using the web-based platform Trint.com. Interview transcripts were analyzed using an inductive, open coding approach guided by a Grounded Theory framework[114], to detect recurring themes and summarize the main ideas expressed by participants.

An iterative process of interviewing and thematic coding was used to guide the analysis. Two members of the research team (CK and SB) initially used the final codebook developed in the Healthy Native Smiles analysis and added thematic codes pertaining to COVID-19 as they emerged. The two members met frequently and established working definitions of each code

before coding the remaining data. This method was used to increase interrater reliability while still allowing for the incorporation of emergent themes. Interrater reliability tests were performed for internal validity. The transcripts were then coded with the NVivo qualitative data analysis software 12[119] on a secured server using an applied thematic analysis technique.

The following questions were asked in the analysis of data: 1.What are the providers' professional roles and work histories with the population? 2. How would providers describe the status of oral health in young children and pregnant women and/or mothers/caregivers in the target population? 3. What do providers identify as contributing factors to that status? 4. What steps have been taken to address ECC in the community and how have they been effective or could be improved? 5. What resources would be needed to do this? 6. Have those efforts changed since the beginning of COVID-19? 7. What do providers see as the major barriers to accessing oral health care for children at the individual, provider, community, and clinic levels? 8. How many patients did providers see each week during 2021-22 and what were the reasons for the visits? 9. What do providers see as the major social and structural issues caregivers face which can prevent positive oral health in children? 10. What do providers anticipate oral health will look like in this population post-pandemic? 11. What factors within the community might have facilitated positive oral health during the COVID-19 pandemic? 12. Are there any programs that providers think could help improve oral health during a pandemic and what would they look like?

The review of current literature and the analysis of the COVID-19 interviews (described above), were used to answer the following questions; 1. How do the dental professionals' perceived

barriers and ideas of improving oral health care for young AI children align with the current literature? 2. Has COVID 19 changed or influenced the recommendations for improved oral healthcare for AI/AN children? If so, in what ways?

Results

Providers' Perceived Barriers to Care

Common barriers to care cited by providers were coded by recurring themes and included limitations in oral health education; limitations in dental services/quality of care; structural factors; social/community factors; follow-up to care; prioritizing oral health; limitations in prenatal healthcare, and additional factors related to COVID-19. The COVID-19 factors received the highest number of references (45) followed by limitations in dental services/quality of care (30), limitations in oral health education (29), structural factors (20), prioritizing oral health (14), social/community factors (12), and limitations in prenatal care (6). Specifically, providers commented on limitations in parent/caregiver oral health knowledge, community education and outreach, and barriers to education caused by cultural and/or communication gaps. Examples of these included parents/caregivers not understanding the importance of baby teeth and how they should be cared for, and not having sustainable community education programs, particularly for pregnant women or parents of very young children. Providers commented on the difficulty in getting specialty providers to their remote IHS clinic and/or keeping them for more than a short period of time and how this negatively impacted the oral health of the community, particularly the children because there had been no pediatric dentist for some time. Other limitations included lack of technology or specialized equipment, such as those necessary to treat children requiring general anesthesia for treatment. Because of the lack of specialty care and geographic isolation

of the Tribe, patients often had to be referred outside of the IHS system to towns and cities several hours away, wherein parents/caregivers may not be able to follow through with referrals, or providers might never hear back from them. Also innate to their isolation was the issue of transportation, which was pervasive in conversation and worsened by additional risk factors such as poverty, not owning vehicles or having to depend on outside sources for rides, not having the time to take off work to travel long distances for care, or not being able to pay for gas. Other systemic limitations included the lack of nutritious foods or community water fluoridation, patients not being able to navigate the system or not knowing how to address the issue on a higher level, and difficulties with AHCCCS/Medicaid reimbursement.

Because prevention of ECC is key, the lack of prenatal care at the IHS facility mitigated interactions with pregnant women and their supports. Providers noted that many pregnant women were unaware that their own oral health could affect the health of their baby, that baby teeth are important, and infants should start oral care as soon as the first tooth erupts, or that dental care is safe—and recommended—during pregnancy.

> *"…It all begins with prevention, education, right? If they have the education. But we don't know what the [Tribe's] prenatal population is receiving when they're pregnant. You know, what information are they given by their OBGYN doctor? Are they continuing to seek services at the clinic? Because I'm not sure what the counselors are sharing with them as far as oral health."* (Dental Provider)

Though ECC has been a problem in AI/AN communities for decades, new and harsher barriers to care were introduced with the global COVID-19 pandemic. The IHS facility closed for roughly two years to any routine or preventive dental care and was reduced to emergent care only. There were also times when the Tribe was on lockdown with mandated curfews, which restricted members from seeking care in neighboring municipalities due to the time necessary to time it would take to travel there.

> *"Well, historically, as you might already know, IHS is focused on early childhood caries. And this goes back to you know, this goes back 30 years. And we were always, always trying to make a difference in the carries rate. And for 20 years at least, that there was no progress, there was just no progress being made. And I would say in the last ten years, there has been some improvement, I've got to say, based on the participation of studies that we were involved in. And it seemed like every year we had to look at the 0 to 3, the 3 to 6, you know, the 6 to 18 group. I mean, those types of programs are always ongoing and we're always trying to conceive of ways that we can get to those groups. But again, early childhood caries has been a focus forever, and it just never seemed to take, to get to the point where we could say, wow, we've really made a difference. And that was during the times when, you know, our clinic was wide open and, you know, we were going great, great guns as far as patient volume was concerned. And of course, all of that stopped in dentistry once we realized that [COVID-19] was an airborne type of pandemic…One of the biggest problems we had in dentistry was, you create aerosols every time the mouth is open, and you do a dental procedure. I mean, you squirt water and somebody's mouth, and it creates an aerosol, let alone use a high speed hand piece on someone. So plus,*

coupled with the fact that we only had three isolation rooms out of 14, so we were really hand cuffed when it came to providing the type of dentistry that we were used to doing. The pandemic created havoc with regard to that." (Dental Provider)

"…Pre-pandemic, I felt like we were making a dent in the population. We had great programs going in schools. We had a pediatric dentist that was getting a good handle on kids, I would say newborn through before junior high. Our concentration was all the way through the school system, but we had a hygienist that would go out and treat all the kids with sealants and X-rays all the way through from kindergarten and do as much as she could through high school, through junior high… When the pandemic happened, all of that stopped and we couldn't go out and do presentations. There was no school to go into anymore. Everything stopped. And so we wondered what's going to happen to the kids? And we knew what was going to happen. I anticipated. And yeah, we only saw kids when it was emergency." (Dental Provider)

Perceived Barriers to Care in the Literature

The thematic barriers to care that surfaced in the interviews with local dental providers echoed much of those found in current literature, particularly for AI/AN communities. Barriers to care include numerous individual, biological/behavioral, family, organizational/community, and health system/policy-level factors.[9,12] Among these, the effects of SDOH, racism, government policies, geographic isolation, living in a Dental Health Professional Shortage Areas, prohibitive costs associated with dental care, low oral health literacy, and fear and anxiety associated with treatment are implicated.[9,36,71,121,122] Tiwari et al. (2018) describe the disproportionate burden of

oral disease experienced by Indigenous populations as, "likely due to a complex web of social determinants that includes poverty, historical consequences of colonialism, social exclusion, government policies of assimilation, cultural annihilation, and racism in all its forms (societal, institutional)." Additionally, the literature discusses challenges with the implementation and maintenance of various oral health programs that do not have sustainable funding or political support.[2,123,124] Working with remote communities also requires abundant time and resources, posing challenges in the planning, development, and implementation of interventions.[71,121] Lack of education and social or community programs such as school sealant programs or community water fluoridation were also included as barriers to care and fell in line with provider's perspectives.[9,35,125–127]

ECC Prevention and Oral Health Promotion-Provider Recommendations

Provider suggestions for improving the oral health of children in this southwest AI community included different forms of education; school and community programs to promote oral health education and screenings that incorporate a verbal consent process; fluoride, sealants, and SDF programs; access to prenatal care that includes comprehensive dental care; incorporating specialty care; the need to reduce turnover; and programs such as WIC to help care for pregnant mothers and prepare them to care for the oral health of their babies. Other recommendations addressed transportation issues through funding traveling dental busses with portable equipment to bring dental care into the villages, providing on-call transportation, improved scheduling, and flexible appointment times. Common themes and the number of times they were referenced in context are shown in Table 4.

Table 4. Common themes in provider suggestions to improve oral care

Theme	**# of References**	***n* (%)**

Oral Health Education	**24**	**7 (100%)**
Individual Education (Parents, Caregivers, Children)	10	5 (71%)
Community Education and Outreach	8	5 (71%)
Nutritional Education	5	3 (43%)
Entertainment Education	2	2 (29%)
Fluoride/SDF/Sealants	**12**	**5 (71%)**
Improved Communications & IPC	**8**	**5 (71%)**
Community/School Programs	**7**	**3 (43%)**
Specialty Care: pediatric dentist/ hygienist/ prenatal	**7**	**2 (29%)**
Transportation	**4**	**2 (29%)**

Note. IPC, Interprofessional Collaboration; SDF, Silver Diamine Fluoride

Education

The majority of suggestions for improved oral health education centered around individuals such as parents, caregivers, children, or pregnant women and were referenced ten times by 5 providers (71%).

> *"I know that there have been a lot of programs and a lot of things tried. I think there's been a lot of education that's been attempted, but I'm not sure how to reach everybody, how to reach the parents, to educate them, because that's really where it begins. The children obviously don't know any better. And if you can somehow get through to the parents, the importance of the preventing the early, early childhood carries and the good oral hygiene habits early on."* (Dental Provider)

The need for community education programs was mentioned 8 times by 5 providers (71%) and included programs to reach pregnant women, health fairs, and a complete integrated care center that could host educational events and handout needed homecare items such as toothbrushes and toothpaste.

"Well, I'm just a huge believer in education. And so, I mean, if there was any way that we could reach people, even with having like a booth or something outside the clinic where people would come in for other things, you know, because most of the facilities also have dialysis and emergency room services and pharmacy and other things. So a lot of patients come through there if there's any way that we could hand out toothbrushes and try to reach them that way and make sure that they have their, the oral health aids that they need at home, that might be the first step in trying to prevent that." (Dental Provider)

Nutrition education was referenced 5 times by 3 providers (43%) as highly important, particularly for older children and adults.

"I think something that would be effective is actually showing them how much sugar is in those substances and how it's affecting their children's teeth. Maybe showing them images of it just really hit home how drastic it can be. And I think that there's a misconception that because they're baby teeth, it doesn't matter. But it can definitely affect the adult teeth and the eruption patterns of the adult teeth if they lose their baby teeth prematurely. So I think that the resources that could be needed, maybe more pamphlets and visual, visual aids and things like that, that maybe might hit home a little bit more." (Dental Provider)

> *"[a program that could work would be to have] oral health promotion personnel in the dental community, medical community get in a group that gathers in a facility like an empty gymnasium. And, and if they can bring those nutritional things and give the education on brush your teeth in the morning, brush in the evening to help prevent trouble in your mouth, just to emphasize the need to continue regular maintenance by brushing your teeth with toothpaste in the morning, in the evening, and then eating quality foods. Slipping away from the sugars, carbonated beverages, a lot of processed foods, a lot of sugary foods, candies. You know, just that little extra guidance of daily, daily oral maintenance of brushing in the morning, in the evening. Just the parents may not have that focus, their determination that they're guiding their children on those pieces."* (Dental Provider)

Entertainment Education, or the use of entertainment, visuals, and hands-on activities to deliver specific health messages was cited by three providers (43%) as a strategy for improving oral health knowledge and reducing risk factors for ECC. Using videos and online meeting platforms such as Zoom were also mentioned as workarounds during COVID-19 closures.

> *"The effective part is the education with the children. We have a provider educating the group of kids, presenting images and, like, amounts of sugar that are in certain beverages and having an interaction where they get an image that they can Velcro onto a board that's a positive or a negative on the oral health. So that's a really good part of that education piece for the kids."* (Dental Provider)

"We would make short videos. So I would dress as a tooth fairy, have my puppet and go over some oral health tips, read books, do a puzzle, do a game. So that way I could send that to the teachers and then they could share that with their students and their families at home." (Dental Provider)

Fluoride/SDF/Sealant Programs

The use of fluoride, both topically and community water fluoridation, Silver Diamine Fluoride (SDF), and sealants were mentioned 12 times by five providers (71%) as important elements of ECC prevention. These references were often in combination with school or outreach programs.

"Evaluating the oral cavities is wonderful and being able to apply that fluoride varnish. We know that statistically it has a benefit for those kids." (Dental Provider)

"So I think children will come away from the reservation to attend school or get a bus ride. And so we do go out to the school systems, I think twice a year, and we try to get all the elementary kids and have them come to our classroom, educate them. And if their parent has signed a permission slip, we evaluate their oral health and apply for Fluoride varnish to their teeth." (Dental Provider)

The use of SDF was suggested not only as a public health treatment to address and prevent ECC, but also an alternative to other aerosol-producing procedures such as composite or amalgam restorations.

"And so pre-COVID, we would screen, we would educate, we would apply fluoride varnish during COVID. Of course, the reservation was on lockdown and was not receiving services. But I also work private practice and I work private practice in a pediatric dental office, and we would provide what we called SDF, it's silver diamond fluoride. And so instead of drilling and filling because of the aerosols, we ended up using more of the SDF. So when I would go out, back out into the schools and scream, I could tell that many of the children were receiving the SDF, which is a great preventable measure, so that we couldn't actually have to put the child under general anesthesia or local anesthesia and not basically have to drill and fill." (Dental Provider)

Improved Communications & IPC

Providers identified several barriers to communication such as patients not having electricity or phones or internet to communicate; not having integrated medical-dental care; inefficient patient communication systems; and other barriers such as cultural and language barriers for native speakers. Solutions to these were offered in 8 references by 5 providers (71%), and included suggestions for integrating medical and dental care/communication about patients, needing cultural competence training, and/or cultural adaptation of information.

"I was part of the customer service team there at [the IHS facility] for a while and a lot of different communities I was on the struggle with all that is people don't have electricity in some of the community or have Internet. They don't have computers, they don't have cell phones that we're calling limited time. So it is constant struggle…and constant struggle with something like that." (Dental Provider)

"We were trying to compliment the medical team, but there was so much turnover with the medical team, they didn't necessarily communicate that with this because the turnover is so high, so just better communication with professionals as well. All the programs and great programs, but nobody's talking to each other, so we don't even know what's going on. They hit their feet running when they had [this community] because there's so much care that needs to be delivered…I knew somebody there that said something about 'I didn't even know we saw kids here." (Dental Provider)

"I think maybe understanding the culture better and then also being able to teach them about [children's oral health], the parents." (Dental Provider)

Community/School Programs

Community and school programs were mentioned 7 times by 3 providers (43%) as possibilities to reduce ECC in this AI community. The recommendations for school programs for screenings overlapped with those for sealant/fluoride application.

"So a lot of the programs that I've seen that help are like our kids who are enrolled in like daycare or first things first or things like that that want them to come in and get screenings. Encouraging, like, the fluoride is definitely helpful because even if they come in just for a screening, it's good, then more able to talk to them and hopefully give them some good tips on keeping their teeth healthy…So any of those programs where they're

going into daycares or things like that and putting on fluoride and recommending they come in and see us, things like that, it's been helpful." (Dental Provider)

"I really, I really like the programs that have, like the, the fluoride varnishes and the screenings. And I think those are helpful because then if there is a problem, it's caught. And then they're coming in to our clinic and if there's not them, at least they're getting the fluoride and a little bit of education." (Dental Provider)

"And we are constantly reinventing ourselves. How do we how do we how do we make a difference? Well, you know, it keeps going to that same thing. We go to them, we go to them at the schools. We go to them and health fairs, we go to them to their villages. And it's, it's nice because they have community centers that reach the villages. So some of that mailing or that distribution can get disseminated with all of them and the word can get spread that way. So there's a communication network that's already in place that can happen, a lot of it to school." (Dental Provider)

Specialty Care

The need for specialty care was stressed, especially for children and pregnant mothers. Providers mentioned needing a dental hygienist, pediatric dentist, oral surgeon, periodontist, and OBGYN/prenatal specialist at the IHS facility.

"Well, one of my biggest pet peeves, you know, in my tenure there was not having specialty care. And in dentistry, you know, gosh, you need you need orthodontics, you

need periodontics, you need pedodontists, you need oral surgery. All of these are, are common issues with regard to the patients that we see. And so because of our location, general dentists were asked to do a lot of specialty care, which is a problem." (Dental Provider)

"They had a midwife, they had all of that. And I think when, when a facility takes care of mom, when she first comes in her first trimester all the way through, there's an ownership of that facility that they feel like, wow, they're going to take care of me. This is my home and this is who I want to take care of me. This is how I want my baby to, you know, be taken care of because they took such good care of me. And when there's that kind of ownership with that kind of care, they can continue on, for their babies to want to come here and their children to want to come here. That was all broken. [This healthcare center] will not get a OB/GY/U wing open again. That's closing for good there. They're redirecting that whole room to other facilities and it really breaks my heart." (Dental Provider)

"I've wanted a full time Hygienist. I was able to experience that a couple of times there at Hopi in 14 years, but it was never long term." (Dental Provider).

Transportation

Transportation was cited as a major barrier to care in this AI community. Suggestions to combat these issues included daily medical/dental transportation across the reservation, funding of

traveling dental vans to bring care out into the communities, and providing on-call transportation.

> *"I can see, like, that Van going to the villages. Getting notices out for people to know we're going to do screenings today, something like that, that we go to them. That is just not a school program, it is all year round program for everybody in the community and not just the kids benefit, but all ages benefit from it and that we go to them."* (Dental Provider)

ECC Prevention and Oral Health Promotion-Current Recommendations from the Literature

AI/AN populations suffer from numerous social and systemic health inequities, including various barriers to care such as lack of knowledge or access to education about prevention and oral health, language obstacles, living in dental professional shortage areas, limited IHS facility hours, lack of fluoride exposure, geographic isolation, and lack of transportation or inability to take off work.[6,33]

Current literature on the prevention and treatment of ECC in AI/AN and other minority or disadvantaged populations was reviewed for evidence of effectiveness and recommendations for future interventions, policies, and other strategies. Several themes emerged including government and state policies and programs that support access to care for all and create a framework for provider support and reimbursement;[9,11,35,36,42,121] individual and community oral health educational programs;[9,34,46,60,125,126,128] integrating ECC prevention into primary and prenatal/maternal healthcare;[42,129,130] population based fluoride programs;[9,121,126,131] use of

sealants, atraumatic restorative treatment (ART) and SDF;[34,128,132–134] community-based participatory research (CBPR) and other culturally adapted approaches that incorporate the community in the research, planning, and implementation processes;[34,43,56,61,71,135,136] interventions utilizing motivational interviewing (MI);[68,72,137] culturally and contextually adapted interventions;[71,86,93,128] expanding the scope of existing dental healthcare workers and increasing the use of mid-level providers;[36,60,121,138] using teledentistry;[11,36] addressing the social determinants of health (SDOH) and other shared risk factors with other chronic, non-communicable diseases;[9,15,29,43,71,122] and creating health research partnerships with high-risk communities.[35,43,71,138]

Major sources of information included recent detailed reports from the World Health Organization (WHO), Global Oral Health Status Report—Towards universal health coverage for oral health by 2030 (2022), the US Surgeon General's 2020 report, The National Institutes of Health (NIH) 2021 report, Oral Health in America: Advances and Challenges, The World Dental Federation (FDI) report, The Challenge of Oral Diseases: A Call for Global Action (2015), the Journal of the American Dental Association (JADA), as well as a number of Cochrane reviews and other articles. The NIH 2021 report includes several calls to action involving policy change to reduce or eliminate systemic inequities that affect oral health, the integration of dental and medical care in schools, community health centers, nursing homes, and dental/medical settings; and to diversify the dental professional workforce.[35] In the Journal of the American Dental Association (JADA), Fellows et. al. (2022) interpreted the updated Surgeon General's report and provided implications for dental practice, stressing the importance of coordinated policies and

resources to support improved access to care, affordable insurance programs, and integration of medical and dental care to reduce oral health disparities.

The WHO's updated implementation manual with recommendations on ending childhood dental caries (2019) includes the above practices and integrating ECC prevention and control interventions into primary care, community, and maternal health programs; creating supportive environments for families; implementing population-based fluoride programs; use of sealants; health education and community engagement; and building framework for the integration of oral health promotion and ECC prevention into health initiatives and policies.[14] The WHO Global Status Report (2022) calls for a shift in oral health policy away from isolated restorative dentistry models towards prevention and oral health promotion, and focused efforts to reduce disparities caused by social determinants of health.[9] Other strategies stressed by the FDI to reduce oral health disparities include increase advocacy efforts and the utilization of new technologies.[11]

In one survey of ECC programs, the authors discussed the myriad of individual endeavors to reduce ECC in targeted populations and noted the financial insecurity of such programs as they are dependent on philanthropy, grants, and other short-term funding.[124] They also suggest that the large number of independent studies could learn from one another's findings, which was incorporated into suggestions for future collaboration and systemic, sustainable support of efforts.

The Effects of COVID-19 on Recommendations for Improved Oral Care for AI/AN Children – Dental Providers

When asked about the lasting effects of COVID-19 on recommendations to reduce ECC in this southwest AI community, providers discussed the use of non-aerosol producing treatments such as SDF, utilizing Zoom and other online platforms for communication, and providing transportation services. When asked what providers thought could be done differently in the future to mitigate the possible oral health effects of another pandemic, two providers offered solutions involving restructuring of clinics to reduce aerosol transmission and preparing oral health kits to distribute in the event of another clinic closure.

> *"Gosh, I mean, this pandemic was so different than anything we've ever experienced. So it's hard to say what we might do differently next time. I mean, we were so scared of the slightest possibility of an aerosol that could, could transfer COVID. So oral health care is a very difficult thing to speak to as far as it goes because it was a high risk environment to be in. You can't have your patient wear a mask when you're working on them, so. Yeah. So, I don't know. I mean, I wish I could imagine something that that would help. But maybe just handing out ending out oral health kits or something like that may have helped people in the emergency room or something to that effect."* (Dental Provider)

> *"I would say that the issue of improved care is going to be a gradual one. It will require reinvestment in the redesign of clinics so that in the future, pandemics can be addressed without shutting down. We had to during this last one again all of our pretty much all*

> *IHS Dental facilities that have been around for years have all had open, open bays. And those are contradictory to any type of pandemic with regard to inner respiratory virus. So when we remake our clinics, we're going to go back into a I'm sure a closed room, you know, type of facility. So the facility design led to, you know, major problems in dentistry."* (Dental Provider)

The Effects of COVID-19 on Recommendations for Improved Oral Care for AI/AN Children – Current Literature

The oral health effects from dental closures due to COVID-19 were most potent in vulnerable communities, however, there were also some lessons learned and changes in dental delivery models that are likely to change or influence the future direction of care.[35,36] Limitations in aerosol-producing procedures and in-person visits led to an increase in the use of personal protective equipment (PPE), teledentistry, and alternative procedures such as SDF placement, all of which are likely to continue as mainstays in treatment. The pandemic also facilitated greater interprofessional collaboration and expanded scope of practice as many dental professionals utilized their licensure to work on the front lines in different ways, such as acute emergency care and administering COVID-10 vaccinations.[35] Many dental professionals and professional associations banned together to share free online resources and seminars to promote shared knowledge and interprofessional collaboration.[139]

The pandemic also brought to light the importance of oral and mental health, as many suffered from challenges with both as a result.[36,139] One of the positive elements that arose from this is the focus on dental professionals' own mental health and their role in identifying and referring

patients at risk.[36,139] The PPE shortages and systemic inability to properly function during the height of the COVID-19 has demonstrated the need for policy reform in order to prepare for care delivery synchronization, equipment demands and shortages, and interprofessional collaboration in the event of another pandemic.[36,139,140]

Discussion

The aim of this research was to identify strategies to address the persistent prevalence of ECC in a southwest AI community. Local dental providers were interviewed to understand individual perspectives on barriers to care and recommendations for improved oral health of young children, and how COVID-19 may have changed that. Because unique perspectives and qualitative data are an important part of the overall research to address this issue, providers answers were also compared and contrasted with current literature on the topic. Providers interviews were focused specifically on the target population, so their responses were more limited in scope and did not tend to include the topical latitude available in the literature at large.

Generally, providers responses were aligned with current literature when it came to identifying barriers to care for this population, but the topics most frequently mentioned by providers were more focused on individual, family, and community-level factors whereas the literature captured a broader view of top-down approaches to improving dental care delivery. One contrast expressed by a couple of providers, was the belief that this particular population did not suffer from access to dental care (aside from COVID-19 closures) but that a lack of transportation in getting there was the greatest culprit. An interesting follow-up question might be that if

transportation was not an issue and the entire Tribe were able to make it to all appointments, whether a lack of provider access would be seen.

Suggestions for improving the oral care and decreasing the prevalence of ECC followed a similar pattern between providers and the literature, many of the same topics were covered, but the focus was more central to the community in the providers' responses. The greatest number of responses made by providers were in relation to increased education, then fluoride/SDF/Sealant programs, improved IPC and integration of care, community/school programs, availability of specialty care, and transportation needs. In the literature, the greatest focus appeared to be on integration of medical/dental care/IPC and maternal health, followed by government policies and programs to support affordable dental care and provider reimbursements, fluoride/SDF/sealant programs, community-based approaches, mid-level providers and expanded scope of practice, health education, and addressing the upstream elements that contribute to SDOH and risk factors shared by other chronic diseases. In the top three from both sources were integrated care and fluoride/SDF/sealant programs, indicating that improvements in these areas could elicit positive results on local and national scales.

Contrasts between providers and current literature mostly surfaced in the form of omission, as providers were focused on the specific Tribe and did not make many references to greater structural issues. Providers did allude to issues of SDOH in their comments about the pervasive poverty and transportation barriers, and some specifically discussed needing policy change as it pertains to how existing IHS facilities function. The literature stressed the need for policy change at every level and reliable financial support so that successful interventions can be sustained.

There was also emphasis on addressing SDOH at large. Due to the paucity of literature specifically on AI/AN populations, much of the information was geared toward minority and disadvantaged populations or Indigenous populations in general; however, there was a shared agreement that culturally centered interventions are needed to address care in these communities. While providers focused on this particular Tribe, there were collective recommendations for increased use of CBPR, cultural competency, increased diversity in the workforce, and other individualized approaches such as specific cultural adaptation of information/interventions and the use of acceptable delivery methods such as MI or storytelling. The literature emphasized including target populations in the research, planning, and implementation of interventions, and increasing the overall diversity of the workforce.

While there was an abundance of literature related to the detriments in oral care related to COVID-19, the focus of this paper was on lessons learned and future strategies that might be implemented in the wake of this pandemic. Local providers did not have a lot of recommendations related to this topic, but did suggest future redesign of clinics to reduce aerosol transmissibility and to prepare oral homecare packages that could be distributed in the event of another clinic closure. The literature cited more systemic changes and policies that were made during the pandemic and are likely to continue such as the increased use of teledentistry and interprofessional collaboration.

Strengths and Limitations

Strengths of this study include access to providers who have worked with the target population for many decades and offered unique insights into the needs of the community. The influx of

recent global and national data on the topic of oral health was also a strength in garnering a great deal of data and recommendations from a wide variety of reliable sources. Limitations of this study include the small sample size and the limited generalizability of findings due to the unique characteristics of and within the population.

Conclusions

This study assessed the barriers to oral care in a southwest AI Tribe and possible solutions to overcome them presented by local dental providers and current literature. AI/AN communities suffer unique challenges and barriers to oral health. Some of these barriers are shared with other Indigenous and minority populations, while others are unique to the Tribe and to different members within the Tribe. Dental providers who work with the population offer unique insights into the challenges and possible solutions to address them. Provider's suggestions were aligned with current literature in the basic themes identified, the most common of which included the integration of medical, dental, and maternal health care, and the need for policies to support population-based fluoride/SDF/sealant programs for disease prevention. Other common themes included broad policy change and reform of the dental care model, the use of community-based interventions, and alleviating barriers related to SDOH, such as transportation and poverty. Many of the suggestions require massive systemic overhaul, but the necessity for change has been realized on national and global levels, particularly in the aftermath of COVID-19.

CHAPTER 5: Overall Discussion of Results and Conclusions

The ultimate goal of these three studies was to identify effective interdisciplinary and culturally relevant strategies to reduce the incidence of ECC among AI/AN children. These studies accomplished the aims of creating a culturally and contextually relevant children's book that contains positive oral health messages and celebrates Tribal culture; assessing the differences in access to and quality of dental care for young AI children before and during COVID-19; and eliciting information from providers and current literature about the barriers to oral care for AI/AN populations and future strategies to negate them.

The first aim was accomplished through a detailed and time-intensive process of building relationships with the community and CAB members who participated in the research and creating the book in an iterative process. The result was a vibrant and creative illustration of the beauty of the culture with a simple story line and an easy-to-understand oral health message that was found acceptable by community members and dental professionals. Interestingly, the multimedia options of the book were not hailed by providers much as advantageous due to the community's limitations in internet access and the technologies capable of accessing it. This brought to a light a theme that occurred throughout all three studies, which was the lack of access to technology, both advanced (internet, smart phones, computers) and basic (electricity, landline phone service, adequate mailing service), which surfaced as significant communication barriers.

Another interesting element from the feedback about the book was the emphasis on the importance of the illustrations. Providers most prominently cited these as critical elements to engaging the audience, fostering cultural pride, making the content memorable, and increasing the likelihood that it will be read multiple times. There were also several suggestions for its use as an educational tool and for programs and places to distribute it. Providers expressed that

parents and caregivers could benefit a great deal from book, which would subsequently help their children as well. Recommendations for places to distribute the book included traditional dental offices/clinics as a chairside educational tool, and to educate other providers or in alternative settings such as WIC, Head Start, and Healthy Families, and using it in various outreach programs to schools, to the hospital, and directly into people's homes. Since the target of early ECC intervention is to education pregnant women, it was also suggested that the book be distributed to in the pre-natal ward at the hospital. Another viable option could also include local OBGYN offices. Though the book has yet to be field tested for effectiveness, it will be distributed in several different arenas both on and off tribal land, such as the IHS facility, the Tribe's Department of Health and Human Services, local dental clinics, WIC, and local public health facilities.

The second aim was accomplished through two sets of interviews with different dental providers who worked with the target community before the start of COVID, and during COVID-19 three years later. Remarkably, the comments about the limitations and negative effects of COVID closures and isolation in the second set of interviews were not the focus of barriers to care given the gravity of ECC prevalence that preceded COVID for decades. The themes in both sets of interviews—before and during—pointed toward the same types of barriers to care, save for the COVID closures. The significance of these findings lies not only in the identification and verification of sustained barriers to care, but in the fact that the oral health status of young children in this population was already so poor providers noted that seeing a difference before and after COVID could be difficult to detect. This is significant because in more affluent communities and those who do not suffer the same barriers to care or are not part of a minoritized or vulnerable group, could see stark contrasts in oral disease status due to

COVID closures and isolation mandates.[141,142] While the world at large has suffered oral consequences from COVID, it has already been well documented that they were particularly devastating for AI/AN and other minority, disadvantaged, and vulnerable populations who were already suffering from higher rates of oral disease.[9,35,141–144]

Providers in each set of interviews identified specific barriers to care, with similar themes surfacing over both. The most common of these were limitations in oral health education, limitations in dental services/quality of care, structural factors, social/community factors, prioritizing oral health, and prenatal care. Possible solutions suggested by providers included different forms of education, school, and community programs to promote oral health education and screenings, and access to prenatal care that includes comprehensive dental care and oral health information for expecting parents. Transportation barriers were also addressed through suggestions for funding traveling dental busses with portable equipment to bring dental care into the communities, providing on-call transportation, and flexible appointment times. Some of these suggestions have been implemented previously in the same community, but were not sustainable for a variety of reasons including loss of funding, difficulty maintaining staffing, and upkeep of equipment. These data should be noted in future advocacy efforts to promote policy change that will address SDOH and increase access to care in strategic ways that will provide ongoing support.

The third aim was accomplished by interviewing local providers who serve the target community and comparing and contrasting their responses to current literature. Recently, there has been an influx of data presented on oral health at national and global levels, generating social attention and, hopefully, support toward improved oral healthcare measures. This study was an interesting compilation of acute, unique, qualitative data focusing on one particular southwest

tribe and a multitude of data including broad epidemiological studies, long-term population surveys, Cochrane reviews, scholarly articles and statements from organizations and professional associations. Given the difference in scope, there was a surprising amount of overlap in responses between the interviews and the literature. These themes mostly centered on integrating dental care with medical and pre-and-post-natal care, and support for public programs to provide screenings, fluoride, SDF, and sealants to increase prevention of oral disease and identify those in need of treatment. Other foci included advancement in government policies and support to reimburse providers and shift the focus from restorative treatment to disease prevention; increase in oral health education across the board and in public/community capacities; increase in CBPR and other community-focused strategies for research, development, and implementation of care; the increase of mid-level providers; continued development and use of teledentistry and other technologies to reach underserved communities; addressing SDOH factors that affect oral health; and increasing the diversity of the workforce.

Implications for Interdisciplinary Health

The ability to access oral healthcare and achieve oral health is a fundamental human right. As evidenced by the data presented here, interdisciplinary collaboration has set the stage for a new type of care delivery system that can improve access to care, is comprehensive and patient-centered, and should encompass more than the traditional sects of medicine. This should include other fields such as music, art, entertainment, traditional medicine, and unique cultural elements that will foster innovative thinking towards resourceful and creative solutions. There are many ways to connect and communicate in our world to provide social and structural support for a healthier society. Integrating dental care into medical and public health initiatives can expand

access to care to all. Just as oral health is essential to the overall health of an individual, the collective health of individuals is essential to the well-being and strength of our society.

Conclusion

The long term goal of these studies was to identify possible interdisciplinary strategies to combat ECC in AI/AN communities. The issue has been long-standing and several interventions over a number of decades have made little impact in this population. The information gleaned from these studies adds to the overall body of knowledge regarding the prevention, treatment, and community impact of ECC. The results from the first study yielded a visually appealing, culturally tailored children's book that was created in close partnership with the target community. The book was found acceptable to the Tribal members and to local dental providers who serve them. One of the recurring themes in all three studies was a lack of oral health education as a barrier to care. This book will help address that barrier and be utilized in several ways to help increase oral health knowledge both throughout the community and in surrounding areas. The book will be distributed free-of-charge and re-printed as needed.

The data from the second study captured perceived barriers to care before and during COVID-19 and provider recommendations to improve them. Providers' offered several suggestions for improvement, but were also candid about, and at times dismayed by, not knowing how to address ECC in a sustainable way. The most seasoned providers expressed the deepest sense of regret at not being able to make a noticeable difference even after decades of serving the community. These data are significant in identifying factors impervious to past efforts in this specific southwest Tribe. Providers discussed SDOH such as poverty and lack of running water, nutritious food, electricity, and access to transportation. While much of the

providers' focus was on addressing individual, family, and community-level factors, there was a thread acknowledging that something drastically different needs to be done in order to incite lasting change, which would involve addressing the identified barriers at all levels (individual, family, community, government/policy).

The third study isolated the opinions of providers serving the community during COVID-19. Their reflections on pre-and during COVID access to care aided in further identifying areas to address. The comparison of provider suggestions and those in current literature served to validate the overlapping themes. These data are significant because even though the local providers and the current literature focused more heavily on different areas (and some not at all), there was general consensus on several of the issues contributing to the high ECC rates in AI/AN communities. With this knowledge, efforts can be enhanced, funded, and promoted on higher systemic and policy levels to begin addressing them. Much of this transformation will have to be accommodated in different forms of policy change, which is perhaps the most daunting task given the highly politicized nature of healthcare in this country. However, the move toward integrated care is already gaining momentum as individuals and healthcare providers realize the benefits of individual and community health. The field of dentistry has a long history of being siloed, accessible only to those fortunate enough to qualify or pay for care. But perhaps with the progressive expansion of IPC, and as we collectively emerge from the COVID-closure era, dentistry too, can end its isolation.

Researcher Characteristics and Reflexivity

This study was conducted as part of my PhD research in Interdisciplinary Heath with a focus on health equity. At the time of this study, I had worked in the dental field for nearly 20 years, 17

years as a Registered Dental Hygienist (RDH), and had taught at the university level for 10 years. I participated in numerus public health events and school dental programs for children, and I am passionate about bringing oral care to underserved communities, which drove my selection of this project. As a professional dental provider in a relatively small community, I knew many of the research participants personally and/or as colleagues. I had to be especially cognizant of these relationships and any pre-existing knowledge of opinions throughout the research process, and I made a great effort to negate bias by following rigorous research practices. The grounded theory framework for this project may contribute to alleviating possible participant bias by eliminating the idea of 'right' or 'wrong' or 'desirable' answers to the interview questions. I strove to be subjective in my analysis of participant responses; however it is likely that my experience as a provider colored some of my viewpoints, though I see this as a strength of the study rather than a limitation.

Ethical Concerns

These studies were conducted according to the guidelines of the Declaration of Helsinki and all researchers were certified by the Collaborative Institutional Training Initiative (CITI Program) through Northern Arizona University. Approval of the Northern Arizona University Institutional Review Board for each of these studies is outlined in the individual chapters.

These studies were judged to have little-to-no risk to participants. Steps taken to minimize risk included housing consent forms and surveys in Research Electronic Data Capture (REDCap) software designed to securely transfer research data to statistical analysis software. REDCap was used to collect all consent forms and survey data, including participants' contact information for

receiving study materials and incentive payments, to assure confidentiality of patient responses. Jefferson REDCap is locally supported by NAU Information Technology Services and data are stored on NAU secure servers. Only participants who screened into the study by fulfilling the entry criteria and were enrolled had their data collected and kept. All enrollments were done electronically. Data obtained were accessible only to the researchers and no subject, including the specific participating Tribe, will be identified in any report of the project. Interviews were audio recorded only and housed on the secure NAU server ADAMS. ADAMS is a Dell PowerEdge R740 server with a directly attached data storage array. The server is configured as a remote desktop server with a full set of applications installed so that sensitive data can be analyzed in a secure environment. Users are required to register for access and accept strict conditions for handling and analyzing the data. Once transcripts of the recording were made, the recordings were destroyed/deleted.

REFERENCES

1. Centers for Disease Control USD of H and HSD of OH. Oral Health Basics-Children's Oral Health. https://www.cdc.gov/oralhealth/basics/childrens-oral-health/index.html. Published 2020.
2. USDHHS. *Oral Health in America: A Report of the Surgeon General- Executive Summary*.; 2000. https://www.nidcr.nih.gov/research/data-statistics/surgeon-general.
3. Phipps KR, Ricks TL. The oral health of American Indian and Alaska Native children aged 1–5 years: results of the 2014 IHS Oral Health Survey. *Rockv Indian Heal Serv*. 2015.
4. Bagramian RA, Garcia-Godoy F, Volpe AR. The global increase in dental caries. A pending public health crisis. *Am J dent*. 2009;22(1):3-8.
5. Dye BA, Hsu K-LC, Afful J. Prevalence and measurement of dental caries in young children. *Pediatr Dent*. 2015;37(3):200-216.
6. American Academy of Pediatric Dentists. AAPD's State of Little Teeth Report: An Examination of the Epidemic of Tooth Decay Among our Youngest Children. *Am Acad Pediatr Dent*. 2014. http://www.aapd.org/assets/1/7/State_of_Little_Teeth_Final.pdf.
7. Borkowski N, Deckard GJ. *Case Studies in Organizational Behavior and Theory for Health Care*. Jones & Bartlett Publishers; 2014.
8. First Things First. *Children's Oral Health Report 2016 - Taking a Bite Out of School Absences*.; 2016. http://azftf.gov/WhoWeAre/Board/Documents/FTF_Oral_Health_Report_2016.pdf.
9. Geneva: World Health Organization. Global oral health status report: towards universal health coverage for oral health by 2030. March 2022.

https://www.who.int/team/noncommunicable-diseases/global-status-report-on-oral-health-2022.

10. American Academy of Pedodontics. Policy on early childhood caries (ECG): Classification, consequences, and preventive strategies. *Oral Heal Policies*. 2016;37(6):50-52. doi:10.1098/rstb.2013.0025

11. World Dental Federation (FDI). The Challenge of Oral Disease-A Call for Global Action. The Oral Health Atlas. 2015.

12. Fischer DJ, O'Hayre M, Kusiak JW, et al. Oral Health Disparities: A Perspective From the National Institute of Dental and Craniofacial Research. *Am J Public Health*. 2017;107(S1):S36-S38. doi:10.2105/AJPH.2016.303622

13. World Health Organization. WHO | Sugars and dental caries. *Who*. 2017;(October):1-4. http://www.who.int/oral_health/publications/sugars-dental-caries-keyfacts/en/#.WmRgwZTEeIU.mendeley.

14. World Health Organization. Ending childhood dental caries: WHO implementation manual. 2019.

15. Peres MA, Macpherson LMD, Weyant RJ, et al. Oral diseases: a global public health challenge. *Lancet*. 2019;394(10194):249-260.

16. Moynihan P, Makino Y, Petersen PE, Ogawa H. Implications of WHO Guideline on Sugars for dental health professionals. *Community Dent Oral Epidemiol*. 2018;46(1):1-7. doi:10.1111/cdoe.12353

17. Anil S, Anand PS. Early Childhood Caries: Prevalence, Risk Factors, and Prevention. *Front Pediatr*. 2017;5(July):157. doi:10.3389/fped.2017.00157

18. American Academy of Pediatric Dentistry (AAPD). Policy on Early Childhood Caries

(ECC): Unique Challenges and Treatment Options. In: *The Reference Manual of Pediatric Dentistry: Definitions, Oral Health Policies, Recommendations, Endorsements, Resources: 2019-2020*. American Academy of Pediatric Dentistry; 2019:74-75.

19. Branger B, Camelot F, Droz D, et al. Breastfeeding and early childhood caries. Review of the literature, recommendations, and prevention. *Arch Pédiatrie*. 2019;26(8):497-503.
20. Tham R, Bowatte G, Dharmage SC, et al. Breastfeeding and the risk of dental caries: a systematic review and meta-analysis. *Acta Paediatr*. 2015;104:62-84.
21. (AAPD) AA of PD. Policy on Early Childhood Caries (ECC): Classifications, Consequences, and Preventive Strategies. *Ref Man Pediatr Dent*. 2016:71-73. https://www.aapd.org/globalassets/media/policies_guidelines/p_eccclassifications.pdf.
22. Warren JJ, Blanchette D, Dawson D V, et al. Factors associated with dental caries in a group of American Indian children at age 36 months. *Community Dent Oral Epidemiol*. 2016;44(2):154-161.
23. Warren JJ, Fontana M, Blanchette DR, et al. Timing of primary tooth emergence among US racial and ethnic groups. *J Public Health Dent*. 2016;76(4):259-262.
24. Levin A, Sokal-Gutierrez K, Hargrave A, Funsch E, Hoeft K. Maintaining Traditions: A Qualitative Study of Early Childhood Caries Risk and Protective Factors in an Indigenous Community. *Int J Environ Res Public Health*. 2017;14(8):907.
25. Pierce A, Zimmer J, Levans A, Schroth RJ. The Association Between Developmental Defects of Enamel and Early Childhood Caries in American Indian Children: A Retrospective Chart Review. *Pediatr Dent*. 2020;42(2):126-131.
26. Goettems ML, Ardenghi TM, Demarco FF, Romano AR, Torriani DD. Children's use of dental services: influence of maternal dental anxiety, attendance pattern, and perception of

children's quality of life. *Community Dent Oral Epidemiol*. 2012;40(5):451-458.

27. Fisher-Owens S, Gansky S, Platt L, et al. Influences on Children's Oral Health: A Conceptual Model. *Pediatrics*. 2007;120:e510-20. doi:10.1542/peds.2006-3084
28. Özen B, Van Strijp AJP, Özer L, Olmus H, Genc A, Cehreli SB. Evaluation of possible associated factors for early childhood caries and severe early childhood caries: A multicenter cross-sectional survey. *J Clin Pediatr Dent*. 2016;40(2):118-123.
29. Yang AJ, Gromoske AN, Olson MA, Chaffin JG. Single and Cumulative Relations of Social Risk Factors with Children's Dental Health and Care-Utilization Within Regions of the United States. *Matern Child Health J*. 2016;20(3):495-506. doi:10.1007/s10995-015-1847-2
30. Rai NK, Tiwari T. Parental factors influencing the development of early childhood caries in developing nations: A systematic review. *Front public Heal*. 2018;6:64.
31. Adair PM, Pine CM, Burnside G, et al. Familial and cultural perceptions and beliefs of oral hygiene and dietary practices among ethnically and socio-economicall diverse groups. *Community Dent Health*. 2004;21(1 Suppl):102-111.
32. Albino J, Tiwari T, Henderson WG, Thomas JF, Braun PA, Batliner TS. Parental psychosocial factors and childhood caries prevention: data from an American Indian population. *Community Dent Oral Epidemiol*. 2018;46(4):360-368.
33. World Health Organization. WHO expert consultation on public health intervention against early childhood caries: report of a meeting, Bangkok, Thailand, 26-28 January 2016. *Rep A Meet – Bangkok, Thailand, 26–28 January 2016*. 2017;(January):26-28.
34. Irvine JD, Holve S, Krol D, Schroth R. Early childhood caries in Indigenous communities: A joint statement with the American Academy of Pediatrics. *Paediatr Child Health*.

2011;16(6):351-357.

35. National Institutes of Oral Health. *Oral Health in America: Advances and Challenges*.; 2021. https://www.nidcr.nih.gov/sites/default/files/2021-12/Oral-Health-in-America-Advances-and-Challenges.pdf.

36. Brian Z, Weintraub JA. Oral Health and COVID-19: Increasing the Need for Prevention and Access. *Prev Chronic Dis*. 2020;17:E82. doi:10.5888/pcd17.200266

37. Satcher D. Oral Health In America: Advances and Challenges, Surgeon General Executive Summary. https://www.cdc.gov/oralhealth/publications/sgr2000_05.htm.

38. Kranz AM, Chen A, Gahlon G, Stein BD. 2020 trends in dental office visits during the COVID-19 pandemic. *J Am Dent Assoc*. 2021;152(7):535-541.e1. doi:10.1016/j.adaj.2021.02.016

39. American Dental Association. ADA Interim Guidance for Minimizing Risk of COVID-19 Transmission Table of Contents After Dental Care is Provided ADA Interim Guidance for Minimizing Risk of COVID-19 Transmission Before Dental Care Starts. 2020:1-8.

40. Centers for Disease Control USD of H and HSD of OH. COVID Statement | Oral Health | CDC: CDC Updates COVID-19 Infection Prevention and Control Guidance. 2022:2022. https://www.cdc.gov/oralhealth/infectioncontrol/statement-COVID.html.

41. United States Department of Labor. COVID-19 Control and Prevention: Dentistry Workers and Employers. *Occup Saf Heal Adm*. 2020;19.

42. Fellows JL, Atchison KA, Chaffin J, Chávez EM, Tinanoff N. Oral Health in America: Implications for dental practice. *J Am Dent Assoc*. 2022;153(7):601-609. doi:10.1016/j.adaj.2022.04.002

43. Phantumvanit P, Makino Y, Ogawa H, et al. WHO Global Consultation on Public Health

Intervention against Early Childhood Caries. *Community Dent Oral Epidemiol*. 2018;46(3):280-287. doi:10.1111/cdoe.12362

44. U.S. Department of Health and Human Services. Oral Health in America: A Report of the Surgeon General. 2000.

45. Heaton B, Crawford A, Garcia RI, et al. Oral health beliefs, knowledge, and behaviors in Northern California American Indian and Alaska Native mothers regarding early childhood caries. *J Public Health Dent*. 2017;77(4):350-359.

46. Brega AG, Jiang L, Johnson RL, Wilson AR, Schmiege SJ, Albino J. Health Literacy and Parental Oral Health Knowledge, Beliefs, Behavior, and Status Among Parents of American Indian Newborns. *J racial Ethn Heal disparities*. 2020.

47. Hiratsuka VY, Robinson JM, Greenlee R, Refaat A. Oral health beliefs and oral hygiene behaviours among parents of urban Alaska Native children. *Int J Circumpolar Health*. 2019;78(1):1586274.

48. Medeiros PB V, Otero SAM, Frencken JE, Bronkhorst EM, Leal SC. Effectiveness of an oral health program for mothers and their infants. *Int J Paediatr Dent*. 2015;25(1):29-34.

49. Plutzer K, John Spencer A, Keirse MJNC. Reassessment at 6–7 years of age of a randomized controlled trial initiated before birth to prevent early childhood caries. *Community Dent Oral Epidemiol*. 2012;40(2):116-124.

50. Öcek ZA, Eden E, Yücel U, Çiçeklioglu M. Effects of an oral health program: Community-based education among mothers of young children living in socioeconomically disadvantaged neighborhoods. *J Educ Health Promot*. 2020;9:40. doi:10.4103/jehp.jehp_434_19

51. Batliner T, Tiwari T, Henderson WG, et al. Randomized Trial of Motivational

Interviewing to Prevent Early Childhood Caries in American Indian Children. *JDR Clin Transl Res*. 2018;3(4):366-375. doi:10.1177/2380084418787785

52. Wilson AR, Brega AG, Campagna EJ, et al. Validation and impact of caregivers' oral health knowledge and behavior on children's oral health status. *Pediatr Dent*. 2016;38(1):47-54.

53. Brega AG, Henderson WG, Harper MM, et al. Association of Ethnic Identity with Oral Health Knowledge, Attitudes, Behavior, and Outcomes on the Navajo Nation. *J Health Care Poor Underserved*. 2019;30(1):143-160. doi:10.1353/hpu.2019.0013

54. Albino J, Tiwari T. Preventing Childhood Caries: A Review of Recent Behavioral Research. *J Dent Res*. 2016;95(1):35-42. doi:10.1177/0022034515609034

55. Braun PA, Widmer-Racich K, Sevick C, Starzyk EJ, Mauritson K, Hambidge SJ. Effectiveness on early childhood caries of an oral health promotion program for medical providers. *Am J Public Health*. 2017;107(S1):S97-S103.

56. Shrivastava R, Couturier Y, Girard F, Papineau L, Emami E. Two-eyed seeing of the integration of oral health in primary health care in Indigenous populations: a scoping review. *Int J Equity Health*. 2020;19(1):1-18. doi:10.1186/s12939-020-01195-3

57. Holve S. An Observational Study of the Association of Fluoride Varnish Applied During Well Child Visits and the Prevention of Early Childhood Caries in American Indian Children. *Matern Child Health J*. 2008;12(S1):64-67. doi:10.1007/s10995-007-0294-0

58. Braun PA, Quissell DO, Henderson WG, et al. A cluster-randomized, community-based, tribally delivered oral health promotion trial in Navajo Head Start children. *J Dent Res*. 2016;95(11):1237-1244.

59. Abou El Fadl R, Blair M, Hassounah S. Integrating Maternal and Children's Oral Health

Promotion into Nursing and Midwifery Practice- A Systematic Review. *PLoS One*. 2016;11(11):e0166760.

60. Batliner TS. American Indian and Alaska Native access to oral health care: a potential solution. *J Health Care Poor Underserved*. 2016;27(1):1-10.

61. Mathu-Muju KR, McLeod J, Walker M Lou, Chartier M, Harrison RL. The children's oral health initiative: an intervention to address the challenges of dental caries in early childhood in Canada's First Nation and Inuit communities. *Can J Public Heal*. 2016;107(2):e188-e193.

62. Weinstein P, Harrison R, Benton T. Motivating mothers to prevent caries: Confirming the beneficial effect of counseling. *J Am Dent Assoc*. 2006;137(6):789-793. doi:10.14219/jada.archive.2006.0291

63. Harrison R, Benton T, Everson-Stewart S, Weinstein P. Effect of motivational interviewing on rates of early childhood caries: a randomized trial. *Pediatr Dent*. 2007;29(1):16-22.

64. Harrison RL, Veronneau J, Leroux B. Effectiveness of Maternal Counseling in Reducing Caries in Cree Children. *J Dent Res*. 2012;91(11):1032-1037. doi:10.1177/0022034512459758

65. Jamieson LM, Smithers LG, Hedges J, et al. Follow-up of an Intervention to Reduce Dental Caries in Indigenous Australian Children: A Secondary Analysis of a Randomized Clinical Trial. *JAMA Netw open*. 2019;2(3):e190648-e190648.

66. Kapoor V, Gupta A, Arya V. Behavioral changes after motivational interviewing versus traditional dental health education in parents of children with high caries risk: Results of a 1-year study. *J Indian Soc Pedod Prev Dent*. 2019;37(2):192.

67. Wagner Y, Greiner S, Heinrich-Weltzien R. Evaluation of an oral health promotion program at the time of birth on dental caries in 5-year-old children in Vorarlberg, Austria. *Community Dent Oral Epidemiol*. 2014;42(2):160-169.

68. Arnett MC, Blue CM, Ahmann L, Evans MD, Reibel YG. Impact of Brief Motivational Interviewing on Periodontal Clinical Outcomes: A randomized clinical trial. *J Dent Hyg*. 2022;96(5).

69. Ismail AI, Ondersma S, Willem Jedele JM, Little RJ, Lepkowski JM. Evaluation of a brief tailored motivational intervention to prevent early childhood caries. *Community Dent Oral Epidemiol*. 2011;39(5):433-448.

70. Blue CM, Arnett MC, Ephrem H, Lunos S, Ruoqiong C, Jones R. Using motivational interviewing to reduce parental risk related behaviors for early childhood caries: a pilot study. *BMC Oral Health*. 2020;20(1):90. doi:10.1186/s12903-020-1052-6

71. Tiwari T, Jamieson L, Broughton J, et al. Reducing Indigenous Oral Health Inequalities: A Review from 5 Nations. *J Dent Res*. 2018;97(8):869-877. doi:10.1177/0022034518763605

72. Faghihian R, Faghihian E, Kazemi A, Tarrahi MJ, Zakizade M. Impact of motivational interviewing on early childhood caries: A systematic review and meta-analysis. *J Am Dent Assoc*. 2020;151(9):650-659.

73. Bernal G, Jiménez-Chafey MI, Domenech Rodríguez MM. Cultural adaptation of treatments: A resource for considering culture in evidence-based practice. *Prof Psychol Res Pract*. 2009;40(4):361.

74. Barrera Jr M, Castro FG, Strycker LA, et al. Cultural adaptations of behavioral health interventions: A progress report. *J Consult Clin Psychol*. 2013;81(2):196-205.

doi:10.1037/a0027085

75. DePue JD, Rosen RK, Seiden A, et al. Implementation of a culturally tailored diabetes intervention with community health workers in American Samoa. *Diabetes Educ*. 2013;39(6):761-771.

76. Henderson S, Kendall E, See L. The effectiveness of culturally appropriate interventions to manage or prevent chronic disease in culturally and linguistically diverse communities: a systematic literature review. *Health Soc Care Community*. 2011;19(3):225-249.

77. Rodríguez MMD, Baumann AA, Schwartz AL. Cultural adaptation of an evidence based intervention: From theory to practice in a Latino/a community context. *Am J Community Psychol*. 2011;47(1-2):170-186.

78. Sanders Thompson VL, Johnson-Jennings M, Bauman AA, Proctor E. Use of culturally focused theoretical frameworks for adapting diabetes prevention programs: a qualitative review. *Prev Chronic Dis*. 2015;12:E60-E60. doi:10.5888/pcd12.140421

79. Nisar A, Yin J, Yiping N, et al. Making therapies culturally relevant: translation, cultural adaptation and field-testing of the Thinking Healthy Programme for perinatal depression in China. *BMC Pregnancy Childbirth*. 2020;20(1):368. doi:10.1186/s12884-020-03044-1

80. Venner KL, Greenfield BL, Hagler KJ, et al. Pilot outcome results of culturally adapted evidence-based substance use disorder treatment with a Southwest Tribe. *Addict Behav reports*. 2016;3:21-27.

81. Slaughter A, Evans LK. Culturally sensitive oral health educational materials for older African Americans. *J Health Care Poor Underserved*. 2007;18(5):868-886.

82. Tiwari T, Albino J. Acculturation and pediatric minority oral health interventions. *Dent Clin*. 2017;61(3):549-563.

83. Cidro J, Zahayko L, Lawrence HP, Folster S, McGregor M, McKay K. Breast feeding practices as cultural interventions for early childhood caries in Cree communities. *BMC Oral Health*. 2015;15(1):1-10.

84. Singelis TM, Garcia RI, Barker JC, Davis RE. An experimental test of the two-dimensional theory of cultural sensitivity in health communication. *J Health Commun*. 2018;23(4):321-328.

85. Hoeft KS, Barker JC, Shiboski S, Pantoja-Guzman E, Hiatt RA. Effectiveness evaluation of Contra Caries Oral Health Education Program for improving Spanish-speaking parents' preventive oral health knowledge and behaviors for their young children. *Community Dent Oral Epidemiol*. 2016;44(6). doi:10.1111/cdoe.12250

86. Heaton B, Crawford AJ, Wimsatt MA, et al. A storytelling intervention reduces childhood caries risk behaviors among American Indian and Alaska Native mothers in Northern California. *J Public Health Dent*. 2019;79(3):183-187.

87. O'Malley L, Adair P, Burnside G, Robinson L, Coffey M, Pine C. An Evaluation of a Storybook Targeting Parental Attitudes, Intention, and Self-Efficacy to Change Their Child's Oral Health Behavior. *Heal Psychol*. 2017;36(2):152-159. doi:10.1037/hea0000428

88. Wang H, Singhal A. Entertainment-education through digital games. *Serious games Mech Eff*. 2009:271-292.

89. Kline KN, Montealegre JR, Rustveld LO, et al. Incorporating cultural sensitivity into interactive entertainment-education for diabetes self-management designed for hispanic audiences. *J Health Commun*. 2016;21(6):658-668.

90. Shin Y, Miller-Day M, Hecht ML, Krieger JL. Entertainment-Education Videos as a

Persuasive Tool in the Substance Use Prevention Intervention “keepin’’ it REAL".” *Health Commun*. 2018;33(7):896-906. doi:10.1080/10410236.2017.1321163

91. Lumsden C, Wolf R, Contento I, et al. Feasibility, Acceptability, and Short-term Behavioral Impact of the MySmileBuddy Intervention for Early Childhood Caries. *J Health Care Poor Underserved*. 2019;30(1):59-69.

92. Israel BA, Schulz AJ, Parker EA, Becker AB. Community-based participatory research: Principles, rationale and policy recommendations. *Success Model community-based Particip Res*. 2000:16-29.

93. Katigbak C, Van Devanter N, Islam N, Trinh-Shevrin C. Partners in health: A conceptual framework for the role of community health workers in facilitating patients’ adoption of healthy behaviors. *Am J Public Health*. 2015;105(5):872-880.

94. Bryant LL, Quissell DO, Braun PA, et al. A Community-Based Oral Health Intervention in Navajo Nation Head Start: Participation Factors and Contextual Challenges. *J Community Health*. 2015;41(2):340-353. doi:10.1007/s10900-015-0102-5

95. Villalta J, Askaryar H, Verzemnieks I, Kinsler J, Kropenske V, Ramos-Gomez F. Developing an Effective Community Oral Health Workers-“Promotoras” Model for Early Head Start”. *Front Public Heal*. 2019;7:175.

96. Lucero J, Wallerstein N, Duran B, et al. Development of a mixed methods investigation of process and outcomes of community-based participatory research. *J Mix Methods Res*. 2018;12(1):55-74.

97. Tiwari T, Sharma T, Harper M, et al. Community based participatory research to reduce oral health disparities in American Indian children. *J Fam Med*. 2015;2(3).

98. Albino J, Batliner TS, Tiwari T. Preventing caries in American Indian children: lost battle

or new hope? *JDR Clin Transl Res*. 2017;2(4):406-409.

99. Tiwari T, Quissell DO, Henderson WG, et al. Factors associated with oral health status in American Indian children. *J racial Ethn Heal disparities*. 2014;1(3):148-156.

100. Xiao J, Alkhers N, Kopycka-Kedzierawski DT, et al. Prenatal oral health care and early childhood caries prevention: a systematic review and meta-analysis. *Caries Res*. 2019;53(4):411-421.

101. Vamos CA, Thompson EL, Avendano M, Daley EM, Quinonez RB, Boggess K. Oral health promotion interventions during pregnancy: a systematic review. *Community Dent Oral Epidemiol*. 2015;43(5):385-396.

102. Albino JEN, Orlando VA. Promising directions for caries prevention with American Indian and Alaska Native children. *Int Dent J*. 2010;60(3S2):216-222.

103. Wilson AR, Fehringer KA, Henderson WG, et al. Fidelity of motivational interviewing in an American Indian oral health intervention. *Community Dent Oral Epidemiol*. 2018;46(3):310-316.

104. Elwell K, Camplain C, Kirby C, et al. A Formative Assessment of Social Determinants of Health Related to Early Childhood Caries in Two American Indian Communities. *Int J Environ Res Public Health*. 2021;18(18):9838.

105. Rosenstock IM, Strecher VJ, Becker MH. Social learning theory and the health belief model. *Health Educ Q*. 1988;15(2):175-183.

106. Bandura A. Health promotion by social cognitive means. *Heal Educ Behav*. 2004;31(2):143-164.

107. Riley AH, Chattoo CB. Developing Multimedia Social Impact Entertainment Programming on Healthy Ageing for Hispanics in the United States. *J Dev Comm*.

2019;30(2):16-29.

108. Slater MD, Brock T, Strange J, Green M. Entertainment education and the persuasive impact of narratives. In: *Narrative Impact: Social and Cognitive Foundations*. Lawrence Erlbaum Associates Publishers; 2011:157-182.

109. Crist JD, Parsons ML, Warner-Robbins C, Mullins MV, Espinosa YM. Pragmatic Action Research With 2 Vulnerable Populations Mexican American Elders and Formerly Incarcerated Women: Mexican American Elders and Formerly Incarcerated Women. *Fam Community Health*. 2009;32(4):320.

110. Lockett HG. *The Unwritten Literature of the Hopi*. Good Press; 2005. http://www.gutenberg.org/files/15888/15888-h/15888-h.htm.

111. Charles River Editors, ed. *The Pueblo Today and Yesterday : The History and Culture of the Anasazi and Hopi*. Boston, MA]: Charles River Editors; 2014.

112. Michie S, Richardson M, Johnston M, et al. The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: building an international consensus for the reporting of behavior change interventions. *Ann Behav Med*. 2013;46(1):81-95.

113. Solar O, Irwin A. A conceptual framework for action on the social determinants of health. Social Determinants of Health Discussion Paper 2 (Policy and Practice). 2010.

114. Glaser BG, Strauss AL. *Discovery of Grounded Theory: Strategies for Qualitative Research*. Routledge; 2017.

115. U.S. Department of Health and Human Services. A Healthy Mouth for Your Baby (for American Indians and Alaska Natives). NIH Free Publication No. 20-7340. https://www.nidcr.nih.gov/sites/default/files/2020-08/healthy-mouth-baby-aian.pdf.

116. Harris PA, Taylor R, Minor BL, et al. The REDCap consortium: Building an international

community of software platform partners. *J Biomed Inform*. 2019;95:103208. doi:https://doi.org/10.1016/j.jbi.2019.103208

117. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—A metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform*. 2009;42(2):377-381. doi:https://doi.org/10.1016/j.jbi.2008.08.010
118. Inc ZVC. Security guide. Zoom Video Communications Inc. *Retrieved Oct*. 2016;9:2020.
119. NVivo Q. NVivo qualitative data analysis software. *Version 10 QSR Int Pty ltd*. 2012.
120. O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. Standards for reporting qualitative research: a synthesis of recommendations. *Acad Med*. 2014;89(9):1245-1251. doi:10.1097/ACM.0000000000000388
121. Bersell CH. Access to Oral Health Care: A National Crisis and Call for Reform. *J Dent Hyg*. 2017;91(1):6.
122. James SL, Abate D, Abate KH, et al. Global, regional, and national incidence, prevalence, and years lived with disability for 354 Diseases and Injuries for 195 countries and territories, 1990-2017: A systematic analysis for the Global Burden of Disease Study 2017. *Lancet*. 2018;392(10159):1789-1858. doi:10.1016/S0140-6736(18)32279-7
123. Harnagea H, Couturier Y, Shrivastava R, et al. Barriers and facilitators in the integration of oral health into primary care: A scoping review. *BMJ Open*. 2017;7(9). doi:10.1136/bmjopen-2017-016078
124. Rubin MS, Nunez N, Quick JD, Edelstein BL. A survey of US early childhood caries programs: findings and recommendations. *J Public Health Dent*. 2019;79(2):116-123.
125. Riggs E, Kilpatrick N, Chadwick B, et al. primary caregivers for preventing early

childhood caries (Review). *Cochrane Database Syst Rev*. 2019;(11). doi:10.1002/14651858.CD012155.pub2.www.cochranelibrary.com

126. Moynihan P, Tanner LM, Holmes RD, et al. Systematic Review of Evidence Pertaining to Factors That Modify Risk of Early Childhood Caries. *JDR Clin Transl Res*. 2019;4(3):202-216. doi:10.1177/2380084418824262

127. Holve S, Braun P, Irvine JD, et al. Early childhood caries in Indigenous communities. *Pediatrics*. 2021;147(6).

128. Kyoon-Achan G, Schroth RJ, Sanguins J, et al. Early childhood oral health promotion for first nations and métis communities and caregivers in Manitoba. *Heal Promot Chronic Dis Prev Canada*. 2021;41(1):14-24. doi:10.24095/hpcdp.41.1.02

129. Centers for Disease Control USD of H and HSD of OH. *Oral Health CDC Announces Medical-Dental Integration Partnership*.; 2020. https://www.cdc.gov/oralhealth/about/md-integration.html#print.

130. Albino J, Dye BA, Ricks T. 2020 Surgeon General's Report: Oral Health in America: Advances and Challenges. 2020. https://www.nidcr.nih.gov/sites/default/files/2019-08/SurgeonGeneralsReport-2020_IADR_June 2019-508.pdf.

131. Marinho VCC, Chong LY, Worthington H V, Walsh T. Fluoride mouthrinses for preventing dental caries in children and adolescents. *Cochrane Database Syst Rev*. 2016;(7). doi:10.1002/14651858.CD002284.pub2

132. WHO. *Global Oral Health Status Report*. Vol 57.; 2022.

133. Duangthip D, Chen KJ, Gao SS, Lo ECM, Chu CH. Managing early childhood caries with atraumatic restorative treatment and topical silver and fluoride agents. *Int J Environ Res Public Health*. 2017;14(10):1-13. doi:10.3390/ijerph14101204

134. Griffin S, Naavaal S, Scherrer C, Griffin PM, Harris K, Chattopadhyay S. School-Based Dental Sealant Programs Prevent Cavities And Are Cost-Effective. *Health Aff*. 2016;35(12):2233-2240. doi:10.1377/hlthaff.2016.0839

135. George A, Sousa MS, Kong AC, et al. Effectiveness of preventive dental programs offered to mothers by non-dental professionals to control early childhood dental caries: A review. *BMC Oral Health*. 2019;19(1). doi:10.1186/s12903-019-0862-x

136. Phipps KR. Improving the oral health of American Indians and Alaska Natives. *Curr Oral Heal Reports*. 2016;3(3):179-186.

137. de Silva AM, Hegde S, Akudo Nwagbara B, et al. Community-based population-level interventions for promoting child oral health. *Cochrane Database Syst Rev*. 2016;2016(12). doi:10.1002/14651858.CD009837.pub3

138. World Health Organization (WHO), World Health Organization. *SEVENTY-FIFTH WORLD HEALTH ASSEMBLY: Follow-up to the Political Declaration of the Third High-Level Meeting of the General Assembly on the Prevention and Control of Non-Communicable Disease*.; 2022.

139. Wu KY, Wu DT, Nguyen TT, Tran SD. COVID-19's impact on private practice and academic dentistry in North America. *Oral Dis*. 2021;27(S3):684-687. doi:10.1111/odi.13444

140. Raskin SE, Diep VK, Chung-Bridges K, Heaton LJ, Frantsve-Hawley J. Dental safety net providers' experiences with service delivery during the first year of COVID-19 should inform dental pandemic preparedness. *J Am Dent Assoc*. 2022;153(6):521-531. doi:10.1016/j.adaj.2021.11.005

141. Gotler M, Oren L, Spierer S, Yarom N, Ashkenazi M. The impact of COVID-19

lockdown on maintenance of children's dental health: A questionnaire-based survey. *J Am Dent Assoc*. 2022;153(5):440-449. doi:10.1016/j.adaj.2021.10.004

142. Lyu W, Wehby GL. Effects of the COVID-19 pandemic on children's oral health and oral health care use. *J Am Dent Assoc*. 2022;153(8):787-796.e2. doi:10.1016/j.adaj.2022.02.008

143. Elster N, Parsi K. Oral Health Matters: The Ethics of Providing Oral Health During COVID-19. *HEC Forum*. 2021;33(1-2):157-164. doi:10.1007/s10730-020-09435-3

144. Dye BA, Albino J, D'Souza RN. Oral health problems are global and need to be addressed in the USA. *Lancet*. 2022;399(10320):127-128. doi:10.1016/S0140-6736(21)02842-7