

THE NATIVE ORAL HEALTH PROJECT

BASELINE SURVEY DATA FROM A STUDY OF CALIFORNIA AMERICAN INDIAN AND ALASKA NATIVE MOTHERS

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STATISTICAL TERMINOLOGY

Analysis of Covariance (ANCOVA): A statistical test that blends the Analysis of Variance (ANOVA: see below) with linear regression. The ANCOVA evaluates whether means (statistical average scores) of an outcome measured on a continuous scale (e.g., dental behavior score) are equal for comparison groups for an indicator (e.g., demographic groups) while statistically controlling for the effects of another continuous indicator (a covariate). [Example: Compare mean scores for dental care behavior differ by gender (males and females) after controlling for number of barriers to dental care access (covariate)].

Baseline survey: A survey assessment conducted before a treatment or intervention program is initiated to establish the initial conditions in the study sample before the intervention occurs. Typically, the survey is repeated after the intervention (post-test), and the results of the post-test are compared with the baseline to determine if the intervention had the desired effect.

Correlation: A measure of association between two variables. The variables are not designated as dependent variable (i.e., outcome) or independent variable (i.e., predictor). The value of a correlation coefficient can vary from minus one to plus one. A minus one indicates a perfect negative correlation, while a plus one indicates a perfect positive correlation. A correlation value of "0" means there is no relationship between the two variables.

Covariate: An indicator measured on a continuous scale that may be associated with the outcome being studied. A covariate may be of direct interest or may be a confounding or interacting influence. [Example: When comparing mean (statistical average) dental scores for employed and unemployed individuals, the number of barriers to accessing dental care (covariate) may interact with their employment status to affect dental care behavior outcomes].

Measures of Central Tendency:

- **Mean (Statistical Average):** Computed by adding all the individual values in the group and dividing by the number of values in the group.
- **Median:** Dividing a set of measurements (e.g., income) into two parts (upper and lower half); the point on the scale that divides the group in this way is called the median.
- **Mode:** The most frequently occurring value in a set of observations.

One-way Analysis of Variance (ANOVA): A statistical test that compares the mean (statistical average) differences for two or more groups on an outcome that is measured on a continuous scale. [Example: Compare average scores for dental behavior for two or more demographic subgroups].

Standard Error of the Mean: A measure of variation. A summary of how widely dispersed the observed values of measure are within a population. More technically: When a sample mean is used as an estimation of the population mean, the standard error is the standard deviation of those sample means over all possible samples of a given size drawn from the population. Second, the standard error of the mean can refer to an estimate of that standard deviation, calculated from the sample of data being analyzed at that time.

EXECUTIVE SUMMARY

Early Childhood Caries (ECC) is an infectious dental disease that begins soon after the primary (baby) teeth erupt. The early onset of infection in American Indian and Alaska Native (AIAN) children makes it essential that AIAN parents or caregivers have information on ECC prevention and that their children are screened and receive early preventive and restorative treatment for ECC. Parental knowledge, beliefs, and behaviors about childhood dental health are important determinants of ECC. In the public health literature, there is little information about the associations between AIAN mothers' oral health knowledge, beliefs, and behaviors with children. A primary aim of the Native Oral Health Project (NOHP) was to identify a baseline of maternal oral health beliefs, knowledge, and behaviors. Because AIAN mothers often experience barriers to professional preventative and restorative oral health care for children related to financial and transportation concerns, a second aim of the NOHP study was to identify barriers to oral health care. The final aim of the NOHP study was to identify potential risk indicators associated with oral health behaviors to inform future investigations of oral health among AIAN families and communities.

A total of 53 AIAN mothers ages 18 to 51 (median age = 29 years old) from Northern California were recruited into the NOHP study and completed a baseline survey about oral health knowledge, behaviors, beliefs, and barriers to dental care. AIAN mothers in the study provided an average of 22 of 25 correct responses to baseline survey items that assessed oral health knowledge and beliefs, and, on average, AIAN mothers in the study reported engaging in 5 of 10 positive oral health behaviors.

Descriptive statistics revealed that a total of 72% of AIAN mothers in this study reported experiencing more than one barrier to oral health care and 42% experienced two or more barriers to oral health care. The barriers to care most frequently identified by AIAN mothers were those that reflected demands on time, including time spent traveling to and attending children's appointments. Results of correlation, analysis of variance (ANOVA), and analysis of covariance (ANCOVA) statistical analyses indicated that mothers' oral health knowledge and beliefs and mothers' barriers to oral health care were associated with oral health behaviors. In addition, mothers' higher education status was marginally associated with higher average oral health behaviors after accounting for mothers' oral health knowledge and beliefs and mothers' barriers to oral health care.

Results of the NOHP study demonstrate a need for AIAN-focused oral health research, prevention, intervention, and policy. Effective oral health promotion strategies will likely involve a multi-pronged approach that includes providing culturally appropriate community outreach and community-based education to prevent ECC; making linkages between pediatric primary care and dental care; and developing and funding programs specifically designed for improving oral health and reducing multiple levels of barriers to dental care access for AIAN mothers and children. Strategic health policies are needed to support oral health research, prevention, and intervention initiatives and to coordinate care between primary care providers, dentists, and other early childhood education and healthcare providers in AIAN communities.

BACKGROUND INFORMATION

Demographics of California AIAN

According to the 2010 Census, California (CA) has more American Indian and Alaska Natives (AIAN) than any other state,¹ with 723,225 (1.9%) people self-identified as AIAN who reported their race as either only AIAN or AIAN in combination with one or more races. Of this group, 362,801 (1.0%) people self-identified as being only AIAN.¹ Fourteen percent of the national AIAN population resides in California. The Bureau of Indian Affairs (BIA) has certified 109 federally recognized tribes, Rancherias, and Federations in CA.² In the 2010 American Community Survey, AIANs in CA had a median household income of \$44,597 compared to \$60,512 for non-Hispanic Whites.³ In addition, one-fifth of the AIAN adult population 25 years of age and older (20%) did not have a high school diploma compared to 17% of non-Hispanic Whites.³ Disparate conditions may contribute to issues of access to prevention, recognition, and treatment of early childhood caries (ECC). Furthermore, in 2005, the birth rate of AIAN women between the ages of 15-24 years was higher than of young women in general, indicating an increasing population of young children at risk for the disease.⁴

High Prevalence and Severity of ECC among AIANs

ECC is an infectious dental disease that begins soon after the primary (baby) teeth erupt.⁵ An oral health survey of AIANs in 1999 indicated that the caries prevalence for AIAN children 2 to 4 years old was the highest of any race/ethnic group (68%) and five times that of Whites.⁶ Data from the National Health and Nutrition Examination Survey (NHANES III) showed that the proportion of AIAN children with untreated decay was more than three times as high as that of children in the United States ages 2 to 5 years old (AIAN: 68%; U.S. children: 19%).⁶

Although the prevalence of dental caries in the United States has improved over the past several decades, ECC prevalence has actually increased.⁷ ECC prevalence continues to climb in AIAN children as well.^{6,8} The California Dental Support Center has noted that the ECC prevalence among AIAN children in tribal communities and tribal Head Starts is disproportionately high as compared to ECC prevalence among other race/ethnicities in the general United States population (personal communications, L. Ratnayake, 2013). A report from other states indicates that AIAN preschool children had a higher ECC prevalence than children of other race/ethnicities.⁹ There is little reason to expect that this disparity is different in CA's AIAN children. If untreated, dental caries may cause pain,¹⁰⁻¹¹ infection, as well as difficulty with eating, socializing, sleeping, and speech and language development.¹²⁻¹³ Of further concern, children with ECC are three times more likely to develop caries in their permanent teeth.¹⁴

Risk Factors and Interventions for ECC

The biological cause of ECC is bacterial infection, primarily but not restricted to *Streptococcus mutans* and Lactobacilli.¹⁵ Children may acquire the bacteria early in life, with new evidence that shows it can be acquired before tooth eruption.¹⁶ Individual risk factors for caries include dietary

habits with frequent consumption of fermentable carbohydrates, poor oral hygiene, inadequate removal of bacterial plaque, decreased salivary flow, and other family and community factors.¹⁷⁻

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There are numerous topical fluoride modalities recommended to prevent ECC that are mainly apply to dentate in children greater than six months of age.¹⁹⁻²⁶ Older children may receive dental sealants.²⁷ The Indian Health Service (IHS) has recommended that Chlorhexidine and Xylitol therapy be provided to women until their children reach two years of age to reduce maternal transmission of cariogenic bacteria to their children, but compliance is an issue.²⁸ The American Dental Association (ADA) recommends that children have their first dental visit within six months of eruption of their first tooth and no later than 12 months of age to reduce the risk of ECC.²⁹ Education is also recommended by the ADA, American Academy of Pediatric Dentistry, and IHS for the children, parents, expectant parents, and caregivers.³⁰⁻³² Integrated programs that combine education for the parent or other caregiver, and fluoride varnish for the child, have been developed to address ECC in AIAN preschool populations.³³⁻³⁴

Challenges with Current Approach to Reducing ECC in AIAN Communities

Colonization with *Streptococcus mutans* at an early age is an important factor for ECC initiation.³⁵⁻³⁶ The progression of the infection may be earlier or more aggressive for AIAN than for other children. High burdens of cariogenic bacteria have been noted in AIAN children less than six months of age.³⁷ Xylitol is an effective therapy for children over two years of age,²⁸ whereas the effectiveness of Chlorhexidine is not well established.³⁸ However, at present, there are no antimicrobial agents appropriate for use in younger children. The early onset of infection in AIAN children makes it essential that parents or caregivers have information on ECC prevention, and that children are screened and receive early preventive and restorative treatment for caries.

Parental knowledge, attitudes, and beliefs are important oral health determinants.³⁹ There is a large body of theory and research which shows that health knowledge and beliefs predict behavior.⁴⁰⁻⁴² Parents have varying knowledge of the caries etiology, and their beliefs and attitudes are in part dependent on their culture and heritage. Data showing the relationship of knowledge and beliefs related to dental care behaviors among AIANs is lacking.

AIAN parents face additional obstacles that decrease compliance with professionally-applied preventive practices and limit use of restorative care for their children. For example, geographic factors, including long distances and the need to cross mountains or deserts to get to dental clinics, are major barriers that limit access to needed oral health care. Other barriers to oral health care may include financial costs, lack of transportation, and telephone service.⁴³ In addition, although health education for parents and caregivers is recommended,³⁰⁻³² it has been shown to be ineffective in reducing caries and influencing behaviors in its current form.⁴⁴⁻⁴⁵

Demographic measures can also play a part in determining parents' oral health behaviors. Higher education status has been associated with positive oral health behaviors,⁴⁶⁻⁴⁷ as has being employed,⁴⁸ and being in a relationship.⁴⁹

These issues underscore the need for a cost-effective and culturally-sensitive primary prevention approach specific to AIAN families and communities. *Baseline data about oral health care knowledge, beliefs, and behaviors is needed in order to develop an effective prevention program for AIAN communities.*

Native Oral Health Project Study and Report Structure

The Native Oral Health Project (NOHP) study was designed to inform public health research, prevention and intervention, and policy by assessing baseline oral health knowledge, beliefs, behaviors, and barriers to oral health care among mothers in AIAN communities. This report is based on survey data collected from AIAN mothers from three northern California tribal communities. In addition to presenting information about the NOHP sample and methodology, the report includes results of descriptive and inferential statistical analyses, a summary of major findings, and recommendations for research, practice, and policy.

NOHP STUDY SAMPLE AND METHODOLOGY

Recruitment Procedure

Based on an existing relationship with the California Dental Support Center housed within the California Rural Indian Health Board, three tribal communities in Northern California were approached and agreed to participate in the Native Oral Health Project (NOHP) study. With help from advisory board members and liaisons from the three tribal communities participating in the project, NOHP staff promoted the oral health study to American Indian and Alaska Native (AIAN) mothers using radio public service announcements, flyers, brochures, postcards, social media, and tribal liaisons' word-of-mouth communications with community organizations. NOHP study staff also sponsored a recruitment event at a variety of tribal facilities and resource centers in each of the three communities. AIAN mothers were invited to enjoy lunch, receive giveaways, learn more about the project, and sign up for the study if interested.

NOHP Study Sample

A total of 53 AIAN mothers ages 18 to 51 (median age = 29 years old) from three tribes in Northern California were recruited into the NOHP study and completed a baseline survey about oral health knowledge, behaviors, beliefs, and barriers to care. A total of 39.6% of mothers in the study reported completing less than or equivalent to a 12th grade education or completing a General Education Diploma (GED). Another 58.5% of mothers had completed at least some college, received a college degree, or obtained a graduate/advanced degree. A total of 39.6% of mothers in the study were employed full or part-time, while 54.8% reported they were

unemployed, including full or part-time students, homemakers, or disabled individuals. More than half of mothers (58.5%) reported they were married or living with a partner, and 35.8% reported that their relationship status was divorced, separated, or never married. The median annual household income for the sample was approximately \$20,000. The maximum income reported fell in the \$60,000 - \$70,000 range. Table 1 shows characteristics of the sample.

Table 1: Characteristics of NOHP Study Participants

Survey Item	% (N = 53)
Education	
Completed less than or equivalent to 12 th grade education or completed GED (includes vocational/technical certificate)	39.6%
At least some college, college degree, or graduate degree	58.5%
Employment Status	
Employed full or part-time	39.6%
Unemployed (includes students, homemaker, disabled)	54.8%
Household Annual Income	
≤ \$20,000	47.2%
Relationship Status	
Married or living with partner	58.5%
Divorced, separated, or never married	35.8%

Note. Cut-points shown here for the demographic indicators were used in the analyses reported in subsequent sections of the report; income categories represent intervals above and below the cut-point closest to the sample's median income; Some percentages will not sum to 100% due to missing cells of data.

Baseline Survey Instrument

Using a paper-administered baseline survey, NOHP study staff assessed the average number of correct answers AIAN mothers gave in response to 25 questions about oral health knowledge and beliefs. An example survey item about oral health knowledge was, “There is no need to go to the dentist unless children have a problem with their teeth [True (1), False (0), Don't know (77)].” In addition, 10 oral health behaviors related to Early Childhood Caries (ECC) disease were assessed using the survey. An example behavior item was, “When your child's teeth are brushed, is fluoride toothpaste usually used? [Yes (1), No (0), Don't know (77)].” Finally, several barriers to oral health care were assessed, including whether the AIAN mothers and their children have access to oral health care (e.g., dental insurance) and transportation to attend appointments.

RESULTS

Data Analysis Approach

Data were analyzed in several stages for this report. First, frequency analyses were used to assess the number of correct answers American Indian and Alaska Native (AIAN) mothers in the study provided to 25 items about oral health knowledge and beliefs, and behaviors with children. Next, frequency analyses were used to assess barriers to childhood oral health care, and a barrier index score was created to examine the number of barriers the AIAN mothers experienced when accessing oral health care for their children.

Correlation analyses were conducted to examine associations between demographic indicators, barriers to oral health care, sum total oral health knowledge and beliefs score, and sum total oral health behavior score. One-way analysis of variance (ANOVA) was used to compare demographic categories with sum total oral health knowledge and beliefs score; sum total oral health behavior score; and sum total barriers to oral health care.

Finally, inferential statistics were used to examine associations between health knowledge and beliefs, oral health behaviors, barriers to care, and demographic indicators. A series of Analysis of Covariance (ANCOVA) were used to assess the association between demographic indicators and oral health behavior after controlling for knowledge and beliefs and barriers to care.

Knowledge, Beliefs, and Behaviors about Childhood Oral Health

On average, AIAN mothers in the study answered 22 of 25 survey items (88%) about oral health knowledge and beliefs correctly, with scores ranging from 10 of 25 questions answered correctly to 25 of 25 questions answered correctly (40 - 100%). Mothers provided the highest percentage of correct responses to knowledge and belief items about whether or not baby teeth are important and whether or not soda/pop affects a child's teeth (survey items 15 and 18). Mothers in the study provided the lowest percentage of correct responses to knowledge and belief items about how often fluoride varnish should be applied to children's teeth and whether maternal oral health practices have an effect on children's oral health practices (survey items 11 and 24). See Table 2.

Table 2: Knowledge and Beliefs about Childhood Oral Health

Survey Item and Correct Multiple Choice Answer(s)	% AIAN Mothers Who Answered Correctly (N=53)
1. Cleaning a pacifier in your own mouth after it has fallen on the floor and giving to baby spreads cavity germs. (Yes)	86.8%
2. Sharing food from the same spoon with family members spreads cavity germs. (Yes)	81.1%
3. Sharing food from the same spoon with a friend spreads cavity germs. (Yes)	84.9%
4. Sharing a toothbrush with a family member spreads cavity germs. (Yes)	90.6%
5. Sharing a toothbrush with a friend spreads cavity germs. (Yes)	88.7%
6. Kissing a baby on the cheek spreads cavity germs. (No)	84.9%
7. At what age should a child first have his/her teeth checked by a dentist or doctor? (less than 1 year old or 1 year old).	84.9%
8. On average, about how many times a year should a child see someone for dental care? (two or more times)	71.7%
9. How many times a day should a child's teeth be brushed? (two or more times)	94.4%
10. If a child has no teeth, how many times a day should gums be wiped? (two or more times)	79.2%
11. In one year, how many times should fluoride varnish be applied to a child's teeth? (Two or more times)	47.2%
12. Cavities are caused by germs in the mouth (True)	67.9%
13. It is best to use toothpaste with fluoride when brushing a child's teeth (True)	64.2%
14. Going to bed with a sippy cup or bottle with anything in it but water can hurt a child's teeth (True)	94.3%
15. Because they do not stay in your child's mouth very long, baby teeth are not that important (False)	96.2%
16. There is no need to go to the dentist unless children have a problem with their teeth (False)	94.3%
17. Eating something after brushing teeth but before going to bed affects child's teeth (Bad)	88.7%
18. Drinking soda or pop affects child's teeth (Bad)	96.2%
19. Eating sweet or sugary foods affects a child's teeth (Bad)	94.3%
20. Sharing a toothbrush with your child affects child's teeth (Bad)	88.7%
21. Using same spoon to taste the food and feed the child (Bad)	81.1%
22. Drinking milk from a sippy cup affects child's teeth (Bad)	86.8%
23. Getting fluoride varnish put on child's teeth affects child's teeth (Good)	77.4%
24. Brushing your own teeth affects child's teeth (Good)	60.4%
25. Brushing child's teeth or wiping gums (if child has no teeth) affects child's teeth (Good)	94.3%

Note. Percentages reported for mothers' correct responses only (correct item response in parentheses). A total of six survey items required mothers to provide "yes/no" responses; four survey items required mothers to select multiple choice responses associated with number of times per year/day; five survey items required mothers to provide "true/false" responses; and nine survey items required mothers to provide "good/bad/does not affect" responses.

On average, AIAN mothers in the study answered 4 of 10 survey items (40%) about oral health behaviors correctly, with scores ranging from 1 of 7 questions answered correctly (10 - 70%). Mothers most frequently reported that their children regularly attended routine dental checkups or cleanings (survey item 1).

Table 3: Behaviors About Childhood Oral Health

Survey Item and Correct Multiple Choice Answer(s)	% AIAN Mothers Who Answered Correctly (N=53)
1. During the past year, has your child been to a dentist or dental clinic for a routine checkup or cleaning? (yes)	64.2%
2. How often are your child's teeth and gums brushed or wiped? (twice or more per day)	47.2%
3. When your child's teeth are brushed, is fluoride toothpaste usually used? (yes)	52.8%
4. How often does your child eat sweet or sugary foods? (rarely/never or at least once per week but not every day)	54.7%
5. How often does your child drink sweet or sugary drinks? (rarely/never or at least once per week but not every day)	58.5%
6. In past week, how often did your child eat or drink something other than water after brushing teeth/wiping gums and before going to sleep? (0 times)	28.3%
7. How often does your child put anything in his/her mouth that has just been in someone else's mouth? (Never)	34.0%
8. During the past year, has your child had fluoride varnish put on his/her teeth? (Yes)	56.6%
9. If your child has had fluoride varnish put on his/her teeth, how many times during the past year has your child had fluoride varnish applied (two or more times)	30.2%
10. How often do you brush your <u>own</u> teeth? (twice or more per day)	52.8%

Note. Percentages reported for mothers' correct responses only (correct item response in parentheses). A total of three survey items required mothers to provide "yes/no" responses; six survey items required mothers to select multiple choice responses associated with number of times per year/week/day; and one survey item required mothers to answer multiple choice responses associated with the general frequency of an oral health behavior.

Barriers AIAN Mothers Experienced When Accessing Oral Health Care

Descriptive statistics indicated that 84.9% of AIAN mothers in this study had access to their own dental insurance and 84.9% to dental insurance for their children. A total of 3.8% and 1.9% of mothers reported not having access to dental insurance for themselves or children, respectively. A total of 77.4% of AIAN mothers in the study reported having access to a car to drive their child to dental appointments, 9.4% reported that they could be driven to children's dental appointments, and 3.8% would use public transportation to attend children's dental appointments.

The majority of AIAN mothers in the study (52.8%) indicated that the dental clinic was 0 to 15 minutes from their starting location, 26.4% said the clinic was 16-30 minutes away, and 9.4% traveled more than 30 minutes to the clinic for children's dental appointments. A total of 9.4% of mothers said children's dental appointments took less than 15 minutes, 34% reported that

children’s dental appointments took 16-30 minutes, 28.3% said appointments lasted 31-60 minutes, and 7.5% of mothers said children’s appointments lasted more than 60 minutes.

The majority of AIAN mothers in the study (58.5%) reported that they did not miss work to take children to the clinic for a dental appointment this year, whereas 11.3% of mothers missed work one time, 5.7% missed work twice, and 3.8% missed work more than two times to attend children’s dental appointments. About half (50%) of the mothers in the study were not employed, which is why a significant number did not miss work to take children to appointments. Of the mothers who were not employed, 29.2% reported that they were full or part-time students, homemakers, or disabled, and another 20.8% reported being unemployed.

Descriptive analyses were taken one step further with the creation of a barrier index score to allow us to: (1) identify the percentage of AIAN mothers in the study who experienced multiple barriers to oral health care; (2) establish a numerical cut-off point for identifying which mothers in the study experienced relatively greater barriers to care than other mothers in the study; and (3) create a summed barrier score to be used in subsequent statistical analyses to examine associations of the summed barrier score, demographic indicators, and oral health behavior.

To create the barrier index score, descriptive statistics (i.e., frequencies) of the responses to each barrier-related survey question were examined. From these statistics, a numerical cut-off point was established for each survey item to separate higher and lower maternal risk responses into dichotomous categories (1 = higher risk, 0 = lower risk). Those with higher risk were counted as having a barrier. See Table 4 for barriers to oral health care presented by higher risk dichotomous category.

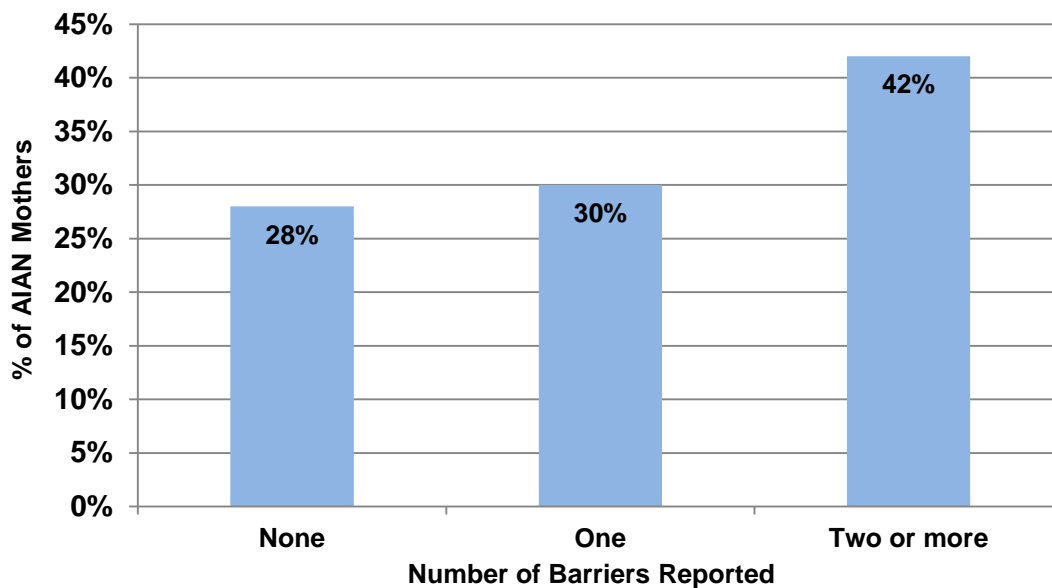
Table 4: Barriers to Oral Health Care

Survey Item and Higher Risk Dichotomous Category	% (N=53)
1. Do you now have any type of insurance that pays for all or part of your child’s dental health care? (No)	1.9%
2. Do you now have dental insurance for yourself? (No)	3.8%
3. During the past 12 months, was there a time when your child needed dental care, but you couldn’t get it at the time? (Yes)	11.3%
4. How long does a dental visit usually take from the time you arrive until the time you leave? (> 30 minutes)	35.8%
5. During the past year, how many times did you miss work to take your child for dental care (≥ 1 time)	20.8%
6. How much time does it (or would it) take you and your child to travel to the dental office or clinic? (> 30 minutes)	35.8%
7. How do you get to the dental office or clinic? (would be driven by another person or use public transit)	13.2%

Note. Dichotomous response categories indicate higher risk cut-point used to define each higher risk barrier in the barrier index score (higher risk dichotomous category in parentheses).

Next a statistical count function was used to sum the number of higher risk barrier responses (i.e., the number of barriers experienced). The resulting barrier index score of the summed values was indicative of mothers reporting between 0 to 7 barriers. After conducting descriptive statistics of the barrier index score, it was determined that some AIAN mothers in the study experienced multiple barriers to accessing oral health care. A total of 28% of mothers in the study reported no barriers to oral health care, 30% experienced one barrier to oral health care, and 42% experienced two or more barriers to oral health care. Thus, 72% of AIAN mothers in the study reported having one or more barriers to oral health care. See Figure 1.

Figure 1. Number of Barriers to Oral Health Care



Average Oral Health Knowledge and Beliefs, Oral Health Behaviors, and Barriers to Oral Health Care

To prepare for inferential statistical analyses, summed scores for two sets of survey items were created. First, an oral health knowledge and beliefs score was created by summing correct responses for the 25 survey questions assessing knowledge and beliefs about oral health care. Second, an oral health behavior score was created by summing the correct responses for the 10 survey questions assessing oral health behaviors. The result of this process was that each AIAN mother in the study had a summed score for oral health care knowledge and beliefs that ranged from in value from 1 to 25 correct responses and another summed score for oral health behaviors that ranged in value from 1 to 10 correct responses.

Table 5 shows the statistical averages (means) of the summed scores for mothers' oral health knowledge and beliefs, oral health behavior, and number of barriers to oral health care experienced by mothers in the study. The average oral health knowledge and beliefs score for mothers in the study was 21.58, indicating that, on average, the mothers had 22 out of 25

possible correct responses to the survey questions assessing oral health knowledge and beliefs. The average oral health behavior score for mothers in the study was 4.85, indicating that, on average, mothers had approximately 5 out of 10 possible correct responses to the oral health behavior questions. Finally, the average number of barriers experienced was 1.23, indicating that the mothers experienced approximately one barrier to care. Mothers experienced a median number of one barrier to oral health care. The mode of barriers experienced by mothers in the study was two. The finding that the mean (i.e., statistical average), median, and mode differed in value indicates there was a slight skew in the distribution for number of barriers experienced. The skewed distribution can be explained by the fact that some mothers in the study experienced a higher than average number of barriers to oral health care.

Table 5: Average Oral Health Knowledge and Beliefs, Oral Health Behavior, and Number of Barriers to Oral Health Care

Indicator	N	M	SE	Min	Max
Oral Health Behavior	52	4.85	0.32	1	10
Oral Health Knowledge and Beliefs	50	21.58	0.43	10	25
Barrier Index Score	53	1.23	0.14	0	4

Note. All indicators are summed scores.

Associations Between Demographic and Oral Health Indicators

Zero-order correlations were conducted to identify demographic indicators (education status, employment status, relationship status) that were associated with mothers' oral health knowledge and beliefs, oral health behaviors, and barriers to oral health care. See Table 6.

Table 6: Zero-order Correlations Between Demographic and Oral Health Indicators

	Oral Health Knowledge and Beliefs	Oral Health Behaviors	Barriers to Oral Health Care	Education Status	Employment Status
Oral Health Knowledge and Beliefs	1				
Oral Health Behaviors	0.325*	1			
Barriers to Oral Health Care	-0.002	0.111	1		
Education Status	0.296*	0.299*	-0.168	1	
Employment Status	0.240+	0.278*	0.179	0.249+	1
Relationship Status	0.162	0.267+	-0.136	0.336*	0.214

Note. * $p < .05$; + $p < .10$.

Results of the zero-order correlation analyses indicated that education status was positively correlated with oral health knowledge and beliefs ($r = .296$, $p < .05$) and oral health behaviors ($r = .299$, $p < .05$). Employment status was also positively associated with oral health behaviors ($r = .278$, $p < .05$). When considering the relationships among oral health indicators, knowledge

and beliefs were positively correlated with behaviors ($r = .325, p < .05$). Zero-order correlations indicated that mothers with higher education status reported having a greater number of positive oral health knowledge, beliefs, and behaviors; employed mothers reported engaging in a greater number of positive oral health behaviors; and mothers with higher levels of oral health knowledge and beliefs reported engaging in a greater number of oral health behaviors. No other associations between demographic and oral health indicators were statistically significant. It is important to note that the absence of significant findings may be a reflection of the low statistical power associated with the study's small sample size.

Demographic Indicators, Barriers to Oral Health Care, and Oral Health Behaviors

One-way analysis of variances (ANOVAs) were used to examine the relation between demographic indicators and oral health behaviors and the relation between barriers to oral health care and oral health behaviors. Table 7 shows the average number of oral health behaviors by demographic indicator.

Table 7: Average Oral Health Behaviors by Demographic Indicator

Indicator	N	Mean	SE	F	p-value
Education					
Completed less than or equivalent to 12 th grade education or completed GED (includes vocational/technical certificate)	21	4.05	0.368	4.923	0.031
At least some college, college degree, or graduate degree	31	5.45	0.456		
Employment Status					
Employed full or part time	21	5.71	0.544	4.031	0.050
Unemployed (includes students, homemaker, disabled)	29	4.41	0.386		
Relationship Status					
Married or living with partner	31	5.42	0.429	3.404	0.071
Divorced, separated, or never married	19	4.21	0.456		

Note. * $p < .05$; + $p < .10$.

Findings indicated that AIAN mothers in the study who had attained at least some college education or a higher education degree had a higher average oral health behavior score than mothers with a high school education or less ($F = 4.92, p = .031$). Mothers in the study who were employed had higher average oral health score than mothers who were unemployed ($F = 4.03, p = .05$). The relation between relationship status and oral health behavior was significant at trend level ($F = 3.40, p = .071$), indicating that mothers who were married or living with a partner had marginally higher average positive oral health behavior scores than mothers who were single.

Results of the second one-way ANOVA examining the relation between barriers to oral health care and oral health behaviors did not indicate any significant differences in oral health

behaviors between mothers in the study who experienced a lower or higher number of barriers to oral health care.

Taken together, findings from the one-way ANOVAs suggested that demographic measures of education and employment are a stronger indicator of mothers' average oral health behaviors than relationship status and barriers to oral health care.

Relation between Demographic Indicators, Oral Health Knowledge and Beliefs, Barriers to Oral Health Care, and Oral Health Behaviors

The final series of statistical analyses were guided by: (1) the theoretical framework of the study which suggested that oral health knowledge and beliefs, barriers to oral health care, and demographic indicators are related to oral health behaviors; (2) correlation analyses that showcased a significant positive association between oral health knowledge and beliefs and oral health behaviors; and (3) findings from one-way ANOVAs which highlighted differences in average oral health behaviors between different demographic groups of mothers in the study.

The first statistical test conducted with an analysis of covariance using average American Indian and Alaska Native (AIAN) maternal oral health behaviors as the outcome variable. Predictor variables in the model were maternal demographic indicators, and covariates included mothers' oral health knowledge and beliefs and barriers to oral health care, which are continuous variables. Due to the small sample of mothers included in the NOHP study and the resulting low statistical power, only one demographic indicator was included in the model at a time.

Table 8 shows the results of the ANCOVA of between-subject effects with education status included in the model. Within the ANCOVA model, there was a statistically significant relation between number of barriers to oral health care and average oral health behaviors ($F = 5.35, p = .03$). There was a trend toward significance for the relation between oral health knowledge and beliefs and oral health behaviors ($F = 3.99, p = .05$) and between education status and oral health behaviors ($F = 3.55, p = .07$). In sum, mothers' higher education status was marginally associated with higher average oral health behaviors after accounting for mothers' oral health knowledge and beliefs and mothers' barriers to oral health care.

Table 8: Relation between Demographic Indicators, Oral Health Knowledge and Beliefs, Barriers to Oral Health Care, and Oral Health Behaviors

Source	Type III SS	df	Mean Sq	F	p-value	Partial Eta Sq	Observed Power
Corrected Model	61.90	3	20.632	5.019	0.004	0.247	0.89
Intercept	0.06	1	0.063	0.015	0.902	0.000	0.05
Oral Health Knowledge and Beliefs	16.42	1	16.415	3.993	0.052	0.080	0.50
Barriers to Oral Health Care	22.00	1	21.999	5.352	0.026	0.104	0.62
Education Status	14.68	1	14.576	3.546	0.066	0.072	0.45
Residual	189.09	46	4.111				
Total	1511.00	50					

Note: * $p < .05$; + $p < .10$.

Two additional ANCOVAs were conducted using employment status and relationship status as indicators. Neither indicator was significantly related to average oral health behaviors after controlling for oral health knowledge and beliefs and barriers to oral health care.

DISCUSSION OF MAJOR FINDINGS AND RECOMMENDATIONS FOR RESEARCH, PRACTICE, AND POLICY

An important finding from the NOHP study was that on average, American Indian and Alaska Native (AIAN) mothers reported more correct responses to survey items about oral health knowledge and beliefs than to survey items about oral health behaviors. Although results were in line with the empirical framework for the study and suggest a positive association between oral health knowledge and beliefs and oral health behaviors, the discrepancy between correct answers warrants exploration in future research. Many health interventions follow an education model aimed at improving oral health knowledge and beliefs in hopes that oral health behaviors will also improve. In the case of AIAN women, it may be that interventions will be most beneficial if they target oral health knowledge and beliefs *and* focus on making improvements in specific oral health behaviors. For example, with the NOHP study sample, interventions could be tailored to improve oral health knowledge and beliefs and to work directly with mothers to record and reduce the numbers of times children eat or drink something other than water after brushing teeth or wiping gums and before going to sleep. Another behavior-focused intervention approach for mothers in the NOHP study could involve working with mothers to schedule fluoride varnish dental appointments for children. Future in-depth research about the discrepancy between reported correct oral health knowledge and beliefs and oral health behaviors among AIAN mothers would also inform prevention or intervention practices for medical and/or dental practitioners who could use findings to shape clinic-based health education initiatives.

Although many AIAN mothers in the NOHP study reported barriers to oral health care for children, a positive finding was that nearly all AIAN mothers and children reported having dental

insurance. That said, some of the most common barriers to oral health care involved the time spent traveling to and attending children's dental appointments. Recommendations for practice and policy involve establishing satellite and mobile dental services closer to the residences of AIAN mothers and actively working to reduce unnecessary wait times at dental clinics.

In the NOHP study, mothers who had attended college or attained a college or graduate degree reported engaging in more positive oral health behaviors. Findings further highlight the extant research about the importance of higher education of tribal members⁵⁰ and suggest that policymakers continue to advocate for advanced educational opportunities for AIAN people.⁵¹

There are additional avenues for future research based on the findings from the baseline surveys of AIAN mothers in the NOHP study. In addition to increasing the sample size to allow for the statistical power necessary for drawing interpretations about statistical analyses, researchers should examine whether demographic indicators and/or oral health knowledge and beliefs interact to influence oral health behaviors for AIAN mothers. For example, in post-study analyses, there was a marginally statistically significant finding which indicated that single, employed mothers in the study demonstrated the lowest level of positive oral health behaviors compared to their non-single, unemployed counterparts. If this finding were replicated in future studies with a larger sample, it would be advantageous to develop and fund support-based interventions targeting single working AIAN mothers. Finally, in future research, it will be important to examine longitudinal relations between demographic indicators, oral health knowledge and beliefs, oral health behaviors, and barriers to oral health care for AIAN mothers.

Conclusion

Results of the NOHP study demonstrate a need for AIAN-focused oral health research, prevention, intervention, and policy. Effective oral health promotion strategies will likely involve a multi-pronged approach that includes providing culturally appropriate community outreach and community-based education to prevent Early Childhood Caries (ECC); making linkages between pediatric primary care and dental care; and developing and funding programs specifically designed for improving oral health and reducing multiple levels of barriers to dental care access for AIAN mothers and children. Strategic health policies are needed to support oral health research, prevention, and intervention initiatives and to coordinate care between primary care physicians, dentists, and other early childhood education and healthcare providers in AIAN communities.

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