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Association of Ethnic Identity with Oral Health Knowledge, Attitudes, Behavior, and Outcomes on the Navajo Nation

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Abstract

American Indians and Alaska Natives (AI/ANs) experience poor oral health. Children and adults living on the Navajo Nation have a particularly high rate of dental decay. The literature suggests that health outcomes are often associated with the strength of one's ethnic identity. We

investigated the association of ethnic identity among Native parents with oral health knowledge, attitudes, behavior, and outcomes. Analyses used baseline data from a randomized controlled trial designed to reduce dental decay among AI/AN preschoolers enrolled in the Navajo Nation Head Start Program. Greater perceived importance of ethnic identity was associated with better oral health knowledge and attitudes but was unassociated with oral health behavior and was linked to worse oral health status. Parents who were better able to speak their tribal language had greater confidence in their ability to manage their children's oral health, engaged in better oral health behavior, and reported better parental oral health status.

Keywords

Social identification; oral health; North American Indians; child

American Indians and Alaska Natives (AI/ANs) have the worst oral health of any racial or ethnic group in the United States.^{1–4} Native people living on the Navajo Nation—the country's largest Indian reservation—experience a particularly high burden of dental disease.^{3,5} Among two-to-five year old children in the Navajo Area, one of 12 geographic areas served by the Indian Health Service, 86% show signs of dental decay, compared with 62% of AI/AN children generally and 23% of White children.^{1–3} Among adults age 35–44 living in the Navajo Area, 74% have untreated dental decay, with an average of 13 teeth affected.⁵

The literature suggests that ethnic identity among Native people is associated with a variety of important health-related constructs. Understood to be the subjective identification with and sense of belonging to one's ethnic group⁶—in this case, one's tribe—ethnic identity is commonly measured by indicators such as participation in cultural activities, use of the language of one's ethnic group, pride in one's cultural heritage, and perceived importance of ethnic group membership to one's self-concept.⁷ Among AI/ANs, strong ethnic identification is linked to higher levels of positive health attitudes,^{8,9} higher rates of positive health behaviors,^{10,11} lower rates of negative health behaviors,^{9,12,13} and better health outcomes.^{7,13–17}

Despite these results, it appears that ethnic identity is not always associated with positive outcomes for Native people.⁷ Indeed, in some circumstances, strong ethnic identity among AI/ANs has been found to be associated with suboptimal health behaviors, such as smoking,¹⁸ drug use,¹⁹ and failure to undergo recommended cancer screening procedures.²⁰ Some investigators have suggested that health-enhancing behaviors may be perceived as inconsistent with the content of one's ethnic identity.²¹ For instance, in many AI/AN tribes, smoking tobacco is an important component of cultural ceremonies. In this case, a behavior known to have negative effects on health plays an important role in cultural practices that may serve to maintain and reaffirm one's ethnic identity.²²

To our knowledge, no studies have assessed the relationship between ethnic identity and oral health in Native communities. We investigated this relationship using data from a randomized controlled trial designed to reduce dental decay among AI/AN preschoolers enrolled in the Navajo Nation Head Start Program.²³ Head Start is a federal program

providing educational and health services to children from low-income families. Given the high prevalence of economic distress on the reservation, where 44% of children live in poverty,²⁴ all preschool-age children on the Navajo Nation are eligible for Head Start. Working in partnership with the tribal Head Start program, the trial's investigators sought to reduce dental decay among preschool-age children through regular application of fluoride varnish and provision of oral health education to enrolled children and their parents.

Using baseline data from the trial, we examined the association of parental ethnic identity with (1) the oral health knowledge, attitudes, and behavior of parents, and (2) the oral health outcomes of parents and their preschool-age children. (Throughout, we use the term "outcomes" to refer to indicators of oral health condition, such as self-reported oral health status [OHS] or oral exam results.) Given prior evidence that strong ethnic identity is frequently linked with positive health-related attitudes, behaviors, and outcomes, we hypothesized that stronger ethnic identity would be associated with better parental oral health knowledge, more positive oral health attitudes and behaviors among parents, and better oral health outcomes among parents and children. Although there is evidence that strong ethnic identification is sometimes associated with poor health behaviors in AI/ANs, we did not anticipate recommended oral health behaviors to be inconsistent with AI/AN identity. We expected positive identity to be linked with positive oral health behavior.

We believe this work represents the first large-scale examination of the link between ethnic identity in Native people and oral health. A key strength is the study's examination of a broad range of health factors (i.e., knowledge, attitudes, behavior, outcomes). This analysis is also innovative in that it examines the association between parents' ethnic identity and the outcomes of their children. Whereas previous studies have made the connection between identification with one's tribal group and one's own health outcomes, this analysis assesses the extent to which parents' ethnic identity is linked to the outcomes of their dependents. A better understanding of these relationships may help to inform the development of culturally appropriate interventions that can successfully reduce oral health problems in Native communities.

Methods

Study design.

Data included in the analyses reported here were collected as part of the study entitled "Preventing Caries in Preschoolers: Testing a Unique Service Delivery Model in American Indians." As described in an earlier report,²³ the study was a cluster randomized trial examining the effects of a health promotion intervention on oral health outcomes among preschool-age children enrolled in the Navajo Nation Head Start program. Randomization was conducted at the level of the Head Start Center. The final sample included 39 Head Start Centers, representing nearly half of the Head Start Centers on the Navajo Nation. Twenty centers were randomized to the intervention arm and 19 to the control arm. There were 26 classrooms in each study arm.

Within each Head Start Center, participants were recruited in parent-child dyads. Children were eligible for participation if they were age three-to-five years, were enrolled in a

participating Head Start Center, and had a parent or caregiver willing to participate in the study (hereafter, referred to as “parents”). Parent-child dyads were excluded if the child was allergic to any component of fluoride varnish, if the child had any serious health conditions, or if the parent did not speak English. One thousand and sixteen dyads were enrolled in the study. Because this analysis used baseline data to examine the association of ethnic identity with oral health, we excluded dyads for which the participating parent was not AI/AN (n=20) and dyads for which baseline data were missing (n=6). Hence, the final analysis sample included 990 dyads.

The intervention involved application of fluoride varnish and provision of oral health education.²³ Over a two-year period, children in the intervention arm had fluoride varnish applied to their teeth four times per school year and participated in oral health education activities five times per school year. Educational sessions for parents were conducted four times per year. Participants in the control arm did not receive study-related fluoride varnish or oral health education, instead receiving the health and educational services that were normally provided through the Head Start Center. In both the intervention and control arms, participants received toothbrushes and toothpaste for all family members.

Data collection.

At enrollment and annually thereafter, participating parents completed the Basic Research Factors Questionnaire (BRFQ),²⁵ which included items assessing parental ethnic identity; parents’ oral health knowledge, attitudes, and behavior; oral health outcomes; and sociodemographic characteristics. The questionnaire was administered via an Audio Computer-Assisted Self-Interviewing system, which allowed parents simultaneously to read the questions and hear them narrated by a member of the Navajo Nation.

At baseline and then annually, an oral exam was conducted with each participating child. Procedures for conducting these examinations and ensuring reliability among examiners were described in detail in an earlier report.²⁶ After brushing the teeth, the examiner conducted a knee-to-knee examination, with parental assistance, using a direct light source and mouth mirror to facilitate visualization. The examiner evaluated each tooth for the presence of decayed, missing, and filled tooth surfaces, with scoring following standardized criteria.^{27,28}

Measures.

Analyses used baseline data to examine the association of parental ethnic identity with measures of parental oral health knowledge, attitudes, and behavior as well as indicators of pediatric and parental oral health.

Ethnic identity.—Ethnic identity was assessed using two items adapted from the Special Diabetes Program for Indians Healthy Heart Project.²⁹ The items were informed by orthogonal cultural identification theory³⁰ and the Bicultural Ethnic Identity Scale.³¹ The first item, which assessed the perceived importance of one’s ethnic identity, asked parents “How important is it to you that you maintain your ethnic identity and your tribe’s values and practices?” Participants chose one of four responses: 1 = not at all, 2 = a little, 3 =

somewhat, or 4 = very much. The second item, which assessed tribal language proficiency, asked parents “How well do you speak your tribal language?” Participants chose one of four responses: 1 = I don’t speak my tribal language; 2 = I speak it a little, but not very well; 3 = I speak it moderately well; or 4 = I speak my tribal language very well. Because responses to these items were not well correlated ($r=0.22$), we analyzed each item separately rather than creating an overall ethnic identity measure.

Parental oral health knowledge.—As described in an earlier report,³² parents answered 14 BRFQ items that assessed knowledge of oral health and recommended parental oral health behaviors (e.g., “How many times a day should a child’s teeth be brushed?”). Responses were coded as correct or incorrect (with “don’t know” responses coded as incorrect). An overall measure of oral health knowledge was computed as the percentage of questions answered correctly.

Parental oral health attitudes.—The BRFQ assessed several constructs related to parents’ attitudes about oral health and recommended oral health behavior. Twelve items assessed self-efficacy (i.e., confidence that one can successfully engage in recommended behaviors), which is a strong predictor of health behavior.^{33,34} These items, which have been previously described,³⁵ asked parents to indicate how sure they were that they could engage in specific oral health behaviors (e.g., use fluoride toothpaste when brushing their children’s teeth). Items used a five-point scale, ranging from 1 = not at all sure to 5 = extremely sure. For analysis, we used the average of the self-efficacy items.

We also examined parents’ perceptions of the importance of engaging in recommended oral health behavior. The BRFQ importance items were identical to the self-efficacy items, except that they asked parents to indicate how important it was to them to engage in each behavior. Items used a five-point scale, ranging from 1 = not at all important to 5 = extremely important. For each participant, we computed the average of the importance items. We expected that participants who believed adherence to recommended parental oral health behaviors to be more important would be more likely to engage in those behaviors.

Prior research suggests that parents who feel they are in control of their children’s oral health have children with better oral health outcomes.³⁶ Using items adapted from existing measures,^{36,37} the BRFQ assessed parents’ dental locus of control (LOC). These items examined the extent to which parents agreed with statements indicating that *they themselves* were in control of their children’s oral health (Internal LOC), that the *dentist* was in control (Powerful Others LOC), or that their children’s oral health was a matter of *chance* (Chance LOC). Parents responded to items using a five-point scale, ranging from 1 = strongly disagree to 5 = strongly agree. For each type of LOC, we computed the average of the items assessing that domain.

Sixteen BRFQ items measured key constructs from the Health Belief Model, a theory developed to explain health behavior.^{38,39} These included perceived susceptibility (i.e., parents’ perceptions that their children were susceptible to developing cavities), perceived severity (i.e., the degree to which parents’ believed oral health problems in children to be severe), and perceived benefits of and barriers to engaging in recommended oral health

behaviors. For these items, which have been previously described,³⁵ parents responded using a five-point scale, ranging from 1 = strongly disagree to 5 = strongly agree. We computed the average of the items associated with each construct, with larger numbers representing a greater degree of the construct. For instance, larger numbers represent a higher level of perceived barriers to good oral health behavior. Consistent with the theory, we expected that parents would be more likely to engage in recommended oral health behaviors to the extent that they perceived their children to be susceptible to cavities, believed oral health problems to be severe for children, and perceived many benefits and few barriers to recommended behaviors.

Parental oral health behavior.—Twelve BRFQ items, which have been previously described,³² assessed parental oral health behavior (e.g., frequency of brushing). For each item, responses were coded as adherent or non-adherent with current recommendations for good oral health care. We computed an overall behavioral adherence score, which represented the percentage of behaviors for which parents reported engaging in the recommended behavior.

Oral health outcomes.—Four indicators of oral health were used in this analysis. Three measures assessed the oral health of participating children and one measure assessed the oral health of participating parents. Using data from the baseline oral examination, we computed the number of decayed, missing, and filled tooth surfaces (dmfs) for each child, a measure that had a potential range of 0 to 88 tooth surfaces.⁴⁰ Three additional measures were computed from BRFQ items that asked parents to rate their children's OHS, their own OHS, and their children's pediatric oral health-related quality of life (POQL). Responding to items adapted from the National Survey of Children's Health,⁴¹ parents rated their children's and their own OHS on the following five-point scale: 1 = excellent, 2 = very good, 3 = good, 4 = fair, or 5 = poor. In evaluating POQL, parents reported the frequency with which their children's oral health affected their daily functioning and how bothered their children were by these experiences. Our POQL measure has been previously validated in AI/AN^{42,43} and other populations.⁴⁴ POQL scores had a potential range from 0 to 100, with lower scores representing better POQL.

Participant characteristics.—Participant characteristics assessed in the BRFQ include parent and child age and gender, parental educational attainment, and household income. Education was coded using a four-point scale: 1 = <high school graduate, 2 = high school graduate or GED, 3 = some college or vocational school, and 4 = college degree or more. Income was measured as the total pre-tax income of all household members for the prior year and was coded using a five-point scale, ranging from 1 = <\$10,000 to 5 = \$40,000. To avoid excluding the 15.7% of participants who declined to provide income information, an additional category was included to identify participants with missing income data. Missing data were minimal for other demographic variables (<2%).

Data analysis.

Descriptive analyses examined participant characteristics and baseline performance on all measures. One-way analysis of variance (ANOVA) was used to examine the relationship

between participant characteristics and ethnic identity. Separate ANOVA analyses were used to assess the extent to which each ethnic identity variable was associated with measures of oral health knowledge, attitudes, behavior, and outcomes. These analyses controlled for parent age, education, gender, and income. A p value of .05 was used to indicate a significant result.

Study approvals.

The study protocol was approved by the Navajo Nation Human Research Review Board and the [Name of Institutional Review Board Retracted for Blind Review]. Participating parents provided written informed consent and Health Insurance Portability and Accountability Act authorization prior to study participation.

Results

Participant characteristics.

Table 1 presents descriptive information about participating parents and children. Parents were 32 years old, on average (range=19–88), with the majority being women (84%). Most adult participants (92%) identified themselves as the mother or father of the participating child. Although nearly half of adult participants reported at least some college or vocational training, 41% of the sample reported a household income <\$10,000 for the prior year. Participating children ranged from three to five years of age, with an average of 3.6. Fifty-one percent were female.

All participating parents were AI/AN, with 96% identifying as enrolled members of the Navajo Nation. As shown in Table 1, 87% of participants felt it was “very” or “somewhat” important to maintain their ethnic identity and their tribe’s values and practices. In addition, the majority of adult participants (57%) reported that they could speak their tribal language “moderately well” or “very well.”

Association of sociodemographic characteristics with ethnic identity.

Ethnic identity was significantly associated with sociodemographic characteristics (Table 2). Participants with higher levels of income felt it was significantly more important to maintain their ethnic identity and reported speaking their tribal language better than did those with lower annual incomes ($p<.0001$). Higher levels of educational attainment were significantly (and positively) associated with ethnic identity importance ($p<.0001$), although they were not associated with the ability to speak one’s tribal language ($p=.14$). Compared with younger individuals, older parents perceived greater importance in maintaining one’s ethnic identity ($p=.03$) and were better able to speak their tribal language ($p<.0001$). There was no association between parent gender and importance of maintaining ethnic identity ($p=.16$) or ability to speak the tribal language ($p=.53$).

Knowledge, attitudes, behavior, and outcomes.

Table 3 presents baseline performance on all oral health-related measures. Scores on the oral health knowledge measure were relatively strong, with parents answering 74% of questions correctly, on average.

Parents' oral health attitudes were generally positive. On average, participants felt it was important to engage in recommended oral health behaviors (mean=4.7) and expressed confidence in their ability to do so (i.e., self-efficacy, mean=4.4). Similarly, parents typically agreed with statements suggesting that LOC for their children's oral health lay with them (mean=4.0) and disagreed with statements suggesting that control over their children's oral health was in the hands of the dentist (mean=2.2) or was a matter of chance (mean=2.5). On average, parents agreed that poor oral health can be a severe problem (mean=4.3), agreed that engaging in good oral health behavior can prevent cavities (i.e., perceived benefits, mean=4.3), and disagreed that they experience barriers to engaging in good oral health behavior (mean=2.2). Parents did not feel that their children were strongly susceptible to cavities (mean=3.4).

Although oral health knowledge was relatively strong and oral health attitudes quite positive, adherence to recommended parental oral health behaviors was low. On average, participating parents reported engaging in only 51% of behaviors recommended to protect the health of their children's teeth.

Indicators of pediatric oral health outcomes showed disparate results (Table 3). Although participating children had a mean dmfs of 21.5—very high compared with other population groups⁴⁰—parent assessment of pediatric POQL and OHS were quite positive. Average POQL score was very low (mean=4.2 on 0–100 scale, with 0 being the best score), suggesting that parents perceived their children's POQL to be very good. Similarly, 68% of parents rated their children's OHS to be good, very good, or excellent. Parents rated their own oral health less positively, however, with 59% rating their OHS to be good, very good, or excellent.

Association of ethnic identity with oral health constructs.

As shown in Table 4, the perceived importance of maintaining one's ethnic identity, values, and practices was significantly related to many of the oral health constructs investigated. Participants with higher levels of ethnic identification had higher oral health knowledge scores ($p<.0001$), perceived recommended oral health behavior to be more important ($p<.0001$), and reported higher levels of self-efficacy ($p=.002$) than did participants who reported a lower level of identification with their tribe. Similarly, participants who reported that it was more important to maintain their tribal identity, values, and practices were more likely to perceive themselves to be in control of their children's oral health outcomes ($p=.001$); they were less likely to feel that their children's oral health was in the hands of the dentist ($p=.02$) or was a matter of chance ($p=.002$). Parents with higher levels of ethnic identification also reported oral health problems to be more severe ($p<.0001$) and perceived fewer barriers ($p<.0001$) and more benefits to good oral health behavior ($p=.01$) than did participants with lower levels of ethnic identification. Perceived susceptibility ($p=.83$) and behavioral adherence ($p=.36$) were not associated with perceived importance of maintaining one's tribal identity.

Oral health outcomes were not associated with ethnic identification in the manner expected (Table 4). No association was seen between perceived importance of maintaining one's ethnic identity and dmfs ($p=.91$) nor between ethnic identity and POQL ($p=.63$). There was a

significant association between ethnic identification and parents' ratings of their own and their children's OHS. Unexpectedly, however, participants with stronger ethnic identification rated their own oral health ($p<.0001$) and their children's oral health ($p=.02$) to be significantly worse than did participants for whom maintaining ethnic identity was less important.

Table 5 presents the association of tribal language with oral health-related constructs. There were fewer significant associations between ability to speak one's tribal language and the measures of oral health knowledge, attitudes, behavior, and outcomes. Participants reporting better tribal language proficiency reported significantly greater oral health self-efficacy ($p=.02$) than did participants reporting a lower level of facility with their tribal language. Further, those reporting better tribal language skills had significantly better behavioral adherence scores ($p=.005$) than did participants with more limited tribal language skills. Oral health knowledge was not significantly associated with tribal language skill ($p=.13$), nor were any additional attitudinal measures. Parents with stronger tribal language skills rated their own OHS significantly better than did participants who reported more limited skills in using their tribal language ($p=.004$). Parental tribal language skills were not associated with any of the three measures of pediatric oral health ($p>.05$).

Discussion

Our findings suggest that ethnic identity among Navajo parents is related to a variety of important oral health constructs. Parents who more strongly endorsed the importance of maintaining one's tribal identity, values, and practices had significantly stronger oral health knowledge scores and more positive oral health attitudes than did parents with lower levels of ethnic identification. Parents with strong ethnic identity did not adhere better to recommended parental oral health behavior, however, and actually reported worse OHS for themselves and their children than did parents who did not identify as strongly with their tribe. Tribal language proficiency was associated in very different ways with the oral health constructs investigated. Individuals reporting better facility with their tribal language felt greater confidence in their ability to manage their children's oral health (i.e., self-efficacy), were more adherent to recommended parental oral health behaviors, and reported having better OHS. Neither dmfs nor POQL was associated with ethnic identification.

Results related to the perceived importance of maintaining one's ethnic identity were not entirely consistent with our expectations. As hypothesized, parents with stronger ethnic identification had better oral health knowledge scores and more positive oral health attitudes. Ethnic identity importance was not linked to behavior, however. This result is striking in that health-related knowledge and attitudes are important predictors of behavior.^{38,39,45} Despite their strong knowledge and attitudes, highly ethnically identified parents did not exhibit better adherence to recommended oral health behavior. This result could suggest that recommended practices—such as brushing with fluoride toothpaste and taking children for routine dental visits—do not align well with AI/AN identity.²¹ Prior research indicates that racial and ethnic minorities—including AI/ANs—perceive some health-promoting behaviors to be associated with White, middle-class populations.⁴⁶ Minority individuals for whom ethnic identity is particularly salient also express greater fatalism about the likelihood of

avoiding poor health outcomes.⁴⁶ This sense of health fatalism and the identification of healthy behaviors as an “out-group” activity may reduce engagement in recommended oral health practices among people strongly identified with their tribal group.

Alternately, there may be other predictors of behavior that outweigh the influence of ethnic identity, knowledge, and attitudes. The economic challenges faced by many Navajo families and the scarcity of dental care resources, for instance, may be important social determinants of parental oral health behavior. On the Navajo Nation, 38% of residents live in poverty.²⁴ Further, although the reservation covers 25,000 square miles and is home to 173,000 people,²⁴ there are only 22 dental clinics and 32.3 dentists per 100,000 residents.⁴⁰ Extreme economic disadvantage and limited access to dental care may compromise parental engagement in recommended oral health behaviors, perhaps lessening the potential impact of ethnic identity and associated oral health knowledge and attitudes.

Although two measures of oral health outcomes were unrelated to ethnic identity (dmfs and POQL), parents who perceived great importance in maintaining their tribal identity reported significantly worse OHS for themselves and their children. Given their strong oral health knowledge and positive attitudes about the value of good oral health and recommended oral health practices, these parents may have been particularly sensitive to any negative oral health events that they and their children were experiencing and may thus have rated OHS more negatively. These ratings may, indeed, have been more accurate. Across the sample, children’s outcomes were reported to be more positive than the clinical data suggested. Although children had an average of 21.5 tooth surfaces that were decayed, missing, or filled, 68% of parents rated their children’s OHS to be good, very good, or excellent and ratings of POQL were extremely positive. Parents with strong ethnic identities showed a smaller discrepancy between these subjective and objective measures.

Greater facility with one’s tribal language was associated with stronger self-efficacy, better behavioral adherence, and better parental OHS. Although these results are consistent with our expectations, tribal language proficiency was unrelated to oral health knowledge and all other attitudinal and outcomes measures. It may be that the importance an individual places on maintaining his/her tribal identity is a better indicator of ethnic identification than is tribal language proficiency. Indeed, facility with one’s tribal language may reflect factors beyond one’s personal affiliation with the tribe. For instance, a person may have learned to speak his or her tribal language to communicate with elderly family members who only speak their Native tongue. Tribal language facility may not be as strong an indicator of personal ethnic identification on the Navajo Nation, where preservation of the tribal language is considered crucial to maintenance of the tribe’s culture and where instruction in the Navajo language is made available at all grade levels in all schools.⁴⁷ Under such circumstances, it is possible that one may become proficient in speaking one’s tribal language even in the absence of a strong personal sense of affiliation with tribal culture.

This study has several important strengths. First, our analysis was based on a large sample, representing nearly half of the Head Start Centers on the Navajo Nation (39 out of 82 centers). Second, use of data from the BRFQ and the oral examinations allowed us to study a

wide array of critical oral health measures, including oral health knowledge, attitudes, behavior, and outcomes.

Despite these strengths, the study also had important limitations. First, ethnic identity was measured using only two items, which assessed perceived importance of maintaining one's cultural identity and ability to speak one's tribal language. Given the complexity of ethnic identity, a measure capturing a broader set of factors (e.g., participation in cultural activities, cultural pride) would have been preferable. Second, the data used in this analysis were cross-sectional. Hence, we cannot establish the direction of the relationships between ethnic identity and the oral health measures under investigation. Finally, because this work was conducted in a single American Indian tribe, results may not be generalizable to other Native populations. Future investigations employing a more comprehensive measurement approach, collecting longitudinal data, and involving multiple tribal communities would further enhance our understanding of the link between ethnic identity and oral health.

To our knowledge, this study provides the first insight into the association of ethnic identity with oral health outcomes in a Native community. Our findings provide the first evidence of a link between ethnic identity and oral health knowledge and support prior research that suggests a positive relationship of ethnic identity with health-related attitudes. Findings related to oral health behavior and outcomes underscore the complexity of the relationship of ethnic identity with health-related variables, which are less consistent among Native people than other racial and ethnic groups.²¹ We recommend the pursuit of future research to clarify the role of social determinants of health, such as economic and access-to-care barriers. To the extent that such barriers prevent AI/AN parents from translating their strong oral health knowledge and attitudes into good oral health practices, future interventions must be designed to address such factors. We also recommend research to investigate the potential perception among Native people that recommended oral health behaviors are inconsistent with strong tribal identification. If such perceptions exist, development of interventions that promote good oral health practices as consistent with AI/AN tribal values will be crucial.

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Abbreviations:

AI/AN	American Indian and Alaska Native
BRFQ	Basic Research Factors Questionnaire
dmfs	decayed, missing, and filled tooth surfaces
LOC	locus of control

OHS	oral health status
POQL	Pediatric oral health quality of life

References

1. Dye BA, Tan S, Smith V, et al. Trends in oral health status: United States, 1988–1994 and 1999–2004. *Vital Health Stat* 11. 2007;248:1–92.
2. Phipps KR, Ricks TL, Manz MC, Blahut P. Prevalence and severity of dental caries among American Indian and Alaska Native preschool children. *Journal of Public Health Dentistry*. 2012;72(3):208–215. [PubMed: 22515656]
3. Indian Health Service. The 2010 Indian Health Service Oral Health Survey of American Indian and Alaska Native Preschool Children Rockville,MD: US Department of Health and Human Services; 2013.
4. Warren JJ, Blanchette D, Dawson DV, et al. Factors associated with dental caries in a group of American Indian children at age 36 months. *Community Dentistry & Oral Epidemiology*. 2016;44(2):154–161. [PubMed: 26544674]
5. Indian Health Service. The 1999 oral health survey of American Indian and Alaska Native dental patients: Findings, regional differences and national comparisons. Rockville, MD: US Department of Health and Human Services, Indian Health Service;2001.
6. Rosenthal DA. Ethnic identity development in adolescents In: Phinney JS, Rotheram MJ, eds. *Children's Ethnic Socialization: Pluralism and Development*. Newbury Park, CA: Sage; 1987.
7. Rivas-Drake D, Seaton EK, Markstrom C, et al. Ethnic and racial identity in adolescence: implications for psychosocial, academic, and health outcomes. *Child Dev*. 2014;85(1):40–57. [PubMed: 24490891]
8. Kulis S, Napoli M, Marsiglia FF. Ethnic pride, biculturalism, and drug use norms of urban American Indian adolescents. *Social work research*. 2001;26(2):101–112. [PubMed: 21399737]
9. Pu J, Chewning B, St. Clair ID, Kokotailo PK, Lacourt J, Wilson D Protective factors in American Indian communities and adolescent violence. *Maternal and Child Health Journal*. 2013;17(7):1199–1207. [PubMed: 22926269]
10. Spillane NS, Greenfield B, Venner K, Kahler CW. Alcohol use among reserve-dwelling adult First Nation members: Use, problems, and intention to change drinking behavior. *Addict Behav*. 2015;41:232–237. [PubMed: 25452070]
11. Duncan GE, McDougall CL, Dansie E, Garrouette E, Buchwald D, Henderson JA. Association of American Indian cultural identity with physical activity. *Ethnicity & disease*. 2014;24(1):1–7. [PubMed: 24620441]
12. Yu M, Stiffman AR. Culture and environment as predictors of alcohol abuse/dependence symptoms in American Indian youths. *Addict Behav*. 2007;32(10):2253–2259. [PubMed: 17289281]
13. Jones MD, Galliher RV. Ethnic identity and psychosocial functioning In Navajo adolescents. *Journal of Research on Adolescence*. 2007;17:683–696.
14. Smokowski PR, Evans CB, Cotter KL, Webber KC. Ethnic identity and mental health in American Indian youth: Examining mediation pathways through self-esteem, and future optimism. *Journal of youth and adolescence*. 2014;43(3):343–355. [PubMed: 23929530]
15. Kenyon DB, Carter JS. Ethnic identity, sense of community, and psychological well-being among Northern Plains American Indian youth. *Journal of Community Psychology*. 2010;39:1–9.
16. Newman DL. Ego development and ethnic identity formation in rural American Indian adolescents. *Child Dev*. 2005;76:734–746. [PubMed: 15892789]
17. Hodge FS, Nandy K. Predictors of wellness and American Indians. *Journal of Health Care for the Poor and Underserved*. 2011;22(3):791–803. [PubMed: 21841279]
18. Soto C, Baezconde-Garbanati L, Schwartz SJ, Unger JB. Stressful life events, ethnic identity, historical trauma, and participation in cultural activities: Associations with smoking behaviors among American Indian adolescents in California. *Addict Behav*. 2015;50:64–69. [PubMed: 26103424]

19. Marsiglia FF, Kulis S, Hecht ML, Sills S. Ethnicity and ethnic identity as predictors of drug norms and drug use among preadolescents in the US Southwest. *Substance Use & Misuse*. 2004;39:1061–1094. [PubMed: 15387204]
20. Perdue DG, Henderson JA, Garrouette E, et al. Culture and colorectal cancer screening on three American Indian reservations. *Ethn Dis*. 2011;21(3):342–348. [PubMed: 21942168]
21. Haslam SA, Jetten J, Postmes T, Haslam C. Social identity, health and well-being: An emerging agenda for applied psychology. *Applied Psychology: An International Review*. 2009;58(1):1–23.
22. Yu M, Stiffman AR, Freedenthal S. Factors affecting American Indian adolescent tobacco use. *Addict Behav*. 2005;30(5):889–904. [PubMed: 15893087]
23. Quissell DO, Bryant LL, Braun PA, et al. Preventing caries in preschoolers: Successful initiation of an innovative community-based clinical trial in Navajo Nation Head Start. *Contemporary Clinical Trials*. 2014;37:242–251. [PubMed: 24469238]
24. Arizona Rural Policy Institute, Center for Business Outreach, W.A. Franke College of Business, Northern Arizona University. Demographic Analysis of the Navajo Nation Using 2010 Census and 2010 American Community Survey Estimates. Available at <http://azcia.gov/Documents/Links/DemoProfiles/Navajo%20Nation.pdf>. Arizona Commission of Indian Affairs.
25. Albino J, Tiwari T, Gansky SA, et al. The Basic Research Factors Questionnaire for studying early childhood caries. *BMC oral health*. 2017;17(83).
26. Warren JJ, Weber-Gasparoni K, Tinanoff N, et al. Examination criteria and calibration procedures for prevention trials of the Early Childhood Caries Collaborating Centers. *Journal of Public Health Dentistry*. 2015;75(4):317–326. [PubMed: 26011444]
27. Pitts NB. Clinical diagnosis of dental caries: A European perspective. *J Dent Educ* 2001;65(10):972–978. [PubMed: 11699999]
28. Pitts NB. Modern concepts of caries measurement. *Journal of Dental Research*. 2004;83 Spec No C:C43–47. [PubMed: 15286121]
29. Manson SM, Jiang L, Zhang L, et al. Special Diabetes Program for Indians: Retention in cardiovascular risk reduction. *Gerontologist*. 2011;51 Suppl 1:S21–32. [PubMed: 21565816]
30. Oetting ER, Beauvais F. Orthogonal cultural identification theory: The cultural identification of minority adolescents. *International Journal of the Addictions*. 1990;25(5A-6A):655–685. [PubMed: 2101397]
31. Moran JR, Fleming CM, Somervell P, Manson SM. Measuring bicultural ethnic identity among American Indian adolescents: A factor analytic study. *Journal of Adolescent Research*. 1999;14(4):405–426.
32. Wilson AR, Brega AG, Campagna EJ, et al. Validation and Impact of Caregivers' Oral Health Knowledge and Behavior on Children's Oral Health Status. *Pediatric dentistry*. 2016;38(1):47–54.
33. Bandura A Social cognitive theory: An agentic perspective. *Annual Review of Psychology*. 2001;52:1–26.
34. Bandura A Health promotion by social cognitive means. *Health Education and Behavior*. 2004;31:143–164. [PubMed: 15090118]
35. Wilson A, Brega A, Thomas J, et al. An extended Health Belief Model addressing oral health beliefs in American Indian parents: Validation of measures. *Journal of Public Health Dentistry*. Under review.
36. Lencova E, Pikhart H, Broukal Z, Tsakos G. Relationship between parental locus of control and caries experience in preschool children - cross-sectional survey. *BMC Public Health*. 2008;8:208. [PubMed: 18547444]
37. Carnahan TM. The development and validation of the Multidimensional Dental Locus of Control Scales. Buffalo, NY: State University of New York;1980.
38. Rosenstock IM. The Health Belief Model and preventive health behavior. *Health Education Monographs*. 1974;2(4):354–386.
39. Janz NK, Becker MH. The Health Belief Model: A decade later. *Health Education & Behavior*. 1984;11(1):1–47.
40. Batliner T, Wilson A, Tiwari T, et al. Oral health status in Navajo Nation Head Start children. *J Public Health Dent*. 2014;74(4):317–325. [PubMed: 24954053]

41. National Survey of Children's Health. Child and Adolescent Health Measurement Initiative, Data Resource Center on Child and Adolescent Health. 2007; http://childhealthdata.org/learn/topics_questions/2007-nsch?itemid=K2Q01_D. Accessed February 21, 2013.
42. Braun PA, Lind KE, Batliner T, et al. Caregiver reported oral health-related quality of life in young American Indian children. *Journal of Immigrant & Minority Health*. 2014;16(5):951–958. [PubMed: 23857123]
43. Braun PA, Lind KE, Henderson WG, Brega AG, Quissell DO, Albino J. Validation of a pediatric oral health-related quality of life scale in Navajo children. *Quality of Life Research*. 2015;24(1): 231–239. [PubMed: 25005885]
44. Huntington NL, Spetter D, Jones JA, Rich SE, Garcia RI, Spiro A, 3rd. Development and validation of a measure of pediatric oral health-related quality of life: The POQL. *Journal of Public Health Dentistry*. 2011;71(3):185–193. [PubMed: 21972458]
45. Brega AG, Ang A, Vega W, et al. Mechanisms underlying the relationship between health literacy and glycemic control in American Indians and Alaska Natives. *Patient Educ Couns*. 2012;88(1): 61–68. [PubMed: 22497973]
46. Oyserman D, Fryberg SA, Yoder N. Identity-based motivation and health. *J Pers Soc Psychol*. 2007;93(6):1011–1027. [PubMed: 18072851]
47. Office of Standards, Curriculum & Assessment Development,. About Us. Accessible at: <http://www.odclc.navajo-nsn.gov/About-Us>. n.d. Accessed September 4, 2017, 2017.

Table 1.

Sample characteristics (N = 990)

	Mean (SD) or %
Parent characteristics	
Age	31.9 (9.4)
Gender: Female	84.0%
Highest grade completed	
< High school graduate	15.8%
High school grad/GED	37.1%
Some college/vocational	35.4%
College degree or more	11.8%
Income	
Income Missing	15.7%
< \$10K	41.4%
\$10K to < \$20K	17.7%
\$20K to < \$30K	9.3%
\$30K to < \$40K	6.9%
\$40K	9.1%
Ethnic identity	
How important is it to maintain tribal identity, values, and practices?	
Not at all	5.2%
A little	7.5%
Somewhat	18.4%
Very much	68.9%
How well do you speak your tribal language?	
Not at all	7.7%
A little	35.8%
Moderately well	22.2%
Very well	34.4%
Child characteristics	
Age	3.6 (0.5)
Gender: Female	50.7%

Table 2.

Association of demographics with ethnic identity (N=990)

	Importance of maintaining tribal identity, values, and practices			Tribal language facility		
	N	Mean (SD)	P value	N	Mean (SD)	P value
Parent characteristics						
Age			.03 ^a			<.0001 ^a
19–25	266	3.4 (0.9)		270	2.3 (0.9)	
26–30	270	3.5 (0.8)		270	2.6 (1.0)	
31–36	208	3.6 (0.8)		210	3.1 (0.9)	
37	230	3.5 (0.9)		234	3.5 (0.8)	
Gender			.16			.53
Male	154	3.6 (0.7)		155	2.9 (1.1)	
Female	820	3.5 (0.9)		829	2.8 (1.0)	
Highest grade completed			<.0001 ^a			.14
< High school graduate	150	3.4 (0.9)		153	2.8 (1.0)	
High school grad/GED	359	3.4 (0.9)		363	2.8 (1.0)	
Some college/vocational	346	3.6 (0.8)		348	2.9 (1.0)	
College degree or more	116	3.8 (0.6)		116	3.0 (0.9)	
Income			<.0001 ^a			<.0001 ^a
Income Missing	144	3.4 (0.9)		150	2.7 (1.0)	
< \$10K	407	3.4 (1.0)		409	2.7 (1.0)	
\$10K to < \$20K	174	3.7 (0.6)		175	3.0 (0.9)	
\$20K to < \$30K	91	3.6 (0.8)		92	3.1 (0.9)	
\$30K to < \$40K	68	3.7 (0.7)		68	3.0 (0.9)	
\$40K	90	3.7 (0.6)		90	3.0 (1.0)	

^a A p value 0.05 was identified as a significant result.

Table 3.

Baseline performance on oral health constructs (N=990)

	Mean (SD) or %
Parent characteristics	
Oral Health Knowledge Score	74.4 (13.3)
Self-Efficacy	4.4 (0.6)
Importance of Oral Health Behaviors	4.7 (0.4)
Locus of Control	
Internal Locus of Control	4.0 (1.0)
External Locus of Control – Powerful Others	2.2 (1.1)
External Locus of Control – Chance	2.5 (1.1)
Health Belief Model	
Perceived Susceptibility	3.4 (0.9)
Perceived Severity	4.3 (0.8)
Perceived Barriers	2.2 (0.7)
Perceived Benefits	4.3 (0.8)
Behavioral Adherence Score	50.7 (22.2)
Oral Health Status	
Excellent	4.7%
Very Good	14.3%
Good	40.1%
Fair	32.3%
Poor	8.7%
Child oral health	
dmfs	21.5 (20.0)
Oral Health Status	
Excellent	11.8%
Very Good	20.7%
Good	35.2%
Fair	25.6%
Poor	6.7%
Pediatric Oral Health-Related Quality of Life	4.2 (9.6)

Table 4.Association of importance of maintaining tribal identity with oral health (N=974)^a

	Not at all (N=51)	A little (N=73)	Somewhat (N=179)	Very much (N=671)	P value
Parental oral health measures					
Oral Health Knowledge Score	66.5	67.4	74.0	76.2	<.0001 ^b
Self-Efficacy	4.2	4.3	4.4	4.5	.002 ^b
Importance of Oral Health Behaviors	4.4	4.5	4.6	4.8	<.0001 ^b
Locus of Control					
Internal Locus of Control	3.7	3.6	4.0	4.1	.001 ^b
External Locus of Control – Powerful Others	2.7	2.6	2.3	2.2	.02 ^b
External Locus of Control – Chance	3.1	2.8	2.6	2.3	.002 ^b
Health Belief Model					
Perceived Susceptibility	3.3	3.4	3.4	3.4	.83
Perceived Severity	3.8	3.9	4.2	4.4	<.0001 ^b
Perceived Barriers	2.6	2.5	2.4	2.1	<.0001 ^b
Perceived Benefits	4.1	4.1	4.1	4.3	.01 ^b
Behavioral Adherence Score	54.9	47.2	49.0	51.1	.36
Oral Health Status	2.7	3.0	3.4	3.3	<.0001 ^b
Child oral health					
dmfs	20.8	22.9	21.1	21.5	.91
Oral Health Status	2.8	2.7	3.0	3.0	.02 ^b
Pediatric Oral Health-Related Quality of Life	5.2	5.7	4.0	4.1	.63

^aTable presents results of one-way ANOVAs controlling for age, education, income, and gender.^bA p value .05 was identified as a significant result.

Table 5.Association of tribal language facility with oral health (N=984)^a

	Not at all (N=76)	A little (N=352)	Moderately well (N=218)	Very well (N=338)	P value
Parental oral health measures					
Oral Health Knowledge Score	70.7	74.2	74.9	75.5	.13
Self-Efficacy	4.3	4.5	4.4	4.5	.02 ^b
Importance of Oral Health Behaviors	4.6	4.7	4.7	4.7	.07
Locus of Control					
Internal Locus of Control	4.0	4.1	4.0	4.0	.27
External Locus of Control – Powerful Others	2.1	2.3	2.1	2.3	.07
External Locus of Control – Chance	2.4	2.5	2.3	2.5	.14
Health Belief Model					
Perceived Susceptibility	3.5	3.5	3.4	3.3	.26
Perceived Seriousness	4.2	4.4	4.2	4.3	.06
Perceived Barriers	2.2	2.2	2.2	2.2	.24
Perceived Benefits	4.1	4.3	4.3	4.2	.36
Behavioral Adherence Score	47.2	48.8	49.1	54.1	.005 ^b
Oral Health Status	3.4	3.3	3.4	3.2	.004 ^b
Child oral health					
dmfs	23.8	21.5	20.1	21.9	.63
Oral Health Status	3.0	3.0	3.0	2.9	.92
Pediatric Oral Health-Related Quality of Life	5.6	4.0	3.3	4.6	.22

^aTable presents results of one-way ANOVAs controlling for age, education, income, and gender.^bA p value = 0.05 was identified as a significant result.