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Dental Caries in a Cohort of Very Young American Indian Children

John J. Warren, DDS, MS¹, Katherine W. O. Kramer, PhD², Kathy Phipps, DrPH³, Delores Starr, BS, RDH⁴, Deborah V. Dawson, PhD, ScM², Teresa Marshall, PhD¹, and David Drake, MS, PhD²

¹Department of Preventive & Community Dentistry, University of Iowa

²Dows Institute for Dental Research, University of Iowa

³Consultant, Morro Bay, California

⁴Indian Health Service, South Dakota

Abstract

OBJECTIVES—This paper reports the prevalence and severity of caries in a group of 16-month-old American Indian children.

METHODS—The study is an ongoing longitudinal study of risk factors for caries in children from a Northern Plains Tribal community. Children were examined for caries and risk factor data collected at approximately 1, 4, 8, 12 and 16 months of age. Surface-specific caries data were collected and the presence of pre-cavitated “white spot” lesions was recorded at the subject level.

RESULTS—The mean age was 15.4 months for the sample of 232 children. Caries prevalence was 31.9%, while an additional 29.3% had white spot lesions only. Mean dmfs was 1.57, and ranged from 0 to 44 surfaces. Nearly 3% of all erupted tooth surfaces were affected and maxillary central incisors had the highest prevalence of caries (22%).

CONCLUSIONS—Among the very youngest children, dental caries prevalence was very high among these American Indian children.

Introduction

Dental caries in US children remains a major public health problem, particularly in certain populations (1). Early childhood caries (ECC) occurs in pre-school children and is often concentrated in children from lower income and minority families (1), and is particularly severe among American Indian and Alaska Native (AI/AN) children.

It is clear that the prevalence and severity of ECC in AI/AN populations is high – many times higher than for other U.S. populations. Tang, et al. (2), compared age specific caries levels among Black, White, Hispanic and American Indian children recruited from WIC and Head Start centers in Arizona. In this study, the mean dmft for American Indian 3-year olds was 3.15, compared to 1.66 for Hispanic children, 0.98 for Blacks and 0.69 for Whites. Caries prevalence was 12% among 1-year old, and 30% among 2-year-old American Indian children, which was higher than the caries prevalence in children of the same ages from other ethnic groups. Further analysis of these data found that, after controlling for family income and education levels, American Indian children had the highest adjusted odds ratios

for caries occurrence compared to the other ethnic/racial groups (3). Several other studies (4–7) reported similarly high levels of caries.

The 2010 Indian Health Service (IHS) Oral Health Survey of AI/AN Preschool Children reported that approximately 62% of AI/AN children between 2–5 years of age had decay experience (7). In comparison, the prevalence of decay as reported from NHANES 1999–2004 data for 2- to 4-year-olds was 20% for non-Hispanic white children, 26% for non-Hispanic black children and 35% for Mexican-American children (1). The IHS survey also reported that the mean dft for 2–5 year-olds was 3.68 (8), much higher than in the general U.S. population as reported in the NHANES 1999–2002 data, which showed the mean dft for all 2- to 5-year-olds to be 1.05 (1).

While these data indicate that AI/AN children have very high rates of caries experience, they also suggest that the disease may occur very early in life among these children. However, there is relatively little data on caries occurrence among AI/AN children very early in life. Therefore, the purpose of this paper is to report on the prevalence and severity of caries in a group of American Indian children from a Northern Plains Tribal community at 16 months of age.

Materials and Methods

This was a longitudinal study of ECC among very young children living in a Northern Plains Tribal community, with a focus on the transmission of cariogenic bacteria from mother to child. Mothers who had recently given birth were recruited into the study between June 2009 and June 2010, resulting in 239 women with 244 children being recruited. To conform to independence assumptions, only the first child enrolled by the mother was included the dataset (239 mother-child dyads). When the child was 1 month old (± 30 days), the mother-child dyad was formally enrolled and baseline data were collected including plaque samples from both the mother and child, a caries exam of the mother, plus detailed information regarding childcare, feeding practices, maternal nutrition, child nutrition, oral hygiene, and other caries-related variables.

Follow-up visits were completed when the child was approximately 4, 8, 12 and 16 months (with additional assessments in process). At the follow-up visits, plaque samples from the mother and child, plus information regarding known risk factors for caries were collected. If the child had teeth, the follow-up visit also included a dental caries examination. A research team consisting of a research assistant and dental hygienist collected all information and specimens during in-home or in-office study visits.

Surface specific dental caries examinations were made for all study participants using the standard DMFS criteria adapted from those used in NHANES (1). Four dental hygienists conducted the caries examinations and were trained by a gold-standard examiner, and calibrated with each other. Reliability of the dental caries examinations was assessed by repeat examinations of 10 children among the four examiners. Pairwise kappa values for the examiners, based on surface-level scoring, ranged from 0.90 to 0.94.

The exams were completed using a halogen headlight, a DenLite® illuminated mirror and #23 explorer. For all exams, the teeth were dried with gauze and visually inspected and a #23 explorer was used to remove debris and was used in diagnosis only to confirm areas of suspected decay. Specifically, caries were diagnosed using an explorer only if there was softness at the base of lesion upon probing with controlled modest pressure. Mothers' caries examinations were conducted using field dental examination protocols in participants' homes with subjects seated in a chair while children's examinations were done using a knee-to-knee technique (8). The children were also assessed for the presence or absence of any

pre-cavitated “white spot” lesions within the mouth. Data were collected on paper forms, then entered into a web-based data entry system developed for the study. All children and mothers with cavitated lesions or other treatment needs were referred to the Indian Health Service dental clinic, which was the only source of dental care within the tribal community.

All study protocols and procedures were approved by three institutional review boards – The University of Iowa IRB, the Aberdeen Area IHS IRB and the Tribal Community’s Human Subjects Review Board.

Results

Of the 239 children in the enrolled dyads, 232 received a 16 month caries examination. Of the seven that did not receive a 16-month caries examination, 1 dropped out of the study, 5 remained in the study but were not available at the time of the 16 month examinations, and 1 child died prior to the 16 month assessment. The mean age of the children at the time of this assessment was 15.4 months, while the mean age at baseline for the mothers was 23.7 years. The final sample included 102 males and 130 females. All of the children were either American Indian (93%) or American Indian and another race (7%). Among mothers reporting household income (n=165), 56% reported annual incomes of \$10,000 or less.

As shown in Table 1, caries prevalence was high, with over 61% having either pre-cavitated or decayed missing or filled (dmf) lesions present. Specifically, 74 children (31.9%) had dmf lesions, with 97% presenting as untreated decay. The mean number of dmf surfaces affected was 1.57, with a maximum of 44 surfaces. The corresponding mean proportion of affected surfaces per surfaces present (erupted) was 2.84%, with a maximum of 65%. Additional data (not shown) demonstrated that males had slightly higher mean numbers of dmfs lesions (1.63) than did females (1.53), although the proportion of surfaces present with caries experience was slightly higher in females (2.90% vs 2.76%).

Figure 1 depicts the specific teeth affected by caries as a proportion of those teeth present. As can be seen in the figure, the maxillary incisors were most commonly affected, with between 11.0% (for tooth G) to 22.8% (tooth E) of these affected. It should be noted that in this age group, very few children had second molars and less than half of the children had canines.

Discussion

The results of this study confirm that caries prevalence is very high among AI/AN children in a Northern Plains Tribal community, and suggests that this disease occurs very early in life. These findings, although somewhat alarming, are not surprising, as a few previous studies have documented high levels of dental caries in populations of pre-school AI/AN children (2–7). The caries prevalence in the present study of 16-month-old children appears to be generally consistent with the 2010 Indian Health Service (IHS) Oral Health Survey of AI/AN Preschool Children (7) which reported 21.2% caries prevalence for 1-year-olds, and 43.7% prevalence for 2-year-olds. Given that the prevalence of cavitated or filled lesions was 32% in the present study, and that an additional 29% had pre-cavitated lesions, it is not unreasonable to expect that as 2-year-olds, caries prevalence among children in the present study would be similar to or greater to the levels reported by the IHS. Regardless, the prevalence of caries found in the study at 16 months is high relative to that found for other minority groups in the most recent NHANES survey, which found caries prevalence among 2–5 year-olds of 42% for Mexican-American children, 32% among Blacks, and 25% among white children (1). The present study found caries prevalence to be somewhat higher than reported by Tang et al (2) for 1- and 2-year-old American Indian children. In that study, it

was found that American Indian children had the highest caries prevalence rates among all racial/ethnic groups studied.

Given the age of the children in the study, the findings regarding specific teeth affected also are not surprising in that the incisor teeth are the first to erupt and are, therefore, subject to risk for the longest period of time. Patterns of highest decay rates among maxillary incisors has been widely reported (3,5), and it has been broadly suggested that infant feeding practices contribute substantially to the disease (7,10), which led to the use of the now-discarded term “Baby-Bottle Tooth Decay”. However, the etiology of early childhood caries in AI/AN populations is far from clear, and more research is needed

Subsequent papers from the present study will examine a broad range of risk factors, particularly dietary and bacterial factors, but because caries is known to be associated with high rates of poverty, the findings of the study are not surprising since over half of the mothers reported annual income of <\$10,000, and the tribal community is located in one of the poorest counties in the U.S. (11). Of course, poverty in and of itself is not a true risk factor, as there is no plausible biological relationship between income and caries, but as this study strongly suggests, certain factors associated with poverty, including poor nutrition and poor living conditions, may contribute to high rates of caries.

In summary, even among the very youngest children, dental caries prevalence is very high among American Indian children, and given the high rates of pre-cavitated lesions, also suggests that prevalence may increase dramatically with age in this population.

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Figure 1.
Distribution of proportion of decayed or filled teeth by tooth

Summary data for the prevalence and number of cavitated or filled surfaces and proportion of surfaces affected per child at age 16 months (N=232)

Table 1

	Frequency	Prevalence (%)	Mean	Std. Dev.	Median	Minimum/Maximum
No decay (no white spot lesions or dmfs)	90	38.79	--	--	--	--
Pre-cavitated (white spot) lesions only [†]	68	29.31	--	--	--	--
Cavitated, filled or missing surfaces (dmfs)	74 [*]	31.89	1.57	4.52	0	0.44
Cavitated, filled or missing teeth (dmft)	74 [*]	31.89	0.91	1.68	0	0.11
Erupted teeth	233	100	12.47	3.38	12	2.20
Erupted surfaces	233	100	52.79	15.07	52	8.88
% erupted surfaces with dmf lesions	--	--	2.83	7.73	0	0.65
% erupted teeth with dmf lesions	--	--	7.10	13.19	0	0.73

[†] Pre-cavitated lesions were recorded on a whole-mouth basis

^{*} Includes 4 with cavitated lesions only, and 70 with both cavitated and pre-cavitated lesions