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A storytelling intervention reduces childhood caries risk behaviors among American Indian and Alaska Native mothers in Northern California

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Abstract

Objectives: To evaluate a storytelling intervention targeting the oral health beliefs, knowledge, and behaviors of AIAN pregnant women and mothers.

Methods: Fifty-three adult AIAN women from three tribal communities in Northern California participated. The intervention story delivered oral health messaging using a traditional storytelling format. The effect of the intervention on self-reported oral health behaviors, dental knowledge, and beliefs was assessed using a pretest-posttest design, with an additional six-month follow-up. Tests of repeated measures using Generalized Linear Models were conducted to assess changes in oral health knowledge, beliefs, and behaviors.

Results: Knowledge and beliefs significantly increased as a result of the intervention and persisted after six months. A consistent, significant increase in positive oral health behaviors from baseline to six-months was also observed.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.
Appendix S1: Supporting information.

Conclusions: The results of this intervention study suggest promise for traditional storytelling to increase oral health-related knowledge, beliefs, and behaviors among self-identified AIAN pregnant women and mothers.

Keywords

early childhood caries; oral health behaviors; Alaska Native; American Indian; oral health knowledge; oral health beliefs

Introduction

Effective interventions to address disparities in Early Childhood Caries (ECC) across populations are needed (1). Interventions that address community-specific barriers to reducing risk behaviors among caregivers of young children have been identified as likely to be especially valuable (2). Yet, few interventions of caregivers in disparities-facing populations have produced promising results (3,4).

American Indian and Alaska Native (AIAN) populations have the highest rates of ECC compared to any other population in the United States (5). AIAN populations are also more likely to be poor, unemployed, and to not have a college degree, compared to the general population (6). Compounding the socioeconomic indicators for higher disease risk, the geographic isolation of rural AIAN communities may further contribute to disease risk through the social promotion of negative behaviors and the presence of community-specific barriers to resources that may facilitate better health.

The Native Oral Health Project (NOHP), administered by the California Tribal Epidemiology Center within the California Rural Indian Health Board, and funded by the National Institute of Dental and Craniofacial Research, was established to explore population-specific barriers and facilitators to oral health among AIAN caregivers residing in Northern California. The ultimate goal of the NOHP was to gain insight into potentially important areas for future intervention among AIAN mothers in Northern California. As a part of this work, we evaluated the ECC-related beliefs, knowledge, and behaviors of participants in the NOHP using the Theory of Planned Behavior (7) as a guiding conceptual framework for the project, and assessed the acceptability of a storytelling intervention to address key oral health behaviors (8,9). This report communicates the findings of an intervention study that investigated the potential of a traditional story, “Coyote and Little Man,” to serve as an effective educational intervention for reducing ECC.

Methods

We recruited eligible participants, from three Northern California AIAN communities, who were pregnant or had at least one child six years old or younger, were at least 18 years of age, and self-identified as AIAN. The NOHP protocol received approval from the California Rural Indian Health Board, Inc., Institutional Review Board.

The intervention story contained 10 key parental positive oral health messages and was developed in consultation with traditional storytellers, an AIAN Community Advisory

Board, and leading experts in the field of ECC and oral health disparities (9). The story features “Coyote,” the trickster (a role the coyote often plays in many AIAN stories told in Northern California), and the “Little Man” in his mouth (i.e., bacteria leading to a cavity). Coyote tries to trick other animals to relieve pain in his mouth by allowing “Little Man’s” family members to live in their mouths, too.

The effect of the intervention on self-reported oral health behaviors, and dental knowledge and beliefs (knowledge/ beliefs) was assessed using a pretest-posttest design, with an additional six-month follow-up. We administered a quantitative pretest paper-and-pencil survey to participants prior to the intervention to obtain participant sociodemographics and baseline measures of the outcome variables. Following pretest completion, the intervention was delivered utilizing a traditional talking circle format. Immediately after the storytelling concluded, participants completed a posttest survey to assess any immediate changes in dental knowledge/beliefs that may have occurred as a result of hearing the story intervention. Six months following the intervention, participants were recontacted by phone and in person to repeat the posttest survey to assess the longer term effect of the intervention on maintenance of knowledge and beliefs and positive oral health behaviors. Behaviors were assessed at baseline and six-month follow-up only due to insufficient time for the caregiver to observe and assess changes in their child’s behaviors between baseline and posttest (which were both assessed in the same session in which the intervention was administered). The survey was a modified version of an instrument created by the National Institute of Dental and Craniofacial Research (NIDCR) Early Childhood Caries Collaborating Centers (EC4) and designed for use in diverse caregiver populations with children aged 0 to 5 (10). Details on the summary measures and scores derived from this instrument have been reported previously (8).

Dependent measures included: (1) an oral health knowledge/ beliefs score calculated by summing the total numbers of 25 questionnaire items answered correctly using a forced choice format (possible range = 0 to 25); and (2) a positive oral health behaviors score calculated by summing 10 selfreport questions answered correctly (forced-choice format).

Independent measures included dichotomized sociodemographic measures of education, median income, employment status, relationship status, oral health-related measures, and a barrier index score created to reflect the accumulated burden of self-reported barriers as a possible predictor of oral health behaviors. A dichotomous cut-point was established for each barrier based on the type of response scale used for the item. The items used and more detailed information on them were published in our baseline paper for this project (8).

Statistical analysis

We conducted chi-square Goodness-of-Fit tests (Fisher’s exact test, two-sided) on 18 variables to test differences between participants who had data at both baseline and six-month follow-up compared with participants who had baseline data only.

Tests of Generalized Linear Models (GLM) with repeated measures were conducted using the knowledge/beliefs oral health summed score as a single dependent variable to assess

changes in oral health knowledge/beliefs over three time-points: baseline, posttest, and six-month follow-up. Mauchly's tests of sphericity were conducted with each GLM analysis to assess variance inequalities for outcome measures. The Greenhouse-Geisser procedure was used as a correction for sphericity violations for within-subjects analyses of changes in positive oral health behaviors and knowledge/beliefs over time. Each GLM analysis was conducted with one independent variable at a time due to the small sample size and resulting low statistical power. To estimate effect sizes, we used the partial eta-squared obtained from the repeated measures ANOVA. A Generalized Linear Mixed Model (GLMM) analysis was also conducted to determine whether a random effects model would yield a better fit to the data.

We conducted a sensitivity analysis analyzing both dependent variables simultaneously across the two time points for which data were available for both dependent variables (baseline and six-month follow-up) to (1) test for interaction effects between knowledge/beliefs and behaviors; and (2) test for potential between subjects effects on the independent variables when the two dependent variables were analyzed simultaneously in the analysis. GLM tests of repeated measures were conducted at baseline (pretest) and six-month follow-up using the two dependent variables operationalized as summed scores of self-reported positive oral health behaviors and knowledge/beliefs. Each GLM analysis was conducted with one independent variable at a time due to the size of the sample.

Results

A total of 53 AIAN mothers or pregnant women aged 18–51 (median age = 29 years) responded to the baseline and posttest surveys, and 44 responded to the six-month follow-up survey, of which 39 had complete data. Sample characteristics of participants at baseline have been reported previously (8). Importantly, participants who completed the six-month follow-up did not differ significantly at baseline from those who completed only the pretest and immediate posttest surveys on oral health behaviors or knowledge/beliefs.

Primary analysis

Table 1 shows results from a series of GLM repeated measures conducted with knowledge/beliefs as the single dependent variable assessed at three time points. The first model assessed the trend over time without any independent variable. Omnibus tests of the within-subjects effects revealed a statistically significant within-subject effect in knowledge/beliefs over time, $F(1, 37) = 29.70$, $P < 0.001$, partial $\eta^2 = 0.445$. Tests of within-subject contrasts indicated a statistically significant increase in oral health knowledge/beliefs between baseline (mean = 21.61) and posttest (mean = 24.08), $F(1, 37) = 34.21$, $P < 0.001$, partial $\eta^2 = 0.102$, which was followed by a smaller, but statistically significant decrease in knowledge/beliefs at six-month follow-up (mean = 23.55), compared to the posttest, $F(1, 37) = 4.78$, $P = 0.035$, partial $\eta^2 = 0.114$.

Next, a GLM was conducted with knowledge/beliefs and one independent variable included in the model at a time. The main effect for time was statistically significant for each of 12

risk factors modeled (Table 1). The interaction between time and each independent variable was not statistically significant.

The within-subjects effects indicated a statistically significant decrease in knowledge/beliefs between posttest and six-month follow-up for six independent variables (see Table 1). However, the effect sizes associated with the decreases in knowledge/beliefs between the posttest and six-month assessments were small (range: 0.040–0.135) relative to the effect sizes associated with the sharp increases observed between the baseline and posttest assessments (range: 0.446–0.484). There were no statistically significant differences for between-subjects effects for any independent variables modeled with knowledge/beliefs.

We conducted a GLMM analysis to determine if modeling random effects would yield a better fit of the data and found that the GLMM analysis yielded the same general pattern of results as our original analyses. A description of the GLMM analyses is presented in Supporting Information.

Sensitivity analysis

Multivariate tests revealed that the main effects for behaviors and knowledge/beliefs were statistically significant for each GLM modeled and indicate that there were significant increases in positive oral health behaviors and knowledge/beliefs from baseline to six-month follow-up, which did not vary by risk factor (all P s < 0.001).

Two risk factors (“visit reason” and “needs help with instructions”) had statistically significant between-subjects effects in GLM repeated measures modeled with two dependent variables (oral behaviors and knowledge/beliefs) at baseline and six-month follow-up. Although both comparison groups reported improved behaviors and knowledge/beliefs over time, participants who reported that the visit reason was for scheduled treatment (e.g., routine check-up, crowns, fillings, etc.) had a more positive oral health summed score ($M = 14.40$) at each time point, when compared with participants whose visit reason was for emergency dental care ($M = 12.63$), $F(1,36) = 9.837$, $P = 0.003$ (partial $\eta^2 = 0.215$). Similarly, participants who reported that they never or rarely needed help reading the dentist’s instructions ($M = 14.39$) had a more positive oral health summed score when compared with participants who reported they needed help sometime, often, or always ($M = 13.31$), $F(1,37) = 4.212$, $P = 0.047$ (partial $\eta^2 = 0.102$).

Discussion

The results of this intervention study suggest promise for traditional storytelling to increase oral health-related knowledge/beliefs among self-identified AIAN pregnant women and mothers. Additionally, results indicate that increased knowledge/beliefs from storytelling can be maintained over a six-month period with effect sizes that indicate practical clinical, as well as statistical, significance of the intervention. We also found a consistent, significant increase in positive oral health behaviors from baseline to six-months, which did not vary by risk factor, suggesting additional potential for traditional storytelling as a vehicle for positive oral health behavior change.

Limitations of this study primarily relate to available sample size. However, the intervention design reflects a valid and reliable assessment of the outcome in relation to the storytelling intervention. As such, additional studies aimed at addressing oral health in other AIAN populations will likely benefit from the findings about Northern California caregivers presented here.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Table 1

Means of Knowledge/Beliefs Summed Scores at Baseline, Posttest, and Six-Month Follow-Up for Each GLM Repeated Measures Model

Variable category	Estimated marginal means			Baseline vs Posttest			Posttest vs 6-month		
	Baseline	Posttest	6-month	F	P	ES	F	P	ES
Knowledge/beliefs outcome (no predictor)	21.61	24.08	23.55	34.21	<0.001	0.480	4.78	0.025	0.114
Education									
Less than college	20.63	23.88	23.69	37.8	<0.001	0.512	3.93	0.055	0.098
At least some college	22.32	24.23	23.45						
Median Income									
\$20,000	21.53	23.95	23.63	37.07	<0.001	0.522	3.61	0.066	0.096
>\$20,000	22.41	24.29	23.76						
Employment status									
Not employed	21.50	24.05	23.15	29.85	<0.001	0.468	4.20	0.048	0.110
Employed	22.19	24.13	24.00						
Relationship status									
Divorced, separated, never married	20.85	23.85	23.38	31.52	<0.001	0.481	3.68	0.063	0.098
Married, living with partner	21.91	24.13	23.57						
Number of barriers									
<2 barriers	21.57	24.05	23.43	32.91	<0.001	0.478	4.33	0.042	0.110
2 barriers	21.65	24.12	23.71						
Mother's overall oral health									
Poor or fair	21.10	24.05	23.80	33.78	<0.001	0.484	5.12	0.030	0.040
Good to excellent	22.17	24.11	23.28						
Time since last visit (mother)									
12 months	21.86	24.11	23.54	30.85	<0.001	0.461	3.08	0.088	0.079
>12 months	20.90	24.00	23.60						
Visit reason (mother)									
Scheduled treatment	22.14	24.29	23.79	28.13	<0.001	0.446	4.74	0.036	0.119
Emergency dental care	21.30	23.96	23.35						
Brushing frequency (mother)									
<twice a day	21.56	24.17	24.06	33.47	<0.001	0.482	4.61	0.039	0.114

Variable category	Estimated marginal means			Baseline vs Posttest			Posttest vs 6-month			n
	Baseline	Posttest	6-month	F	P	ES	F	P	ES	
twice a day	21.65	24.00	23.10							
Instructions help										
Never	22.12	24.27	23.65	34.43	<0.001	0.489	3.29	0.078	0.084	38
Rarely to always	20.15	23.67	23.33							
100 cigarettes ever										
No	21.63	24.11	23.16	30.64	<0.001	0.467	5.47	0.025	0.135	37
Yes	21.78	24.06	23.89							
Cigarette frequency now										
0 days	21.67	24.07	23.50	24.05	<0.001	0.401	2.48	0.124	0.064	38
>0 days	21.38	24.13	23.75							

ES, effect size (partial η^2); **bold** font, $P < 0.05$.