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ORIGINAL REPORT: MULTI-METHODS RESEARCH

What Can We Learn from Parents of Caries-Free and Caries-Active Hispanic Children?

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Abstract: ***Objective:*** *This study evaluated strength-based motivators within Hispanic families that support the creation of health in their children. A mixed-methods approach was used to understand differences in Hispanic parental factors between caries-free (CF) and caries-active (CA) children.*

Methods: *A cross-sectional survey was conducted with 200 parent-child triads (primary child: between 0 and 6 y; reference child: between 0 and 10 y) recruited from health centers in the Denver Metro area. All the participating children received an oral examination, and the triads were grouped as CF or CA based on the caries status of the primary child. Qualitative data were collected through in-depth individual interviews with the parents. The analysis only involved the primary child. Bivariable analysis were conducted between parent factors (independent variables) and presence or absence of caries (outcome variable). The variables with P < 0.20 in the bivariable analysis were subjected to 2 multivariable logistic regression models. The children in the*

CF group had mean (SD) age of 2.8 (1.28) y compared to the CA group at 4.0 (1.55) y (P < 0.001). Bivariable analysis demonstrated that parents in the CF group reported higher oral hygiene behavior scores (P = 0.047), perceived fewer barriers (P = 0.009) to accessing preventive dental care, and considered their children more susceptible to cavities (P = 0.001) compared to parents in the CA group. Multivariable model (adjusting for socioeconomic characteristics) demonstrated that parents of CF children perceived high susceptibility to caries for their children (P = 0.040). Multivariable model (adjusting for acculturation) demonstrated an association of parental oral hygiene behavior (P = 0.040) and parent-perceived susceptibility to caries (P = 0.010) with CF child status. Qualitative interviews revealed that parents in the CF group were concerned about their children's higher susceptibility to caries and tried to establish good oral hygiene routines for their children.

Conclusion: *The results of this study demonstrated that parental behaviors*

and health beliefs could be significant determinants of caries status in Hispanic children.

Knowledge Transfer Statement:
Results of this study indicate that parental oral health beliefs and behaviors are significant determinants of caries status in children of Hispanic population. Parental beliefs could motivate them to take action or establish behavior that prevents dental caries in their children. Health care providers and caries prevention efforts can incorporate this information to tailor oral health promotional messaging and approaches to improve the oral health of Hispanic children.

Keywords: dental caries, oral health behaviors, health beliefs, perceived susceptibility, perceived barriers, acculturation

Introduction

Hispanic children experience the worst dental caries of all populations in the United States, with the exception of American Indian children (Dye et al. 2012; Tiwari and Albino 2017).

Twenty-nine percent of Hispanic children ages 2 to 5 y have untreated dental decay compared to 14% of White non-Hispanic children of similar ages (Fleming and Afful 2018). In Colorado, Hispanic children experience a higher overall burden of caries than White children (55% vs. 31%), and untreated decay is also higher in Hispanic children than in White children (18.5% vs. 13.5%) (Calanan et al. 2018).

Most published reports on the oral health of children have studied either prevention of dental caries or risk factors associated with oral diseases. Only a few investigations have focused on variables associated with caries-free status in children (i.e., protective factors leading to healthy dentition in children). Several have reported differences in diet and oral hygiene behavior such as tooth brushing, while others reported parental income, mother's education, and oral health knowledge as protective factors leading to caries-free status of children (Duany et al. 1972; Habibian et al. 2001; Hallett and O'Rourke 2003; Leong et al. 2012). Others have discussed parental psychosocial factors, including higher internal locus of control or more elevated sense of coherence scores, which seem to be the underlying factors related to positive behaviors that lead to caries-free status of the child (Lencova et al. 2008; Dorri et al. 2010; Albino et al. 2014).

In this report, we have taken a similar approach to the later studies discussed above, to understand why some Hispanic children do not develop dental caries in their primary dentition, although they belong to a high-risk population. We used a strength-based model to collect information from parents in both groups—caries free (CF) and caries active (CA). The strength-based model uses a positive view of strengths of "at-risk" individuals, families, and communities (Maton et al. 2004). It does not ignore their problems or difficulties; instead, the critical assumption is that individuals and families are defined by their multiple strengths, and prevention of future challenges begins

with identifying and marshaling these strengths (Maton et al. 2004; Glasgow Center for Population Health 2011). The strength-based model assumes that health is open-ended and dependent on the individual or family's skills to organize the resources available in the community and society to generate health and well-being (Alliance for Children and Youth of Waterloo Region 2009). For individuals and families, strengths encompass varied cognitive, psychosocial, and behavioral capabilities. We aimed to investigate the specific protective factors, or strength-based motivators, within Hispanic families that support the creation of health and to learn how Hispanic parents use these protective factors or strengths in helping their children to stay healthy (Mejia et al. 2008). Within the context of this research, the strength-based model was used to understand how parents and families used oral health beliefs, perceptions, and social support to promote positive oral health behaviors and produce health for their children. The study used a mixed-methods approach to understand differences in Hispanic parental factors between caries-free and caries-active children.

Methods

Study Design and Sample Size

The study followed a partially mixed concurrent equal status design with the quantitative and qualitative portions of the study occurring at the same point in time (i.e., at the same appointment) (Leech and Onwuegbuzie 2009). In addition, the quantitative and qualitative portions of the study were not mixed until both data types had been collected and analyzed.

A cross-sectional survey was conducted with 200 mother-child triads enrolled from health centers. Two hundred triads consisting of a Hispanic parent (most of the parents identified as Mexicans or Mexican Americans, at least 18 y of age) with 2 children: 1 child between 0 and 6 y and the second child between 0 and 10 y were enrolled in the study.

The child between 0 and 6 y was the primary child in the study, whose caries status indicated if that triad would be grouped as CF or CA. The second child was the reference child in this study. The study enrollment started in July 2017 and was completed in March 2019. All the triads were enrolled in the Denver Metro area, Colorado. This study was approved by the Colorado Multiple Institutional Review Board (COMIRB).

Data Collection

Basic Research Factors Questionnaire

The questionnaire used in this study was a portion of the Basic Research Factors Questionnaire (BRFQ) (Albino et al. 2017). The BRFQ collects information on parents' and children's sociodemographic characteristics, household characteristics, and health status and is available in both English and Spanish. The parents were prescreened using the electronic health records for their children. A member of the research team approached the parent in the waiting area to explain the study procedure. Certified translators provided the study information to the Spanish-speaking parents. If the parents agreed to participate in the study, they were moved to a quiet room to sign the consent form and complete the survey questionnaire. The parents were asked to consider the primary child while answering survey questions. The survey was completed in English or Spanish based on the parents' preferred language with an iPad using the REDCap (Research Electronic Data Capture, version 9.X.Y) electronic data capture tool hosted at the University of Colorado Anschutz Campus (Harris et al. 2009; Harris et al. 2019). REDCap is secure, web-based software supporting clinical research data capture, which includes 1) an interface for validated data capture, 2) audit trails for tracking data manipulation and export, and 3) automated export for download to common statistical packages (Harris et al. 2009; Harris et al. 2019).

Qualitative data were collected through in-depth individual interviews with

parents in each group. Each parent was given the choice of participating in the interview after they completed the survey. Parents were given a choice to complete the interview in Spanish or English. Parents did not know whether they belonged to the caries-free or caries-active group.

Measures

Oral health behavior. Twelve items were used to obtain an overall behavior score representing the percentage of oral health behavior items answered with an "adherent" response. *Adherent* is the recommended oral health behavior as defined by the study instrument. The oral health behavior measure was divided further into 2 measures: hygiene and diet. Five items were used to obtain an overall hygiene score representing the percentage of oral health hygiene items answered with an adherent response. Two items were used to obtain an overall behavior related to diet score representing the percentage of items answered with an "adherent" response. The other 5 items covered topics including adult supervision in brushing and use of different kind of water sources for drinking purposes.

Oral health knowledge. Fourteen items were used to obtain the overall knowledge score representing the total percentage of oral health knowledge items answered with an adherent response.

Dental utilization knowledge. Five items were used to measure parent knowledge on utilization of oral health services.

Self-efficacy. Ten items were used to represent the overall self-efficacy scores. Self-efficacy measures maternal confidence in her ability to successfully engage in recommended oral health behaviors for her child.

Health belief model. Sixteen items assessed parent health behavior, comprising 4 subscales of 4 items each, including perceived benefits, perceived barriers, perceived severity, and perceived susceptibility. Items under perceived susceptibility are reverse coded.

Multidimensional oral health locus of control. Nine items assessed multidimensional locus of control, including 3 subscales of 3 items each representing the parents' belief over control of their children's oral health outcomes. They include internal locus of control (the mother), external locus of control—powerful others (the dentist), and external locus of control—chance (fatalistic or random factors).

Parent stress index. Nine items were used to measure perceived stress related to the caregiving role of the parents.

Social support. This measure indicates the degree to which parents believe they have others available to help them when needed. Four items were used to measure the overall social support.

Acculturation. The 12-item Acculturation Rating Scale for Mexican Americans (ARSMA-II) was used to measure acculturation.

Preferred language. Parent preferred language was measured based on whether they chose to discuss the study and complete the survey in English or Spanish.

Demographics. Demographic data were collected on parents' age, education, employment status, household size, number of minors in the household, housing tenure (number of years family has lived at the current residence), and health insurance.

Number of decayed, missing, and filled primary tooth surfaces (dmfs) measure. A study-trained and calibrated licensed dentist and a dental hygienist conducted the visual screenings of the enrolled children to count their dmfs. Examinations were conducted at the dental centers using a mouth mirror and an overhead light attached to the dental chair using the method described by Pitts (Pitts 2001;

Warren et al. 2015). Surface-level caries charting was entered into a secure, customizable electronic dental research software program, CAries Research Instrument (CARIN) (University of California, San Francisco 2010). The 200 parent-child triads enrolled in the study were divided into 2 groups: CA and CF. Classification criterion for the CF group was the absence of dental caries in the child's mouth, defined as no cavitated lesions in the child's mouth. Noncavitated lesions on pits and fissure sand white spot lesions were not classified as decay. Classification criterion for the CA group was the presence of dental caries in the child's mouth, defined as cavitated lesions with evidence of tooth structure loss (Pitts 2004); lesions were considered cavitated if clinically visible with irreversible loss of enamel structure or breaks in the enamel surface (Pitts 2004).

Data Analysis

Data analyses for this study involved only the primary child. For descriptive statistics, the categorical variables were summarized with counts and percentages and the continuous variables were summarized with means and standard deviations (Table 1). Two-sample t tests for continuous variables were conducted to compare means of CA and CF groups. Fisher exact tests were conducted to compare categorical variables by CA and CF groups. A P value of ≤0.05 was considered beyond chance.

The bivariable associations between independent variables (parent psychosocial factors and demographic characteristics) and the dependent variable (presence or absence of caries, caries: yes/no) were modeled using simple logistic regression model analysis (Hidalgo and Goodman 2013). The independent variables were checked for multicollinearity using the Pearson correlation (Hidalgo and Goodman 2013).

All the independent variables with a bivariable association of $P ≤ 0.20$ with the outcome variable were entered into 2 multivariable logistic regression models

Table 1.
Descriptive Statistics.

Variable	Value	Caries Active (*n* = 100)	Caries Free (*n* = 100)	*P* Value[a]
Child age, y		4.0 (1.6)	2.7 (1.3)	<**0.001**
Child sex	Male	43 (44.8%)	55 (55.6%)	0.835
	Female	53 (55.2%)	44 (44.4%)	
Parent language	English	45 (46.4%)	48 (48.0%)	0.544
	Spanish	52 (53.6%)	52 (52.0%)	
Parent age		29.6 (12.6)	28.8 (10.1)	0.580
Parent education	Less than high school	42 (43.3%)	38 (38.0%)	0.139
	At least high school	55 (56.7%)	62 (62.0%)	
Parent employment	Employed	28 (28.9%)	49 (49.0%)	0.824
	Unemployed	69 (71.1%)	51 (51.0%)	
Household size		5.7 (1.7)	5.1 (1.8)	**0.015**
Household minors		3.4 (1.4)	2.9 (1.4)	**0.007**
Years in household	Less than 5 y	56 (57.7%)	71 (71.0%)	0.656
	At least 5 y	41 (42.3%)	29 (29.0%)	
Insurance	Yes	79 (81.4%)	82 (82.0%)	0.051
	No	10 (10.3%)	7 (7.0%)	
Travel time	Less than 30 min	78 (80.4%)	77 (77.0%)	0.791
	At least 30 min	19 (19.56%)	23 (23.0%)	
Mode of transportation	Drive	83 (83.6%)	85 (85.0%)	0.895
	Public transportation	14 (14.4%)	15 (15.0%)	
Missed work	Twice or less	83 (83.6%)	87 (87.0%)	0.684
	More than twice	14 (14.4%)	13 (13.0%)	
Age of child at first dental visit	1 y or less	55 (56.7%)	61 (61.0%)	0.139
	Greater than equal to 2 y	42 (43.3%)	39 (39.0%)	
Overall behavior		59.4 (18.9)	62.8 (18.9)	0.261
Oral health behavior—hygiene		57.5 (21.8)	63.7 (21.1)	**0.040**
Oral health behavior—diet		76.3 (33.9)	75.5 (33.7)	0.807
Knowledge		71.0 (18.8)	71.4 (16.3)	0.881
Social support		1.2 (0.3)	1.2 (0.3)	0.858
Parent stress index		2.5 (0.9)	2.4 (0.9)	0.279
Chronic stress		1.7 (0.5)	1.8 (0.6)	0.437
Self-efficacy		2.6 (0.5)	2.5 (0.5)	0.339
Knowledge on dental utilization		3.6 (1.0)	3.5 (1.1)	0.310

(continued)

Table 1.
(continued)

Variable	Value	Caries Active ($n = 100$)	Caries Free ($n = 100$)	P Value[a]
Acculturation		3.8 (0.9)	3.8 (0.9)	0.586
LOC internal		4.0 (1.0)	4.0 (1.0)	0.873
LOC external—others		2.4 (1.1)	2.2 (1.0)	0.267
LOC external—chance		2.7 (1.2)	2.5 (1.1)	0.116
HBM severity		3.0 (1.0)	2.8 (1.0)	**0.050**
HBM barriers		3.3 (1.0)	2.9 (0.9)	**0.008**
HBM susceptibility		3.1 (1.0)	3.6 (1.2)	**<0.001**
HBM benefits		4.0 (1.3)	3.9 (1.2)	0.841

Continuous variables are presented as means (SD). Categorical variables are presented as n (%). Boldface indicates statistical significance.
HBM, health belief model; LOC, locus of control.
[a]*P* values result from *t* tests and Fisher exact test for each variable by cohort (caries free and caries active).

to assess the simultaneous, independent association between each variable and caries adjusting for parent characteristics. The 2 models include multivariable logistic regression model adjusting for parent socioeconomic characteristics and a multivariable logistic regression model adjusting for acculturation variables. The models were estimated using the likelihood ratio method. Estimates and *P* values were reported. All the data cleaning and analyses were conducted using SAS (version 9.4; SAS Institute).

These models were chosen on the basis of the analysis of the qualitative data and directed acyclic graphs (DAGs) developed to describe the authors' view of the interrelationships among variables. This technique supported the mixing of quantitative and qualitative data at the analysis level and helped to validate one methodology against the other. DAGs helped the authors to visualize the associations of variables and supported network building in qualitative analyses, as well as later model building in quantitative analysis.

Qualitative data were analyzed using ATLAS.ti (Scientific Software Development GmbH). Spanish interviews were first translated into English. All interviews were transcribed, and a systematic approach that allows for open discovery of emergent concepts, with a focus on generating themes or theory, was used to analyze the data. A grounded theory approach was used to develop the code structure. With this approach, the coding was done using a purely inductive technique. This minimized the potential for "forcing" a preconceived result and provided for a more valid reflection of "the ground" or the true experiences of participants.

Results

Quantitative Results

The response rate of the invited parents was 83.2%. Survey data were completed for 197 parents, and oral screenings were completed for 200 children (100 in the CF group and 100 in the CA group).

Table 1 shows the descriptive data for the study participants. The children in the CF group had a mean (SD) age of 2.8 (1.28) y, which was younger than the mean age of the CA group at 4.0 (1.55) y ($P < 0.001$). There was no difference in frequencies by sex for the 2 groups.

Parents in the CF group reported smaller average household size (CF $\bar{x} = 5.1$, CA $\bar{x} = 5.7$, $P = 0.015$) and fewer minors in the household (CF $\bar{x} = 2.9$, CA $\bar{x} = 3.4$, $P = 0.007$) compared with the CA group. Parents of CF children had higher mean oral health behavior score related to maintaining children's oral hygiene than CA group parents (CF $\bar{x} = 63.7\%$, CA $\bar{x} = 57.5\%$, $P = 0.04$). Parents of CF children perceived fewer barriers to accessing preventive dental care (CF $\bar{x} = 2.9$, CA $\bar{x} = 3.3$, $P = 0.008$) and perceived their children to be more susceptible to caries (CF $\bar{x} = 3.6$, CA $\bar{x} = 3.1$, $P < 0.001$) as compared to CA group parents.

Child CF status was associated with parental oral health behavior (hygiene) scores, 2 subscales of the health belief model—perceived barriers and perceived susceptibility (Table 2). Parents in the CF group reported a higher behavior score for oral hygiene than those in the CA group ($\beta = 0.013$, $P = 0.047$). They perceived fewer barriers ($\beta = -0.406$, $P = 0.009$) to accessing preventive dental care for their children versus those in the CA group. Parents of the CF group considered their children more susceptible to cavities ($\beta = -0.443$, $P = 0.001$) than the parents in the CA group did. Parents in the CF group had a smaller household size ($\beta = -0.224$, $P = 0.013$) and fewer minors in their household ($\beta = -0.316$, $P = 0.006$) compared with parents in CA group.

Table 3 presents the multivariable logistic regression model analysis.

Table 2.

Association between Caries Status and Parental Factors.[a]

	Estimate	Odds Ratio	P Value
Parental psychosocial factors			
Overall behavior	0.0094	1.01	0.214
Oral health behavior—hygiene	0.0133	**1.01**	**0.047**
Oral health behavior—diet	−0.0007	1.00	0.869
Knowledge	0.0013	1.00	0.873
Social support	−0.0117	0.99	0.980
Parent stress index	−0.1372	0.87	0.435
Chronic stress	0.2263	1.25	0.421
Self-efficacy	−0.2684	0.76	0.373
Knowledge on dental utilization	−0.1570	0.85	0.265
Acculturation	−0.0270	0.97	0.872
OHLOC internal	−0.0219	0.98	0.880
OHLOC external—others	−0.1629	0.85	0.244
OHLOC external—chance	−0.1967	0.82	0.108
HBM perceive severity	−0.2118	0.81	0.146
HBM perceive barriers	−0.4061	**0.67**	**0.009**
HBM perceive susceptibility	−0.4433	**0.64**	**0.001**
HBM perceive benefits	−0.0299	0.97	0.797
Parental characteristics			
Parent language	−0.0645	0.94	0.821
Parent age	−0.0001	1.00	0.098
Parent education	0.2197	1.25	0.448
Parent employment	−0.8619	**0.42**	**0.003**
Household size	−0.2245	**0.80**	**0.013**
Household minors	−0.3165	**0.73**	**0.006**
Years in household	−0.5836	0.56	0.051
Insurance	0.0084	1.01	0.168
Type of insurance	−0.0008	1.00	0.801
Travel time	0.2040	1.23	0.558
Mode of transportation	0.0452	1.05	0.910
Missed work	−0.0598	0.94	0.528

Boldface indicates statistical significance. HBM, health belief model; OHLOC, oral health–locus of control.
[a]Bivariable logistic regression.

Table 3.
Models Studying the Association between Caries-Free Status and Parental Factors.

Parental Psychosocial Factors	Estimate	Odds Ratio	*P* Value
Adjusting for parental SES[a]			
Oral health behavior—hygiene	0.0094	1.01	0.233
OHLOC external—chance	0.0060	1.01	0.969
HBM perceive severity	0.0774	1.08	0.695
HBM perceive barriers	−0.2471	0.78	0.322
HBM perceive susceptibility	−0.4165	**0.66**	**0.042**
Parent employment	−0.6151	0.54	0.096
Household size	−0.1086	0.90	0.476
Minors in household	−0.1825	0.83	0.339
Adjusting for acculturation[b]			
Oral health behavior—hygiene	0.0155	**1.02**	**0.040**
OHLOC external—chance	−0.0199	0.98	0.890
HBM perceive severity	−0.0530	0.95	0.780
HBM perceive barriers	−0.2241	0.80	0.350
HBM perceive susceptibility	−0.4999	**0.61**	**0.010**
Acculturation	0.1344	1.14	0.500
Language	−0.0571	0.94	0.860

Variables with $P < 0.2$ included in the final model. Outcome: caries (yes/no). Boldface indicates statistical significance.
HBM, health belief model; OHLOC, oral health–locus of control.
[a]The overall *P* value for this model is 0.002.
[b]The overall *P* value for this model is 0.004.

Two models were developed based on the DAG figures and qualitative analysis. Model A adjusting for parent socioeconomic characteristics demonstrated an association of parental perceived susceptibility with child CF status. Parents of CF children perceived their children to be highly susceptible to caries (β = –0.421, *P* = 0.040). Model B, adjusting for parent acculturation, demonstrated an association of parental oral health behavior related to hygiene (β = 0.016, *P* = 0.040) and parent-perceived susceptibility of their child to caries (β = –0.500, *P* = 0.010) with child CF status.

Qualitative Results

Forty-nine interviews were conducted with parents: 27 in the CF group and 22 in the CA group. Interviews lasted between 30 and 40 min. The interviews were semistructured, and the interviewer probed the parent based on initial answers. The following were the larger themes that were included in the interview guide.

1. Parental motivation that contributed to children's oral health
   a. Strength-based motivators
   b. Fear-based motivators
2. External factors that contributed to children's oral health
3. Social support that affected children's oral health
4. Parent knowledge that affected children's oral health

The data generated from the interviews were sufficient in scope to produce themes and codes; coders were able to reach saturation in data analysis. These codes were used to develop 2 networks in ATLAS.ti: one for parents in the CF group (Fig. 1) and the other for parents in CA group (Fig. 2) to gain a deeper understanding of how interactions of parents with their surroundings and their internal perceptions influenced their children's health.

Parents in CF Network

Parents of CF children discussed several ways they motivated themselves and their children to maintain oral hygiene (Fig. 1, developed in ATLAS.ti). They believed in the well-being of their children and wanted their children to have healthy teeth, which is the premise behind strength-based motivators.

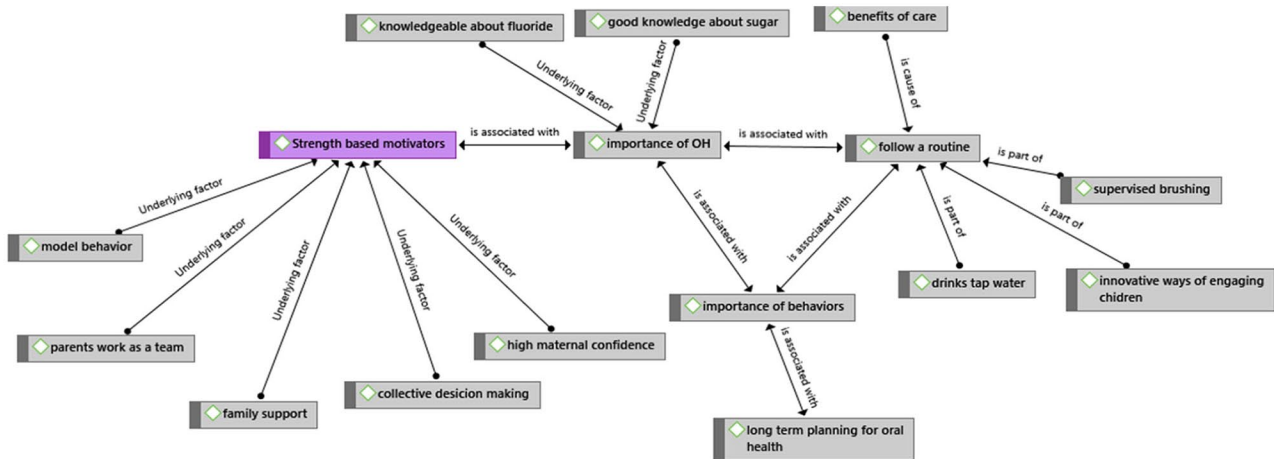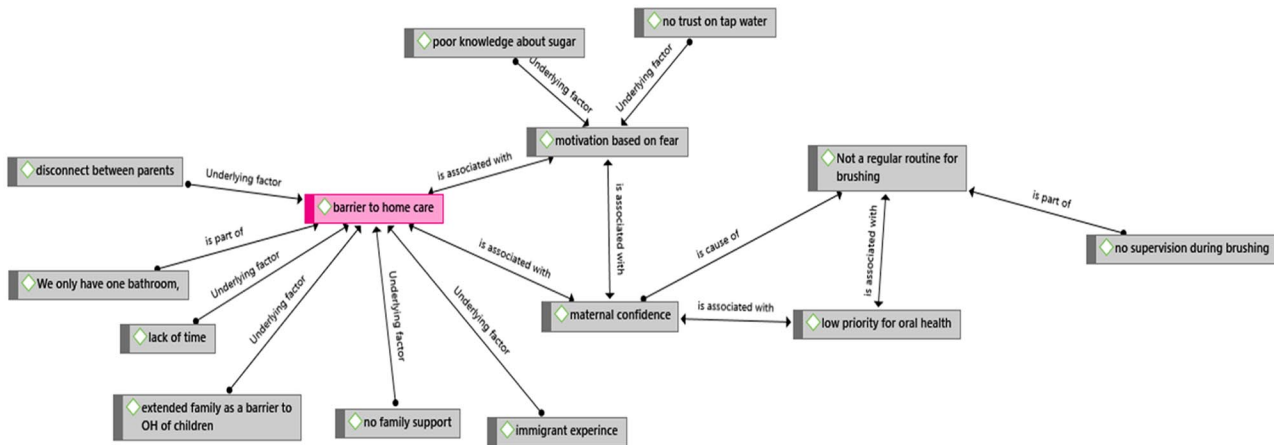**Figure 1.** Caries-free group network.

Figure 2. Caries-active group network.

The following terms were constantly repeated by parents in this group.

> "By wanting to help my children have good teeth."

> "I tell them to brush their teeth because it's good for their health."

> "It motivates me wanting to keep their teeth healthy."

> "For them to be in good health, it's very important that their teeth are always well taken care of."

> "It's for their well-being."

We identified several underlying factors for strength-based motivators. Participants spoke about support and cooperation between the parents, and although the mothers were primarily taking care of the children, they said that their husbands/partners were involved in decision making related to sugar consumption in the household and helped with supervised tooth brushing. Several mothers reported in the interviews that they were a team and collectively decided what was good for their child's teeth.

> "It is a responsibility [supervised brushing] we share together."

> "Yes, he brushes their teeth in the morning and at night but not during the day. That is my job."

Participants also spoke about the support they received from their families, friends, and extended families. The participants discussed that their families understood the importance of oral health and felt comfortable leaving their children with grandparents during the day when they were at work. Participants emphasized that they felt a sense of similarity with their friends and family when discussing oral health of their children and the challenges they faced in maintaining oral hygiene and that they exchanged notes and information on how to overcome challenges.

> "I do work, and they [children] stay with my mom, and my mom brushes their teeth also, and she brings them to most of their dental appointments."

> "I talk with my sisters about our children's health and how to take care of them."

"Yeah, everyone is supportive. They are pretty much like me. They try and stick to no sugar drinks and brushing and stuff like that."

Another underlying factor for the strength-based motivator was high parental confidence. Parents in this group were confident that they would be able to brush their children's teeth and restrict the consumption of sugary products such as soda, candy, and chocolates. Parents said that because they were making collective decisions for their children and they worked as a team, it was easier for them to make the decision not to buy soda in their household and to take turns supervising their child's brushing.

"No, I don't give them soda or candy."

"I always go [with her to the bathroom] I always brush her teeth first since she was a baby."

Parents in the CF group discussed the importance of oral health and the importance of oral health behaviors that co-occurred and were associated with strength-based motivators (Fig. 1). Parents in the CF group understood the importance of preventive oral behavior and how it was linked to the well-being of their children. Parents discussed the importance of following a routine to establish healthy behaviors early for their children and the importance of following these behaviors on a daily basis. They clustered oral health behaviors such as tooth brushing with overall behaviors such as eating fruits and vegetables and visiting the pediatrician and dentist regularly. Some of the oral health behaviors that the parents in the CF group discussed repeatedly were drinking tap water, supervising tooth brushing, and finding innovative ways to engage their children in oral hygiene activities.

"We should be very, very alert, morning and night, regarding our children's oral health and should make sure that they brush their teeth after they eat."

"So it's mainly just structure and routine to keep it consistent and kind of automatic."

"We have a schedule. When they wake up in the morning, they know that they must brush their teeth."

"Visit your dentist every six months, brush your teeth twice a day, and eat more vegetables and fruits."

Parents in the CF group were knowledgeable about fluoride, its sources, and its role in caries prevention. Most parents in this group emphasized that their children drink tap water and that they receive information about fluoride from dentists' and pediatricians' offices.

Parents in CA Networks

Parents in the CA group discussed barriers they faced in taking care of their child's oral health (Fig. 2, developed in ATLAS.ti). They spoke about the physical barriers, challenges they faced with their spouse and family, immigrant status, and lack of time as challenges that stopped them from providing good oral hygiene for their children.

Most parents in the CA group who participated in interviews were mothers; they spoke about the disconnect within their families, which made it difficult to follow a routine for their children. Parents also discussed a lack of support from their extended families. Some parents in the group discussed that their children received sugary food products from grandparents. Moreover, they noted their families were not supportive in bringing their children to the dentist for preventive care. They felt discouraged when they spoke about their children's oral health and dental visits to their families; thus, some of them were reluctant to bring up such discussions within the family setting.

"I always tell him [husband] not to buy candy because he is the one always buying them candy and not taking care of them."

"I don't speak with my mother [about oral health], almost never."

"They stay with my mother-in-law, but she is not helpful, so I limit how much time they can spend with them because they [in-laws] can't follow directions."

"It's [a] free for all, they can do whatever they want pretty much, and they always have soda, chips, candy, gum; they have all that, all the time, at my mother's house."

Parents discussed physical barriers, such as having only 1 bathroom in the house, making it difficult to brush their child's teeth at night. Several parents in this group discussed the lack of time as a barrier to following a routine for their children's oral hygiene.

"I do, but sometimes it's just hard for me to make that time."

"We only have one bathroom."

Parents in the CA group also discussed their immigrant experience and its relationship with decision making to access preventive care for their children. Parents discussed that their perceptions about seeking dental care were based on having pain and not for preventive reasons. They discussed how their own experiences as children affected their decision making for their children. Some parents said they did not want their children to suffer from cavities as they did in their childhood and thus preferred to visit the dentist for prevention. They mentioned that it was easier to access preventive dental care in the United States compared to their home country.

"We came from El Salvador, and if you have an emergency, then you got to go to the dentist. It wasn't something that was built into what we normally did to take care of our health."

"We didn't have good dental care in Mexico, so I don't want my kids to suffer from cavities."

"I didn't have the opportunity to go to the dentist until I was 14 years old; I don't want the same thing for my daughters."

Parents in the CA group used fear-based motivation to motivate their children for oral hygiene and less consumption of sugary foods. They discussed pain, suffering from cavities, tooth infections, and tooth extraction as motivators to encourage their children

to brush their teeth. They believed that if they instilled fear in their children about pain from cavities and loss of teeth, their children would be more inclined to brush their teeth regularly. They discussed the consequences their children would suffer if they did not brush their teeth or ate too much candy.

> "I don't want them to have pain."

> "I don't want them to have bad teeth or have no teeth at all when they grow up."

> "They can get cavities, and that would be very painful."

> "Wanting to make sure she doesn't suffer from cavities."

> "I tell them that, if they don't (brush), they'll get cavities, and their teeth will fall off [out]."

Parents reported having lower confidence in setting up a routine for their children. Parents discussed that it was hard to stick to a routine for brushing, which seems to be associated with low maternal confidence. Parents discussed that they asked their children to brush but could not regularly supervise their children while brushing due to lack of time or other factors.

> "I think I have neglected their teeth. When they eat sweets, I don't brush their teeth."

> "I do, but sometimes it's tough saying no to them for candy."

> "Yes, but sometimes my kids go to bed early, and they don't want to brush their teeth."

> "Sometimes they [children] get lazy, and they just go to bed or start watching TV."

Several parents in this group reported that their children did not drink tap water because they do not trust tap water. They felt bottled water was better for their children's health because it is cleaner than tap water. Parents said that they received information about fluoride from the dentist, the pediatrician, and the school.

Discussion

This study reports the association of parental factors with the caries status of their children in a Hispanic community. Using both quantitative and qualitative methodologies allowed us to get an in-depth understanding of the differences in beliefs, perceptions, social support, and behaviors of parents in the CA and CF groups.

The quantitative results demonstrated that there was not much difference between the parents' socioeconomic status between both groups. There was no difference in parent education, health insurance, mode of transportation used to reach the clinic, or amount of time missed at work to take their children to the dentist. The groups differed in the number of minors in the household, parent employment, and the overall household size. These results helped to establish that parents in both groups in this cohort were similar in many ways.

One central thesis that emerged from the quantitative analysis was about parental health beliefs. Parents of CF children perceived dental caries to be a serious disease, their children to be more susceptible to disease, and fewer barriers to seeking preventive dental care for their children. These parents also had a higher average oral health behavior score related to the oral hygiene of their children compared to parents in the CA group. According to the health belief theory, acceptance of susceptibility to, and seriousness of, a disease can lead to action (Rosenstock 1974; Hollister and Anema 2004). Both the qualitative and quantitative results demonstrated that parents in the CF group were concerned about the high susceptibility of their children to caries and thus tried to establish good oral hygiene routines for their children. Figures created as DAGs suggested that a parent's socioeconomic status could influence the association of parental factors with caries status. After adjusting for parent income and number of minors in the household, parental perceived susceptibility remained significantly associated with their children being caries free.

Parents in both groups, however, were less likely to make dietary changes for their children. Neither the qualitative nor the quantitative results provided any significant discussion about reducing children's sugary food consumption. Although a few parents in the CF group discussed sugary foods during the interviews and had more knowledge as compared to the CA group, this was not a significant study theme. One reason parents did not respond positively about diet in either the survey or the interviews could be that they may have less control over their children's diets. Food consumption is based on several other factors such as child temperament, availability of sugary foods in the house, and the role of extended family who may provide childcare (Moynihan et al. 2019).

Oral hygiene, on the other hand, was a significant theme in both the qualitative and quantitative results. In the survey, questions related to oral hygiene asked if the parents supervised their children during tooth brushing, frequency of tooth brushing, and nighttime tooth brushing. In the interviews, parents of the CF children regularly emphasized establishing routines for their children and supervising children during tooth brushing.

Although there was no difference in the acculturation measure quantitatively, the qualitative analysis pointed to some differences related to acculturation between the parents in the 2 groups. Interviews with the parents in the CA group highlighted some aspects of acculturation when they discussed the influence of their immigrant experiences on decision making for their children. Based on this qualitative result, we decided to adjust for acculturation in model B instead of socioeconomic status in model A (Table 3), which demonstrated that parents in the CF group still had significantly better oral health behavior related to oral hygiene of their children as compared to parents of the CA group. Acculturation has been associated with higher dental preventive

behaviors, including higher frequency of tooth brushing, accessing dental care services, and dental sealant applications especially in Hispanic communities (Mejia et al. 2011; Tiwari and Albino 2017).

Methods parents use to motivate themselves and their children for oral health differed between the 2 groups. Parents of CF children believed in their children's overall well-being rather than focusing on disease prevention. Their actions were motivated to maintain health rather than prevent illness; in doing so, they also understood that it was necessary to engage their children in oral hygiene practices through modeling behavior, using technology (such as videos), and other innovative techniques. Overall, this study highlights that when oral hygiene practices and oral health are imbedded with overall healthy behaviors and part of a routine, parents can more easily implement and sustain behaviors. These parental approaches could be considered their strengths or protective factors that are applied to generate children's health.

One crucial difference between the qualitative and quantitative data was related to social support. The survey results did not display any significant difference between social support in the CA and CF groups. However, in the individual interviews, parents gave in-depth accounts of how their families played a role in caregiving for their children and support for (or barriers to) preventive activities, including tooth brushing and dental visits. Parents of CF children expressed that they had more support from their family, friends, and peers as compared to parents of CA children. Hispanic communities are interconnected and follow group norms; thus, it can be speculated that parents of CF children belong to social groups or networks that emphasize health and well-being more than CA groups (Mejia et al. 2008). More extensive studies with sophisticated social network analysis are needed to understand these differences.

Conclusion

Parental health beliefs and motivational methodologies can be significant

determinants of caries status in Hispanic children. Parents' beliefs could motivate them to take action or establish behavior that prevents dental caries in their children. Parent motivations rooted in the child's well-being and generation of health (i.e., strength-based motivations), with an understanding of disease susceptibility, can reasonably be assumed to result in better sustainability of oral hygiene behavior. Health care providers can incorporate these methodologies in oral health promotional messaging, directing their approaches to improve the oral *health* of Hispanic children rather than to prevent *disease*.

Last, in Hispanic communities, family and social support are essential components of child caregiving, and having multiple caregivers is a common practice. Familism related to health prevention and status in Hispanics is a multifaceted and important influence on oral health (Updegraff et al. 2017). Oral health preventive interventions for Hispanic children should therefore be developed at the community or family level to include more than 1 generation and several caregivers to have a higher impact.

Author Contributions

Acknowledgments

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