Published in final edited form as:

J Am Dent Assoc. 2019 June ; 150(6): 540–548. doi:10.1016/j.adaj.2019.01.032.

Association between Child Dental Caries Experience and Mother's Perception of her Child's Oral Health Status

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Abstract

Objectives.—Mothers play a primary role in the health of their children. This role may be of particular importance for children in Appalachia who have increased caries relative to children in other regions of the United States. We examined the degree to which child dental caries experience was in concordance with mother's perception of the health of her child's teeth, and how concordance varied by sociodemographic factors.

Methods.—We obtained cross-sectional data on mother-child dyads with children under six years-old through the Center for Oral Health Research in Appalachia study. A community-based sample of 815 mother-child dyads were interviewed and clinically examined in Pennsylvania and West Virginia. We estimated the association between mother's perception of her child's oral health status and her child's dental caries experience using an unadjusted zero-inflated negative binomial

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Disclosure: None of the authors has any financial interest related to the article

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Disclosure. None of the authors reported any disclosures.

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model. We compared sociodemographic factors between concordant and non-concordant mother-child dyads using chi-square tests.

Results.—Mother's perception of child oral health status was associated with child dental caries experience ($p<0.001$). Two-thirds of mother-child dyads showed concordance between the mother perception of her child's oral health status and the child's dental caries experience ($n=522$, 64%). Concordance was associated with younger child age and having child dental insurance ($p<0.01$).

Conclusions.—On average, mothers accurately perceived their child's dental caries experience. This accuracy was higher for younger children and children with dental insurance.

Practical Implications.—Mother's awareness of her child's oral health status could be used to develop effective prevention and treatment strategies, particularly for young children vulnerable to dental caries.

Keywords

Mother-Child Relationship; Oral Health; Dental Caries; Appalachia

INTRODUCTION

Dental caries is one of the most common chronic diseases among children in the United States.^{1, 2} Untreated dental caries can cause pain, disrupted sleep, dysphagia, and increased missed school days resulting in poor school performance.^{1, 3, 4} Children in Northern Appalachia have an increased prevalence of decayed, missing and filled teeth relative to children in other regions of the US.⁵⁻⁷ In 2012, 5% of the two-year-olds, 21% of the three-year-olds, 35% of the four-year-olds, and 51% of the five-year-olds in Northern Appalachia had dental caries.⁸

The oral health of young children is primarily overseen by their mothers; further, 97% of preschoolers live in households where their mother present.^{3, 9-14} A positive maternal attitude is related to a lower incidence of caries in the child, better child oral hygiene, and more dental treatment received by the child.¹⁵ Since a large proportion of a child's early life may be spent with the mother, children may learn routines and habits involving diet and oral hygiene from their mothers.^{12, 16} In addition, mothers often are the primary caregivers who take their children for dental care.^{9, 10} Through daily oral health practices and dental health-seeking behavior, a child's oral health status is significantly affected by their mother.

Two previous studies examined the association between children's oral health status and mother's perception of her child's oral health needs.^{17, 18} Divaris and colleagues (2012) found a low correlation, with a Spearman rank correlation coefficient of 0.13, between child oral health status and caregiver's assessment of their children's oral health status within the community-based sample of 53 caregivers of children under three years-old in North Carolina. Similarly, Weyant and colleagues (2007) analyzed 530 parent-adolescent pairs in Pennsylvania and found no association between the adolescent's history of oral symptoms (pain, difficulty in chewing) and the parent's perception of adolescent's oral health status and treatment need using multiple logistic regression and path analysis.¹⁸

While previous studies depict a low to modest association between children's oral health status and their caregiver's perceptions of their child's oral health status, there is no research analyzing this relationship in a population with persistently high rates of dental caries such as Northern Appalachia. This study fills that gap by determining the degree to which mother's perception of child oral health status is in concordance with her child's dental caries experience among mother-child dyads from Northern Appalachia. We hypothesized that concordance between mothers' perceptions and child dental caries would be low, consistent with previous literature which found a poor correlation between caregiver's assessment of child oral health status and their child's restorative dental treatment needs both in children and adolescents.^{17, 18}

As a secondary aim, we compared family and child sociodemographic factors between concordant and non-concordant families. Based on previous literature on the impact of income, education, and employment on child's oral health,¹⁹ we hypothesized that families with higher sociodemographic status will have improved concordance between child dental caries status and the mother's perception of her child's oral health status.

METHODS

Study Design and Data Sources.

We used data collected from the Center for Oral Health in Appalachia (COHRA)^{A1}, particularly the COHRA1 study,⁶ a cross-sectional investigation conducted between 2002 to 2009 that sought to characterize the oral health of disadvantaged families in rural and urban locations in Pennsylvania and West Virginia.⁸ A non-health care seeking community-based sample was recruited via radio and newspaper announcements, flyers, schools, clinics, and other community public sites.⁶

Caregivers completed structured face-to-face interviews on socio-demographic and oral health factors. Following the interview, children underwent clinical exams with trained examiners.⁸ The clinical exam on the child included a standardized assessment of the dentition, soft tissues and supporting structures. Exams were performed by an assistant and either a dentist or dental hygienist using a dental chair and light.⁶ Children under the age of three were screened using an abbreviated lip lift exam to assess early childhood caries and missing teeth.⁶ Following the caries assessment, the d2ft index was used to characterize each coronal tooth structure as sound (no dental caries), decayed (D2 for lesions seen in enamel), or filled (restorations presents with no decay).⁶

This study was approved by the Institutional Review Boards at the University of Pittsburgh and West Virginia University, and informed consent was obtained from all participants. We limited our analytic sample to female caregivers whose youngest child was under the age of six years, yielding 588 non-redundant mother-child dyads.

^{A1}The Center for Oral Health Research in Appalachia (COHRA) houses numerous studies funded by the National Institutes of Health, one of which is described in this manuscript (NIDCR R01 DE014899).

Variables.

The main exposure variable, mother's perception of her child's oral health status, was obtained during the oral health interview in response to the question, "How would you classify the condition of your children's teeth?" We collapsed the responses to a three-level categorical variable: 1) excellent/very good, 2) good, and 3) fair/poor. We re-assigned "don't know" (n=25) to missing.

The main outcome variable, child dental caries experience, was obtained during the child's clinical exam and measured using the decayed, filled, tooth (d2ft) index. The decayed score was obtained at the d2 level and therefore did not include white spots.

In the absence of a valid and reliable measure of concordance between caregiver's perceptions of child oral health and a child's clinically-determined oral health status, we developed a definition for concordance *a priori*. The mother-child dyad was defined as concordant if they met the following criteria: 1) mother perceived that the child had "excellent/very good" oral health status and the child had a d2ft index of zero, 2) mother perceives that the child had "good" oral health status and the child had a d2ft index of one, or 3) mother perceived that the child has "fair/poor" oral health status and the child had a d2ft index more than one.

We also examined concordance by the following sociodemographic variables: family income, child age, child gender, child fluoridated toothpaste use, child last dental visit, reason for child last dental visit and child dental insurance. Family income was obtained in response to the question, "What is the total yearly income for everyone in the household put together?" and coded as a five-level categorical variable: 1) less than \$10,000, 2) \$10,000 to 14,999, 3) \$15,000 to \$24,999, 4) \$25,000 to \$49,999, and 5) \$50,000 or more. We coded child age as a six-level categorical variable corresponding to the age of the child from 1 to 6 years of age. We coded child gender and child fluoridated toothpaste use as binary variables. We coded child last dental visit as a four-level categorical variable: 1) never, 2) 6 months or less, 3) more than 6 months, and 4) more than 1 year ago. We coded reason for child last dental visit as a two-level categorical variable: 1) check-up/exam/cleaning and 2) something was bothering. Child dental insurance was coded as a three-level categorical variable: 1) none, 2) private, and 3) public.

Analytical Approach.

We used descriptive statistics and an unadjusted zero-inflated negative binomial model to examine mother's perception of her child's oral health status and child dental caries experience. The zero-inflated negative binomial model was chosen due to two tests: 1) the goodness-of-fit test ($p < 0.05$), which rejected the Poisson distribution; and 2) the Vuong test depicted improved fit with the zero-inflated negative binomial model compared to the standard negative binomial model ($p < 0.05$).

We used descriptive statistics and graphics to explore the distribution of sociodemographic variables (including, family income, child age, child gender, child fluoridated toothpaste use, child last dental visit, reason for child last dental visit, and child dental insurance) between concordant and non-concordant mother-child dyads. Chi-square tests were used to examine

statistically significant associations of sociodemographic variables by concordant and non-concordant mother-child dyads. All analyses were conducted using STATA 15 (StataCorp, College Station, TX).

RESULTS

Most of the 588 children (72%) under six years-old included in this study had no dental caries using the d2ft index (Figure 1). Approximately 8% (n=62) of the children had one d2ft and 20% had two or more d2ft (Figure 1). The majority of children did not have dental caries and the majority of mothers correctly reported that their child's oral health status was "excellent" or "very good" (n=484, 59%) (Table 1). Moreover, as mother's perceptions of her child's oral health status worsened, her child's mean d2ft index was greater (Table 1, Table 3, Figure 2). For mothers that reported her child's oral health status as "excellent," the mean d2ft was 0.17 (n=229) (Table 1, Figure 2). For mothers with a child self-reported oral health status of "very good", "good", "fair", and "poor" the mean d2ft index was 0.6 (n=255), 1.4 (n=223), 4.0 (n=63) and 5.4 (n=45) respectively (Table 1, Figure 2). The distributions of the d2ft score shifted higher for each level of mother's report of her child's oral health status (Figure 3). Furthermore, in our unadjusted zero-inflated negative binomial model, we found a significant association between mother's perception of child oral health status and child dental caries experience ($p<0.001$) (Table 3).

The results from our descriptive findings were confirmed in our concordance analysis. We found that approximately two-thirds of the mother-child dyads showed concordance (n=522, n=64%). Therefore, approximately one-third of mother-child dyads were not concordant (n=293 n=36%).

Concordance between the mother's perception of her child's oral health status and the child's dental caries experience was associated with child age and child dental insurance ($p<0.05$) (Table 2). A total of 22% of mother-child dyads in our sample had one-year-old children, of which 17% of were concordant and 5% were non-concordant (Table 2). In contrast, 14% of mother-child dyads in our sample had six-year-old children, of which 9% were concordant and 5% were non-concordant (Table 2). In general, rates of non-concordance were similar across the child ages from one to six years-old (5 to 8%) while rates of concordance dropped as children grew older (from 17% at child age 1 to 9% at child age 6) (Table 2). Also, a higher percentage of children had dental insurance among concordant mother-child dyads compared to non-concordant mother-child dyads (46% versus 28%) (Table 2). The remaining sociodemographic variables that we examined – family income, child gender, child fluoridated toothpaste use, child last dental visit, and reason for child last dental visit – were not associated with concordance ($p>0.05$) (Table 2).

DISCUSSION

In this study, mother's perception of her child's oral health status was significantly associated with her child's clinical presentation of dental caries. Most young children did not have previous dental caries experience; and in general mothers' accurately assessed that their child had excellent or very good oral health status. For children under six years-old,

mothers in this Northern Appalachian sample were, on average, accurate in their assessment of their child's oral health. Our result was contrary to our hypothesis, that mother's perception of her child's oral health status may have poor concordance with child dental caries experience based on the studies by Divaris and colleagues (2012) and Weyant and colleagues (2007).^{17, 18}

When comparing our results to the community-dwelling sample of caregiver-child dyads in the study by Divaris and colleagues (2012), our study design differed with respect to the outcome measure and limiting caregivers to only mothers.¹⁷ Divaris and colleagues (2012) compared caregiver's perceptions to child's clinically determined treatment needs while we compared mother's perceptions to child's previous dental caries experience using the d2ft index. The d2ft index was obtained by clinical exam with trained research staff and may be more accurate at capturing the child's oral health status. In addition, mothers, as opposed to other caregivers, may be more attuned to their children's oral health, which may have contributed to the stronger concordance in our study.

The results on concordance for this study were also different than the findings from the study performed by Weyant and colleagues (2007).¹⁸ The main difference between these studies is that the children in this study were all under the age of six and consequently, not able to express their oral care needs like the adolescents examined in the study performed by Weyant and colleagues (2007). Compared to adolescents, young children are more dependent on their mothers for oral health practices; and mothers may spend more time with their kids at a young age. Therefore, mothers may have more information necessary to assess their child's oral health status due to the closer relationship that young children have with their mothers compared to the distance that many adolescents naturally create with their parents.

A second main result of this study was that the rate of concordance varied by child age and insurance status. Child age was significantly associated with concordant mother-child dyads, particularly for children less than two years-old. This finding, that mothers of very young children are attuned to their child's oral health status, may also indicate that early childhood is a window of opportunity during which mothers may be receptive to oral health messages and willing to start a pattern of preventive oral health behaviors. Public health advocates can capitalize on this time during which mothers may be motivated to take their child to the dentist. Therefore, the accuracy of assessing the oral health of young children by mothers in Northern Appalachia has the potential to drive adherence to the Age 1 dental visit endorsed by the American Academy of Pediatrics, American Dental Association, Academy of General Dentistry, and American Academy of Pediatric Dentistry.²⁰⁻²³ Concordance when the child is at a young age may also provide a window during which mothers may be receptive to children's oral health information provided during an Age 1 dental visit.

Child dental insurance was also significantly associated with concordant mother-child dyads. This is a factor that is widely accepted as influencing a child's ability to obtain dental care, thus effecting a child's oral health status. According to the US Surgeon General Report on Oral Health in America, "uninsured children are 2.5 times less likely than insured children to receive dental care."¹ Therefore, the same elements that drive a mother to obtain and

utilize dental insurance for her child may cause her to be more aware of her child's oral health status, supporting the results of this study.

Limitations and Future Research.

There are several limitations to this study and opportunities for future research. First, our analysis was limited to an association based on the cross-sectional study design of the COHRA cohort. Second, mothers may have a reporting bias in favor of better health, which would result in an over-estimation of concordance in this study since the majority of the children had no previous dental caries experience. Third, future research can examine caries trends and concordance stratified by age cohort, particularly due to the strong relationship between caries and age combined with the potential reporting bias towards over-estimating health. Fourth, fathers and other caregivers also can be important in determining a child's oral health, so future research should include them. Fifth, the results of this study may have limited generalizability to other populations in the United States. Sixth, our results are dependent on the definition of concordance developed for this study. Future research is needed to examine the relationship between this definition of concordance and oral health outcomes in children. Finally, the findings from this study, combined with both a conceptual framework and the results in previous literature, can be used in future research to develop a multivariate model on the predictors of mother-child concordance. If we are able to identify the factors that predict concordance and develop interventions that give mothers the best situation possible to maximize awareness of her child's oral health, then both preventive oral health behaviors and timely dental treatment may be improved, particularly for young children vulnerable to dental caries.

Conclusion.

This was the first study to examine concordance between mother's perception of her child's oral health status and the child's dental caries experience in a population with persistently high child dental caries: Northern Appalachia. The positive association of mother's perceptions of her child's oral health status and her child's dental caries experience suggests that mothers in the Center for Oral Health Research in Appalachia study accurately perceived their child's dental caries. This finding is testament to the importance of self-reported oral health outcomes in disadvantaged populations.

Moreover, a mother's awareness of her child's oral health status could be used to aid in effective prevention strategies for early childhood caries. From a clinical and dental public health perspective, our finding of accuracy among mothers' assessments of their child's oral health can lead to optimal children's oral health and improved dental health-seeking patterns for children. Future research can examine the relationship between concordance and these dental outcomes for children in Northern Appalachia. Dental public health stakeholders can also harness mothers' ability to accurately assess their child's oral health when developing resources to help reduce child dental caries in Northern Appalachia.

Acknowledgements:

This research was supported by the National Institute of Dental and Craniofacial Research, Factors Contributing to Oral Health Disparities in Appalachia, Grant Number R01 DE014899.

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Figure 1.

Number of Decayed and Filled Teeth for Children Under 6 Years-Old in the Center for Oral Health Research in Appalachia study (N=815). *Note: Number of decayed and filled teeth was determined by clinical exam and measured using the decayed and filled tooth (d2ft) index.*

Figure 2.

Association between Mother's Perception of Child Oral Health Status and Child Dental Caries Experience in the Center for Oral Health Research in Appalachia study (N=815).

Note: Child Dental Caries Experience was determined from the child's clinical exam and measured using the decayed and filled tooth (d2ft) index. Mother's perception of child's oral health status was obtained during the oral health interview in response to the question, "How would you classify the condition of your children's teeth?"

Figure 3.

Histograms of the Number of Decayed and Filled Teeth for Children Under 6 Years- Old for each level of Mother's Perception of Child Oral Health Status in the Center for Oral Health Research in Appalachia study (N=815). *Note: Mother's perception of child's oral health status was obtained during the oral health interview in response to the question, "How would you classify the condition of your children's teeth?" The number of decayed and filled teeth was determined by clinical exam and measured using the decayed and filled tooth (d2ft) index.*

Table 1.

Descriptive Findings on Mother's Self-reported Child Oral Health Status and Child Dental Caries Experience for Children Under 6 Years-Old in the Center for Oral Health Research in Appalachia Study (N=815).

Mother's Self-Reported Child Oral Health Status	Child Dental Caries Experience (d2ft)*				
	<u>n</u>	<u>Mean</u>	<u>SD</u> ^Ω	<u>Minimum</u>	<u>Maximum</u>
Excellent	229	0.17	0.96	0	11
Very Good	255	0.57	1.60	0	11
Good	223	1.40	2.76	0	12
Fair	63	4.05	3.53	0	12
Poor	45	5.40	3.58	0	13

* Child Dental Caries Experience was determined from the child's clinical exam and measured using the decayed and filled tooth (d2ft) index.

^Ω Standard Deviation

Table 2.

Sociodemographic Variables by Concordance[∞] between Mother's Perception[♢] of Child Oral Health Status and Child Dental Caries Experience^{*} for Children Under 6 Years-Old in the Center for Oral Health Research in Appalachia Study (N=815).

	<u>Total</u>		<u>Concordant (n=522)</u>		<u>Non-Concordant (n=293)</u>		<u>p-value^a</u>
	<u>n</u>	<u>%[€]</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	
Family Income							0.258
Less than 10,000	177	22	112	14	65	8	
10,000 to 14,999	115	14	71	9	44	5	
15,000 to 24,999	122	15	68	8	54	7	
25,000 to 49,999	200	25	132	16	68	8	
50,000 or more	68	8	48	6	20	2	
Child Age							<0.001
1	182	22	141	17	41	5	
2	147	18	100	12	47	6	
3	120	15	74	9	46	6	
4	143	18	74	9	69	8	
5	108	13	58	7	50	6	
6	115	14	75	9	40	5	
Child Gender							0.756
Male	428	53	272	33	156	19	
Female	387	47	250	31	137	17	
Child Fluoridated Toothpaste Use							0.801
No	53	7	33	4	20	2	
Yes	758	93	485	60	273	33	
Child Last Dental Visit							0.074
Never	394	48	270	33	124	15	
6 months or less	261	32	160	20	101	12	
More than 6 months	114	14	70	9	44	5	
More than 1 year ago	40	5	21	3	19	2	
Reason for Child Last Dental Visit							0.601
Check-up/exam/cleaning	336	41	205	25	131	16	
Something bothering them	89	11	57	7	32	4	
Child Dental Insurance							0.002
None	184	23	128	16	56	7	
Private	216	27	152	19	64	8	
Public	391	48	226	28	165	20	

* Child Dental Caries Experience was determined by clinical exam and measured using the decayed and filled tooth (d2ft) index.

^a P-values are for chi-square test comparing concordant and non-concordant groups. Values from the missing categories were excluded from the chi-squared test.

[€] All percentages may not equal 100 due to the exclusion of the missing categories.

[∞] Mother-child dyads were defined as concordant if they met the following criteria: 1) Mother perceived that the child had “excellent/very good” oral health status and the child had a d2ft index of zero, 2) Mother perceived that the child had “good” oral health status and the child had a d2ft index of one, or 3) Mother perceived that the child had “fair/poor” oral health status and the child had a d2ft index more than one.

[§] Mother’s perception of Child’s Oral health status was obtained during the oral health interview in response to the question, “How would you classify the condition of your children’s teeth?” The responses were coded as a five-level categorical variable: excellent, very good, good, fair and poor.

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Table 3.

Zero-inflated Negative Binomial Model[∞] of the Association between Mother's Perception[§] of Child Oral Health Status and Child Dental Caries Experience^Ω for Children Under 6 Years-Old in the Center for Oral Health Research in Appalachia Study (N=815).

	<u>Model coefficient (Standard Error)</u>	<u>95% Confidence Interval</u>	<u>p-value</u>
Mother's Perception of Child's Oral Health Status			<0.001
Excellent	Referent		
Very Good	0.29 (0.33)	-0.33, 0.93	0.372
Good	0.62 (0.31)	0.01, 1.22	0.046
Fair	0.94 (0.32)	0.32, 1.56	<0.001
Poor	1.07 (0.32)	0.44, 1.70	<0.001
Constant	0.62 (0.29)	0.04, 1.20	0.035

[∞]Zero-inflated Negative Binomial Model was chosen due to the goodness-of-fit test ($p < 0.05$), which rejects the Poisson distribution, and the Vuong test ($p > 0.000$), which showed that a zero-inflated model was a better fit than a non-zero-inflated-negative binomial model.

[§]Mother's perception of child's oral health status was obtained during the oral health interview in response to the question, "How would you classify the condition of your children's teeth?"

^ΩChild Dental Caries Experience was determined by clinical exam and measured using the decayed and filled tooth (d2ft) index.