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Brushing Behaviors and Fluoridated Toothpaste Use among Children less than Three Years Old in Chicago, IL

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Abstract

Background/Aim—limited data exists about toothbrushing behaviors in children. The purpose of this study is to describe toothbrushing frequency/duration and toothpaste use among young children in an urban, vulnerable population.

Methods—Caregivers of children under three years were recruited from a university or community pediatric dental clinic. Caregivers completed a 37-item questionnaire in English or Spanish about predictors/covariates (demographics, child/caregiver oral health, access to dental care) and primary outcomes (child toothbrushing behaviors, toothpaste use). Models employed generalized logit and ordinal logistic regression.

Results—148 caregivers completed the survey. Average child age was 18.8 months (SD= 7.4). Approximately 41% of children brushed once a day or less, and 19% of caregivers did not regularly assist. Almost all children used toothpaste (96%), but 36% of caregivers did not know if it contained fluoride. Increased child brushing frequency was associated with older child age, higher caregiver brushing frequency, history of a child dental visit, and caregiver assistance ($p<.05$). Children with a history of a dental visit were seven times more likely to brush for 30 seconds or more, and receiving caregiver assistance was associated with longer brushing duration (>2 minutes) ($p<.05$).

Conclusions—These data indicate that many children could improve adherence with brushing recommendations. This poses opportunities for education around brushing behaviors as a means to promote oral health.

Keywords

Pediatric Dentistry; Preventive Dentistry; Toothbrushing; Oral Hygiene; Fluoridation; Dental Care for Children; Health Promotion; Infant Oral Health

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Author Attestation: We attest that all authors meet the following conditions: (1) substantial contributions to conception and design of, or acquisition of data or analysis and interpretation of data, (2) drafting the article or revising it critically for important intellectual content and (3) final approval of the version to be published.

Introduction

Despite expanded dental coverage for children in the United States under the Affordable Care Act (ACA), high rates of caries persist. Forty-three percent of children aged 2–19 have experienced dental caries, and 13% have untreated dental caries.¹ Historically, caries disproportionately affects children from disadvantaged subgroups, including low-income and select minority groups, such as Hispanic and Black populations.^{2,3} There are also disparities in dental care utilization, access to healthy food choices, food security, oral health literacy, and compliance with preventive behaviors.^{4–6} Caries is costly to society, but the cost of childhood caries goes beyond the cost of direct healthcare; it includes the social cost of pain, adverse effects on cognitive development, increased school absenteeism, increased caregiver absenteeism from work, and lower oral health-related quality of life.⁷

The Coordinated Oral Health Promotion (CO-OP) Chicago study was funded by the National Institute for Dental and Craniofacial Research as part of a consortium to develop and test interventions to reduce these oral health disparities in children. CO-OP Chicago first sought to establish baseline estimates of toothbrushing behaviors for children under the age of three years old. Twice daily toothbrushing with fluoridated toothpaste is recommended as both cost-effective and clinically effective in reducing caries for all dentate children.^{8–10} However, insufficient data exist about the toothbrushing frequency and behaviors of children under the age of three. Even the National Health and Nutritional Examination Survey (NHANES), the largest health survey conducted in the United States, does not report these behaviors in children under the age of three.¹¹

This manuscript describes the toothbrushing frequency, brushing duration, child brushing assistance, fluoridated toothpaste use, and quantity of toothpaste used gathered from a cross-sectional sample of children under the age of three years old from vulnerable communities in Chicago. As a secondary aim, the study explored associations between demographic factors and brushing behaviors. These data will inform subsequent interventions targeting caregivers and families of young children.

Methods

This study was approved by the University of Illinois at Chicago (UIC) Institutional Review Board (Protocols 2015–0815 and 2016–0773).

Surveys were conducted in two dental clinics between October 2016 and April 2017. The University of Illinois at Chicago Pediatric Dentistry clinic is an academic tertiary care center. It is the largest provider of dental care for Medicaid enrolled children in Illinois with nearly 20,000 patient visits annually. Greater than 95% of children are Medicaid eligible, and the patients are primarily Hispanic (33%) and African American (25%). The Infant Welfare Society of Chicago is a full-service federally qualified health center that sees more than 13,000 patients annually with a continuum of medical care, dental care, and other health services. Both clinics primarily serve greater Chicago and Cook County, IL.

Bilingual (English and Spanish) research assistants (RAs) recruited participants by approaching caregivers with children less than 3 years old in the waiting areas of the

pediatric dental clinics. Subjects would be a child seeking an initial dental visit, recall visit, treatment visit, or the sibling of a patient. Potential participants were screened, and verbal consent was obtained. Inclusion criteria were as follows: caregiver was at least 18 years old, spoke English or Spanish, had a dentate child under the age of three (by self-report), and lived with the child at least five days out of the week.

All questions were asked verbally in a semi-private space in the waiting area of the clinics; data collection lasted 5 to 10 minutes. The survey consisted of 37 items related to demographics, child and caregiver oral health, child toothbrushing frequency and duration, toothpaste use, caregiver self-efficacy and support, dental access, and medical/dental insurance. A five-item oral health knowledge survey was included to establish oral health knowledge. Where possible, items were used from validated surveys. Data was inputted directly into a Surface Pro tablet through Qualtrics® (Provo, UT). Participants were given a \$5 gift card and toothbrushes after the survey was completed.

Descriptive statistics, including frequencies, means, and standard deviations were calculated for all variables. Some response categories were collapsed if the distribution of responses was too sparse. The primary outcomes of interest (dependent variables) were child brushing frequency (ordinal response with three categories: less than once a day, once a day, and twice or more a day), brushing duration (ordinal response with four categories: 0–30 seconds, 30–60 seconds, 60–120 seconds, and more than 120 seconds), amount of toothpaste used when brushing (ordinal response with three categories: smear, pea, and half-load or more), and child use of fluoridated toothpaste (nominal responses: Yes, No, Unsure). A half-load of toothpaste is defined as covering half the surface of the toothbrush, and a full-load covers the entire toothbrush.

Multiple regression models were used to examine associations between select dependent variables and a predefined set of covariates. The final regression model for each primary outcome was determined using backward elimination. Specifically, analysis began with demographic constructs and retained covariates with p-values of 0.15 or less. Insurance, oral health behaviors, and oral health knowledge variables were added and adhered to the same p-value of 0.15 for individual variable retention in the model within each construct. Analysis used ordinal logistic regression for the child brushing frequency, amount of toothpaste, and child brushing duration outcomes, and generalized logit for the fluoridated toothpaste outcome. The proportional odds assumption was satisfied for all cumulative logit models. Final model results are presented as odds ratios with 95% confidence intervals. Variables with p-values ≤ 0.05 were reported as statistically significant. Analyses were performed using SAS version 9.4 (Cary, North Carolina, USA).

Results

From October 2016 to April 2017, 362 caregivers were approached for the survey. In total, 104 (29%) caregivers refused, 101 (28%) did not qualify or were excluded (three subjects were excluded from the analyses due to contradictory responses in the primary outcomes during validation), nine (2%) did not complete the surveys, and 148 (41%) were included for analysis. Ninety-six (65%) completed surveys originated from the academic medical center

clinic, while 52 (35%) were from the community clinic. RAs spent a total of 248 hours recruiting participants.

Demographic characteristics of survey respondents and their children are described in Table 1. The type of child health insurance most commonly reported was public (54%), or the caregiver was unsure of the type of insurance (45%). Recent changes in Medicaid organization in Illinois resulted in a great deal of confusion among caregivers regarding the origin of their child's health insurance; "Unsure" responses were likely public insurance based on the predominant insurance status of patients at the two study sites. Only 61% of caregivers had health insurance, and 41% of them reported that it covered dental. (Table 2)

Over 40% of caregivers reported a child brushing frequency of less than twice a day. Nineteen percent of caregivers reported someone helps the children brush only sometimes or not at all. There was considerable variation in toothbrushing duration, with 8.8% brushing for 30 seconds or less, 25.6% brushing 30 seconds to one minute, 35.8% brushing for one to two minutes, and 24.8% brushing for more than two minutes. Forty-two percent of caregivers reported that activities of daily life get in the way of brushing their children's teeth at least some of the time, and 26% have no family support with their child's tooth brushing. Toothpaste was used by 96.3% of the sample, with 50.4% indicating the toothpaste was fluoridated and 35.9% unsure of fluoride content. Approximately 55.7% of those who used toothpaste used a smear of toothpaste, while 32.8% used a pea-sized amount. (Table 3)

Nearly half of the children had been to the dentist in the last six months, but 44% had never been seen by a dentist despite most children being of age to have had their first dental visit and recruited in a dental clinic waiting room (Table 4). Caregivers reported that 21% of children had experienced tooth decay. Ninety-three percent of caregivers reported brushing their own teeth twice or more a day. Forty-three percent had not been to the dentist in the last year, and 55% described their oral health as "Fair" or "Poor."

A five-item scale was used to score self-reported oral health knowledge based on correct responses to five oral health statements (Wilson, and Albino). The average knowledge score was 4.4 out of a maximum of 5 (results not shown in tables). Items were scored as correct if they responded affirmatively that cavities are cause by germs in the mouth (79.7% correctly responded), baby teeth are important (85.3% correctly responded), children should go to the dentist regularly—even when there is no problem (92.3% correctly responded), it is best to use toothpaste with fluoride for children (84.6% correctly responded), and children should stop using the bottle at 1 year old (93.0% correct responses).

The regression models of associations between caregiver and child demographics and toothbrushing behaviors are shown in Table 5. Older children (Odds Ratio [OR] 1.08, 95% Confidence Interval [CI] 1.02–1.15), children who had been to the dentist (OR 2.87, 95% CI 1.20–6.86), and caregivers who brush more frequently (OR 2.23, 95% CI 1.02–4.87) were more likely to brush their child's teeth more frequently, while a higher report of activities interfering was associate with less brushing frequency (OR 0.53, 95% CI 0.02–0.43). Children who received caregiver assistance were more likely to brush twice a day compared to those who brushed less (OR 2.18, 95% CI 1.38–3.45). Privately insured caregivers

compared to publicly insured (OR 0.10, 95% CI 0.02–0.43) and families where activities interfere with daily living (OR 0.53, 95% CI 0.38–0.75) reported less frequent child brushing.

Increased caregiver age (OR 1.08, 95% CI 1.03–1.14) and those with more family assistance with brushing (OR 1.25, 95% CI 1.02–1.55) had a higher brushing duration, whereas caregivers with better oral health (OR 0.59, 95% CI 0.39–0.90) reported lower child brushing duration. Children who had been to the dentist were 3.13 times as likely to brush for at least 1 minute (95% CI 1.43–6.86), and 7.13 times as likely to brush for at least 30 seconds (95% CI 2.12–24.03) compared to children who had not been to the dentist.

The correct amount of toothpaste was associated with higher caregiver brushing frequency (OR 1.98, 95% CI 1.00–3.91). Hispanics were less likely to use higher quantities of toothpaste compared to non-Hispanics (OR 0.34, 95% CI 0.14–0.84). Reported use of fluoridated toothpaste for younger children within the four to thirty-six-month age range of the sample, was associated with higher caregiver oral health knowledge (OR 3.19, 95% CI (1.53–6.68). However, when comparing the “yes” responses to the “unsure” responses for the use of fluoridated toothpaste, caregivers were more likely to be confident (report “yes”) for older children (OR 1.10, 95% CI 1.03–1.18) – defined as closer to 36 months—and children who had already had tooth decay (OR 4.50, 95% CI 1.30–15.63). Caregivers with a greater length of time since their last dental visit were less likely to be sure about the use of fluoride toothpaste (OR 0.59, 95% CI 0.40–0.87).

Discussion

The purpose of this study was to establish baseline toothbrushing behaviors in children less than three in an urban, primarily Medicaid-enrolled, population at high-risk for developing caries. The data suggest that brushing frequency, duration, and caregiver assistance are opportunity areas for intervention. These behaviors are associated with caregiver reports of daily life stress and existing supports, as well as gaps in oral health knowledge. These data inform target areas for the subsequent behavioral trial that employs community health workers (CHWs) to address social challenges and oral health knowledge gaps in an urban population at high-risk for childhood caries.

Almost all children in this study used toothpaste, but a high percentage of caregivers did not use fluoridated toothpaste or were unsure if the child’s toothpaste contained fluoride. These results suggest that caregivers are generally aware of recommendations surrounding toothbrushing frequency but may not be clear about whether fluoridated toothpaste is appropriate for children under three years of age. The potential for inaccurate self-report of toothpaste used is a limitation of the study. Despite the universal recommendation for using fluoridated toothpaste in children, there remains wide variability in the adoption of this recommendation. Data from the Iowa Fluoride Study suggest that the use of fluoride toothpaste in infants is low, with 58% not using fluoride toothpaste at 12 months.^{12,13} Our participants reported comparably higher rates of fluoride toothpaste use, and higher caregiver oral health knowledge was associated with the use of fluoridated toothpaste again emphasizing the importance of knowing and applying recommendations. The large number

of “unsure” responses may be driven by the mixed messages families receive from clinical and non-clinical sources. This confusion is made worse by product labeling, which suggests that parents consult a dentist or physician for use in children less than two years of age. Confusion may also stem from, marketing of non-fluoridated toothpaste to young children using product packaging (such as popular children’s cartoon characters), product placement, and statements asserting “safe for babies”.¹⁴ This study is the first to report on toothbrushing behaviors in children less than three since the American Dental Association changed its recommendation to use fluoridated toothpaste for all children. This variability highlights the need for educating caregivers about current guidelines and mitigating fears about potential fluorosis and ingesting trace amounts of fluoride when brushing.

Findings from this study suggest that interventions aiming to increase brushing frequency, duration, and the universal use of fluoride use in children less than three years of age must include an educational component targeted to the individual caregiver and the household. This finding is based on data showing that assistance with toothbrushing led to higher brushing frequency and duration. Our data indicate that oral knowledge was associated with the use of fluoride toothpaste, meaning education may increase compliance. However, oral health education should not be limited to education by a dental provider, as nearly 45% of children in our study had never seen a dentist. Brushing behaviors improved with age, which is not surprising, but it is unclear if brushing behaviors in very young children are hindered by child cooperation, lack of knowledge about brushing recommendations in children, or both. Other brushing outcomes were associated with family support and the home environment. This proposes a possible intervention opportunity through social support at the family level. Caregivers’ interactions with the dental system and self-reported oral health condition were associated with child brushing habits. This highlights the important relationship between child and caregiver oral health and behaviors and is consistent with previous research findings.¹⁵ Consequently, interventions aimed at the caregiver/family may have a positive effect on children by promoting healthy behaviors in the family unit.

In this study, all data are self-report from caregivers. While self-reporting health behaviors is subject to bias, it is the most convenient and cost-effective method of collecting this data in the absence of validated objective measures. Nevertheless, our results follow comparable patterns to NHANES in three to five-year-olds. NHANES data is presented in table 3 to determine if the study sample differs from the general population regarding the few instrument items captured by NHANES. The distribution of responses in the study sample is similar to NHANES which shows generalizability of study findings, despite the limited geographic area of recruitment. This present study may over-report appropriate brushing behaviors because the survey was conducted in a dental care setting, suggesting that families in this survey had more awareness of oral health issues and recommendations. Despite this sampling technique, large portion of families was not aware of or achieving oral health recommendations; this is an opportunity to improve education and family support within the current dental system and among the general population who have not yet interacted with the dental system. The population from which the sample was drawn is an urban, vulnerable, predominantly Hispanic, Medicaid-insured population who is already seeking dental care. While this limits the generalizability of the study findings, this population is the primary demographic of interest for implementing interventions to reduce health disparities.

Compliance with toothbrushing recommendations and the use of fluoridated toothpaste reduces caries.^{8,9} We observed that in a vulnerable cohort of families with children under the age of three, many behaviors fit within recommendations, but opportunities to achieve greater adherence are also evident. Among young children, prevention efforts are primarily under the control of parents, and healthy behaviors are established early in life. Initiating good toothbrushing behaviors early in life is a cost-effective approach to reduce the lifelong burden and cost of dental caries. Multilevel interventions are needed to promote culturally-sensitive oral health behavior interventions that address individual, family, and community needs. Further population-level oral health data should be pursued on toothbrushing behaviors in children under the age of three years old, including questions about whether toothpaste is used, if toothpaste contains fluoride, brushing duration, and other oral health-promoting behaviors. Such data would be useful to guide future policy and interventions.

Conclusions

- Among children less than three years of age, most children brush at least one daily, and nearly all children use toothpaste. However, twice daily brushing and use of recommended amount of fluoridated toothpaste were less common.
- Access to dental care, parental involvement and parental oral health were associated with favorable child toothbrushing behaviors.
- Toothbrushing duration, frequency, and encouraging family assistance are modifiable protective factors and opportunities for intervention based on the behaviors reported in this study.

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Table 1.

Survey Participant Demographics

Demographic Characteristics	N=148(%)
Caregiver female ^a	128 (90.1)
Caregiver age in years ^b mean, [SD]	30.9 [6.8]
Child female ^a	81 (57.0)
Child age in months ^b mean, [SD]	18.8 [7.4]
Caregiver race ^c	
White	13 (9.4)
Black	13 (9.4)
Asian	3 (2.2)
Mixed	1 (0.7)
Other	109 (78.4)
Caregiver Hispanic ^b	
Mexican	117 (83.6)
Puerto Rican	95 (81.2)
Other Hispanic	7 (6.0)
Refused	15 (12.8)
Place of birth for Hispanic ^d	
US Mainland	31 (26.5)
Mexico	72 (61.5)
Puerto Rico	2 (1.7)
Other	12 (10.3)
Caregiver education ^e	
Less than high school	48 (34.0)
High school/GED	61 (43.3)
Some college	15 (10.6)
College degree or higher	17 (12.1)
Caregiver relationship status ^c	
Single	38 (27.3)
Living with partner/married	99 (71.2)
Other	2 (1.4)
Number of adults live in home ^c	
Median (Range)	2 (1 – 6)

Demographic Characteristics	N=148(%)
Number of children live in home ^c	
Median (Range)	3 (1 – 7)
Employment Status ^b	
Employed > 32 hrs/week	36 (25.7)
Employed < 32 hrs/week	17 (12.1)
Student	2 (1.4)
Homemaker	56 (40.0)
Retired	1 (0.7)
Unemployed	28 (20.0)

^a: N=142

^b: N=140

^c: N=139

^d: N=117

^e: N=141

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Table 2.

Caregiver and Child Insurance Status

	Caregiver, N=148 (%)	Child, N=148 (%)
Health insurance type ^a		
Public	34 (24.3)	76 (53.9)
Private	14 (10.0)	2 (1.4)
Has insurance, not sure public or private	37 (26.4)	63 (44.7)
No insurance	55 (39.3)	0 (0.0)
Does health insurance cover dental ^a		
Yes	64 (48.9)	130 (92.2)
No	59 (45.0)	4 (2.8)
Don't know	8 (6.1)	7 (5.0)
Is there separate dental insurance? ^a		
Yes	11 (7.9)	5 (3.6)
No	125 (89.9)	127 (90.1)
Don't know	3 (2.2)	9 (6.4)

^a: the reported N is less than 148 for some characteristics due to missing responses

Table 3:

Caregiver Reported Child Oral Health Behaviors

	CO-OP Chicago Clinic Survey N=148 (%)	NHANES 2014, ages 3–5 years old N=449 (%)
BRUSHING		
Child brushing frequency (%)		
Never	11 (7.4)	1 (0.3)
Sometimes but not every day	10 (6.8)	0 (0.0)
Once a day	39 (26.4)	164 (37.5)
Twice a day	74 (50.0)	278 (54.3)
More than twice a day	14 (9.5)	35 (7.9)
Does parent or adult help child brush teeth ^a		
No	1 (0.7)	
Yes, sometimes	25 (18.3)	
Yes, most of the time	21 (15.3)	
Yes, always	90 (65.7)	
How long are child's teeth brushed for ^a		
30 sec or less	12 (8.8)	
More than 30 sec to 1 minute	35 (25.6)	
More than 1 minute to 2 minutes	49 (35.8)	
More than 2 minutes	34 (24.8)	
Don't Know	7 (5.1)	
How often do activities of daily life get in way of caring for child's teeth ^b		
All of the time	11 (7.5)	
Most of the time	6 (4.1)	
Some of the time	44 (30.1)	
Rarely	17 (11.6)	
Never	68 (46.6)	
How often does your family help you care for child's teeth ^b		
All of the time	42 (28.8)	
Most of the time	16 (11.0)	
Some of the time	41 (28.1)	
Rarely	5 (3.4)	
Never	38 (26.0)	
Don't know	1 (0.7)	
Other	3 (2.1)	
Does child use toothpaste? ^c		

	CO-OP Chicago Clinic Survey N=148 (%)	NHANES 2014, ages 3–5 years old N=449 (%)
Yes	131 (96.3)	
No	5 (3.7)	
Does toothpaste have fluoride? ^d		
Yes	66 (50.4)	
No	18 (13.7)	
Don't know	47 (35.9)	
How much toothpaste does child use? ^d		
Full load	3 (2.3)	80 (18.3)
Half load	12 (9.2)	75 (16.9)
Pea	43 (32.8)	230 (52.2)
Smear	73 (55.7)	56 (12.6)

^a: N=137 for Clinic Survey

^b: N=146 for Clinic Survey

^c: N=136 for Clinic Survey

^d: N=131 for Clinic Survey

Table 4:

Child and Family Oral Health Risk Factors

	CO-OP Chicago Clinic Survey N=148	NHANES 2014, ages 3–5 years old N=449
CHILD DENTAL CARE UTILIZATION		
When did child last go to dentist? ^a		
6 months or less	72 (49.7)	278 (62.0)
6 months -- 1 year ago	6 (4.1)	58 (12.9)
1 year -- 2 years ago	2 (1.4)	13 (2.9)
Never has been	63 (43.5)	99 (22.0)
Don't know	2 (1.4)	0 (0.0)
CHILD ACCESS TO FLOURIDATED WATER		
What kind of water does child drink? ^b		
Tap water	9 (6.3)	
Filtered water from tap	27 (18.9)	
Bottled water	105 (73.4)	
Other	2 (1.4)	
CHILD DENTAL HISTORY		
Has child ever had a cavity or tooth decay? ^b		
Yes	30 (21.0)	
No	104 (72.7)	
Don't know	9 (6.3)	
Has child received anesthesia for dental care? ^b		
Yes	6 (4.2)	
No	137 (95.8)	
CAREGIVER/FAMILY RISK FACTORS		
Caregiver brushing frequency ^c		
Never	0 (0.0)	0 (0.0)
Sometimes but not every day	0 (0.0)	0 (0.0)
Once a day	10 (7.1)	103 (30.7)
Twice a day	98 (68.1)	198 (58.6)
More than twice a day	35 (24.8)	36 (10.7)
When did caregiver last go to dentist? ^c		
6 months or less	53 (37.6)	2,818 (46.2)
6 months -- 1 year ago	28 (19.9)	914 (15.0)

	CO-OP Chicago Clinic Survey N=148	NHANES 2014, ages 3–5 years old N=449
1 year -- 2 years ago	33 (23.4)	697 (11.4)
2 years – 3 years ago	13 (9.2)	471 (7.7)
3 years – 5 years ago	6 (4.3)	386 (6.3)
More than 5 years ago	5 (3.6)	775 (12.4)
Never has been	3 (2.1)	64 (1.05)
Condition of caregiver's mouth and teeth ^c		
Very good	6 (4.3)	
Good	55 (39.0)	
Fair	53 (37.6)	
Poor	25 (17.7)	
Don't Know	2 (1.4)	
Have other children in the home received anesthesia for dental care? ^b		
Yes	27 (17.5)	
No	117 (81.8)	
Don't know	1 (0.7)	

^a: N=145

^b: N=143

^c: N=141

Table 5.

Association Between Demographics and Tooth Brushing Behavior

	Child Brushing Frequency ^a N=133 OR (95% CI)	Child Brushing Duration ^b N=126 OR (95% CI)	Amount of Toothpaste ^c N=128 OR (95% CI)	Fluoridated Toothpaste (Yes vs No) N=120 OR (95% CI)	Fluoridated Toothpaste (Yes vs Unsure) N=120 OR (95% CI)
Caregiver Hispanic (Reference: Non-Hispanic)	n/a	n/a	0.34 (0.14–0.84)*	n/a	n/a
Caregiver Age in Years	n/a	1.08 (1.03–1.14)**	n/a	n/a	n/a
Child Age in Months	1.08 (1.02–1.15)*	n/a	n/a	1.06 (0.97–1.16)	1.10 (1.03–1.18)**
Caregiver Health Insurance					
Public insurance	REF				
Not sure insurance type	1.26 (0.41–3.80)	n/a	n/a	n/a	n/a
No insurance	1.00 (0.36–2.79)				
Private	0.10 (0.02–0.43)**				
Activities interference	0.53 (0.38–0.75)**	0.80 (0.61–1.05)	n/a	n/a	n/a
Caregiver Brushing Frequency	2.23 (1.02–4.87)*	n/a	1.98 (1.00–3.91)*	n/a	n/a
Caregiver Last Dental Visit (in years)	n/a	n/a	n/a	0.66 (0.41–1.08)	0.59 (0.40–0.87)**
Child Cavity or Tooth Decay (Reference: No decay)	n/a	n/a	n/a	4.64 (0.77–28.05)	4.50 (1.30–15.63)*
Condition of Caregiver’s Mouth and Teeth^d	n/a	0.59 (0.39–0.90)*	0.72 (0.47–1.11)	n/a	n/a
Assistance with Brushing	2+ times vs less: 2.18 (1.38–3.45) ^{e***} Once/day vs less: 1.31 (0.99–1.73)	1.25 (1.02–1.55)*	n/a	n/a	n/a
Child has been to Dentist (Reference: never been to the dentist)	2.87 (1.20–6.86)*	>2 mins vs. less: 1.39 (0.58–3.37) ^e	n/a	n/a	n/a

	Child Brushing Frequency ^a N=133 OR (95% CI)	Child Brushing Duration ^b N=126 OR (95% CI)	Amount of Toothpaste ^c N=128 OR (95% CI)	Fluoridated Toothpaste (Yes vs No) N=120 OR (95% CI)	Fluoridated Toothpaste (Yes vs Unsure) N=120 OR (95% CI)
		>1 min vs. less: 3.13 (1.43–6.86) **			
		>30 secs. vs. less: 7.13 (2.12–24.03) **	n/a	3.19 (1.53–6.68) **	1.27 (0.69–2.35)
Oral Health Knowledge^f	n/a	n/a	n/a		

a: Outcome variable regressed as 3 ordinal categories: less than once a day, once a day, twice a day or more

b: Outcome variable regressed as 4 ordinal categories: 0–30 seconds, 30–60 seconds, 60–120 seconds, more than 2 minutes

c: outcome variable regressed as 3 ordinal categories: pea, smear, half-load or more.

d: poor/fair (reference) vs. good/very good.

e: Effect of covariate changes with the point of dichotomization of ordinal outcome.

f: higher score indicates more oral health knowledge

* p < 0.05

** p < 0.01

*** p < 0.001