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Pediatric Clinicians Can Help Reduce Rates of Early Childhood Caries: *Effects of a Practice Based Intervention*

Nancy R. Kressin, PhD^{*,†,‡,§}, Martha E. Nunn, DDS, PhD^{*,¶}, Harpreet Singh, RDH, MS^{*,¶}, Michelle B. Orner, MPH^{*,§}, Lori Pbert, PhD^{||}, Catherine Hayes, DMD, DMSc^{*,**}, Corinna Culler, RDH, MPH^{*,¶}, Stephan R. Glick, MD^{††}, Sean Palfrey, MD^{‡‡}, Paul L. Geltman, MD, MPH^{*,‡‡}, Cynthia Cadoret, RDH, MPH^{*,¶}, and Michelle M. Henshaw, DDS, MPH^{*,¶}

^{*}Northeast Center for Research to Evaluate and Eliminate Dental Disparities, Boston, MA

[†]HealthCare Disparities Research Program, Section of General Internal Medicine, Boston University School of Medicine, Boston, MA

[‡] VA Boston Healthcare System, Boston, MA

[§]Center for Health Quality, Outcomes and Economic Research, VAMC, Bedford, MA

[¶]Boston University School of Dental Medicine, Boston, MA

^{||}Department of Medicine, Division of Preventive and Behavioral Medicine, University of Massachusetts Medical School, Worcester, MA

^{**}Tufts University School of Dental Medicine, Boston, MA

^{††}Department of Pediatrics, Allegheny General Hospital, Pittsburgh, PA

^{‡‡}Department of Pediatrics, Boston University School of Medicine, Boston, MA

Abstract

Objective—Early childhood caries (ECC) is a serious and preventable disease which pediatric clinicians can help address by counseling to reduce risk.

Research Design—We implemented a multifaceted practice-based intervention in a pediatric outpatient clinic treating children vulnerable to ECC (N = 635), comparing results to those from a similar nearby clinic providing usual care (N = 452).

Intervention—We provided communication skills training using the approach of patient centered counseling, edited the electronic medical record to prompt counseling, and provided parents/caregivers with an educational brochure.

Outcome Measures—We assessed changes in provider knowledge about ECC after the intervention, and examined providers' counseling practices and incidence of ECC over time by site, controlling for baseline ECC, patient sociodemographics and parents'/caregivers' practice of risk factors (diet, oral hygiene, tooth-monitoring), among 1045 children with complete data.

Results—Provider knowledge about ECC increased after the intervention training (percentage correct answers improved from 66% to 79%). Providers at the intervention site used more

Reprints: Nancy R. Kressin, PhD, Section of General Internal Medicine, Crosstown Center, 2nd Floor, 801 Massachusetts Ave, Boston, MA 02118. nkressin@bu.edu.

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counseling strategies, which persisted after adjustment for sociodemographic characteristics. Children at the intervention site had a 77% reduction in risk for developing ECC at follow up, after controlling for age and race/ethnicity, sociodemographics and ECC risk factors; $P \leq 0.004$.

Conclusions—The multifaceted intervention was associated with increased provider knowledge and counseling, and significantly attenuated incidence of ECC. If validated by additional studies, similar interventions could have the potential to make a significant public health impact on reducing ECC among young children.

Keywords

early childhood caries; physician-patient relations; physicians'; practice patterns; intervention studies

Early childhood caries (ECC) is a serious, but preventable, form of tooth decay that affects children's primary dentition. Untreated, it can lead to serious illness, including abscesses, necessitating costly therapeutic interventions such as surgery with general anesthesia. The infection and pain caused by ECC can impair growth and weight gain,¹ cause speech, learning and eating problems, and increase school absenteeism,² negatively affecting children's quality of life.³ Thus, a national public health goal is to reduce the prevalence of children with dental caries in primary teeth (Healthy People 2010 goal 21-1a).⁴

ECC disproportionately affects poor, racial/ethnic minority children.⁵⁻⁸ Several risk factors including sugary diet, excessive bottle use, and poor oral hygiene have been identified.^{9,10} ECC risk can be reduced by minimizing children's exposure to caries-promoting food and drinks, weaning from the bottle as early as possible, and regularly cleaning children's teeth. It is vital that at-risk children and their caregivers be educated, advised, and counseled about prevention strategies. Thus, "counseling, reinforcement of health promoting behaviors with care givers of children, and intervention by dental and other professionals to improve parenting practices" have been called the best available means to prevent or mitigate ECC.¹¹

To monitor children's teeth for ECC, the American Academy of Pediatric Dentistry recommends that all children begin regular dental visits by 1 year. Unfortunately, children most at risk for ECC face the greatest barriers to accessing health care in general,¹² and dental care in particular.¹³ However, because most (88%) American children see a pediatrician annually,¹⁴ pediatric clinicians could potentially counsel parents about decreasing children's ECC risk. Thus, the American Academy of Pediatrics has adopted a policy supporting the use of caries risk assessment and referral to a dental home.¹⁵ However, pediatricians are not well trained to do so,^{16,17} despite their belief that they have an important role in identifying dental problems and in counseling parents about caries prevention.^{18,19}

Others have addressed the problem of ECC by teaching pediatricians to apply fluoride varnish,²⁰ or increasing their knowledge regarding the disease and ability to screen children for ECC risk.²¹⁻²⁶ Evidence is clear that increasing clinician knowledge does not necessarily lead to behavior change,²⁷ but notably absent from prior approaches are strategies to provide pediatric clinicians with the communication tools needed to effectively convey such information, or the skills needed to enlist parents/caregivers in behaviors to reduce children's ECC risk.

To capitalize on pediatricians' commitment to children's oral health, and to address the deficit in pediatricians' preparation to help prevent ECC^{19,28} we developed and implemented a multifaceted pediatric practice-based intervention where children especially vulnerable to ECC receive care, building on the proven educational methodology of patient centered

counseling (which has been successfully applied in other clinical settings^{29–32}). Patient centered counseling has successfully changed provider behavior, effected changes in patients' risk-related behaviors, and, ultimately, improved clinical outcomes,^{29–34} although the evidence for the effectiveness of such programs applied specifically to the oral health of young children is lacking.²⁸ Our goal was to assess the effects of this intervention on provider ECC counseling practices, and on children's subsequent development of ECC.

Methods

Study Locations

Parents and children were recruited from the pediatric outpatient practices of 2 academic medical centers in Boston. The intervention site was selected because it serves underserved populations (primarily African-American and Latino children). The comparison site was another nearby urban hospital-based primary care pediatric clinical practice, serving a similar patient population but with more Asian Americans.

Study Participants

Patients—We asked parents/caregivers of children aged 6 months to no older than 5 years attending well-child visits to participate in the study (during the same time period for both sites), to ensure the children likely had at least some erupted teeth and thus were “at risk,” and to limit our sample to younger children. Children were to be excluded from the study if they self-reported or had congenital oral anomalies, ectodermal dysplasias, or other diseases (other than ECC) upon examination affecting the dentition or oral mucosa, although no children were excluded for these criteria. At the intervention site, a total of 635 children were recruited after their providers had received the study training intervention, and 452 children were recruited at the comparison site.

Providers—We invited all attending pediatricians (not residents or medical students) who care for regular panels of patients (N = 19), as well as clinic nurses (RNs and NPs; N = 14), to participate in the 1-hour study training intervention, as each has the opportunity to provide anticipatory guidance counseling in the clinic. After offering multiple early morning and lunchtime sessions, and a \$100 gift certificate incentive, 68% of the eligible physicians (13/19), and 100% of the eligible nurses (14/14) were trained. Although we did not conceal the purpose of the study, we did not explicitly describe it during the training.

Questionnaire Interview and Clinical Examination—Procedures and Measures

After the educational program was given to providers at the intervention site, and with the simultaneous initiation of recruitment at the comparison site, parents/caregivers of young children were approached in the clinic waiting room before a regular well-child visit, the study was described (respondents were not blinded to the study purpose but were blinded as to which group they were in), and those expressing interest were asked to provide informed consent. After the visit, participants completed an interview assessing demographic information including the child's date of birth, gender, race and ethnicity (Hispanic or not, following the US Census conventions for assessing ethnicity), the education and employment status of the parent, and language spoken at home. Study participants were again asked to participate in a similar interview and clinical examination, approximately 1 year later, at another well-child visit. In our analyses, we used baseline data on all variables except ECC, positing that follow up ECC would be a function of physician counseling regarding ECC at the baseline visit.

One component of the questionnaire was a “Patient Exit Interview” (PEI), a series of questions inquiring about the parent's discussions with the child's doctor or nurse. These

assessed the degree to which the clinician covered the topics on which they had been trained to counsel regarding ECC risk reduction. PEIs have been demonstrated to accurately measure the actual content of clinical discussions through comparisons of audiotapes of such interactions to patient reports³⁵ (see Table 1 for all PEI questions); they do not assess knowledge gained. The PEI score was a sum of the questions to which there was a positive response (range: 0–22).

The interview also included questions about the 3 dimensions important to preventing ECC (eg, “risk factors”). We assessed the child's diet and feeding behaviors (eg, “Does your child usually drink from a bottle?” and “How often does the child get a bottle in bed with something besides water?”; 6 questions total; score range: 0–6), oral hygiene (eg, “Do you help your child brush his or her teeth?”; “When brushing, do you use toothpaste with fluoride?”; 6 questions total; score range: 0–6), and tooth monitoring (eg, “Do you ever check your child's teeth for spots or cavities?”; 3 questions total; score range: 0–3). We created summary scores from the items assessing each dimension, by dichotomizing answers and summing the affirmative responses, provided that at least 75% of the questions were answered.

The research hygienist examined each child's dentition to identify ECC, recording both white and cavitated lesions, by tooth (because this was a research-focused interaction, no counseling regarding hygiene or diet was provided by the study hygienist). In our analyses, we define ECC as the more serious, irreversible cavitated lesions in any tooth, which require restorative treatment (vs. the reversible white lesions which do not).

Content of the Intervention

The intervention had 3 components: communication skills training, edits to the electronic medical record's (EMR's) anticipatory guidance section, and provision of an educational brochure. The communication skills training educational program was designed to enhance clinicians' ability to advise and counsel patients' parents or caregivers about decreasing risks for ECC. In a 1 hour training session led by experts in dentistry and patient centered counseling, pediatric clinicians (nurses and physicians) were taught, using a 1-page counseling algorithm handout, to address 3 primary dimensions with parents/caregivers: consuming foods and drinks that strengthen teeth and limit sugars (diet), toothbrushing/keeping teeth clean (hygiene), and monitoring teeth to detect the development of caries (tooth monitoring). Through didactic presentations and role play exercises, providers were asked to implement the 4A's: Assess the parent/caregiver's status on each of the dimensions, identifying barriers to each, Assist with addressing barriers to each behavior, Advise (or educate) about ECC and its etiology, and finally, Arrange for follow up (eg, making a dentist appointment; see the Fig. 1 for additional detail).

Immediately before and after the study intervention training sessions, we administered a 5 item multiple choice pre- and post-test to the participants to assess the effects on ECC knowledge. We also edited the anticipatory guidance section (a listing of topics that parents should be counseled about at each well child visit, which providers must document they followed) of the EMR to include age-appropriate information for each of the dimensions we trained the providers to address. Our edits were not the pop-up prompts typically used in EMR reminders but rather additions to the topics on which providers are to counsel. We also prepared an educational brochure that summarized these same areas for the parent/caregiver to address in caring for the child. These brochures were available in both clinics, but intervention providers were asked to distribute them, as part of their counseling.

Institutional Review Board

The Institutional Review Boards at both study sites approved this study's protocol.

Data Analysis

We compared sociodemographics, and summary scores for the ECC risk factors of diet, oral hygiene, and tooth monitoring practices by site using χ^2 tests of independence for the former and Mann-Whitney *U* tests for the latter 3 variables. We examined PEI items and overall scores by site, using the Mann-Whitney *U* test.

Then, we conducted 2 random effects least squares regressions to examine the independent effects of site on provider counseling, adjusting for sociodemographic characteristics, with and without controlling for ECC risk factors, which we anticipated might affect rates of clinician counseling. These analyses accounted for clustering of patients-within-provider.

To determine the effect of the intervention on the development of ECC over time (defined as the presence/absence of an irreversible cavitated lesion in any tooth), survival analysis was used. A multiple mixed model (frailty) proportional hazards regression model was fit including only children free of ECC at baseline with physician treated as a random effect, adjusting for age group, race/ethnicity, caregiver employment status and educational level, whether English was spoken at home, and the ECC risk factors.

Results

Only parents/caregivers who could be interviewed in English were included (study staff made this determination; 9% of the parents screened at the comparison site and 7% of those screened at the intervention site were excluded for this reason). Refusal rates were 3% at the intervention site, and 14% at the comparison site. Of the children recruited, the study hygienist was unable to conduct a clinical examination with 42 children, 28 (67%) of these patients were from the intervention clinic and 14 (33%) were from the control clinic. We excluded these 42 children from analyses using clinical data, leaving an analysis sample of 1045. The number of patients seen by intervention providers ranged from 1 to 134 for each provider; mean: 32, median: 25. The average (mean) number of patients seen by all providers was 18 (out of 62). The median was 7.

Provider ECC Knowledge

Prior to the training, participants answered 66% of the questions correctly on a 5 item ECC knowledge test. Subsequent to the intervention, this rate increased to 79%. Improvements in knowledge were observed on 3 of the items—those focused on knowledge about dental caries being the most common infectious disease of childhood, understanding of risk factors for dental caries in infants and toddlers, and the recommended age for a first dental visit, but many clinicians still did not realize that ECC risk is related to the oral health of the caregiver.

Characteristics of the Patients

Sociodemographic Characteristics—The mean initial age of the sample was just under 2 years, with no differences by site (not shown; 1.93 years vs. 1.87, $P = 0.20$). There was no difference in age group or gender distribution across sites (Table 2). More parents from the comparison site were employed (69% vs. 56.7%, $P < 0.0001$). The racial group distribution, but not the proportion of Hispanics, differed significantly by site ($P < 0.0001$)—about half of the comparison site sample were white, while over three-quarter of the intervention site were black. More parents from the comparison site reported that English

was the primary language spoken at home (73.6% vs. 39.5%; $P < 0.0001$), and they were more likely to have a high school education or greater (92.9% vs. 84.3%, $P < 0.0001$).

Risk Factor Profiles

Patients at the comparison site had better baseline diets and more tooth-monitoring than those at the intervention site ($P < 0.0001$ and $P = 0.001$, respectively; Table 2); however, hygiene practices were better among patients at the intervention site ($P < 0.0001$).

Patient Exit Interview

Clinicians at the intervention site were more likely to ask the parents for ideas about how best to keep his/her child's teeth clean, limit dietary sugars, and how to get the child to the dentist (Table 1). They were also significantly more likely to explain what cavities are, their causes and their effects on other aspects of the child's health. More clinicians from the intervention site discussed limiting sugary foods and drinks, the child's fluoride intake, and cleaning teeth nightly. Intervention providers more frequently discussed using toothpaste with fluoride, helping the child brush his or her teeth up until age 6, and monitoring the child's teeth for spots, or whether the child had a dentist. Also, a greater percentage of intervention providers mentioned that they would discuss caries prevention at the next visit, gave parents written information about cavities, and discussed caries prevention strategies. Intervention providers asked or counseled an average of 2 more issues than comparison site providers (means: 6.4 vs. 4.1; medians: 5 vs. 3; $P < 0.0001$).

Factors Associated With Provider Counseling

Random effects least squares regression analyses were performed to examine the independent effects of site on provider counseling (PEI), after adjusting for sociodemographic factors and before and after controlling for ECC risk factors (Table 3). In the first model, the PEI score was significantly higher (better) at the intervention site, indicating that intervention providers counseled on approximately 2 more issues than comparison site providers. After adjusting for ECC risk factors, however, the PEI score was not significantly different between the 2 sites.

Factors Associated With ECC

A person-level multiple proportional hazards frailty regression model with physician included as a random effect was fit for ECC incidence for all children free of ECC (cavitated lesions) at baseline, adjusting for demographic variables that varied significantly between sites without a large number of missing observations (Table 4). At baseline, there was no difference in ECC prevalence at the 2 sites (5.8% at the intervention site vs. 6.4%; $P = 0.664$). After adjustment for age and race/ethnicity (2 known influences on ECC), children at both sites were similarly likely to have ECC (OR = 1.13, 95% CI: 0.64–2.00), $P = 0.672$). At the last follow-up visit, unadjusted ECC prevalence at the intervention site was 17.7%, compared with 31.7% at the comparison site ($P = 0.086$). Children at the intervention site were 77% less likely to develop ECC over time compared with children at the comparison site (HR = 0.23, 95% CI: 0.09–0.62, $P = 0.004$).

Discussion

Recognition of the profound deleterious effects of ECC on children's health and well being has led to a growing interest in and commitment to the role of primary care clinicians in children's oral health.¹⁹ To address the paucity of interventions oriented towards enhancing providers' knowledge and skills in counseling parents to reduce risk for ECC,²⁸ we developed, implemented, and evaluated the effects of a multifaceted practice-based

intervention for pediatric providers. Providers at the intervention site provided significantly more counseling regarding reducing ECC risk than comparison site providers, with the differences in rates spanning between 7 and 34 percentage points, depending on the item. Further, more provider counseling for ECC at the intervention site was associated with 77% lower incidence of ECC over time. While the rates of ECC increased over time at both sites, the progression was markedly attenuated at the intervention site, suggesting that such multifaceted interventions in the pediatric setting might have significant public health impact.

While intervention providers provided more counseling, their rates of counseling were often only around 20% to 40% (the maximum rate of counseling observed, on only 1 item, was 60%, Table 1). Thus, although our intervention was associated with more counseling, there is still room for improvement, so further training during medical school or residency might help foster such adoption. However, competing demands for time during clinic visits presents a challenge for increasing such rates.

Providers of patients who are perceived to be at greater risk might exert greater effort at counseling to prevent ECC, as we have found in other work on hypertension care.³⁶ Intervention providers conducted significantly more counseling than at the comparison site after controlling for patients' sociodemographic factors, but not after adjusting for ECC risk factors. However, such adjustment conservatively assumes that providers conducted an accurate risk assessment, which may not be the case.

Interest by pediatricians regarding children's oral health has led to a variety of efforts, many focusing on increasing pediatricians' knowledge base regarding the etiology of dental caries.^{17,24,26} Our study is one of the first attempts to increase providers' skills in translating knowledge about the risk factors for ECC into useable information which can be conveyed to parents to change behavior to reduce ECC risk. Relatively low cost interventions (brief provider training, educational materials, and changing an existing EMR to include cues to counsel patients) were associated with significantly greater amounts of provider counseling, which suggests that it may be valuable to implement such interventions on a more widespread basis. While the limited length of clinic visits may be a barrier to counseling, our results suggest that providers were able to incorporate ECC counseling into their visits, although we were not able to assess the added time needed to do so. The tools we developed for our intervention are easily accessible and transportable for use by other providers (Available at <http://www.creedd.org/affiliate.html>) including family physicians, midlevel providers, and for pediatric residency training and continuing medical education.

These results are consistent with prior studies of patient centered counseling, which have consistently shown that providers are willing to incorporate such methods into their practices, and that they successfully do so after training.^{29,31–34} Our findings indicate that this method of changing provider behavior is useful in the pediatric setting as well.

This study was limited by the absence of baseline data on providers' counseling habits, and by the fact that the samples were different in several respects. However, the findings from the training pretest/post-test indicated an increase in provider knowledge (albeit with a short recall period, and without comparative data from clinicians at the control site). Another potential limitation of the study was that we were unable to disentangle the specific effects of each element of the intervention, although we viewed them as a package which should be implemented together in the future because each piece addresses a different aspect of ECC prevention.

Further, we still observed differential rates of counseling after adjusting for the sociodemographic differences between sites. Also, while our focus on very young children

may be viewed as a limitation in that our findings are not generalizable to older children, the dearth of information about ECC and its risk factors among children in this age group warrants such a focus.

Ideally, a cluster-randomized controlled design (randomized by site) would be used to test the effectiveness in training pediatric clinicians to conduct oral health counseling with parents/caregivers of very young children. To obtain a true random sample, one would need to recruit clinicians from the private sector to participate, which might introduce selection bias since such clinicians are less likely to see the economic and racial diversity of children whom we studied. Although our quasi-experimental design offered benefits for investigating the effect of training pediatric clinicians to deliver such counseling, these findings should be replicated elsewhere before widespread use of this intervention.

In summary, a relatively brief intervention was associated with increased provider counseling and reduced subsequent ECC. Such interventions are feasible to implement on a more widespread basis, and if validated by additional studies, may have a significant public health impact, by reducing rates of ECC in young children.

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Tooth brushing/keeping teeth clean

Assess	Assist
<ul style="list-style-type: none"> Does child have own toothbrush? Brush teeth nightly? <i>Goal: establish habit!</i> 	<ul style="list-style-type: none"> Offer toothbrush from dental study How do you think you can get him to do that?
<ul style="list-style-type: none"> Do you help child brush? (up to age 6) Use toothpaste with fluoride? (pea sized amount) 	<ul style="list-style-type: none"> What do you think would work? Find a tasty, colorful fluoridated toothpaste

Consume foods and drinks that strengthen teeth and limit sugars

Assess	Assist
<ul style="list-style-type: none"> Child getting fluoride? Limiting sugary drinks and foods? 	<ul style="list-style-type: none"> Prescribe Fluoride drops/tablets How do you think you could do that?
<ul style="list-style-type: none"> Limit bottle/sippy cup use to meal or snacktime? (<i>goal: decrease frequency of exposure to sugars – sippy cups aren't any better than bottles</i>) 	<ul style="list-style-type: none"> How could you limit these?
<ul style="list-style-type: none"> Eliminating bedtime bottles by one year old (except water)? 	<ul style="list-style-type: none"> How could you eliminate bedtime bottles?

Monitor teeth (parent, doctor and dentist)

Assess	Assist
<ul style="list-style-type: none"> Check teeth for spots? 	<ul style="list-style-type: none"> Here's how you can do it...(also can do while brushing)
<ul style="list-style-type: none"> Have a dentist? 	<ul style="list-style-type: none"> Here's a referral list
<ul style="list-style-type: none"> Seen the dentist yet? (first visit at 2 years) 	<ul style="list-style-type: none"> What would help you get to the dentist?

- Summarize and develop plan**

- You're doing a great job with _____, keep up the good work
 - [SHOW BROCHURE]. In the brochure, I've checked the things we've agreed you'll work on. Your plan is to...(e.g. put child to bed with only water; substitute fruit for snacks instead of candy)
 - Arrange follow-up:** I'll check in with you at your next visit to see how you're doing.

Important Education Points About Cavities (Advise):

- A disease which can be seen as white, yellow, brown or gray spots on teeth
- Can lead to pain, trouble eating and talking, or to lost teeth, and infected baby teeth can lead to having infected permanent teeth
- Caused by germs that feed on sugars
- Can be prevented by keeping teeth clean, using fluoride, and limiting sugary/starchy foods and drinks

FIGURE 1.

Patient Centered Counseling to Decrease ECC Risk: 4As: Assess, Assist, Advise, Arrange.

TABLE 1

Sociodemographic and Risk Factor Characteristics of the Sample, by Study Site

	Provider Training Intervention Site (n = 635)	Comparison Site (n = 452)	P
Age (%)			0.0962
<1 yr	1	3	
1 to <2 yr	55	55	
2 to <3 yr	25	26	
3–4 yr	19	16	
% male	51	53	0.4810
Caregiver employed (% yes)	57	69	<0.0001
Caregiver education (≥12 yr)	84	93	<0.0001
Race			<0.0001
% white	17	45	
% black	76	35	
% Asian	6	19	
Hispanic (%)	13	15	0.3811
Language spoken at home (% English)	40	74	<0.0001
Diet summary score *			<0.0001
Mean ± SD (Median)	3.2 ± 1.0 (3.6)	3.5 ± 1.1 (4.0)	
Range	0–6	0–6	
Hygiene summary score *			<0.0001
Mean ± SD (Median)	4.9 ± 1.0 (5.0)	4.5 ± 1.1 (5.0)	
Range	2–6	2–6	
Tooth-monitoring summary score *			0.0197
Mean ± SD (Median)	0.7 ± 0.7 (1.0)	0.9 ± 0.9 (1.0)	
Range	0–3	0–3	
ECC (baseline) %	5.8	6.4	0.664
ECC (follow up) %	17.7	31.7	0.086

* Baseline score; higher scores indicate better diet, hygiene and more tooth monitoring.

TABLE 2

Patient Exit Interview Items and Overall Score, by Study Site

Did the Doctor or Nurse ...	Intervention Site (% Yes)	Comparison Site (% Yes)	P
Ask for your ideas about how best to keep your child's teeth clean?	41	30	0.001
Ask for your ideas about how to limit the sugars your child gets in foods and drinks?	41	25	<0.0001
Ask for your ideas about how to get your child to the dentist?	30	22	0.003
Explain what cavities are?	22	9	<0.0001
Explain what causes cavities?	19	13	0.015
Explain how cavities can be prevented?	19	16	0.387
Describe how cavities can affect other aspects of your child's health?	13	7	0.007
Discuss limiting sugary foods and drinks to reduce the chance of cavities?	52	29	<0.0001
Discuss limiting your child's bottle or sippy cup use to meals or snack time only?	33	28	0.086
Discuss stopping bed- or naptime bottles by 1 year of age, except for those containing water?	25	29	0.277
Discuss whether your child is getting enough fluoride?	24	16	0.005
Discuss cleaning teeth every night to prevent cavities?	60	32	<0.0001
Discuss using toothpaste with fluoride?	32	15	<0.0001
Discuss having a separate toothbrush for each child?	17	13	0.098
Discuss helping your child brush his or her teeth up until age 6?	52	18	<0.0001
Discuss monitoring kids' teeth for spots?	24	13	<0.0001
Discuss whether your child has a dentist?	37	28	0.002
Discuss whether your child has been to the dentist yet?	33	28	0.074
Recommend that your child see a dentist now?	23	24	0.934
Mention that they would talk about preventing cavities in your child at the next visit?	13	5	0.0001
Give you written information about cavities and how to prevent them?	10	3	<0.0001
Go over things for you to work on to help prevent your child from getting cavities?	24	10	<0.0001
Overall PEI summary score mean $\pm$ SD (Median) range	6.4 $\pm$ 5.6 (5.0) 0–21	4.1 $\pm$ 4.8 (3.0) 0–22	<0.0001

TABLE 3

Multiple Linear Regression Results: Site Differences in Rates of Provider Counseling*

	Model 1 [†] PEI Score [§]		Model 2 [‡] PEI Score [§]	
	Parameter Estimate	Std Error	Parameter Estimate	Std Error
Intervention Site (ref = comparison site)	1.24 [¶]	0.53	1.02	0.55
Age group (ref = 3 yr or older)				
<2 yr old	− 1.70 [¶]	0.46	− 1.40 [¶]	0.54
2 to <3 yr old	−0.87 ^{//}	0.53	−0.69	0.54
Non-Hispanic white (ref = Hispanic or Non-white)	− 1.18 [¶]	0.49	− 1.02 [¶]	0.49
Caregiver employment (ref = not employed)	0.58	0.36	0.60	0.36
Caregiver education (ref = <12 yr)	−0.41	0.52	−0.40	0.52
English spoken at home (ref = other)	−0.28	0.38	−0.38	0.38
Diet score [§]	—	—	−0.30	0.18
Hygiene score [§]	—	—	0.39 [¶]	0.18
Tooth monitoring score [§]	—	—	0.36	0.23

* Scores from Patient Exit Interview (PEI) reflect the number of counseling behaviors performed by physicians, based on exit interviews with parents and caregivers. For instance, in Model 1, physicians at the intervention site performed, on average, 1.24 more counseling behaviors than physicians at the control site.

[†] Controlling for sociodemographic factors and accounting for clustering of patients-within- provider.

[‡] Controlling for sociodemographic factors as well as diet, hygiene, and tooth monitoring scores and accounting for clustering of patients-within-provider.

[§] Higher scores are better on all dimensions (eg more counseling, better dietary habits, more tooth monitoring).

[¶] $P < 0.05$.

^{//} $P > 0.05$ and $P < 0.10$.

TABLE 4

Multiple Proportional Hazards Regression Model for Development of Early Childhood Caries (Cavitated Lesions) in Any Primary Tooth (n = 375 Subjects)

Variable	HR*	95% CI†	P
Site			
Comparison site	1.00	—	0.004
Intervention site	0.23	(0.09, 0.62)	
Age group			
<2 yr old	1.00	—	0.001
2 to <3 yr old	3.23	(1.57, 6.57)	
3 yr or older	3.18	(1.52, 6.68)	
Race/ethnicity			
Non-Hispanic white	1.00	—	0.117
Hispanic or Non-white	2.56	(0.79, 8.30)	
Caregiver employment			
Yes	1.00	—	0.465
No	0.81	(0.45, 1.43)	
Caregiver education			
Less than high school	1.00	—	0.115
High school or greater	0.57	(0.29, 1.15)	
Language spoken at home			
English	1.00	—	0.435
Other	1.27	(0.70, 2.32)	
Diet score	1.09	(0.82, 1.45)	0.551
Hygiene score	1.08	(0.80, 1.46)	0.599
Tooth monitoring score	1.40	(1.00, 1.98)	0.049

* HR indicates hazard ratio; adjusted for all other factors listed in the table.

† CI indicates confidence interval.