Characteristics of Publicly Insured Children with High Dental Expenses

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Abstract

Background: *Dental coverage is provided for all children with Medicaid in Washington State. The goal of this study was to illuminate the characteristics of a sample of Medicaid-enrolled children with high dental expenses.* ***Methods:*** *Dental care utilization data for a 33-month period were obtained from Washington State's Medicaid database. For children, 0 to 6 years, these data were linked with a parent survey addressing oral health behaviors, knowledge, family history of caries, snacking patterns, and access to dental care. Children with dental expenses of $1,000 or more were classified as the "high-expense" group. Risk factors for the high-expense group were evaluated using multiple logistic regression.* ***Results:*** *345 children had at least one dental procedure including preventive and diagnostic care. Among these, 30 children (9 percent) incurred 64 percent of total dental expenses for the entire group. Parent perception of lack of dental coverage was associated with incurring high dental expenses. Children of Asian or Pacific Islander heritage were at disproportionately high risk compared to White children. Age of child and family history of caries were also associated with increased risk for high expenses.* ***Conclusions:*** *Not all low-income children on Medicaid are at high risk for caries. A combination of factors, including family history of caries and parent's perception of lack of dental insurance coverage, can potentially increase a child's likelihood for high-expense dental treatment. This study highlighted a small group of children with disproportionately high dental expenses. For some, earlier knowledge of coverage may have resulted in more timely access to preventive and diagnostic care, reducing the subsequent need for expensive restorative treatment.*

Key Words: Medicaid, oral health, dental expenditures, children

Introduction

Children of low-income families are often described as having poor oral health and inadequate access to oral health services in the United States (1-5). Over the past decade, there has been an increase in the utilization of dental services for children of all income levels; however, the prevalence of unmet dental needs has consistently remained higher in children of low-income families (5). While there has been a significant reduction in the prevalence rate of caries in 6- to 11-year-old children's permanent teeth between 1988 and 2002, the prevalence of caries in primary teeth slightly increased for 2- to 5-year-olds during the same period (5). The rate of caries was slightly higher in children of low-income families than their higher-income counterparts, and the gap between lower- and higher-income children increased between 1988 and 2002 (5). In addition to discomfort and pain, unmet dental needs can lead to higher dental expenses. Not all children from low-income families are at increased risk for dental disease requiring extensive and costly treatment. Although not all dental expenses are caries related, higher expenses for dental services for a particular child relate to two factors: the number of teeth affected with dental caries and the extent of the disease in each individual tooth. A tooth with more extensive caries can require more complex and expensive procedures to restore. Significantly high total treatment expenses occur when the disease involves many teeth requiring complex restorations and pulp treatments. When high dental disease involvement affects a child 5 years old or younger, it may be necessary to perform services in a hospital under general anesthesia (6), greatly escalating the cost.

In Washington State, children who qualify for Medicaid benefits receive both medical and dental coverage. Medicaid is an important source of dental insurance for children; however, Medicaid dental budgets are limited, and resources must be allocated wisely to best meet the needs of the total population served. If Medicaid-enrolled children who are at the highest risk could be identified, earlier referral and programs to assure access to services would be an effective use of resources and would improve oral health outcomes for this population. If specific risk factors that affect children who incur high dental expenditures are identified, interventions could be implemented to target these children, again a more effective use of scarce resources.

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A conceptual model, based on individual and family demographic, behavioral, and belief characteristics, as well as access to dental care indicators, guided this study. These concepts are: a) for children, individual characteristics, such as age, ethnic background, family history of caries, educational attainment of parents, parent beliefs about oral health, dietary and oral hygiene practices at home, are related to oral health outcomes (7-12); b) early preventive oral health care, including screening and early intervention, can reduce the need for costly restoration of severely decayed teeth in children (13-15); and c) having dental insurance and a family dentist/dental home are important enabling factors in receiving timely preventive oral health care (16-18). The authors propose that the consequences of a perception of lack of dental insurance are potentially equivalent to not having insurance in terms of access to dental care. The purpose of this article is to report on dental procedure types and expenses for a group of children, younger than 6 years of age, enrolled in Washington State Medicaid, and to identify the demographic, behavioral, and access to care factors that were associated with high total dental expenditures.

Methods

Between December 2001 and December 2004, the Healthy Smiles Project provided training focused on oral health evaluation and promotion during well-child visits in three western Washington State private pediatric medical practices. The proportion of children with Medicaid coverage ranged from 33 to 79 percent of the patients served in the practices. The goal of Healthy Smiles was to improve pediatric oral health through training of primary care pediatricians. The training focused on the role of medical personnel in recognizing oral health problems, providing parents with oral health guidance, initiating primary prevention measures when appropriate, and increasing referral skills (19).

In this project, parents or primary caregivers (referred to as "parents" throughout the text) of children 0 to 6 years of age who came to any of the three pediatric offices for a well-child visit were surveyed. The Institutional Review Boards at Children's Hospital and Regional Medical Center and the Washington State Department of Social and Health Services (DSHS) approved this project.

A one-time 20-item questionnaire assessed parent oral health knowledge, attitudes, beliefs, and behaviors and asked for parent consent to access their child's Medicaid-funded care records during the study period. The parents were also asked their age, educational attainment, and type of health and dental insurance coverage for their child.

Only the children who had Medicaid for their medical coverage (confirmed by valid linkable Medicaid identification number) and who had at least one dental procedure in the Medicaid database were included in the study. Medicaid utilization data were linked with information from the Healthy Smiles survey of enrollees' parents. Data from the Medicaid extended database of dental procedures were obtained from DSHS for children whose parents gave consent at the time of the survey. The data covered a period of 33 months from January 1, 2002, through September 30, 2004. This represents Medicaid utilization data for 12 months prior to the start of the parent surveys and 9 months after enrollment was stopped. Raw data from this DSHS fee-for-service database were formatted and labeled according to the codebook provided by DSHS. The Medicaid dental fee schedule was used to categorize individual procedures.

The frequency and types of dental procedures and expenses related to each dental procedure were described for all children. Aggregate summaries for the number, types, and total dollar amounts for various categories of dental procedures for each child were calculated. Once the summaries were created for each child, the child's record from the Healthy Smiles parent-survey database was linked with Medicaid data summaries, using the unique identification number assigned by DSHS.

In this retrospective study, the data from Healthy Smiles, including the child's parent-reported family history of dental disease, dental hygiene practices at home, parent knowledge and attitudes about oral health, child snacking patterns, and parent perception of dental coverage were linked with DSHS dental service utilization patterns for the child. The data were analyzed using the entire 33-month period to identify trends in utilization patterns and risk factors specific to children with high dental service utilization costs.

Outcome and Independent Variables. The outcome variable was defined as having dental expenses of over $1,000, indicating a significant amount of restorative dental treatment. This threshold was based on one of the authors' 16 years of experience in dental practice at a large regional medical center. Most basic dental insurance policies have a maximum yearly coverage of $1,000. The participants were divided into two expense groups. Children with dental expenses of $1,000 or more, resulting from any type of procedures over the period of the study, were classified as the "high-expense" group, and others as the "low-expense" group.

This study assessed the association of high dental expenses (outcome) with individual and family characteristics, oral hygiene behaviors and beliefs, and access to dental care indicators. The independent variables used in univariate and multivariate analyses were

- Age of child at enrollment used as a categorical variable; four groups: under 1 year, 1 to 2 years old, 3 to 4 years old, and 5 to 6 years old.
- Race/ethnicity; six mutually exclusive groups: White, African-American, Asian/Pacific Islander, Native American, Hispanic, and Other/Unknown.

- Family history of dental disease, defined as parent-reported history of "cavities or fillings" in the child's siblings (ever) and/or mother (in the past year).
- Parent education level, dichotomized as high school (HS) education (some HS or HS graduate) or postsecondary education (some college or college graduate).
- Parent beliefs about oral health: "Do germs cause cavities?" and "Can cavities be prevented in your child?", dichotomized as yes/no.
- Oral hygiene practices: the child had a toothbrush at home; the child typically used toothpaste at home; did an adult help the child in brushing or cleaning teeth (all dichotomized: yes/no); how many times per day did the child use toothbrush (continuous).
- Dietary practices: parent-reported total number of daily servings of snacks ("milk," "fruit/vegetables," "sweets/candy," "crackers/cookies/cake," and "other snacks") and total number of daily servings ("cups") of sweet drinks ("juice" and "cola/soda/pop/Kool Aid"); both used as continuous variables.
- Access to dental care indicators: the perception of having a family dentist ("Do you have a dentist that your family usually goes to?"); the perception of having medical and dental coverage: "What type of medical insurance does your child have?" response choices: private, military, Medicaid/government/health department, Indian Health Service, specified other, or no insurance. "Does your child have dental insurance?" And if yes, is it through private insurance, Medicaid, or specified other?

When a parent indicated that the child had Medicaid for medical insurance but reported no dental insurance, this was coded to represent the parent's perception of lack of dental insurance for the child and lack of knowledge that Washington State Medicaid provides both medical and dental coverage.

With the exception of race/ethnicity, the source of all independent variables was the Healthy Smiles questionnaire. The race/ethnicity variable was drawn from the Medicaid database and is self-reported.

Statistical Analysis. Descriptive statistics (means and standard deviations [SD] for continuous variables and percentages for dichotomized variables) were calculated for the participants. Dental services utilization patterns were described by the type of dental procedure. Demographic characteristics, oral health behaviors and beliefs, and access to dental care indicators were described by the expense group and were compared in univariate analyses. To characterize the group of children with the highest dental expenses, multivariable analyses were performed using the linked Medicaid and Healthy Smiles database. Risk factors for high-expense dental procedures were evaluated using multiple logistic regression methodology (20). Odds ratios (OR) and 95 percent confidence intervals (CI) for the odds of having high expenses were calculated for each of the independent variables. All logistic regression analyses were performed using a robust variance estimator, providing wider CI and more conservative *P*-values compared to using a nonrobust standard error. All statistical analyses were performed with Stata SE 8.2 statistical software (StataCorp 2005, College Station, TX).

Results

Sample Description. The Medicaid database contained the records of 533 children who were enrolled in Healthy Smiles. All Healthy Smiles enrollees had completed a study questionnaire. Of these, 345 (65 percent) had at least one dental procedure documented in the database during the study interval. The majority of those without any dental procedures ($n = 188$) were younger children, with an average age of 1.1 years at the time of enrollment in Healthy Smiles, compared with 2.5 years for those who did have dental records. The following results reflect the records of the 345 children who did have dental procedures and completed parent questionnaires.

Demographic Characteristics. The sample consisted of children who were enrolled in Medicaid. Seventy-two percent of study participants were White, 10 percent were Hispanic, 5 percent Native American, 2 percent Asian or Pacific Islander, 1 percent African-American, and for 10 percent race and ethnicity were unknown or had been specified as "Other." The mean age of respondents was 28.2 years (SD = 8.7). Fifty-five percent had some postsecondary education. Children ranged in age from under 1 to 6 years when they first enrolled, and up to 8 years at the time of their last dental procedure. Fifty-two percent of the children were male.

Medicaid Dental Service Utilization Patterns. Over the 33-month period, a total of 3,244 dental procedures were recorded for the 345 children. All dental procedures were categorized into eight general categories: diagnostic, preventive, restorative, endodontics, periodontics (gingivectomy and gingival grafts), oral surgery, adjunctive general services, and inpatient dental procedures in hospitals (multiple restorative procedures, extractions, and general anesthesia). The majority of procedures (64 percent) were diagnostic and preventive. Table 1 summarizes the dental procedures over the study period.

Total expenses for each child ranged from $13.39 (the reimbursement rate for fluoride varnish at a pediatrician's office) to $6,838.97. As with the general child population, a majority of children with Medicaid used diagnostic and preventive dental services with relatively low total expense. However, a subset of children that had the highest dental expenditures ($1,000 or more per child) consumed the greatest proportion of total Medicaid dental expenditures for this entire group of children. Figure 1 provides the number of children and the dollar amount spent on dental care within

four expense categories. While 79 percent of the children used less than $250, 30 children (9 percent) used 64 percent of the Medicaid dollars provided for the dental care of these 345 children. The highly skewed distribution of dental expenses readily lent itself to dichotomization and use of logistic regression rather than standard linear regression.

Characteristics of Children with Low and High Dental Expenses. Table 2 describes the characteristics of all participants arranged by expense group. While all study participants were enrolled in Medicaid and thus had dental coverage, 28 percent reported that their child did not have dental coverage at the time of the survey. After completion of the survey, some children received Medicaid-covered dental services as reflected in our data. The mechanism whereby parents gained knowledge of Medicaid dental coverage is unknown. Parents may have gained awareness through referral to a dentist from the pediatric office; or if they presented to a dentist or a hospital with a dental emergency, Medicaid dental coverage could have been identified or explained at that time.

Among those with high dental expenses, 33 percent did not know about their child's Medicaid dental coverage at the time of the survey. Among all participants, 55 percent said they did not have a family dentist. In univariate analyses, there were no statistically significant differences between the low and high expense groups in these indicators of access to dental care. However, in multivariate analysis (Table 2), the perception of a lack of dental coverage became statistically significant when adjusted for all other variables in the model.

The spread of race and ethnicity in the two expense categories was about equal for Whites, Native Americans, and Hispanics. The few Asian/Pacific Islander participants were mostly in the high-expense category (four out of six children). The African-American children ($n = 3$) fell into the low-expense category. Those designated as "other" race or ethnicity, or for whom this information was unknown, were all in the low-expense group. In multivariable analysis, the Asian/Pacific Islander

Table 1
Dental Procedures, January 2002 to September 2004 ($n = 3,248$)

Type of dental procedure	% of procedures	Number of children with procedures	Total expenses ($)
Diagnostic	28.8	190	13,653
Preventive	35.1	333	16,255
Restorative	15.9	68	30,285
Endodontics	1.5	22	2,178
Periodontics	9.5	57	10,088
Oral surgery	1.6	22	3,580
Adjunctive general services	2.7	51	2,522
Inpatient hospital procedures	4.8	30	34,366
Unspecified	0.1	4	308
Total	100	345*	113,235

* Most children had more than one type of procedure, therefore the sum adds up to more than 345. There were 345 unique children with any dental procedures.

Figure 1
Percent and number of children in expense groups, and percent and total dollar amounts paid by Medicaid

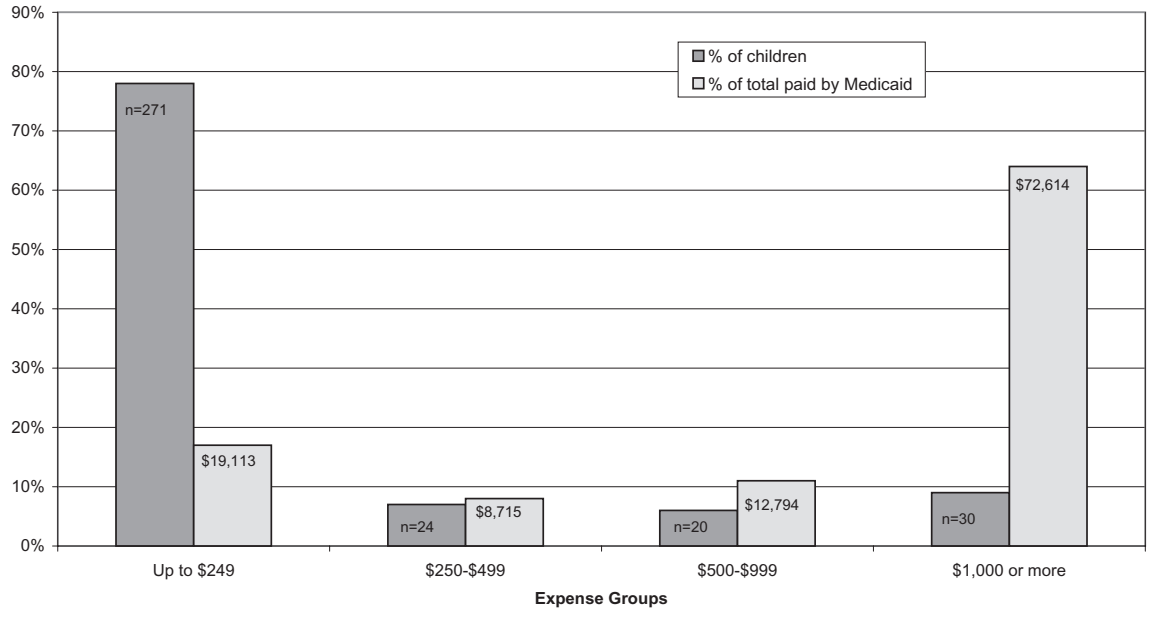

Table 2
Characteristics of Sample and Comparison by Dental Expense Group; Univariate and Multivariate OR (Robust 95% CI) for Outcome of Having High Dental Expenses

	All Children % or mean (SD) $n = 345$	Up to $999 % or mean (SD) $n = 315$	$1,000 or more % or mean (SD) $n = 30$	Univariate OR (95% CI)	Multivariate OR (95% CI) $n = 271$
Age at enrollment (years)					
Under 1	26	28	7	Reference	Reference
1 to 2	34	36	17	1.9 (0.4-10.3)	1.1 (0.1-10.1)
3 to 4	23	23	57	10.1 (2.3-45.4)¶	9.0 (1.3-60.4)§
5 to 6	14	14	20	6.1 (1.2-31.4)§	4.8 (0.6-40.8)
Race/ethnicity					
White	72	73	67	Reference	Reference
African-American	1	1	0	†	†
Asian or Pacific Islander	2	1	13	23.0 (4.0-133.8)¶	31.5 (4.6-214.5)¶
Native American	5	5	7	1.5 (0.3-7.2)	1.7 (0.3-10.3)
Hispanic	10	10	13	1.5 (0.5-4.8)	0.6 (0.2-2.2)
Other/unknown	10	11	0	†	†
Family history of dental disease					
History of caries in family	61	60	71	1.7 (0.7-3.9)	3.5 (1.3-9.2)¶
Education level of parent					
Postsecondary education	45	45	50	1.2 (0.5-2.7)	1.0 (0.4-2.7)
Parental oral health beliefs					
Said cavities can be prevented	91	91	93	1.4 (0.3-6.3)	∞
Said germs cause cavities	60	60	53	0.8 (0.4-1.6)	∞
Oral hygiene practices					
Used toothpaste at home	73	71	89	3.2 (0.9-11.1)•	∞
Child had toothbrush at home	92	92	100	‡	∞
An adult helps child clean teeth	89	89	89	1.0 (0.3-3.5)	∞
Mean number of times of daily brushing	1.8 (0.7)*	1.8 (0.8)*	1.9 (0.7)*	1.3 (0.8-2.0)	∞
Dietary patterns					
Mean number of all snacks per day	8.6 (4.5)*	8.5 (4.6)*	10.3 (4.0)*	1.1 (1.02-1.2)¶	∞
Mean number of sweet drinks per day	1.8 (1.5)*	1.7 (1.5)*	2.4 (1.7)*	1.3 (1.02-1.6)§	1.2 (0.8-1.7)
Access to dental care indicators					
Perceived no dental coverage	28	27	33	1.4 (0.6-3.0)	3.4 (1.3-9.2)¶
Had no family dentist	55	55	53	1.0 (0.4-2.0)	1.3 (0.5-3.1)

* Mean (SD).
† All were in the low-expense group; OR not calculated.
‡ Entire high-expense group had toothbrushes; OR not calculated.
¶ P-value ≤ 0.01.
§ 0.01 < P-value ≤ 0.05.
• 0.05 < P-value ≤ 0.10.
∞ Not included in multivariate model.
SD, standard deviation; OR, odds ratios; CI, confidence intervals.

group was significantly overrepresented in the high-expense category, compared with the reference group (White).

The high-expense category consisted mostly of children who were older. The mean age was 3.8 years (SD = 1.5) in the high-expense group versus 2.4 years (SD = 1.8) in the low-expense group. Generally, older children are more likely to have developed more extensive dental disease, and also more likely to have a thorough diagnosis including X-rays, as children under the age of 3 may not cooperate for diagnostic X-rays.

A higher proportion of children in the high-expense group had a family history of dental disease. Although such history was not statistically different between the two groups in univariate analysis, it became significant in multivariable analysis when other variables were taken into account. The education level of the respondents was comparable in the expense groups and was not statistically different in univariate or multivariate analyses. The total number of daily snacks and total servings of sweet drinks varied significantly between the two groups of children in univariate analyses. Children with higher dental expenses had a higher mean number of daily snacks, 10.3 versus 8.5 servings, and higher servings of sweet drinks, 2.4 versus 1.7 cups daily. These variables were collinear, and only the number of sweet drinks was included in the multivariable model.

Once adjusted for age, there were no statistically significant differences between the two groups with respect to oral hygiene practices. Oral hygiene behaviors were evenly distributed among all study participants according to the child's age.

Risk Factors for Incurring High Dental Expenses – Multivariable Analysis. Multivariable analysis included all the variables in the univariate analyses, except for the specific hygiene practices and beliefs. Inclusion of variables in the final model was not based on statistical significance in univariate analyses. Rather, inclusion in the final model was largely based on our conceptual model and elimination of redundancies. The final model variables were age of the child, race/ethnicity, family history of dental disease, parent education level, sweet drink consumption, perception of dental insurance, and having a family dentist.

Parent education level was deemed as a suitable proxy variable representing the beliefs about oral health. Most parents, 91 percent, said that cavities could be prevented in their child. Parents with more than a high school education were more likely to have this belief (95 percent versus 90 percent, $P = 0.07$) and the belief that germs cause cavities (65 percent versus 57 percent, $P = 0.13$). These variables were tested in multivariable models but their inclusion did not change the significance of other variables, and they were not statistically significant themselves. Variables related to oral hygiene – use of toothbrush and toothpaste and adult help with brushing or cleaning teeth – were highly correlated with child age (in all cases $P < 0.01$). The use of a toothbrush and adult help were not individually, or after adjustment for age, associated with dental expenses. In univariate analysis, the use of toothpaste was associated with higher dental expenses ($P = 0.06$), but this relationship diminished significantly once the age of the child was introduced ($P = 0.66$). All three oral hygiene variables were tested in the full multivariable model. None affected the significance of other variables in the model, with the exception of age. Age became less statistically significant ($0.10 < P < 0.20$) each time any of these variables was introduced. None of the hygiene variables was statistically significant when tested in multivariable models ($P > 0.65$ in all models). Age had a positive relationship with oral hygiene variables – older children more often had a toothbrush and used toothpaste than younger children; older children less frequently had adult help. As noted earlier, older children also had higher dental expenses compared to younger children ($P < 0.01$). The number of times a child used his/her toothbrush in a day was distributed around a mean of 2, skewed toward 1; 33 percent used a toothbrush once a day, 52 percent used it twice, and 10 percent three times. There was no significant difference by age or expense group in the frequency of using a toothbrush. The exclusion of these oral hygiene variables in the final model reduced the redundancy without affecting the significance of other variables.

In multivariable analysis several factors were statistically associated with high total expense for dental procedures for the children enrolled in Medicaid (Table 2). Although some factors were not statistically significant in univariate analysis, they became significant after other variables were added in the model. Age was a significant factor in both univariate and multivariate analysis. Three- to four-year-old children had the highest OR compared to the reference group (OR = 9.0, $P = 0.02$). Children of Asian or Pacific Islander heritage were at disproportionately high risk for high dental expenditures compared to White children (OR = 31.5, $P < 0.01$). Children with a family history of dental disease were also at increased risk for having high individual dental expenditure. Children whose mother or sibling(s) previously had caries were almost four times more likely to have high dental treatment costs (OR = 3.5, $P = 0.01$).

The perception of not having dental coverage was influential. Children whose parents did not know their child had dental coverage at the time of the survey were more likely to have higher dental expenditures over the period of the study. This group of children was about three times more likely to have higher expenditures than the group of children whose parents reported knowing their child was insured by Medicaid for dental care (OR = 3.4, $P = 0.01$). Having a family dentist was positively related to having less total dental expense (OR = 1.3),

although not statistically significant. While the consumption of a higher number of daily servings of sweet drinks was significantly associated with higher dental expenses in univariate analysis, this factor was not statistically significant in the multivariable regression analysis. Parent education did not show a statistically significant relationship with high dental expenses. It is noteworthy that parent education level was not correlated with the perception of lack of dental insurance. Twenty-five percent of those with postsecondary education and 29 percent of those with no more than a high school education thought that their child was not covered for dental insurance.

Discussion

Limitations. This study assumes no dental visits other than the ones documented in the DSHS database. It is possible that children without dental records in the Medicaid database may have received dental care on a self-pay basis, at a free clinic, or through schools or public health services outside of their Medicaid coverage. It is also possible that children who did appear in the Medicaid database had additional dental visits outside of their Medicaid coverage.

The total number of snacks used in the univariate analyses included the number of all daily snacks including milk, fruit, cookies, and candy. The individual numbers for each category of snacks were available, but the numbers were small, and thus, using the overall number of snacks provided more stability. As expected, the numbers of individual snack categories were collinear with the overall number of all snacks. The authors felt that including a variable representing snacks was important. This variable was not used in the multivariable analysis as it included both beneficial and nonbeneficial snacks (i.e., fruit as well as candy). Instead, the number of juice and soda servings a child had in a day was included in the multivariable analysis.

Oral hygiene variables were excluded from the multivariable analysis. One may reasonably expect a positive correlation between good oral hygiene and good oral health, and thus, lower dental expenses. Having a toothbrush, using toothpaste, and the frequency of brushing may not necessarily represent good oral hygiene. For example, in these data, toothpaste use was associated with higher dental expenses in univariate analysis. This paradoxical observation may be explained by the fact that age adjustment diminishes this relationship, possibly showing that oral hygiene behaviors, including parent assistance, may be age related.

The subsample of children with high dental expenses ($n = 30$) was selected because they represented the highest dental expenditures, and the authors wanted to highlight this specific group. Analysis of the highest expense group has significant potential for the greatest positive influence on child health outcomes and increased efficiencies of oral health interventions. Thus, overall, our numbers in the analyses were small (only 10 had high dental expenses and were not aware of their dental coverage). Even though statistical significance was observed for some variables, these results are not conclusive; rather, they point to a direction where further investigation is warranted using a larger sample of children enrolled in Medicaid. Our sample included a very small number of African-American, Asian and Pacific Islander, and Native American children. This reflected the demographics of the pediatric practices in the Healthy Smiles Project. Within this sample, the small number of African-American children all fell within the low-expense category. Of course, this does not preclude oral health problems in this population. Two-thirds of the Asian and Pacific Islander children fell within the high-expense category. Findings related to ethnicity need to be studied further to understand the role of culture, language, and other correlates of ethnicity in relation to barriers to adequate dental care for children.

Increased dental disease identified in the three- and four-year-old age group may relate to the amount of time the child has had primary teeth and that a thorough dental examination, including X-rays, often can be accomplished in this age group. Although caries is a progressive disease and often starts well before this age, it may not be comprehensively diagnosed without X-rays. This is more likely in situations where the child does not have a professional dental examination before the age of 3 or 4 years.

One element that can potentially increase the cost of dental treatment is the presence of special needs in young children (21). Our study did not have access to data to assess this factor. In our study, the distribution of dental expenses was highly skewed (Figure 1). A majority (70 percent) of children with high dental expenses had received inpatient hospital treatments, versus 3 percent in the group of children with expenses below $1,000. Dental treatment, while hospitalized, typically involves restorative/pulpal treatment of multiple teeth and extractions, and rarely periodontal procedures – mainly gingivectomies or gingival grafts. These treatments become necessary through lack of earlier periodic preventive, diagnostic, and simple restorative treatments. Hospitalization may be necessary for acute, rare issues such as facial cellulitis from dental infection or for the management of severe traumatic injuries to the dentition and jaw structures. Additionally, young children with extensive treatment needs often require general anesthesia. Regardless of the cause of hospitalization, these large expenses create a skew in the distribution of expenditure data.

Using Medicaid status alone as an indicator of income leaves out those low-income families that either do not have or do not qualify for Medicaid. However, there is value in looking within the Medicaid subgroup, as a relatively homogeneous economic group, for identifying utilization patterns. In the fiscal year 2003-04, 31 percent (487,750) of all

children in Washington State were enrolled in DSHS' Medicaid program (22). Among families with income below 100 percent of the federal poverty level, 65 percent of children were enrolled in Medicaid (22). While the sample did not constitute a randomly selected group of children, the Healthy Smiles cohort of children provided a unique opportunity to link information on specific oral health characteristics of this subset of the Medicaid population with data on dental care utilization.

The time element is another limitation of this study. The data were analyzed cross-sectionally; however, children enrolled in the Healthy Smiles program at different times and their Medicaid utilization data may represent differing total periods of time. Finally, as with all studies using a questionnaire, specific wording may affect interpretation. The difference in wording medical and dental coverage questions may affect the interpretation of these questions. For example, some parents may perceive major dental work as "medical" and believe that having medical insurance also means having dental insurance.

Conclusions. All participants in this study were covered by Medicaid medical coverage. In Washington State, Medicaid includes dental coverage; however, when asked if their child had dental coverage, 27 percent of the respondents said their child did not have dental coverage. We assume that families with private dental insurance are typically aware of their coverage because they either have to pay for it out of pocket or select options for employer-provided dental coverage. This study suggests that among families who do not have private dental coverage, and have Medicaid medical coverage, some may not be aware that dental coverage is provided for all children on Medicaid in Washington State. This may be particularly true for families who have Medicaid managed care through a health carrier and may not realize that they also have Medicaid fee-for-service dental coverage. This difference in the coverage system between medical and dental care under Medicaid may be confusing to families as well as to providers.

In the Healthy Smiles Project, staff members of three pediatric practices were surveyed about their understanding of Medicaid coverage for dental, and 45 percent ($n = 25$ of 56) were not aware that Medicaid included dental coverage (19). Data from the present study suggest that parent education level was not a significant factor in the knowledge about Medicaid dental coverage. Families who said they did not have dental coverage did use dental services covered under Medicaid. Although this result may sound counterintuitive, it is possible that some parents may have known that somehow, dental expenses were being covered but were not aware of the paying agency. Dental services may have been provided in a pediatrician's office (preventive care such as application of fluoride vamish), in a hospital prior to the family's awareness of Medicaid dental coverage, or in a dentist's office after the family gained knowledge of the dental coverage through Medicaid. Simply completing the Healthy Smiles questionnaire may have influenced the parents' knowledge about the coverage. Earlier lack of knowledge about dental coverage may prevent families from seeking preventive dental care, and thus could increase the child's risk of developing undetected dental disease, resulting in costly restorative intervention. Other authors have previously discussed the fact that the majority of children covered by Medicaid do not receive preventive oral care services for which they are eligible (23). The present study may offer a potential explanation for this phenomenon.

Attention is often focused on disparities in access to dental care between lower- and higher-income families. In this study, the sample of children included only those from low-income families who were enrolled in Medicaid in order to identify the characteristics associated with incurring high dental expenses. Not all low-income children are at high risk for dental disease, but a combination of high risk for disease (family history of dental disease) and a lack of knowledge about having dental coverage may be associated with an increase in likelihood of high dental expenses. Even though statistical significance was observed for some variables, these results cannot be seen as conclusive, but document certain associations in this particular group. Admittedly, the sample size was small in certain instances. For example, the number of children of Asian/Pacific Islander background was small ($n = 6$). In our study, this small group was found to have more costly dental visits compared to the reference group. Further studies are warranted to fully understand the role of these risk factors. At the same time, to address these risk factors, families and primary care providers would benefit from education about Medicaid coverage for child dental care. Health care providers should encourage parents to become familiar with the specifics of their Medicaid coverage. If high-risk children are identified using simple risk assessment methods, such as family history of caries (19), they can be referred for timely preventive services, thereby reducing the potential need for extensive and complex dental treatment.

It is alarming that no advances have been made toward decreasing caries in primary teeth in the past several years (5). Further attention needs to focus on the prevention of caries in primary teeth, which is a predictor of caries as the child grows (24). This study elucidates some of the characteristics of a small group of young children in Washington State who had high dental expenses. Further investigations are needed to fully understand the causative and preventive factors for tooth decay in all young children.

All children need and deserve access to dental care and a dental home. For children on Medicaid, access may be particularly difficult depending on many factors –

number of dentists who treat children in the community, Medicaid dental coverage and reimbursement levels (25), parent ability to take the child to appointments, transportation constraints, or work time lost (26). Recognition of factors that are associated with children having high dental expenses may support earlier diagnostic and preventive intervention. This would not only reduce the consumption of public resources, but would also positively affect the quality of life for the individual child. In this study, a small proportion of children (9 percent) used a majority of resources (64 percent). Targeting at-risk families and children to assure timely access could reduce high-cost-treatments. Medicaid dental dollars preserved could then be used to enhance access to preventive care for more children.

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