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Disparities in Receipt of Preventive Dental Services in Children From Low-Income Families

Liang Wei, MS[1], **Susan O. Griffin, PhD**[2], **Valerie A. Robison, DDS, MPH, PhD**[2]

[1]DB Consulting Group, Inc., Atlanta, Georgia

[2]Division of Oral Health, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia

Abstract

Introduction: *Healthy People 2020* includes a goal of increasing use of preventive dental care among children from low-income families. The services used to define preventive care are evidence-based services (i.e., dental sealants and professionally applied topical fluoride) and professional dental cleaning, which lacks evidence of effectiveness in preventing caries. This study examined how increasing preventive dental care use and reducing disparities by race/ethnicity among children from low-income families varied by the services included in case definitions of preventive dental care use.

Methods: Three case definitions of past-year preventive dental care use were considered: (1) the *Healthy People 2020* definition; (2) receipt of an evidence-based caries prevention service; and (3) dental cleaning only. Using pooled data from the 2001–2002 and 2013–2014 Medical Expenditure Panel Survey for each definition, this study conducted in 2017 used multivariate logistic regression to estimate changes in preventive dental care use among children from low-income families by race/ethnicity.

Results: Use increased for all racial/ethnic groups for all definitions. Use of preventive dental care (*Healthy People 2020* definition), however, was at least two times higher than evidence-based preventive dental use for all racial/ethnic groups in both survey periods. After controlling for insurance status and parental education, the disparity between non-Hispanic black and non-Hispanic white children in use of preventive dental care that was present in 2001–2002 was not detected in 2013–2014 whereas the disparity for evidence-based preventive dental care use persisted.

Conclusions: Case definitions of preventive dental care that include non–evidence-based services may overstate receipt of effective preventive dental care and reductions in certain racial/ethnic disparities.

Address correspondence to: Susan O. Griffin, PhD, Division of Oral Health, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, 4770 Buford Hwy., Atlanta GA 30341. sig1@cdc.gov.

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SUPPLEMENTAL MATERIAL

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INTRODUCTION

Preventive dentistry is the cornerstone of good oral health. Dental sealant and topical fluoride application show strong evidence of effectiveness,[1–3] and sealants can be cost saving when delivered to children at high risk for tooth decay.[4] Preventive dental services, however, may be underused by children from low-income families and racial/ethnic minorities. Although low-income and non-Hispanic black (NHB) children are about twice as likely to have untreated dental caries[5] compared with higher-income and non-Hispanic white (NHW) children, respectively, they are about half as likely to have received a preventive dental service with evidence of effectiveness.[6]

Dental caries, if left untreated, can lead to problems in eating, speaking, and learning.[7] Increasing the receipt of preventive dental services among children from low-income families could thus substantially reduce untreated tooth decay and also improve children's quality of life. A report by the National Academy of Medicine (formerly the Institute of Medicine) highlighted the importance of DHHS promoting the use of effective preventive dental services, because of the strong evidence that they prevent tooth decay and their potential to substantially reduce future restorative care costs.[8] Eliminating disparities and increasing the proportion of children from low-income families and adolescents who receive a preventive visit to 33.2% by the year 2020 is a national priority and a *Healthy People 2020* goal.[9]

The definition of a preventive dental visit (PDV) used by *Healthy People 2020*, however, includes both dental services with evidence of effectiveness in preventing dental caries (i.e., topical fluoride and dental sealants) and a dental service that lacks such evidence (i.e., professional dental cleaning).[10,11] The case definition of a PDV used on the Centers for Medicare & Medicaid Services form 416 to monitor use over time and across states also includes dental cleaning.[12]

The aim of this study is to examine the effect of including dental cleaning in the case definition of preventive dental care in measuring progress in increasing the use of preventive dental care and reducing its racial and ethnic disparities among children from low-income families.

Andersen's behavioral model of healthcare use[13] was used to select independent variables in the adjusted analysis. In this model, healthcare use is influenced by three factors: availability of resources to access care (enabling characteristics including income and insurance); health status, which determines need for health care; and the tendency to seek health care (predisposing characteristics including age, race/ethnicity, and education). Social structure (i.e., the status of the person in the community, his/her ability to cope with presenting problems including having the necessary resources to address the problem, and how healthy or unhealthy the physical environment is likely to be) is a major determinant of a person's predisposition to use health care.

METHODS

Study Sample

This study used the same population and data source as in the *Healthy People 2020* framework.[9] Data from the 2001–2014 Household Components of the Medical Expenditure Panel Survey (MEPS) were used for this analysis. MEPS is a nationally representative survey managed by the Agency for Healthcare Research and Quality. The MEPS Household Components included self-reported information on sociodemographic characteristics, health status and conditions, health insurance coverage, and use of clinical services. MEPS data provide specific information about the type of services rendered at each dental visit. Subjects were interviewed on five different occasions over 15 months, so that they do not need to recall details of dental care received > 3 months earlier.[14]

The analytic sample included children and adolescents, aged 2–18 years, living in households with incomes < 200% of the federal poverty level. Hereafter this sample is referred to as children. From 2001 to 2014, ≅ 4,200–6,000 children from low-income families representing 26.0–30.7 million children (37.7%–43.6% of all children) nationally, have been included in MEPS each year. All analyses were conducted in 2017.

Measures

Three case definitions of preventive dental care use within the preceding 12 months were considered: (1) the *Healthy People 2020* definition, which included receipt of a dental sealant, professionally applied topical fluoride, or professional dental cleaning, and the *Healthy People* definition disaggregated into two mutually exclusive categories: (2) receipt of an evidence-based caries prevention service (i.e., dental sealant or professionally applied topical fluoride); and (3) professional dental cleaning only.

Disparities were estimated for each measure of preventive dental care, where a disparity was defined as the absolute difference in each measure of preventive dental use between the reference category and other categories of independent variables.

The primary independent variable was race/ethnicity (NHW, NHB, Hispanic, or Asian). NHW children were the reference category when measuring disparities.

Other independent variables affecting PDVs included predisposing variables: age (2–4, 5–11, or 12–18 years), with the youngest age group being the reference category; sex, with males being the reference category; and parental education (less than 12th grade, 12th grade, or more than 12th grade), with the lowest education level being the reference category. Because the analysis was restricted to children from low-income families, the only enabling variable was health insurance status (private medical and dental, private medical and no dental, public, or uninsured); having private medical and dental insurance was the reference category. Because MEPS does not include information on a child's clinical oral health status (which measures the need for health care in the Andersen model), parent-reported child health status was included as a proxy for oral health status. Studies indicate that oral health is associated with general health.[7] Three categories of general health were included

(excellent/very good, good, and fair), with excellent/very good health as the reference category.

Statistical Analysis

Unadjusted estimates of changes in an annual PDV and evidence-based PDV (EPDV) for each category of race/ethnicity were obtained by using linear regression models. To test whether the obtained annual change in utilization was significant, *t*-tests were used. For the remaining analyses, data were pooled into two time periods: 2001–2002 and 2013–2014. Two years of data were used in each period to reduce variance of prevalence estimates and to increase statistical power to detect differences. A chi-square test was used to test whether the distribution of other variables differed by race/ethnicity. The three measures of past-year preventive dental use were estimated for all independent variables, and disparities between categories of each independent variable were estimated. The percentage of children receiving an evidence-based dental service among children with a preventive dental service was also estimated. A *t*-test was used to test for disparities in crude estimates of preventive dental use in each survey period and significant changes in disparities between surveys and to test changes in the percentage of children receiving an evidence-based dental service among children with a preventive dental service between surveys.

Logistic regression models were used to obtain adjusted estimates of disparities in preventive dental care use by race/ethnicity and changes in disparities over time for each of the three preventive dental care use measures (PDV, EPDV, dental cleaning only). Adjusted changes in EPDV were also compared with changes in dental cleaning for each race/ethnicity category. A *z*-test was used to test whether these differences were statistically significant.[15] The regression models included all independent variables, an indicator variable for time period, and a term for interaction between time period X race/ethnicity. A significant interaction term would indicate a significant change in disparities by race/ethnicity between surveys that was not fully explained by the other main effect and independent variables. A *t*-test was used to test whether estimates of disparities and changes in disparities from the regression were significant. SAS-callable SUDAAN, version 9.3, which accounts for the complex survey design and oversampling of certain groups in MEPS, was used for all statistical analyses. All reported disparities and changes in disparities were considered to be significant at $p<0.05$.

RESULTS

For PDV and EPDV, the trend over time was significantly positive for all groups of children (Figure 1; Appendix Table 1, available online).

Parental education, insurance status, and health status varied significantly by race/ethnicity in both data cycles of 2001–2002 and 2013–2014, but age group and sex did not (Appendix Table 2, available online).

The percentage of children with a PDV was notably higher than the percentage with an EPDV for all groups in all years (Table 1). From 2001 to 2014, the percentage of children with a PDV increased from 30.4% to 38.8% for NHW children, from 22.3% to 35.1% for

NHB children, from 19.8% to 39.1% for Hispanic children, and from 17.9% to 35.1% for Asian children. Although all other racial/ethnic groups had disparities relative to NHW children for PDV use in 2001–2002, no evidence was found for disparities in 2013–2014. The disparity between Hispanic and NHW children decreased by 10.9 percentage points.

From 2001 to 2014, the percentage of children with an EPDV increased from 10.9% to 18.0% for NHW children, from 6.5% to 10.9% for NHB children, from 4.9% to 14.9% for Hispanic children, and from 3.8% to 13.9% for Asian children (Table 1). There were significant disparities in EPDV use for all racial/ethnic groups relative to NHW in 2001–2002. In 2013–2014, the only disparity detected was the disparity between NHB and NHW children.

In contrast to EPDV, disparities in dental cleaning only among NHB and Hispanic children relative to NHW children in 2000–2001 were no longer detected in 2013–2014. The increase over time in dental cleaning in NHB and Hispanic children was significantly greater than the increase in NHW children (Table 1).

Between 2001–2002 and 2013–2014, among children receiving a PDV, the percentage who also received an EPDV (sealants or topical fluoride) increased by >10 percentage points for all racial/ethnic groups with the exception of NHB children (Figure 2). The change between surveys for NHB children was not statistically significant.

Adjusted estimates of preventive dental care use were similar to unadjusted estimates (Table 2). For PDV, disparities between all other race/ethnicities relative to NHW children that existed in 2001–2002 were no longer detected in 2013–2014. There was a significant decrease in the disparity for PDV between Hispanic and NHW children (11.1 percentage points decrease, 95% CI=10.5, 11.9) that could not be fully explained by covariates. For EPDV, disparities were not detected for any racial/ethnic group in 2013–2014 except for NHB children (6.5 percentage points, 95% CI=5.2, 8.1). For dental cleaning only, the disparity between NHB and NHW children in 2001–2002 was not detected in 2013–2014. For dental cleaning only, there were increases among NHB children (7.2 percentage points, 95% CI=6.7, 7.8) and Hispanic children (7.8 percentage points, 95% CI=7.3, 8.4) relative to NHW children that could not be fully explained by covariates. Changes in EPDV relative to changes in dental cleaning varied by race/ethnicity—whereas the increase in EPDV exceeded that of dental cleaning alone by almost 6 percentage points among NHW children, the increase in dental cleaning exceeded that in EPDV by 4 percentage points among NHB children (Appendix Table 3, available online).

DISCUSSION

This is the first analysis of changes in racial/ethnic disparities in receipt of evidence-based preventive dental services among children from low-income families using nationally representative data over a long time period after controlling for the influence of covariates. Although this analysis showed an increase over time in the proportion of children using all three measures of preventive dental care, the proportion of children using PDV (including a non–evidence-based intervention [dental cleaning]) was at least double the proportion of

children using EPDV (only including evidence-based interventions, fluoride or sealants, or both) in both survey periods. In addition, disparities between NHB and NHW children persisted for EPDV in 2013–2014 whereas none were detected for PDV. This was due to NHW children being more likely to receive EPDV relative to dental cleaning alone over time and NHB children being less likely.

Children receiving dental cleaning alone represent missed opportunities at the dental office for providing evidence-based caries prevention services. A study in California using survey data from 2005 found that among Medicaid/State Children's Health Insurance Program (SCHIP)–enrolled children, the time between dental visits was longer for NHB and Hispanic children compared with NHW children.[16] This study's findings suggest that barriers to NHB children receiving evidence-based preventive dental services exist both in obtaining an appointment and during the dental visit.

The population of children and adolescents from low-income families at risk for dental caries is large. In 2011–2014, a total of 66% of this population aged 12–19 years had experienced caries.[5] Thus, increasing EPDV could have a large impact in reducing dental caries and the associated loss in quality of life. In addition, these findings highlight the importance of identifying the specific services provided during a PDV. Using the PDV definition as a performance measure could reward providers currently delivering services without evidence of effectiveness. Similarly, using the PDV definition would overstate progress in increasing use of evidence-based preventive dental services and reducing disparities.

The proportion of children receiving a PDV had surpassed the *Healthy People 2020* target of 33.2%, and all disparities for PDV relative to NHW children in 2001–2002 were not detected in 2013–2014. Progress made in reaching the *Healthy People 2020* target and in reducing disparities, however, was primarily due to an increase in dental cleaning only.

This study did not examine why children were less likely to receive an evidence-based preventive dental service and, among children receiving a preventive dental service, why NHB children were less likely than NHW children to receive an evidence-based service. The findings from the multivariate regression, however, suggest that these differences are not fully explained by lack of insurance or parental education, a predictor of oral health literacy. A report released by the National Academy of Medicine in 2002 found that in addition to lack of insurance and low income, evidence suggested that minorities may receive unequal treatment in clinical healthcare encounters because of both provider behaviors (stereotyping, bias, and clinical uncertainty) and patient characteristics (barriers in language, geography, and cultural familiarity).[17] A recent commentary suggested that the higher likelihood of receiving a service without evidence of effectiveness versus an evidence-based intervention may be because of structural issues, such as the payment system for dental care, unlike that for medical care, being fee-for-service with no incentives to influence service delivery.[11] The perspective also argued that delivering preventive dental services in schools would be the most effective way to address structural challenges. Two analyses conducted in Ohio found that disparities in sealant prevalence among low-versus high-income children

attending schools without sealant programs would be eliminated if the school had a sealant program.[18,19]

This may be the first analysis to find that, among children from low-income families receiving a preventive dental service, NHW children were more likely than NHB children to receive an evidence-based dental care prevention service. Although this study did not examine why this may be so, knowledge of the existence of the disparity could influence decisions made by dental providers and their low-income patients' parents during a dental visit, and encourage further research in this area.

Limitations

Limitations with this study are primarily related to the design of MEPS. First, it is a cross-sectional survey, so the authors were unable to assess the causality of disparity reduction. Second, the results in this study are based on parent-reported data, which may be subject to social desirability and recall bias for specific services received at a child's dental visit.

Recall bias, however, may be lower in MEPS as respondents are interviewed over a relatively short term (within 3–4 months) compared with other national surveys (within 1 year).[20] Third, preventive dental services delivered in schools and other non-dental settings were not considered because MEPS only included information on services delivered during a dental visit. There are no national data on children participating in school sealant programs. An analysis of Centers for Medicare & Medicaid Services data in 2012, however, suggests this value may be low. Nationally, about 3.5% of children in Medicaid/SCHIP received dental services from non-dental providers or dental professionals not directly supervised by a dentist.[21] Finally, some variables included in the Andersen model related to social structure and physical environment could not be included in this analysis because they were not in the MEPS data set. In addition, this study had no measure of oral health status or perceived need for dental care or preventive orientation. A review of studies using the Andersen model found this to be a common limitation of studies using secondary data sets with limited data availability.[22]

CONCLUSIONS

This study found that including services with no evidence of effectiveness can overestimate preventive dental service use and reductions in disparities. After controlling for insurance status and parental education, children from low-income families were at least twice as likely to use preventive dental care that included a service without evidence of effectiveness than use preventive dental care limited to services with such evidence. This study also found that among children from low-income families receiving a preventive dental service, NHW children were more likely than NHB children to receive an evidence-based caries prevention service. In light of the evidence that providing preventive dental services in schools may reduce income-related disparities in receipt of evidence-based dental services, this delivery modality also may be effective in reducing racial/ethnic disparities.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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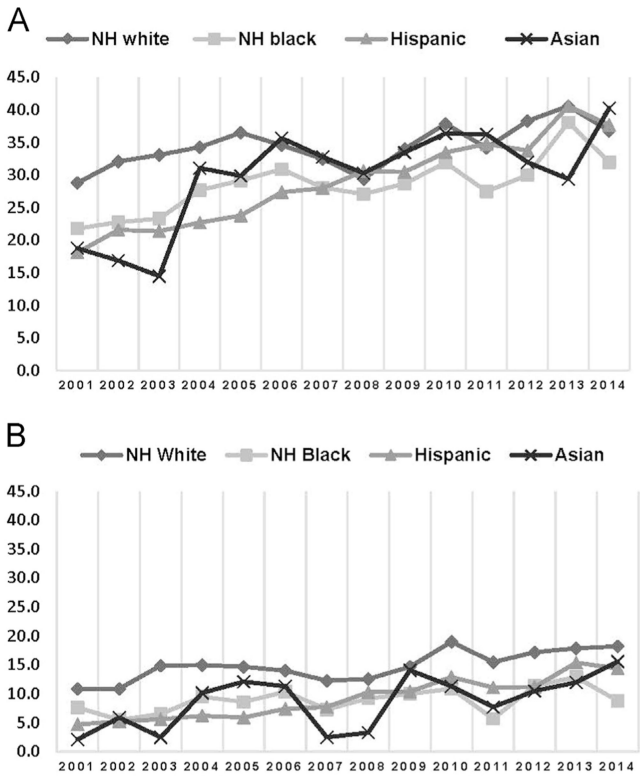

Figure 1.

(A) Prevalence of having PDV among U.S. children from low-income families aged 2–18 years, MEPS 2001–2014. **(B)** Prevalence of having EPDV among U.S. children from low-income families aged 2–18 years, MEPS 2001–2014. EPDV, evidence-based preventive dental visit; MEPS, Medical Expenditure Panel Survey; PDV, preventive dental visit.

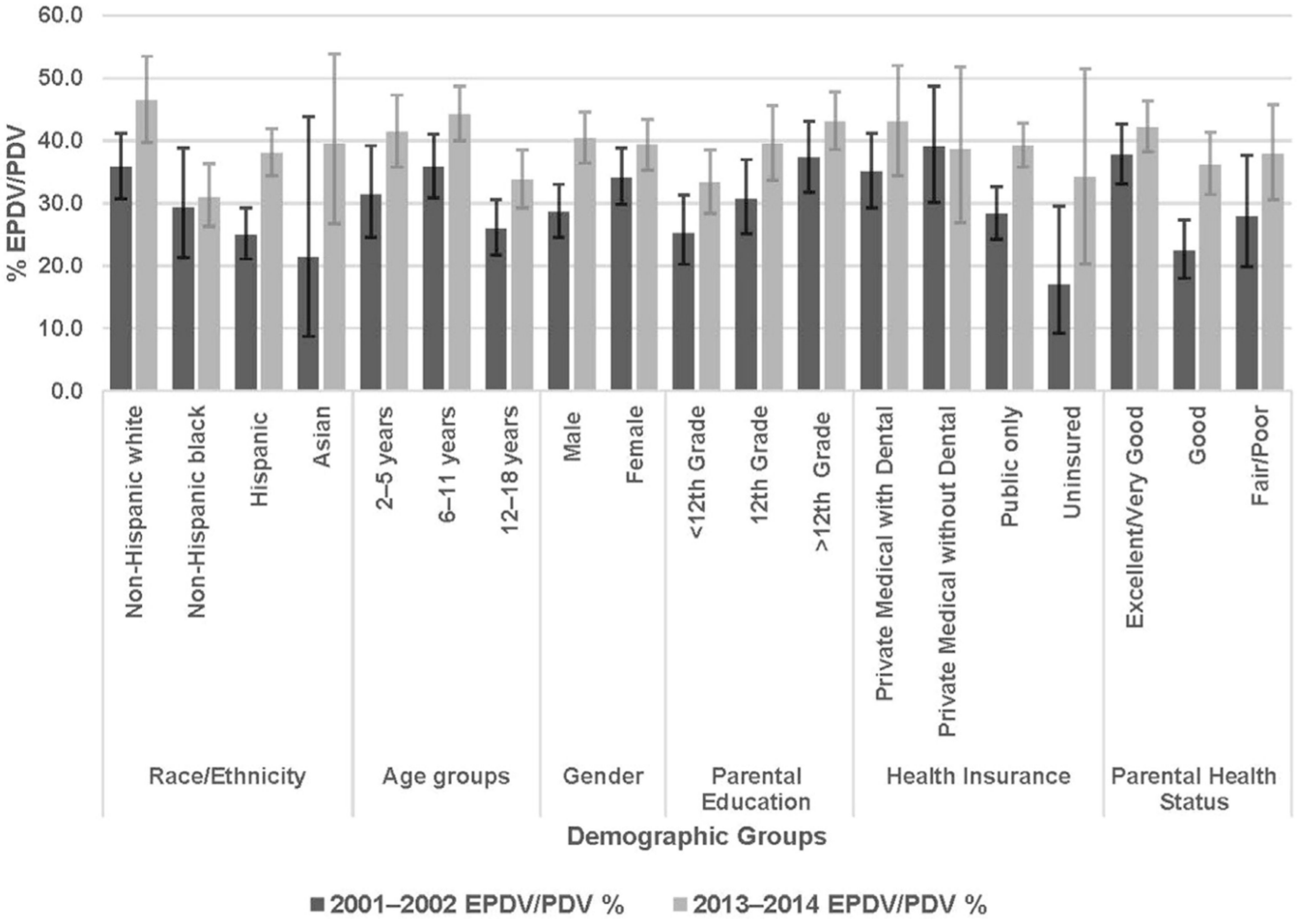

Figure 2.

Percentage of EPDV over PDV among children aged 2–18 years from low-income families in MEPS 2001–2002 and 2013–2014. EPDV, evidence-based preventive dental visit; MEPS, Medical Expenditure Panel Survey; PDV, preventive dental visit.

Table 1.

Crude Prevalence of PDV, EPDV, and Dental Cleaning Only Among Children From Low-Income Families

	PDV[a,b]			EPDV[a]			Dental cleaning only[a]		
	2001–2002	2013–2014		2001–2002	2013–2014		2001–2002	2013–2014	
Characteristics	**Disparity (%)**	**Disparity (%)**	**Change**	**Disparity (%)**	**Disparity (%)**	**Change**	**Disparity (%)**	**Disparity (%)**	**Change**
Race/ethnicity									
Non-Hispanic white (ref)	(30.4)	(38.8)		(10.9)	(18.0)		(19.5)	(20.7)	
Non-Hispanic black	**8.1** (22.3)	3.7 (35.1)	−4.4	**4.4** (6.5)	**7.1** (10.9)	2.7	**3.7** (15.8)	−3.5 (24.2)	**−7.2**
Hispanic	**10.6** (19.8)	−0.3 (39.1)	**−10.9**	**6.0** (4.9)	3.1 (14.9)	−2.9	**4.6** (14.9)	−3.5 (24.2)	**−8.1**
Asian	**12.5** (17.9)	3.7 (35.1)	−8.8	**7.1** (3.8)	4.1 (13.9)	−3.0	5.4 (14.1)	−0.5 (21.2)	−5.9
Age groups									
2−5 years (ref)	(17.1)	(32.8)		(5.4)	(13.6)		(11.7)	(19.2)	
6−11 years	**13.7** (30.8)	**11.5** (44.3)	−2.2	**5.6** (11.0)	**6.1** (19.7)	0.5	**8.1** (19.8)	**5.5** (24.7)	−2.6
12−18 years	**7.1** (24.2)	2.5 (35.3)	−4.6	0.9 (6.3)	−1.7 (11.9)	−2.6	**6.2** (17.9)	**4.2** (23.4)	−2.0
Sex									
Male (ref)	(24.0)	(37.6)		(6.9)	(15.2)		(17.1)	(22.4)	
Female	1.8 (25.8)	0.7 (38.3)	−1.1	**1.9** (8.8)	−0.1 (15.1)	−2.0	−0.1 (17.0)	0.9 (23.3)	1.0
Parental education[c]									
<12th grade (ref)	(18.3)	(35.0)		(4.6)	(11.6)		(13.7)	(23.3)	
12th grade	**7.2** (25.5)	0.6 (35.6)	**−6.6**	**3.2** (7.8)	2.5 (14.1)	−0.7	**4.0** (17.7)	−1.8 (21.5)	**−5.8**
>12th grade	**14.7** (33.0)	**6.8** (41.8)	**−7.9**	**7.7** (12.3)	**6.4** (18.0)	−1.3	**7.0** (20.7)	0.5 (23.8)	**−6.5**
Health insurance									
Private medical with dental (ref)	(33.2)	(43.8)		(11.7)	(18.8)		(21.6)	(25.0)	
Private medical without dental	3.8 (29.4)	7.7 (36.1)	3.9	0.2 (11.5)	4.8 (14.0)	4.6	3.7 (17.9)	2.8 (22.2)	−0.9
Public only	**9.1** (24.1)	**5.1** (38.7)	−4.0	**4.9** (6.8)	3.6 (15.2)	−1.3	**4.3** (17.3)	1.5 (23.5)	−2.8
Uninsured	**25.2** (8.0)	**30.8** (13.0)	5.6	**10.3** (1.4)	**14.3** (4.5)	4.0	**14.9** (6.7)	**16.4** (8.6)	1.5
Parental health status[d]									
Excellent/very good (ref)	(26.8)	(38.3)		(10.1)	(16.2)		(16.7)	(22.1)	
Good	3.3 (23.5)	0.6 (37.7)	−2.7	**4.8** (5.3)	2.6 (13.6)	−2.2	−1.5 (18.2)	−1.9 (24.0)	0.4

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Characteristics	PDV[a,b] 2001–2002 Disparity (%)	PDV[a,b] 2013–2014 Disparity (%)	PDV[a,b] Change	EPDV[a] 2001–2002 Disparity (%)	EPDV[a] 2013–2014 Disparity (%)	EPDV[a] Change	Dental cleaning only[a] 2001–2002 Disparity (%)	Dental cleaning only[a] 2013–2014 Disparity (%)	Dental cleaning only[a] Change
Fair/poor	**5.3** (21.5)	0.1 (38.2)	−5.2	**4.1** (6.0)	1.7 (14.5)	−2.4	1.2 (15.5)	−1.6 (23.7)	−2.8

Note: Boldface indicates statistical significance at po0.05 for t-test. Changes in disparities from 2001–2002 to 2013–2014 were measured by disparities at data point 2013–2014 minus disparities at data point 2001–2002. A positive value indicates an increase in disparities, and a negative value indicates a decrease.

[a]Sample sizes for children, age 2–18 years, in Medical Expenditure Panel Survey: 2001–2002, N=9,411; 2013–2014, N=10,731.

[b]PDV is the sum of EPDV and dental cleaning only.

[C]554 and 434 children have missing values on parental education in 2001–2002 and 2013–2014, respectively.

[d]60 and 35 children have missing values on Health Status in 2001–2002 and 2013–2014, respectively.

EPDV, evidence-based preventive dental visit; PDV, preventive dental visit.

Table 2.

Adjusted Prevalence[a] and Disparities in PDV, EPDV, and Dental Cleaning Only Among Children From Low-Income Families

	PDV[b,c]			EPDV[b]			Dental cleaning only[b]		
	2001–2002	2013–2014		2001–2002	2013–2014		2001–2002	2013–2014	
Race/ethnicity	Disparity (%)	Disparity (%)	Change	Disparity (%)	Disparity (%)	Change	Disparity (%)	Disparity (%)	Change
Non-Hispanic white (ref)	(30.8)	(36.5)		(10.9)	(16.4)		(19.9)	(19.8)	
Non-Hispanic black	**8.1** (22.7)	3.8 (32.7)	−4.3	**4.0** (6.9)	**6.5** (9.9)	2.5	**4.2** (15.7)	−3.0 (22.8)	**−7.2**
Hispanic	**7.1** (23.7)	−4.1 (40.6)	**−11.2**	**4.6** (6.3)	0.5 (15.9)	−4.1	2.8 (17.1)	−5.0 (24.8)	**−7.8**
Asian	**12.3** (18.5)	5.4 (31.1)	−6.9	**6.7** (4.2)	4.2 (12.2)	−2.5	5.7 (14.2)	1.0 (18.8)	−4.7

Note: Boldface indicates statistical significance at $p < 0.05$ for t-test. Changes in disparities from 2001–2002 to 2013–2014 were measured by disparities at data point 2013–2014 minus disparities at data point 2001–2002. A positive value indicates an increase in disparities, a negative value indicates a decrease.

[a]Prevalence was adjusted for race/ethnicity, age, gender, parental education, health and dental insurance, and parental reported health status, interaction term of race/ethnicity and data cycles.

[b]Sample sizes for children, age 2–18 years, in Medical Expenditure Panel Survey: 2002–2002, N=9,411; 2013–2014, N=10,731.

[c]PDV is the sum of EPDV and dental cleaning only.

EPDV, evidence-based preventive dental visit; PDV, preventive dental visit.