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## Trends of children being given advice for dental checkups and having a dental visit in the United States: 2001–2016

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### Abstract

**Introduction:** The objectives of this study were to describe trends of children being given dental checkup advice by primary care providers (PCPs) and having dental visits and to assess factors associated with being given dental checkup advice and having a dental visit.

**Methods:** Data were from the annual, cross-sectional Medical Expenditure Panel Survey (MEPS) from 2001 to 2016. The sample included 126,773 children ages 2–17 years. We used predictive margins to estimate the probability of being given dental checkup advice and having a dental visit. We examined time trends of the proportion of children being given dental checkup advice from PCPs, as well as trends in the proportion of children having a dental visit from 2001 to 2016. Multiple logistic regression was used to assess the association between being given dental checkup advice and having a dental visit.

**Results:** Overall, the proportion of children being given dental checkup advice increased from 31.4% in 2001 to 51.8% in 2016 (Trend  $P < 0.001$ ). No significant increasing trend was found for having a dental visit among those being given dental checkup advice (Trend  $P > 0.05$ ). Children being given dental checkup advice were more likely to have a dental visit (AOR = 1.54,  $P < 0.001$ ).

**Conclusions:** Although there was an increase in the proportion of children being given advice to have dental checkups by PCPs from 2001 to 2016, there was no significant increase in having a dental visit among children being given the advice. More research is needed to better understand how dental care advice from a PCP can effectively motivate and facilitate dental care for children.

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## Keywords

Children; dental checkup advice; dental visits; trends

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## Introduction

Tooth decay is the most common chronic disease in children. In the United States, national survey data from 2011 to 2014 showed that about 24% of children aged 2–5 years have experienced dental caries in their primary teeth, with 11% having untreated caries; 58% of adolescents aged 12–19 years have experienced dental caries in their permanent teeth, with 19% having untreated caries.<sup>1</sup> Hispanic and non-Hispanic black children aged 2–8 years have two times as much untreated caries in their primary teeth as non-Hispanic white children.<sup>2</sup>

Untreated dental caries can cause pain and affect children's ability to speak, eat, and learn.<sup>3</sup> Children's oral health is a key public health priority.<sup>4</sup> To improve children's health, collaboration between medical and dental care professionals is needed.<sup>5</sup> In recent years, efforts have been implemented to promote the integration of medicine and dentistry. For example, in 2000, Oral Health in America: A Report of the Surgeon General called for individuals, health professionals, and their communities to work together to bridge the longstanding gap between medical and dental care to reduce disparities<sup>6</sup>; in 2011, the Institute of Medicine reinforced the call for multidisciplinary health-care teams working together to improve oral health<sup>7</sup>; in 2014, the Health Resources and Services Administration (HRSA) launched initiatives to introduce core clinical competencies within primary care practices that specifically address oral health<sup>8</sup>; and, the Affordable Care Act (ACA) has included pediatric dental services as one of 10 essential health benefits that must be offered by all small-group and individual health plans.<sup>9</sup> In addition, other professional organizations have also promoted early dental visits.<sup>10-12</sup>

A few cross-sectional studies<sup>13-17</sup> have reported the provision of preventive dental services and referrals to dental providers by non-dentist physicians. Yet, the impact of the above-mentioned policy initiatives and efforts over time on pediatric primary care providers (PCPs) offering dental checkup advice and the effectiveness of such recommendation on having a dental visit has not been assessed recently. Our study aimed to assess whether a recommendation by a PCP was effective in increasing the use of dental services. The findings may inform new strategies to further promote the integration of medicine and dentistry.

The objectives of this study were to assess: (a) the trend of the proportion of children being given dental checkup advice from PCPs by age and by race/ethnicity; (b) the trend of the proportion of children having a dental visit by whether or not they were given dental checkup advice over 2001–2016; and (c) predisposing and enabling factors associated with being given dental checkup advice and having a dental visit.

## Methods

Data were from the annual, cross-sectional Medical Expenditure Panel Survey (MEPS) from 2001 to 2016. The MEPS provides nationally representative estimates of health-care use, expenditures, sources of payment, and health insurance coverage for the US civilian noninstitutionalized population. The MEPS Household Component collects data on respondents' health status, demographic and socio-economic characteristics, and access to care. Information about each household member is provided by a single household respondent (e.g., adult) and a sample of medical providers is contacted by telephone to obtain information when necessary. Survey data are representative of the civilian, noninstitutionalized household population of the United States. Detailed information about MEPS can be found elsewhere.<sup>18</sup>

From 2001 to 2016, a total of 132,722 children aged 2–17 years participated in MEPS, the sample size ranging from 7,357 children in 2007 to 9,747 children in 2002. Of these children, 5,671 (4.3%) were excluded due to missing data relevant to this analysis. The final sample included 126,773 children.

### Outcome variables

We included two outcome variables: (a) Dental checkup advice (Yes/No). A child was classified as being given dental checkup advice if the respondent (i.e., a parent/household adult) answered “Yes” to the question of whether a doctor or other health-care provider had ever given advice about the need for routine dental checkups, and answered “within the previous year” to the question when the advice was received. (b) Dental visit in the past year (Yes/No). A child was classified as having a dental visit if the child was recorded (i.e., from the dental visits event files) as having at least one dental visit in the year of the survey. A dental visit included care of any type provided by general dentists, dental hygienists, and all dental specialists.

### Independent variables

Independent variables for this analysis were selected based on the Andersen's model of health service utilization and findings from previous research.<sup>13,14</sup> Predisposing factor variables included: Age (2–5, 6–11, and 12–17 years old), race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, Asian American [including native Hawaiian/Pacific Islanders], and other/multiracial), sex, the child's self-rated health status (excellent/very good, good, and poor/fair), and residential geographic region (Northeast, South, Midwest, and West).

Enabling factor variables included: health/dental insurance (private health insurance with dental coverage, private health insurance without dental coverage, public insurance [Medicaid, Child Health Insurance Program (CHIP), or other public insurance], and neither medical nor dental insurance), usual source of medical care (USC) (Yes/No) (whether the child has a USC provider), family income level (poor income [ $<100\%$  of federal poverty line [FPL], near poor income [100–199% of FPL], low income [200–299% of FPL], middle income [300–399% of FPL], and high income [400% of FPL] in the year of the data

collection), parents' highest educational level (the parent who did the interview and lived with the child) (less than high school, high school graduate, and some college or above).

### Statistical analysis

First, we used predictive margins to estimate the probability (i.e., rate) of being given dental checkup advice and having a dental visit among all children in each survey year (2001–2016). Predictive margins are a type of direct standardization, where the predicted values from the logistic regression models are averaged over the covariate distribution in the population.<sup>19</sup> Then, time trends of the proportions of children being given dental checkup advice by age and racial/ethnic groups and time trends of having a dental visit were assessed using simple linear regression models with survey year (2001–2016) as the independent variable. Last, multiple logistic regression models were created to assess factors associated with being given dental checkup advice and the association between being given dental checkup advice and having a dental visit. All analyses were conducted using the Stata SVY routine to account for the survey design. Statistical significance was set at the  $P = 0.01$  level (for the trend analysis, a significance level of  $P < 0.05$  was used because the sample size is the 16 waves of the MEPS survey).

### Results

Table 1 presents characteristics of the sample according to whether or not a child was given a dental checkup advice and whether or not a child had a dental visit. A significant difference was found by all variables except sex. Overall, 40.6% of children were given dental checkup advice and 53.1% had a dental visit in the past year.

Figure 1 displays the trend of being given dental checkup advice by the three age groups. Overall, the proportion of being given dental checkup advice increased from 31.7% in 2001 to 50.9% in 2016 ( $b = 1.29$  [Linear regression coefficient], Trend  $P < 0.001$ ). During 2001–2016, the proportion of being given dental checkup advice increased from 38.6% to 59.7% ( $b = 1.01$ , Trend  $P < 0.001$ ) for the 2–5 year age group; from 33.9% to 51.2% for the 6–11 year age group ( $b = 1.01$ , Trend  $P < 0.001$ ); and from 26.0% to 44.8% for the 12–17 year age group ( $b = 1.04$ , Trend  $P < 0.001$ ). The trend line for the 2–5 year age group was above the other trend lines, indicating that they were more likely to being given dental checkup advice than the other age groups. These trend lines also indicated that there was no significant difference in the increasing rate among the three age groups.

Figure 2 presents the trend of being given dental checkup advice by race/ethnicity. For brevity, only the trend lines of the four major racial/ethnic groups were presented (the trend line for “other/ multiracial” group was not presented in the figure). Increasing trends were observed for all four racial/ethnic groups (All Trends  $P < 0.001$ ). The trend lines indicated there was no significant difference in the increasing rate among racial/ethnic groups.

Figure 3 presents the trends for having a dental visit among all children, for those who were given the dental checkup advice and those who were not given the advice. The trend line of having a dental visit among those who were given the dental checkup advice was above that for those who were not given the advice, indicating the former group was more likely to

have a dental visit, overall, 59.0% versus 49.0% ( $P < 0.001$ ). During the period, however, there was no significant change in having a dental visit among those who were given the dental checkup advice ( $b = 0.02$ , Trend  $P = 0.833$ ) while a significant increase in having a dental visit was seen in the group who were not given the dental checkup advice ( $b = 0.17$ , Trend  $P = 0.020$ ). Overall, a significant increase in having a dental visit was found for all children ( $b = 0.225$ ,  $P = 0.003$ ).

Multiple logistic regression model results are presented in Table 2. A significant time effect was found for being given dental checkup advice (AOR [adjusted odds ratio] = 1.05, 95% CI: 1.04–1.05). Children aged 6–11 and 12–17 years were less likely to be given dental checkup advice than children aged 2–5 years ( $P < 0.001$ ). Children of racial/ethnic minority groups (i.e., non-Hispanic blacks, Hispanics, and Asians) were more likely to be given dental checkup advice than non-Hispanic white children ( $P < 0.001$ ). Children with fair/poor health status were more likely to be given dental checkup advice than those with good or very good/excellent health status ( $P < 0.001$ ).

The enabling factors—USC provider, high family income, parents with some college education or above, public insurance coverage—all increased the likelihood of receiving advice for a dental checkup ( $P < 0.001$ ). Uninsured children were less likely to be given the advice ( $P < 0.001$ ).

For having a dental visit, no significant time effect was found. Children aged 6–11 and 12–17 years were more likely to have had a dental visit than children aged 2–5 years ( $P < 0.001$ ). Non-Hispanic black, Hispanic, and Asian American children were all less likely to have had a dental visit than non-Hispanic white children ( $P < 0.001$ ). Children with a USC provider, from families with higher income levels (middle- and high-income levels), with parents with some college education or above, were more likely to have had a dental visit compared to their counterparts. Children with private health insurance but no dental coverage (AOR = 0.82, 95% CI: 0.77–0.87) and uninsured children (AOR = 0.38, 95% CI: 0.34–0.43) were less likely to have had a dental visit. Finally, children being given the dental checkup advice were more likely to have a dental visit than those not being given the advice (AOR = 1.54, 95% CI: 1.48–1.60) (Table 2).

## Discussion

Poor oral health is an important public health issue and there is a need for medical and dental care providers to work together to enhance care. The present study showed that the proportion of children who got dental checkup advice from a PCP increased significantly over the period of 2001–2016, but no significant increase was observed for having a dental visit among those children who were given the advice. Racial/ethnic minority children were more likely to be given the dental checkup advice, but were less likely to have actually had a dental visit than non-Hispanic white children. To the best of our knowledge, this is the first study to assess the trend of PCPs giving dental checkup advice for dental services for children in the United States in the past decade.

From 2001 to 2016, steady increases occurred in the proportion of children being given dental checkup advice across multiple age and racial/ethnic groups. That is, more PCPs were advising their child patients to receive dental services; still, more is needed to promote dental care for children within primary medical care settings. Our study results showed that about half of children did not get dental checkup advice from their PCPs every year in the study period. For instance, about 50% of all children (40% of the 2–5 year age group) were not given the advice in 2016. Several factors may account for these findings, including a lack of cross-training for PCPs on dental caries assessment, thereby impeding the ability to conduct risk assessment and making referrals.<sup>16</sup> It is also possible that PCPs may be unable to arrange a dental appointment for their patients in some communities due to a shortage of dentists and/or due to low Medicaid reimbursement.<sup>20</sup>

Despite the significant increase in recommendations for dental checkups in the past decade, there has not been a concurrent increase in children actually getting this recommended dental checkup. Access to dental services among children being given the dental checkup advice has remained stagnant. Among those who got the dental checkup advice, about 40% consistently did not have a dental visit during 2001–2016; among those who did not get the dental checkup advice, about 50% did not have a dental visit. Previous research has shown that patient level factors, such as limited knowledge of oral health or low health literacy in caregivers was associated with children having worse oral health status and bad oral health behaviors.<sup>21,22</sup>

The study results showed that younger children (2–5 year age group) were more likely to be given dental care advice but were less likely to have a dental visit than older children (6–17 year age group). It is possible that older children, being more likely to have had a dental visit than younger children, did not need a recommendation from their PCPs for a dental checkup. Nevertheless, many dentists are uncomfortable treating children under age 3 and this may be a barrier.<sup>23</sup> Our results also showed that dental checkup advice increased the odds of having a dental visit by 52% compared to those children without receipt of the advice. The American Academy of Pediatric Dentistry, the American Dental Association, and the American Association of Public Health Dentistry all recommend a dental visit for children by 1 year of age.<sup>24</sup> Young children are more likely to visit a medical office than a dental office. Thus, pediatric PCPs play an important role in increasing children's use of dental services and promoting oral health.<sup>17</sup> Our study suggests that PCPs may be missing opportunities to offer dental care guidance, caries risk screening, and preventive treatment.<sup>16</sup>

The present study results showed that racial/ethnic minority children were more likely to be advised for a dental checkup than non-Hispanic white children, but they were less likely to have had a dental visit. It is likely that racial/ethnic minority children may have greater oral health needs (e.g., more dental problems) than non-Hispanic white children, which prompted PCPs to recommend a dental checkup; yet the odds of them having had a dental visit after being recommended are smaller than non-Hispanic white children. Prior research has found that dental caries is more concentrated among children in low-income families and racial/ethnic minorities.<sup>1,2</sup> This gap demands continuous efforts to address this disparity in dental care for minority children and children from low-income families.



Finally, the results of predisposing and enabling variables are consistent with findings in previous studies.<sup>13,14</sup> Our study found that dental insurance coverage contributed to having a dental visit. For instance, children with private health insurance only (i.e., no dental benefits coverage), and children without insurance (i.e., neither health insurance nor dental insurance) were less likely to have a dental visit than those with private insurance plus dental coverage. Cost is a proven barrier to dental care for many children in low-income families. Dental insurance coverage can mitigate this barrier and help children get appropriate care.<sup>25</sup>

Although not statistically significant, the odds of having a dental visit with public insurance (i.e., Medicaid/CHIP) was smaller (AOR = 0.93,  $P = 0.15$ ) compared with private health insurance plus dental coverage. Low Medicaid reimbursement has discouraged dentists from accepting Medicaid beneficiaries.<sup>26,27</sup> Children with public insurances have lower rates of dental care utilization than their privately insured peers.<sup>28</sup>

In the past decade, children's dental insurance coverage has increased significantly from 78.3% in 2001 to 87.8% in 2013 while the proportion of children with private dental insurance decreased from 57.8% to 49.8% during the period. Therefore, the main contributor to the increased coverage was from the Medicaid/CHIP programs, increasing from 20.5% to 38.0%.<sup>29</sup> This may explain the nonsignificant increase in having a dental visit discussed above. Expanding Medicaid coverage and increasing Medicaid reimbursement<sup>20</sup> would likely enhance dental care utilization since children with public insurance were more likely to have a dental visit than those uninsured (AOR = 2.1,  $P < 0.001$ ) (data not shown in table). These findings highlight the linkages between dental insurance coverage, reimbursement rate, and dental care utilization.

Limitations should be noted for this study. First, data were self-reported, thus subject to reporting bias. Second, children's actual oral health status is not available to be included to assess the necessity of dental checkup advice. Third, we could not account for contextual factors like dentist density per capita in the community or the impact of local or state policy initiatives on children's oral health care. Fourth, the data do not allow us to determine whether a dental visit followed or preceded the advice received to get the dental checkup. We estimated the rate of having a dental visit assuming all dental visits occurred after the dental checkup advice. That is, the rate of having a dental visit after the dental checkup advice could be even lower. Nonetheless, the study results indicated dental checkup advice played an important role in having a dental visit. Fifth, we did not account for physician's attitude on referral to dentists. A physician may not provide a dental checkup advice if they believe that parents would not follow their advice to take their children to see a dentist.<sup>30</sup>

This study has three public health implications: (a) gap continues to exist between receiving dental checkup advice from a PCP and having a dental visit; (b) community-based intervention studies can be designed to evaluate different ways to narrow this gap—including the effective use of modern public health initiatives such as an effective electronic health record (EHR), tele-dentistry, patient navigators. Many successful programs of collaboration exist between medicine and dentistry, such as Into the Mouths of Babies (IMB) statewide program in North Carolina where medical providers are reimbursed by Medicaid for delivering preventive oral health services to children; Grace Health in Michigan where

dental hygienists are embedded in the obstetricsgynecology clinic to provide oral screening, prophylaxis, and education to pregnant women; HealthPartners in Wisconsin where medical care providers refer patients with diabetes to dentists and waive copays for periodontal care; and the InterCommunity Health Network Coordinated Care Organization in Oregon where dedicated patient coordinators, technology, and coordinated payment and referral mechanisms are employed to facilitate care.<sup>5</sup> Nonetheless, practice-based research is needed to identify the barriers to integration between medicine and dentistry. (c) Policies and programs to support these interventions are likely needed to promote oral health for all children.

## Conclusions

The 2001–2016 MEPS data showed that there was an increase in the proportion of children that were given dental checkup advice by PCPs, but no significant increase in having a dental visit among children who were given the dental checkup advice. Racial/ethnic disparities in access to dental care persisted over time. Policies and initiatives such as expanding dental insurance coverage for children, increasing Medicaid reimbursement, and use of compatible medical-dental EHR would likely enhance progress. More research is needed to better understand how a PCP's advice on dental care can effectively motivate and facilitate dental care for children.

## Acknowledgments

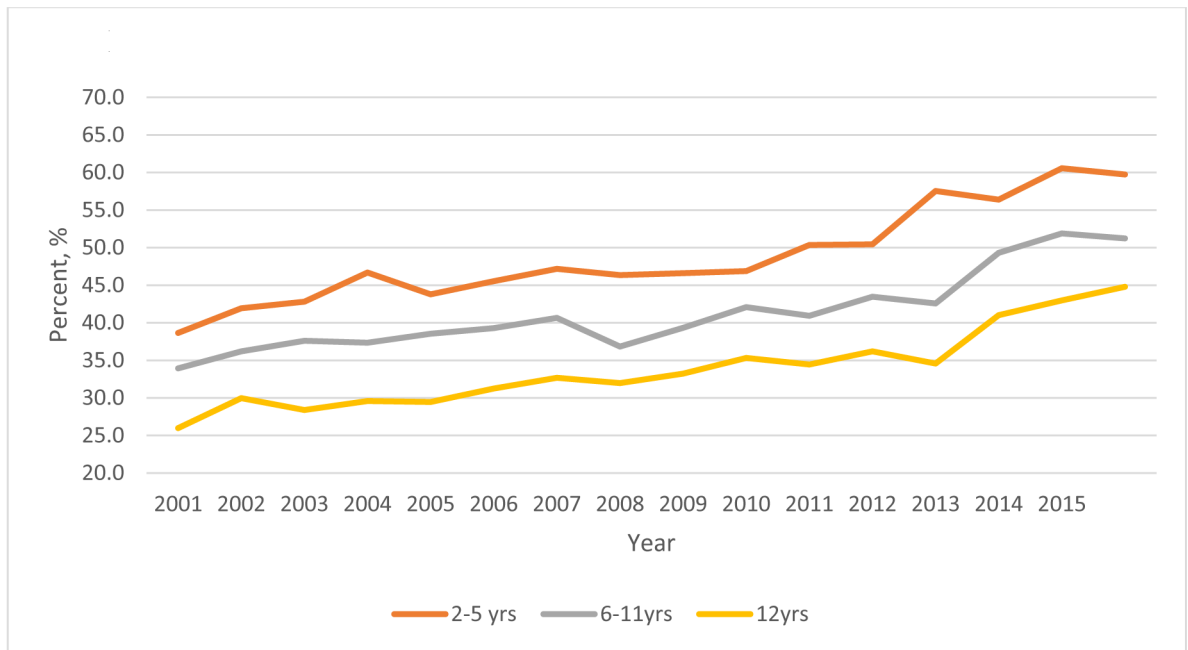
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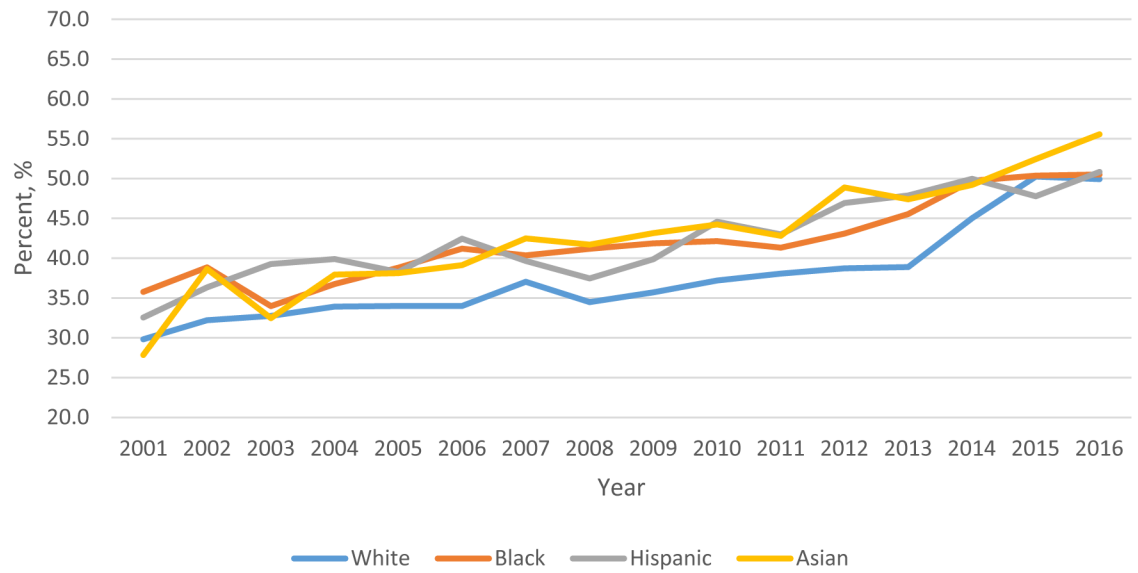
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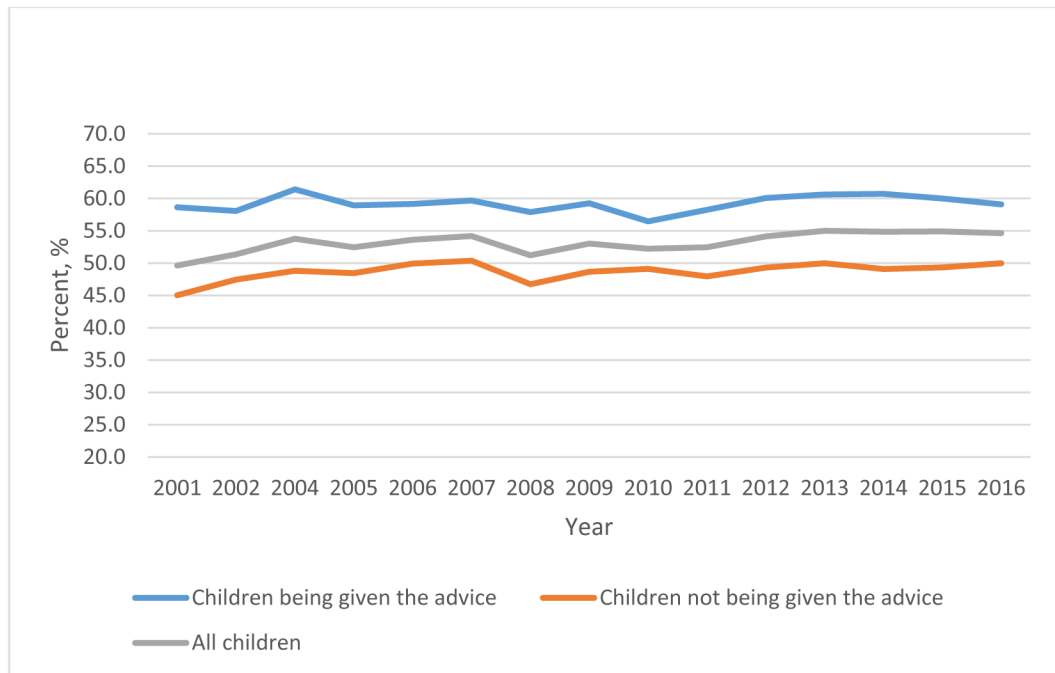
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**Fig 1.** Trend of being given the dental checkup advice, by age groups. [Color figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]



**Fig 2.** Trend of being given the dental checkup advice, by race/ethnicity. [Color figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]



**Fig 3.** Trend of having a dental visit, by whether or not being given the dental checkup advice. [Color figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

**Table 1**

Sample characteristics by being given the dental checkup advice and having a dental visit (N = 126,773)

Characteristics	Being offered the dental checkup advice			Having a dental visit		
	Yes	No	P <sup>+</sup>	Yes	No	P <sup>+</sup>
Age groups			<0.001			<0.001
2-5 yrs	49.9	50.1		48.4	51.6	
6-11 yrs	41.9	58.1		62.8	37.2	
12 + yrs	33.7	66.3		62.9	37.1	
Female	40.6	59.4	0.886	59.5	40.5	0.014
Race/ethnicity			<0.001			<0.001
NH white	39.2	60.8		64.5	35.5	
NH Black	42.0	58.0		48.6	51.4	
Hispanic	42.5	57.5		51.7	48.3	
NH Asians	44.3	55.7		58.6	41.4	
Others	40.4	59.6		57.8	42.2	
Having usual source of care	42.4	57.6	<0.001	59.6	40.4	<0.001
Income category (% of poverty level)			<0.001			<0.001
Poor	42.0	58.0		48.1	51.9	
Near poor	38.5	61.5		46.9	53.1	
Low income	38.4	61.6		51.7	48.3	
Middle income	37.7	62.3		59.6	40.4	
High income	44.6	55.4		70.2	29.8	
Parents' educational level			<0.001			<0.001
less than high school	37.2	62.8		47.1	52.9	
High school	36.6	63.4		52.6	47.4	
Some college or above	43.5	56.5		64.3	35.7	
Insurance type			<0.001			<0.001
Private with dental	41.0	59.0		65.6	34.4	
Private without dental	39.2	60.8		61.4	38.6	
Public	43.4	56.6		50.6	49.4	
Uninsured	26.1	73.9		40.0	60.0	
Health status			0.004			<0.001
Excellent/very good	40.5	59.5		60.0	40.0	
Good	40.6	59.4		53.4	46.6	
Poor/fair	45.8	54.2		51.0	49.0	
Region			<0.001			<0.001
Northeast	50.3	49.7		60.7	39.3	
Midwest	36.9	63.1		62.5	37.5	
South	39.7	60.3		55.2	44.8	
West	38.5	61.5		59.3	40.7	
Overall	40.6			53.1		

<sup>+</sup>According to Chi-square test

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**Table 2**

Factors associated with being given the dental checkup advice and having a dental visit (N=126,773)

Variables	DV=Being offered dental checkup advice				DV=Having a dental visit			
	AOR	95% CI	P		AOR	95% CI	P	
Time	1.05	1.04	1.05	<.001	1.00	1.00	1.01	0.131
Age groups (vs. 2-5 yrs)								
6-11 yrs	0.73	0.70	0.77	<.001	2.47	2.36	2.59	<.001
12 + yrs	0.53	0.50	0.56	<.001	2.41	2.29	2.54	<.001
Female	1.00	0.96	1.03	0.803	1.10	1.06	1.14	<.001
Race/ethnicity (vs. NH white)								
NH Black	1.17	1.10	1.25	<.001	0.65	0.61	0.69	<.001
Hispanic	1.27	1.19	1.35	<.001	0.81	0.76	0.87	<.001
NH Asians	1.21	1.10	1.33	<.001	0.68	0.61	0.75	<.001
Others	0.97	0.86	1.09	0.589	0.84	0.74	0.94	0.003
Usual Source of Care (USC)	2.09	1.94	2.25	<.001	1.82	1.69	1.97	<.001
Income (% of poverty level) (vs. Poor)								
Near poor	0.90	0.84	0.98	0.013	0.98	0.89	1.07	0.597
Low income	0.93	0.87	0.99	0.034	1.04	0.97	1.11	0.313
Middle income	0.93	0.87	1.00	0.041	1.27	1.19	1.36	0.000
High income	1.20	1.11	1.29	<.001	1.92	1.77	2.09	0.000
Parents' education level (vs. less than high school)								
High school	1.01	0.95	1.08	0.666	1.13	1.06	1.20	<.001
Some college or above	1.28	1.20	1.37	<.001	1.57	1.46	1.68	<.001
Insurance type (vs. Private with dental)								
Private with no dental coverage	0.97	0.91	1.03	0.312	0.82	0.77	0.87	<.001
Public	1.15	1.08	1.24	<.001	0.90	0.84	0.96	0.002
Uninsured	0.72	0.65	0.80	<.001	0.38	0.34	0.43	<.001
Health status (vs. Excellent/very good)								
Good	1.07	1.01	1.13	0.014	0.89	0.85	0.94	<.001
Poor/fair	1.28	1.15	1.42	0.000	0.84	0.75	0.94	0.002
Region (vs. Northeast)								
Midwest	0.59	0.54	0.65	<.001	1.13	1.02	1.25	0.020
South	0.67	0.61	0.73	<.001	0.91	0.82	1.00	0.043
West	0.62	0.56	0.69	<.001	1.06	0.95	1.18	0.282
Being offered dental checkup advice	NA				1.54	1.48	1.60	<.001

AOR=adjusted odds ratio