Published in final edited form as:

Am J Orthod Dentofacial Orthop. 2016 April ; 149(4): 516–522. doi:10.1016/j.ajodo.2015.09.025.

Racial Disparities in Orthodontic Service Utilization for Medicaid-Enrolled Children: An Evaluation of the Washington Medicaid Program

Jantraveus M. Merritt, DMD, MSD^a [Resident, Graduate Program in Orthodontics], Geoffrey Greenlee, DDS, MSD, MPH^b [Clinical Associate Professor], Anne Marie Bollen, DDS, MS, PhD^c [Professor], JoAnna M. Scott, PhD^d [Acting Assistant Professor], and Donald L. Chi, DDS, PhD^e [Associate Professor]

^a University of Washington School of Dentistry, Department of Orthodontics, Box 357446, Seattle, Washington 98195, USA, tramerritt@gmail.com

^b University of Washington School of Dentistry, Department of Orthodontics, Box 357446, Seattle, Washington 98195, USA, geoffg@uw.edu

^c University of Washington School of Dentistry, Department of Orthodontics, Box 357446, Seattle, Washington 98195, USA, mine@uw.edu

^d University of Washington School of Dentistry, Department of Pediatric Dentistry, Box 354915, Seattle, Washington 98115, USA, elorra@uw.edu

^e University of Washington School of Dentistry, Department of Oral Health Sciences, Box 357475, Seattle, Washington 98195, USA

Abstract

Introduction—We assess the relationship between race and orthodontic service utilization for Medicaid-enrolled children.

Methods—This cross-sectional study focused on 570,364 Washington Medicaid-enrolled children ages 6–19 years. The main predictor variable was self-reported race (White versus non-White). The outcome variable was orthodontic service utilization, defined as children who were pre-authorized for orthodontic treatment by Medicaid in 2012 and subsequently received orthodontic records and initiated treatment. Logistic regression models were used to test the hypothesis that non-Whites would be less likely to utilize orthodontic care than Whites.

Results—A total of 8,223 children were approved by Medicaid for orthodontic treatment and 7,313 received records and initiated treatment. Non-Whites were significantly more likely to

Corresponding Author: Donald L. Chi, DDS, PhD, University of Washington, School of Dentistry, Box 357475, Seattle, Washington 98195, USA, Phone: 206-616-4332, Fax: 206-685-4258, dchi@uw.edu.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ETHICS APPROVAL

The study was approved by Washington State Institutional Review Board.

utilize orthodontic care than Whites (Odds Ratio [OR]=1.18; 95% confidence interval [CI]=1.02, 1.36; $p=.031$). Hispanic non-White children were more likely to utilize orthodontic care than non-Hispanic White children (OR=1.42; 95% CI=1.18, 1.70; $p<.001$).

Conclusion—In 2012, non-White children in Washington Medicaid were significantly more likely to utilize orthodontic care than White children. The Washington Medicaid program demonstrates a potential model for addressing racial disparities in orthodontic service utilization. Future research should identify mechanisms underlying these findings and continue to monitor orthodontic service utilization for minority children in Medicaid.

INTRODUCTION AND LITERATURE REVIEW

Racial and ethnic minorities comprise a significant portion of the U.S. population. According to the Centers for Disease Control and Prevention, minorities are defined as Hispanic or Latinos, Black or African Americans, Asian Americans, American Indians and Alaska Natives, and Native Hawaiian or Pacific Islanders.¹ Based on 2011 U.S. Census Bureau data, 36.6% of the U.S. population is of minority descent, including 16.7% of whom are Hispanic or Latino, 13.1% are Black or African American, 5% are Asian, 1.2% are American Indian or Alaska Native, and <1% are Native Hawaiian or Pacific Islander.² As the proportion of minorities in the U.S. continues to grow,³ it is critical to understand and address racial and ethnic oral health disparities, which is an important step toward achieving health equity and social justice.⁴

Minority children experience oral health disparities. Based on data from the 2007 National Survey of Children's Health (NSCH), 15% of non-Hispanic White children did not have an annual preventive dental visit whereas 24% of Hispanic children and 18% of Black children did not have a visit.⁵ Based on the same data, 8.8% of White children were rated by their parent as having fair or poor oral health, but 20.4% of Hispanic children and 10% of Black children had fair or poor oral health.⁵ In another study focusing on privately insured children in Milwaukee, Wisconsin, Black and Hispanic children received significantly fewer preventive dental procedures than White children.⁶ After adjusting for household income, Black children were less likely to receive most dental procedures compared to Whites.⁶ These findings parallel studies focusing on Medicaid populations. In Iowa, African American children in Medicaid were significantly less likely to have a dental check-up than White children.⁷

Minorities are also more likely to have malocclusion and orthodontic treatment needs. A study from 1998 examined class II and class III malocclusions using National Health and Nutrition Examination Survey (NHANES) III data for 7,000 children.⁸ Class II malocclusion was defined as an overjet >2mm. Whites, Blacks and Mexican Americans had a varying prevalence of class II malocclusion (57.6%, 64.4%, and 66.4%, respectively).⁸ Class III malocclusion was defined as an overjet 0mm. The prevalence of class III malocclusion among Whites, Blacks, and Mexican Americans was 4.9%, 8.1%, and 8.3% respectively.⁸ These data indicate class II and class III malocclusions are more prevalent in Blacks and Mexican Americans. The Index of Orthodontic Treatment Need (IOTN) was used to evaluate need and minorities were more likely to have orthodontic treatment needs.

Despite data indicating great orthodontic treatment needs for minorities, there are relatively few studies on minority orthodontic service use. Over 30% of White teenagers reported receiving orthodontic treatment – three times the rate for Mexican American and four times the rate for Black teenagers.⁸ In another study based on Medical Expenditure Panel Survey (MEPS) data, Whites accounted for 59.9% of population, yet disproportionately accounted for 77.1% of individuals who received orthodontic treatment. After adjusting for income, Blacks and Hispanics were less likely to have received orthodontic treatment compared to Whites.⁹ Using survey data from over 2,800 U.S. high school sophomores in Ohio, a 2004 study reported that orthodontic utilization for Whites, Mexican Americans, and African Americans was 31%, 11%, and 8%, respectively.¹⁰ Orthodontic use in schools located in suburban, affluent areas utilization was over 50% and less than 10% in inner city high schools, which consist disproportionately of lower-income, minority students.¹⁰

The federal Early and Periodic Screening, Diagnosis, and Treatment (EPSDT) program mandates orthodontic care to correct handicapping malocclusion for all Medicaid-enrollees through age 21 years.¹¹ Based on previous findings,^{9,10} it is unlikely that requirements of the federal EPSDT program are being met by state Medicaid programs for minorities, but studies to date have not examined orthodontic care utilization for minorities in Medicaid. To address this knowledge gap, we hypothesized that among Medicaid-enrolled children in Washington, non-Whites would be less likely to utilize orthodontic services than Whites. We also hypothesized factors like ethnicity would modify the relationship between race and orthodontic utilization. This study is the first step in assessing the extent to which racial disparities in orthodontic care exist within Medicaid programs.

MATERIALS AND METHODS

Study Location

There are 1.6 million children ages 0-17 years in Washington state and 39% are non-White.¹² In comparison, 59% of Medicaid-enrolled children in Washington are non-White.¹² The Handicapping Labiolingual Deviation Index (HLD) is used by Washington Medicaid as a orthodontic treatment screening tool.¹³ The HLD provides diagnostic information about anterior overjet, overbite, ectopic eruption, crowding, buccal overjet, and labiolingual spread. Once a potential candidate is identified by an orthodontic care provider, an application with HLD data is submitted to the state approval committee. If a child is pre-authorized for care, orthodontic records are obtained and treatment is initiated. The orthodontic provider submits claims at the appropriate intervals to get reimbursed by Medicaid for treatment. In January 2012, Washington Medicaid reimbursement rates for orthodontic care were as follows: \$276.75 for records, \$1,836.18 for treatment initiation, and \$308.46 for each additional three months of active treatment.¹⁴

Data Source

Medicaid enrollment and claims data were obtained from the Washington State Department of Social and Health Services (DSHS) Research and Data Analysis Division's Integrated Client Database. The enrollment files included demographic information (e.g., child's date of birth, race, ethnicity, gender) and the specific months during 2012 in which the child was

enrolled in Medicaid. The claims data included information on dental care received by the child identified using the American Dental Association's Current Dental Terminology (CDT) codes. A unique identifier was used to link the enrollment and claims files. The study was approved by Washington State Institutional Review Board.

Study Population

This study focused on children ages 6-19 years enrolled for at least one month in the Washington Medicaid program anytime between January 1, 2012 and December 31, 2012 (N=570,364). This age range takes into consideration the ages at which orthodontic services are typically provided to children.¹⁴

Study Variables

Predictor Variable—The main predictor was child's race, as reported by the child's primary caregiver. Children were classified as White or non-White (Black, Asian, American Indian, Alaskan Native, Hawaiian, Pacific Islander, other, missing).

Outcome Variable—The outcome variable was orthodontic service utilization (no/yes). This was defined through CDT code D8660, which indicates a claim submitted by a provider for orthodontic records between January 2012 and September 30, 2012. This 9-month window served as the baseline period and the latter date of this range was selected to allow children up to three months to initiate treatment after obtaining records. CDT codes of D8010-D8080 represented initiation of orthodontic treatment.¹⁵ Children with a code of D8660 followed by a code D8010-D8080 were classified as having utilized orthodontic services and remaining children were classified as not having utilized orthodontic services.

Other Variables—There were four additional study variables: gender (female/male), age (6-11 years or 12-19 years) calculated as of December 31, 2012, Hispanic ethnicity (caregiver reported as Hispanic or non-Hispanic), and preventive dental care use in 2012 (no/yes). Children with any of the following CDT codes were classified as having utilized preventive dental care in 2012: D1110-1120 (dental prophylaxis), D1206 or 1208 (topical fluoride treatment), D1330 (oral hygiene instructions), or D1351 (sealant application). Each variable was conceptualized as potential effect modifiers of race and were not part of the main effects model.

Statistical Analyses

Descriptive statistics were calculated for study variables and logistic regression models were used to estimate odds ratios and corresponding 95% confidence intervals ($\alpha=0.05$). To identify effect modifiers, we included interaction terms in separate regression models between race and the following variables: ethnicity, age, and preventive dental care use. Data were analyzed using Stata 13 for Windows.

RESULTS

Descriptive Statistics

A total of 899,088 enrollees ages 0-21 years were enrolled in the Washington Medicaid Program for 1 month in 2012 (Figure 1). After excluding children under age 6 years and those older than age 19 years, 570,364 children were part of the study population, with a mean age of 12.7 years (standard deviation=4.1). Of children in the study, 46.4% were ages 6-11 years and the remaining 53.6% were ages 12-19 years (Table 1). About 50% of children were female, 48% were White, 24.1% were of Hispanic ethnicity, and 53% utilized preventive dental care in 2012.

Orthodontic Service Utilization

Of the 570,364 children in the study, 1.4% (n=8,223) were authorized for orthodontic treatment and received records, and 1.3% (n=7,313) initiated orthodontic treatment in 2012. Among children who utilized orthodontic care, 38.9% were White and 52.4% were non-White (Table 2). Of the 910 children who obtained records but did not initiate orthodontic treatment, 40.2% were White and 46.0% were non-White.

Logistic Regression Models

Non-White children had a significantly greater odds of utilizing orthodontic care than White children (Odds Ratio [OR]=1.18; 95% confidence interval [CI]=1.02, 1.36; p=.03) (Table 3). Ethnicity moderated the relationship between race and orthodontic care utilization (p=0.04). Hispanic non-White children were significantly more likely than non-Hispanic White children to utilize orthodontic care (OR=1.42; 95% CI=1.18, 1.70; p<.001). Compared to non-Hispanic White children, there were no significant differences in orthodontic use for non-Hispanic non-White (OR=0.92; 95% CI 0.75, 1.14; p=.45) and Hispanic White children (OR=0.95; 95% CI 0.65, 1.41; p=.82). Child's age and history of regular dental care did not modify the association between race and orthodontic service use.

DISCUSSION

Contrary to our hypothesis, we found that Medicaid-enrolled non-White children were significantly more likely to utilize orthodontic services than White children. Ethnicity modified the effect of race on orthodontic service use, whereby Hispanic non-White children were significantly more likely to use orthodontic care than non-Hispanic White children. These findings suggest that minority children enrolled in the Washington Medicaid program did not exhibit disparities in orthodontic dental service use in 2012 and received orthodontic care consistent with greater levels of need as previously documented for minority children.⁸

Our main finding that non-White children were more likely to use orthodontic services than White children is inconsistent with previous findings in which minorities were significantly less likely to use orthodontic care despite greater levels of need.^{8,10} This suggests that, for the given study period, there were no measurable racial disparities in orthodontic service use for Medicaid-enrolled children in Washington, which should be the goal of programs like Medicaid. A possible supply-side explanation is the Medicaid reimbursement rates for

orthodontic treatment in Washington, which have improved since 2006¹⁶ and are comparable to private dental insurance reimbursement rates. Data comparing 2009 Medicaid reimbursement rates from 30 states indicated that Washington reimbursed up to \$4,370 for orthodontic care, placing the state in the top 5% for reimbursement (Unpublished results, A.M. Bollen). Insufficient reimbursements rates are one of the reasons orthodontists do not treat Medicaid enrollees.^{17,18} Higher reimbursement may have increased dental provider motivation to care for children in Medicaid. This finding underscores the importance of establishing and maintaining Medicaid reimbursement rates consistent with market rates, which is a possible way to reduce disparities for minority children in Medicaid. However, reimbursement rates alone are insufficient in explaining increased patient demand for care, particularly in terms of the mechanism by which minorities in Medicaid utilize orthodontic care. Future work should survey orthodontic providers who treat minority children in Medicaid to identify facilitators to participation in Medicaid beyond higher reimbursement rates. Furthermore, there is a need to identify demand-side mechanisms that have helped minority Medicaid-enrolled children in Washington access orthodontic services, which is critical information in preserving these trends in Washington and disseminating effective strategies to Medicaid programs in other states.

We also found that ethnicity modified the relationship between race and orthodontic use for children in Medicaid whereas child's age and preventive dental care use did not. Because this is the first study to examine modifiers of race, there are no studies to which we can compare our findings. However, these findings suggest differential use of orthodontic care based on race and ethnicity, which underscores the importance of examining interaction terms to identify subgroups of children who may exhibit different patterns of dental care use as done in previous work.¹⁹ Future research should continue to explore this finding by interviewing Hispanic White and non-White families whose Medicaid-enrolled children who have accessed orthodontic services to identify facilitators and barriers to care.

There appeared to be other clinically-relevant factors associated with orthodontic service use we identified through post-hoc analyses. For example, 85.2% of the children utilizing orthodontic care also utilized preventive dental care (compared to 53.0% of all children in the study), which reveals a potential mechanism by which children get referrals for orthodontic care. This is consistent with previous findings from the Iowa Medicaid program²⁰ and highlights the importance of ensuring that all children in Medicaid have access to primary dental care services, which can enable dentists to identify and refer children in need of orthodontic care. In addition, of the 514 providers in the study sample who were orthodontic care providers, we estimated that 42.4% were non-orthodontists. This suggests that non-orthodontists, likely general dentists and pediatric dentists, provide a substantial amount of orthodontic care to Medicaid-enrolled children. Pre-doctoral dental school curricula may need to include additional clinical experiences for students planning to practice as general dentists in areas of high orthodontic need.

The main study strength is that we operationalized orthodontic service utilization using a two-step CDT-based protocol consistent with the way in which orthodontic treatment is provided. However, there are four main limitations. First, we did not have information on treatment need or completion rates. Having these data would have allowed for a more

complete analysis of racial disparities in orthodontic use. Recent data indicate that Medicaid enrollees are not less likely to complete orthodontic care compared to non-Medicaid enrollees²¹, which does not preclude racial differences in completion rates within Medicaid. Second, our findings are generalizable to Medicaid-enrolled children in Washington. Based on differences across states in dental provider participation, reimbursement rates, and other factors, racial disparities in orthodontic service use may persist in other state Medicaid programs. Third, these findings are based on data from 2012. Longitudinal analyses are needed to examine trends in orthodontic use for Medicaid enrollees by race. Changes to the program, including Medicaid orthodontic reimbursement rate decreases expected in Washington in 2015, are likely to influence utilization of orthodontic services for children in Medicaid and may disproportionately affect minorities. Fourth, our non-White race category included children from a number of different racial subgroups, which we did not analyze as separate groupings because of sparse data. Future work examining racial disparities should examine potential heterogeneity in orthodontic care use within the non-White pediatric population.

CONCLUSIONS

Based on the study, we conclude the following:

- Non-White minority children in the Washington state Medicaid program were significantly more likely to utilize orthodontic dental care services than White children during calendar year 2012.
- State Medicaid policies have the potential to address racial disparities in dental care use and should seek to optimize the oral health of racial and ethnic minority enrollees within Medicaid.

ACKNOWLEDGEMENTS

We would like to thank the Washington State Department of Social Health Services for providing access to Medicaid data, the University of Washington Orthodontic Alumni Association, and the National Institute of Dental and Craniofacial Research Grant Number K08DE020856 (DLC).

REFERENCES

1. [2013 April 6] Racial and Ethnic Minority Populations Centers for Disease Control and Prevention. 2012. Available from: <http://www.cdc.gov/minorityhealth/populations/REMP/definitions.html>
2. [2013 April 6] United States Census Bureau State & County QuickFacts. Available from: <http://quickfacts.census.gov/qfd/states/00000.html>
3. Passel, JS.; Cohn, D.; Lopez, MH. [2015 June 6] Hispanics account for more than half of nation's growth in past decade.. Pew Hispanic Center. Available from: <http://pewhispanic.org/files/reports/140.pdf>
4. Treadwell HM, Northridge ME. Oral health is the measure of a just society. J Health Care Poor Underserved. 2007; 18(1):12–20. [PubMed: 17337792]
5. Fisher-Owens SA, Isong IA, Soobader MJ, Gansky SA, Weintraub JA, Platt LJ, et al. An examination of racial/ethnic disparities in children's oral health in the United States. J Public Health Dent. 2013; 73(2):166–74. [PubMed: 22970900]
6. Bhagavatula P, Xiang Q, Eichmiller F, Szabo A, Okunseri C. Racial/ethnic disparities in provision of dental procedures to children enrolled in Delta Dental insurance in Milwaukee, Wisconsin. J Public Health Dent. 2014; 74(1):50–6. [PubMed: 22970893]

7. Valencia A, Damiano P, Qian F, Warren J, Weber-Gasparoni K, Jones M. Racial and ethnic disparities in utilization of dental services among children in Iowa: the Latino experience. *Am J Public Health*. 2012; 102(12):2352–9. [PubMed: 22698039]
8. Proffit WR, Fields HW Jr, Moray LJ. Prevalence of malocclusion and orthodontic treatment need in the United States: estimates from the NHANES III survey. *Int J Adult Orthodon Orthognath Surg*. 1998; 13(2):97–106. [PubMed: 9743642]
9. Okunseri C, Pajewski NM, McGinley EL, Hoffmann RG. Racial/ethnic disparities in self-reported pediatric orthodontic visits in the United States. *J Public Health Dent*. 2007; 67(4):217–23. [PubMed: 18087992]
10. Nelson S, Armogan V, Abel Y, Broadbent BH, Hans M. Disparity in orthodontic utilization and treatment need among high school students. *J Public Health Dent*. 2004; 64(1):26–30. [PubMed: 15078058]
11. Wallace HM, Goldstein H, Oglesby AC. The health and medical care of children under Title 19 (Medicaid). *Am J Public Health*. 1974; 64(5):501–6. [PubMed: 4594293]
12. [2013 March 3] Washington State Department of Social & Health Services Client Counts and Service Costs. 2012. Available from: <http://clientdata.rda.dshs.wa.gov/>
13. [2013 June 6] Washington State Health Care Authority. Available from: http://www.hca.wa.gov/medicaid/forms/documents/13_666.pdf
14. [2014 December 16] Washington State Health Care Authority Rates Development Fee Schedules. Available from: <http://www.hca.wa.gov/medicaid/rbrvs/Pages/index.aspx>
15. [2015 June 6] Washington State Health Care Authority. Medicaid Provider Guide Orthodontic Services. Available from: http://www.hca.wa.gov/medicaid/billing/Documents/guides/orthodontics_services_bi_03_012013-04302014.pdf
16. El-Gheriani AA, Ehrmantrout ZP, Oesterle LJ, Berg R, Wilkerson DC. Medicaid expenditures for orthodontic services. *Am J Orthod Dentofacial Orthop*. 2007; 132(6):728, e1–8. [PubMed: 18068586]
17. Im JL, Phillips C, Lee J, Beane R. The North Carolina Medicaid program: participation and perceptions among practicing orthodontists. *Am J Orthod Dentofacial Orthop*. 2007; 132(2):144, e15–21. [PubMed: 17693361]
18. King GJ, Hall CV, Milgrom P, Grembowski DE. Early orthodontic treatment as a means to increase access for children enrolled in Medicaid in Washington state. *J Am Dent Assoc*. 2006; 137(1):86–94. [PubMed: 16457004]
19. Chi DL, Leroux B. County-level determinants of dental utilization for Medicaid-enrolled children with chronic conditions: how does place affect use? *Health Place*. 2012; 18(6):1422–9. [PubMed: 22981229]
20. McKernan SC, Kuthy RA, Momany ET, McQuistan MR, Hanley PF, Jones MP, Damiano PC. Geographic accessibility and utilization of orthodontic services among Medicaid children and adolescents. *J Public Health Dent*. 2013; 73(1):56–64. [PubMed: 23289856]
21. Dobbs ME, Manasse R, Kusnoto B, Costa Viana MG, Obrez A. A comparison of compliance in Medicaid versus non-Medicaid patients. *Spec Care Dentist*. Mar-Apr. 2015; 35(2):56–62. [PubMed: 25080966]

HIGHLIGHTS

We examine racial disparities in orthodontic use for children in Medicaid.

Non-whites were significantly more likely to use orthodontic services than whites.

State Medicaid programs can address racial disparities in pediatric orthodontic use.

Fig 1.
Study Population Flow Chart

Table I

Demographic characteristics of the study population of Medicaid-enrolled children ages 6 to 19 years in Washington

Demographic characteristic	Total sample (n = 570,364), n (%)
Sex	
Female	284,815 (49.9)
Male	285,541 (50.1)
Age (y)	
6-11	264,756 (46.4)
12-19	305,608 (53.6)
Race	
White	272,038 (47.7)
Black	33,526 (5.9)
Asian	17,862 (3.1)
American Indian	16,553 (2.9)
Alaskan Native	262 (0.1)
Hawaiian	1,500 (0.3)
Pacific Islander	11,638 (2.0)
Other	144,049 (25.2)
Missing	72,936 (12.8)
Ethnicity	
Hispanic	137,447 (24.1)
Non-Hispanic	340,167 (59.6)
Missing	92,750 (16.3)
Preventive dental care use in 2012	
Yes	302,171 (53.0)
No	268,193 (47.0)

Table II

Demographic characteristics of children by orthodontic treatment status in the Washington Medicaid program in 2012

Demographic characteristic	Children who obtained records and initiated orthodontic treatment	Children who obtained records but did not initiate orthodontic treatment	Children who obtained records, with or without orthodontic treatment initiation
	n = 7313	n = 910	n = 8223
	mean (SD) or n (%)	mean (SD) or n (%)	mean (SD) or n (%)
Age (y)	13.6 (2.6)	13.3 (3.0)	13.6 (2.7)
<12	1985 (27.1%)	319 (35.0%)	2304 (28.0%)
12	5328 (72.9%)	591 (65.0%)	5919 (72.0%)
Race			
White	2844 (38.9%)	366 (40.2%)	3210 (39.0%)
Black	365 (5.0%)	56 (6.2%)	421 (5.1%)
Asian	213 (2.9%)	30 (3.3%)	243 (3.0%)
American Indian	153 (2.1%)	25 (2.8%)	178 (2.2%)
Alaskan Native	6 (0.1%)	0 (0%)	6 (0.1%)
Hawaiian	7 (0.1%)	1 (0.1%)	8 (0.1%)
Pacific Islander	81 (1.1%)	19 (2.1%)	100 (1.2%)
Other	3009 (41.1%)	288 (31.6%)	3297 (40.1%)
Missing	635 (8.7%)	125 (13.7%)	760 (9.2%)
Ethnicity			
Hispanic	2791 (38.2%)	287 (31.5%)	3078 (37.4%)
Non-Hispanic	3640 (49.8%)	503 (55.3%)	4143 (50.4%)
Missing	882 (12.0%)	120 (13.2%)	1002 (12.2%)
Preventive dental care use in 2012			
Yes	6301 (86.2%)	775 (85.2%)	7076 (86.0%)
No	1012 (13.8%)	135 (14.8%)	1147 (14.0%)

Table III

Logistic regression models for associations between race and orthodontic service use and effect modification of variables of interest

	Beta coefficient	Odds ratio (95% CI)	P value
Race			
White	Reference	Reference	0.03
Nonwhite	0.163	1.18 (1.02, 1.36)	-
Interactions with race			
Interaction between race and age	0.173	1.19 (0.86, 1.63)	0.29
Interaction between race and ethnicity	0.474	1.61 (1.03, 2.51)	0.04
Interaction between race and preventive dental care use	-0.009	0.99 (0.65, 1.50)	0.97

Table IV

Effect modification of ethnicity on the association between race and orthodontic service use with logistic regression

Race by ethnic subgroups	Beta coefficient	Odds ratio (95% CI)	P value
Non-Hispanic white	Reference	Reference	
Hispanic nonwhite	0.347	1.42 (1.18, 1.70)	<0.001
Hispanic white	-0.046	0.95 (0.65,1.41)	0.82
Non-Hispanic nonwhite	-0.081	0.92 (0.75, 1.14)	0.45