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Provision of Fluoride Varnish Treatment by Medical and Dental Care Providers: Variation by Race/Ethnicity and Levels of Urban Influence

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Abstract

Background: In 2004, Wisconsin Medicaid policy changed to allow medical care providers to be reimbursed for fluoride varnish treatment (FVT) to children's teeth to improve access and utilization. To date, no study has been published on whether geographic and racial/ethnic variation in the provision of FVT in response to this policy change exists.

Objective: To examine the association of rates of FVT for children enrolled in Wisconsin Medicaid with race/ethnicity, Urban Influence Codes (UIC), and Dental Health Professional Shortage Area (DHPSA) designation based on county of residence.

Methods: A retrospective, pre-post design was used based on FVT claims for children in the Wisconsin Medicaid program from 2002 to 2006. Poisson Regression Models were used to evaluate the association of rates of FVT claims with race/ethnicity, UIC, and DHPSA designation.

Results: The rate of FVT claims varied by resident county-type according to UIC and DHPSA designation, age, and race/ethnicity. Post policy, the largest increases were observed for Native Americans residing in none DHPSA counties, enrollees living in rural counties and for Hispanics living in partial and entire DHPSA counties. African-Americans residing in partial DHPSA and metropolitan counties displayed the lowest rates of FVT claims.

Conclusions: Overall access and utilization of fluoride varnish treatment increased, but substantial racial/ethnic and geographic variation in the provision of FVT for children enrolled in Wisconsin Medicaid was observed. Future policies should incorporate measures that will specifically address the racial and geographic variations identified in this study.

Keywords: Fluoride varnish treatment, Children, Ethnic groups, Health services accessibility

Introduction

The dental Medicaid program has made considerable changes aimed at improving access to dental care, including increased reimbursement, broadened coverage, and reduced administrative

burden.¹⁻³ However, many Medicaid enrollees still suffer disproportionately from dental disease.⁴ To reduce oral health disparities and improve access to primary preventive dental care, many states now involve medical care providers as an additional source of primary preventive procedures and oral health risk assessment.^{5, 6} Fluoride varnish treatment (FVT) represents one such procedure advocated by the American Dental Association (ADA) for caries prevention for children as young as 6 months old.⁷ As of December 2008, 28 states have implemented policies whereby medical care providers can be reimbursed for fluoride varnish treatment to children's teeth.⁸ In a recent study by our group, it was shown that such a policy, implemented in 2004, has led to an appreciable increase in the rate of fluoride varnish treatment received by children enrolled in the Wisconsin Medicaid program.⁹ In particular, medical care providers were instrumental in the provision of fluoride varnish treatment for children under the age of 3, accounting for approximately three quarters of claims submitted after the policy change.⁹

However, an issue that was not addressed in this previous study was the relationship of race/ethnicity and geographic variation in the provision of fluoride varnish treatment following the involvement of medical care providers. This relationship is particularly important given that the shortage and geographic mal-distribution of dentists nationally has led many areas to be designated as Dental Health Professional Shortage Areas (DHPSAs).^{10,11} In 2008, the Health Resources and Services Administration (HRSA) identified 4,048 DHPSAs nationally with 48 million residents, implying that approximately 9,432 additional dental providers would be needed (assuming a population to practitioner ratio of 3,000:1) to meet the dental care needs of the population.^{12,13} From a policy and planning perspective, it is important to assess whether the involvement of medical care providers is more or less effective in areas suffering from differential shortages of dental professionals. Such investigations could illuminate geographic regions that may be less receptive to the involvement of medical care providers in the delivery of preventive oral health care, thus necessitating further alternative approaches.

Geographic variation in the provision of fluoride varnish treatment is also invariably tied to the issue of rural-urban disparities

in access to dental care. For example, Byck *et. al.*, in a study of Medicaid enrolled children in Illinois, documented lower dental service utilization rates in rural counties compared with metropolitan counties.¹⁴ Vargas *et. al.*, using data from the National Health and Nutrition Examination Survey, reported that rural children were more likely to lack dental insurance, report unmet dental needs, and to not have visited the dentist in the past year.¹⁵ The goal of the present study was to examine geographic and racial/ethnic variation in the provision of fluoride varnish treatment following the 2004 policy change that allowed medical care providers to be reimbursed for fluoride varnish treatment in Wisconsin. The policy change was statewide and included training sessions for physicians. The Department of Health Services (formerly Department of Health and Family Services), Division of Public Health led the training and recruited physicians through office contact. We sought to investigate such variation at the county-level both as a function of whether an enrollee lives in a county designated as a Dental Health Professional Shortage Area and according to its urban influence code (see methods). We also sought to examine whether there is a racial/ethnic component to this variability, i.e. whether the provision of fluoride varnish treatment across racial/ethnic groups differed by geographic location.

Methods

Data Source

We used Medicaid claims data from 2002 to 2006 from the Electronic Data Systems of Medicaid Evaluation and Decision Support (MEDS) database for the state of Wisconsin. This database, managed by the Division of Health Care Financing in the Wisconsin Department of Health and Family Services, contains all Medicaid claims for the state of Wisconsin. The claims data consisted of fee for service (FFS) claims and managed care encounter information for those children receiving fluoride varnish treatment (procedure code D1203). We employed a retrospective pre-post design whereby fluoride varnish treatment claims were extracted two years prior to the policy change involving medical care providers, as well as for the three years following its initiation. Because an individual's enrollment status can

change within the course of a year, enrollment data was used to normalize the rate of claims for fluoride varnish treatment relative to the number of person-years of enrollment. The Medicaid enrolled population was defined as children between the ages of 1 to 6 years with at least one month of eligibility between January 1, 2002 and December 31, 2006. As an example, a child enrolled for an entire year contributes one person-year of enrollment for calculating the rate of fluoride varnish treatment.

Demographic Variables

Demographic variables obtained from the MEDS database included: the race/ethnicity and age of each Medicaid enrolled child. Race/ethnicity was self-designated under the following categories: White, African-American, Hispanic, Asian/Pacific Islander, Native American, Multiracial, and Unknown. In all analyses, unknown race/ethnicity was treated as a separate category (2,189 records, 6.7%), rather than as missing. Age groups were defined as: 1-<2 years, 2-<3 years, 3-<4 years, 4-<5 years, and 5-<6 years.

County-Level Information

County of residence at the time of the claim was used to define two county-level variables: DHPSA designation, and Urban Influence Code (UIC). DHPSA designation was developed by the federal government to address communities with high unmet dental needs and services.^{16,17} In this study, we used the classification followed in a recent oral health report by the Wisconsin Department of Health Services (formerly the Wisconsin Department of Health and Family Services).¹⁸ Under this classification scheme, a county is considered an entire DHPSA when it meets the criteria established by the Bureau of Health Professionals, which are "that the area should be a rational area for the delivery of dental services; the population to full-time dentist ratio should be less than 5,000:1 but greater than 4,000:1 and has unusually high needs for dental services or insufficient capacity of existing dental providers; or dental professionals in the contiguous area are over utilized, or excessively distant, or inaccessible to the population of the area under consideration."^{16,17} For the 72 counties in

Wisconsin, 29 were classified as none DHPSA, 9 as partial DHPSA, and 34 were designated as entire DHPSA.

The 2003 UIC, published by the United States Department of Agriculture, were used as a measure of the rurality of the county of residence for each enrollee.¹⁹ The UICs use population and commuting data from the 2000 Census to classify the 3,141 United States counties and county equivalents into 12 groups. For the purposes of this study, we only used the three major classification levels: metropolitan, micropolitan, and non-core/rural. Based on this classification, 25 counties were designated as metropolitan, 13 as micropolitan, and 34 as non-core/rural.

Analytic Methods

Descriptive statistics were computed to examine the distribution of study variables within the Wisconsin Medicaid population. The primary statistical analysis consisted of comparing the overall rate of claims for fluoride varnish treatment before and after the policy change in 2004. The rates were computed as the number of claims relative to the number of person-years of Medicaid enrollment within each study period. Poisson regression, allowing for over-dispersion, was used to compare fluoride varnish treatment rates pre-and post-policy. Stratified analyses were performed by DHPSA and UIC designation in comparing the rate of fluoride varnish treatment claims across racial/ethnic groups. All analyses were performed using SAS v9.1.3 (SAS Institute, Cary, NC). The study was approved by the Institutional Review Boards of Marquette University and the Medical College of Wisconsin.

Results

Characteristics of Wisconsin Medicaid Enrollees with FVT Claims Pre-Post Policy Period

Overall, 3,631 and 28,304 FVT claims were analyzed in the pre and post policy periods. Before the policy change, 4–6 year olds (0.86 per 100 person years) and African-Americans (1.22 per 100 person years) had the highest rates of fluoride varnish treatment claims

(Table 1). Residents of metropolitan counties and those designated as partial DHPSA accounted for 96.3% and 87.2% of fluoride varnish treatment claims respectively. Following the policy change, the overall rate of FVT claims increased almost four times. Rates of FVT claims were once again higher for children in the 4–6 year old group (3.11 per 100 person years), as well as for Native-Americans (7.09), residents of rural counties (3.64), and those living in partial DHPSA counties (2.87).

Table 1 Characteristics of Wisconsin Medicaid Enrollees with Fluoride Varnish Treatment (FVT) Claims: 2003-2006

Characteristics	Pre-policy period (2002-2003)			Post-policy period (2004-2006)		
	# FVT claims	Person-years of eligibility	Rate of FVT per 100 person-years	# FVT claims	Person-years of eligibility	Rate of FVT per 100 person-years
Age (years)						
1-3	557	266,565	0.21	9,053	446,060	2.03
4-6	3,074	355,980	0.86	19,251	618,587	3.11
Race/ethnicity						
White	874	294,120	0.30	12,062	503,451	2.40
African-American	1,789	146,355	1.22	4,112	222,935	1.84
Native American	39	12,534	0.31	1,613	22,762	7.09
Asian	62	20,722	0.30	869	35,868	2.42
Hispanic	583	84,550	0.69	7,315	164,908	4.44
Multiracial	42	11,948	0.35	497	24,508	2.03
Unknown	242	52,316	0.46	1,836	90,216	2.04
UIC						
Metropolitan	3,498	455,786	0.77	18,739	780,418	2.40
Micropolitan	41	65,222	0.06	4,026	120,352	3.35
Rural	18	84,172	0.02	5,198	142,676	3.64
DHPSA						
No shortage	375	185,828	0.20	7,947	340,494	2.33
Partial shortage	3,165	299,498	1.06	14,264	496,768	2.87
Entire shortage	17	119,954	0.01	5,752	206,181	2.97

UIC, urban influence codes; DHPSA, dental health professional shortage area.

Multivariable Poisson Regression for the Rate of FVT Claims at Baseline and Effect of the Policy Change

Prior to the policy change, Asians [Rate Ratio (RR):0.46; 95% CI 0.32, 0.65] and the unknown group [Rate Ratio (RR):0.63; 95% CI 0.51, 0.70] were the racial/ethnic group with a rate of FVT claims significantly lower from that of whites. However, after the policy change, Asians, Hispanics, and Native Americans all displayed rates that were approximately 2 fold higher than whites. Compared to metropolitan counties, residents of micropolitan counties had higher rates of FVT, while those in rural counties had lower rates of FVT in the pre-policy period. After the policy change, the rate of FVT claims was approximately 10-fold higher for residents of micropolitan and rural counties. While the adjusted rate of FVT claims for enrollees living in

entire DHPHA counties was the lowest pre-policy, residents of these counties actually displayed the highest adjusted rate following the policy change [RR: 10.65; 95% CI 5.49, 20.60] compared to none DHPHA.

Stratified Analysis of Rate Differences for FVT Claims

The figure show rate differences for FVT claims by age and race/ethnicity stratified by UIC and DHPHA designation. Rate differences are presented (as opposed to rate ratios) due to many covariate combinations with zero claims prior to the policy change. Further details for the stratified rates are presented in Appendices 1 and 2. The large change in FVT claims observed for Native Americans was largely driven by enrollees residing in none DHPHA counties. Hispanics and Native Americans (and to some extent Asians) exhibited the largest rate differences, seemingly regardless of the UIC classification for their county of residence. However, it should be noted that estimates for certain groups, such as 4 to 6 year old Asians living in metropolitan counties, correspond to a small number of person-years of enrollment (see appendices). Therefore these estimates should be interpreted with caution as they only represent a very small proportion of the enrolled population.

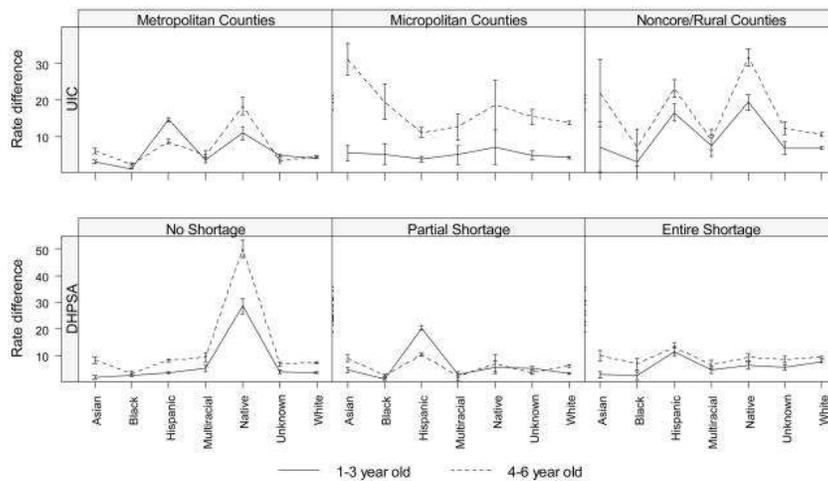


Figure: Rate Differences for FVT Claims for Wisconsin Medicaid Enrollees Stratified by Age, Race, and DHPHA Designation

Appendix 1 Rate of Fluoride Varnish Treatment (FVT) Claims for Wisconsin Medicaid Enrollees Stratified by Age, Race/Ethnicity, and Dental Health Professional Shortage Area (DHPSA)

Characteristic	Rate of FVT claims for 1- to 3-year-olds		Rate of FVT claims for 4- to 6-year-olds	
	Pre-policy period*†	Post-policy period	Pre-policy period*†	Post-policy period*†
Non-DHPSA				
White	0.17 (15,745)	3.51 (27,341)	0.91 (22,042)	8.09 (40,055)
African-American	0.11 (1,893)	2.58 (3,064)	1.53 (2,752)	4.67 (4,434)
Native American	0.00 (680)	28.55 (1,272)	0.11 (912)	50.21 (1,681)
Asian	0.11 (932)	1.92 (1,723)	0.54 (1,301)	8.56 (2,300)
Hispanic	0.07 (4,470)	3.4 (8,743)	0.96 (4,583)	8.93 (10,507)
Multiracial	0.14 (711)	5.16 (1,433)	1.44 (902)	10.54 (1,821)
Unknown	0.10 (1,978)	3.78 (3,735)	1.00 (2,690)	7.74 (4,767)
Partial DHPSA				
White	0.79 (10,979)	3.92 (17,559)	3.55 (14,423)	9.60 (24,893)
African-American	1.53 (17,230)	2.53 (25,713)	5.69 (24,663)	8.02 (38,281)
Native American	1.88 (320)	7.22 (776)	6.17 (518)	12.94 (842)
Asian	0.41 (1,457)	4.79 (2,526)	2.28 (1,977)	11.13 (5,487)
Hispanic	1.19 (8,217)	21.36 (13,790)	4.75 (8,892)	14.95 (18,079)
Multiracial	0.16 (643)	2.89 (1,317)	3.47 (779)	5.51 (1,562)
Unknown	0.72 (3,875)	5.87 (7,722)	2.82 (5,858)	6.02 (9,044)
Entire DHPSA				
White	0.02 (13,153)	7.51 (21,842)	0.06 (18,697)	9.21 (32,193)
African-American	0.00 (217)	2.20 (364)	0.00 (291)	6.72 (536)
Native American	0.00 (721)	6.06 (1,206)	0.00 (950)	9.14 (1,675)
Asian	0.00 (420)	2.55 (667)	0.17 (591)	9.94 (956)
Hispanic	0.00 (596)	11.35 (1,243)	0.30 (657)	13.07 (1,530)
Multiracial	0.00 (402)	4.27 (842)	0.00 (432)	6.56 (990)
Unknown	0.00 (1,026)	5.49 (1,750)	0.00 (1,532)	8.41 (2,414)

* Rate of claims per 100 person-years of enrollment.

† (. . .) Denotes number of person-years of enrollment.

Appendix 2 Rate of Fluoride Varnish Treatment (FVT) Claims for Wisconsin Medicaid Enrollees Stratified by Age, Race/Ethnicity, and Urban Influence Code

Characteristic	Rate of FVT claims for 1- to 3-year-olds		Rate of FVT claims for 4- to 6-year-olds	
	Pre-policy period*†	Post-policy period*†	Pre-policy period*†	Post-policy period*†
Metropolitan				
White	0.46 (24,150)	4.54 (40,283)	2.16 (32,064)	6.68 (57,182)
African-American	1.38 (19,139)	2.51 (28,767)	5.26 (27,378)	7.56 (42,716)
Native American	0.77 (781)	11.60 (1,569)	2.86 (1,118)	21.11 (1,942)
Asian	0.28 (2,514)	3.22 (4,354)	1.55 (3,425)	7.56 (5,980)
Hispanic	0.88 (11,516)	15.44 (20,110)	3.72 (12,317)	12.27 (25,686)
Multiracial	0.14 (1,418)	3.65 (2,957)	2.30 (1,698)	7.10 (3,535)
Unknown	0.5 (5,792)	5.13 (11,200)	2.25 (8,404)	5.46 (13,460)
Microropolitan				
White	0.01 (7,066)	4.22 (12,378)	0.28 (9,569)	13.92 (17,138)
African-American	0.00 (129)	5.02 (239)	0.00 (187)	19.47 (318)
Native American	0.00 (60)	6.95 (115)	0.00 (89)	18.52 (157)
Asian	0.00 (262)	5.35 (505)	0.00 (387)	31.12 (662)
Hispanic	0.00 (1,243)	3.72 (2,555)	0.87 (1,144)	11.88 (2,988)
Multiracial	0.00 (180)	4.89 (286)	0.44 (227)	12.98 (416)
Unknown	0.00 (503)	4.70 (1,065)	0.28 (721)	15.57 (1,284)
Rural				
White	0.05 (8,662)	6.83 (14,080)	0.05 (13,529)	10.48 (22,821)
African-American	0.00 (71)	2.96 (135)	2.85 (140)	9.69 (217)
Native American	0.00 (880)	19.26 (1,568)	0.09 (1,173)	31.77 (2,099)
Asian	0.00 (33)	7.02 (57)	0.00 (58)	21.93 (100)
Hispanic	0.00 (524)	16.48 (1,110)	0.00 (672)	23.08 (1,443)
Multiracial	0.00 (158)	7.46 (348)	0.00 (189)	9.00 (422)
Unknown	0.17 (584)	6.90 (942)	0.10 (955)	12.23 (1,480)

* Rate of claims per 100 person-years of enrollment.

† (. . .) Denotes number of person-years of enrollment.

Discussion

Fluoride varnish has been shown to be an effective way to minimize the development of dental caries and to remineralize carious lesions, as well as being safe and easy to apply.²⁰⁻²² It has been widely used for this purpose in Europe, Canada and other parts of the world for over 40 years.²⁰⁻²² This study highlights findings concerning the relationship between race/ethnicity, UIC, and DHPSA designation with the provision of FVT following a Medicaid policy change in Wisconsin. Prior to the policy change, residents of rural counties and those classified as entire DHPSA displayed the lowest rates of FVT claims; however, following the involvement of medical care providers, almost an exact opposite situation was observed. This result is promising given that the policy change had a larger impact in areas where access to preventive services was most likely the worst. At the same time, it shows that the policy was less effective in areas with the highest density of enrollees, i.e. metropolitan counties. Therefore, in order to have a larger impact on the Medicaid population as a whole, future policy may need to specifically target enrollees living in urban areas.

Amongst the racial/ethnic minority groups, Native-Americans exhibited the largest increase in the rate of FVT claims, particularly for those residing in none DHPSA. This finding is not surprising given that a designation as none DHPSA is based on having favorable conditions for access to dental care. Interestingly, while the policy change only addressed medical care providers and did not include increases in reimbursement, 88.4% of FVT claims for Native Americans residing in none DHPSA were submitted by dental providers. Because we did not have provider specific data, it is unclear why this increase for Native-Americans was particularly driven by dentists. Nonetheless, this result is promising given the higher levels of dental disease in Native-American populations.²³⁻²⁵ Hispanics residing in counties classified as partial or entire DHPSA also displayed high increases in the rate of FVT claims. In contrast to Native Americans, these rate increases were mostly driven by medical care providers (60.9% of FVT claims), indicating a more direct result of the policy change for this ethnic minority group.

In the multivariable and stratified analyses, African-Americans generally had the lowest rate of FVT claims, especially for younger children under the age of 3. While the rate of FVT claims for African-Americans were somewhat higher (relative to the other racial/ethnic groups) for those living in micropolitan counties, it is important to note that the vast majority of African-Americans enrolled in Medicaid reside in metropolitan counties (98.7% of person year of enrollment). Decreased utilization of FVT for African-Americans could be related to findings that African-Americans are less likely to have a usual source of care, thus making them more likely to make emergency department visits for dental conditions.^{26,27} Future policy changes should thus be tailored to specifically address the short coming of this particular policy by targeting African-American children, along with other Medicaid enrollees residing in urban areas.

There have been a number of reports indicating that residents of rural counties experience difficulty accessing and utilizing medical and dental care services,^{15, 28-30} due to fewer numbers of dental and medical providers and hospital settings¹⁵. In our study, the rate of FVT claims for rural residents not only increased substantially, but also surpassed that of enrollees living in metropolitan counties. This result is in line with Larson and colleague, who reported that residents of rural counties were more likely to report that they have a usual source of care, with fewer visits per year compared with metropolitan residents.³¹ While these results support the involvement of medical care providers in providing oral health services, it is important to recognize that increased utilization of FVT only represents a surrogate for reducing the dental disease burden. Therefore, further monitoring is required in order to validate the success of this policy in reducing the prevalence of dental caries.

Limitations

Our results should be interpreted within the context of a number of limitations. We examined only Wisconsin Medicaid enrollees; therefore it is possible that our findings cannot be generalized to other states. However, given that Wisconsin's Medicaid population consists of a racially/ethnically diverse population with both urban and rural poor, we believe our results should extend to other similar states. We

did not have access to detailed provider information beyond whether a claim was submitted by a medical or dental provider. Therefore, we were unable to investigate the role that other provider characteristics (practice size, location, etc.) may play in the provision of FVT. This also prevented us from adjusting the analyses for potential clustering within a specific provider, which has the potential to underestimate variances associated with the various estimated rates of FVT claims. In addition, we did not include Medical HPSA information in the study to allow for comparisons with DHPHA information. The pre-post study design suffers from a lack of comparison data from other states that did not allow medical care providers to bill for FVT, limiting our ability to explain the observed increase amongst dental providers. Finally, the procedure code extracted from the MEDS database (1203) could include any fluoride treatment in children. Therefore, it is possible that some children could have received fluoride gels in lieu of fluoride varnish, although our data does not permit any assessment of this statement. We believe that the inclusion of other types of fluoride treatment would likely have a minimal impact on our results, as most medical providers were unlikely to be set up to provide anything beyond fluoride varnish. In addition, dental providers are unlikely to use fluoride gels for children under the age of 3 or 4 years due to an inability to control young children from swallowing significant amounts of the gel.

Conclusions

This study demonstrates significant geographic and racial/ethnic variation in the provision of FVT after a policy change allowing medical care providers to be reimbursed for this procedure. Native American children and those living in less populated areas exhibited the largest increases in utilization, supporting the receipt of preventive oral health care for these populations in medical settings. Future policies should incorporate measures that will specifically address the racial and geographic variations identified in this study.

Table 2 Multivariable Poisson Regression for the Rate of Fluoride Varnish Treatment (FVT) Claims Before and After Policy Change

Characteristic	Regression estimates rate ratio (95% CI)	
	Pre-policy period	Effect of policy change
Race/Ethnicity		
White	Reference	Reference
Asian	0.46* (0.32, 0.65)	2.16* (1.50, 3.10)
African-American	1.07 (0.90, 1.20)	0.61* (0.53, 0.69)
Hispanic	0.98 (0.84, 1.10)	2.00* (1.71, 2.33)
Multiracial	1.04 (0.9, 1.57)	1.12 (0.72, 1.71)
Native American	0.97 (0.62, 1.49)	1.96* (1.26, 3.04)
Unknown	0.63* (0.51, 0.70)	1.37* (1.10, 1.68)
Age (years)		
1-2	0.07* (0.05, 0.09)	9.92* (7.40, 13.20)
2-3	0.38* (0.32, 0.43)	1.80* (1.53, 2.10)
3-4	0.82* (0.72, 0.90)	1.24* (1.09, 1.40)
4-5	0.99 (0.88, 1.10)	1.27* (1.11, 1.43)
5-6	Reference	Reference
DHPSA		
No shortage	Reference	Reference
Partial shortage	4.08* (3.03, 5.46)	0.43* (0.36, 0.50)
Entire shortage	0.25* (0.12, 0.50)	10.65* (5.49, 20.60)
Urban influence codes		
Metropolitan counties	Reference	Reference
Micropolitan counties	1.78* (1.10, 2.85)	10.10* (6.63, 15.30)
Non-core/rural counties	0.49* (0.24, 0.99)	9.40* (4.93, 17.00)

* Indicates significance at the 5% level.

CI, confidence interval; DHPSA, dental health professional shortage area.

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