



HHS Public Access

Author manuscript

J Rural Health. Author manuscript; available in PMC 2020 January 01.

Published in final edited form as:

J Rural Health. 2019 January ; 35(1): 3–11. doi:10.1111/jrh.12340.

Delivery of Preventive Oral Health Services by Rurality: A Cross-Sectional Analysis

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Abstract

Purpose: Integrating oral health care into primary care has been promoted as a strategy to increase delivery of preventive oral health services (POHS) to young children, particularly in rural areas where few dentists practice. Using a multistate sample of Medicaid claims, we examined a child's odds of receiving POHS in a medical office by county rurality.

Methods: We used 2012–2014 Medicaid Analytic eXtract claims data for 6,275,456 children younger than 6 years in 39 states that allowed Medicaid payment for POHS in medical offices. We used county-level characteristics from the Area Health Resources File, including a 3-level measure of county rurality. We used logistic regression to estimate a child's odds of receiving POHS in a medical office by county rurality, while controlling for other patient and county characteristics.

Findings: POHS in medical offices were received by 7.8% of children. Rates of POHS in medical offices were higher in metropolitan (metro) counties (8.4%) than non-metro adjacent to metro (5.8%) and non-metro not adjacent to metro (4.3%). In adjusted analysis, children living in non-metro not adjacent to metro (OR=0.79, 95% CI: 0.64–0.99) and adjacent to metro counties (OR=0.70, 95% C: 0.59–0.82) were significantly less likely to receive POHS in medical offices than children living in metro counties.

Conclusions: In this study of POHS in medical offices among young Medicaid-enrolled children, we found POHS rates were lowest in non-metro counties. Given barriers to dental care in rural areas, states should take additional steps beyond allowing Medicaid reimbursement to increase delivery of POHS in medical offices.

Keywords

access to dental care; child health; Medicaid; pediatrics; preventive oral health services

Integration of oral health care into primary care has been promoted as a strategy to increase delivery of preventive oral health services (POHS) to young children. POHS, which can include application of fluoride, screening, and oral health counseling/anticipatory guidance for parents, are intended to promote oral health and reduce dental caries, commonly called tooth decay.¹ In 2014, the US Preventive Services Task Force recommended that primary care clinicians apply fluoride varnish to the teeth of all children aged 5 years and younger.² This recommendation was intended to increase fluoride varnish applications, an evidenced-based strategy for preventing dental caries in young children.³ Dentists are the traditional provider of POHS, yet rates of dental visits are low for young children,⁴ and even lower for Medicaid-enrolled children who all have dental benefits.⁵ Primary care providers can be trained to apply fluoride varnish in medical offices⁶ with high levels of parental satisfaction.⁷ Integration of POHS into medical offices can help increase access to care because infants and toddlers are more likely to visit physicians than dentists,⁸ at least in part because of recommended well-child medical visits at 9, 12, 15, 18, and 23 months and 3, 4, and 5 years of age.⁹

The number of state Medicaid agencies supporting the delivery of POHS in medical offices has increased from 12 states in 2007 to all 50 states and the District of Columbia in 2018.^{10,11} Evidence from state Medicaid programs indicates that delivery of POHS in medical offices increases utilization^{12–15} and reduces dental caries¹⁶ and caries-related treatments^{17,18} in young children. Studies from North Carolina suggest children who received POHS in medical offices 4 or more times before 3 years of age had less tooth decay than children not receiving POHS.^{3,18} National studies have found that 4 years after enacting a Medicaid POHS policy, states have higher rates of oral health services provided by non-dentists, and children's oral health is better than that of children in states with policies implemented for shorter periods of time.^{10,19}

Delivery of POHS in medical offices may be particularly important in rural areas because of its potential to address barriers to rural children's dental care. These include having less access to dentists,²⁰ which is exacerbated because many general dentists are reluctant to treat young children.^{21,22} With few pediatric dentists practicing in rural areas,^{23,24} children in rural areas often have to travel far for a dental visit.^{25–27} An additional challenge to obtaining dental care for children living in rural areas, who are more likely to live in poverty and have public insurance compared to children living in urban areas,²⁸ is the reluctance of many dentists to accept Medicaid.^{29–32}

Unsurprisingly, rates of annual preventive dental visits for children 1 to 5 years of age are lower in large rural areas (48.3%) compared with small rural areas (52.9%) and urban areas (55.3%).⁴ There is a paucity of information regarding the impact of integrating POHS in medical offices in rural areas, despite the importance of understanding how such integration may increase receipt of POHS. To our knowledge, only a single state study has examined rates of POHS in medical offices by rurality. Using 2002–2006 data to examine how a 2004 Wisconsin Medicaid policy allowing medical care providers to be paid for fluoride varnish influenced rates of fluoride varnish applications among 1- to 6-year-old children enrolled in Wisconsin Medicaid,¹² authors found fluoride varnish applications were higher in rural

counties than micropolitan and metropolitan counties and higher in counties classified as a full dental health professional shortage area (HPSA) as compared with not a full dental HPSA. A more recent article described the successful implementation of a quality improvement project to start applying fluoride varnish in a single rural pediatric practice in Vermont.³³ We are unaware of any multistate studies examining the delivery of POHS in medical offices in rural areas.

To address this gap in the literature, we used a multistate sample of Medicaid claims for young children eligible to receive POHS in medical offices to examine receipt of POHS in medical offices and dental offices by county rurality. Additionally, we evaluated a child's odds of receiving POHS in a medical office by county rurality, while controlling for other patient and county characteristics.

Methods

Sample

To examine use of POHS in medical offices, we used 2012–2014 Medicaid Analytic eXtract (MAX) claims data. As of July 2018, MAX data were available for 45 states in 2012, 25 states in 2013, and 15 states in 2014. We used data from the most recent year available for each state in order to report the most current information; therefore, the study period was defined as the last calendar year of data available in each state. Our sample was limited to children younger than 6 years of age during the study period who ever received POHS in medical offices and a sample of children who never received POHS in medical offices, weighted to be representative of all children in each state in each year. We examined services received by children in the 39 states that provided Medicaid payment for POHS in medical offices during the study period (year of data used for each state is listed in Appendix Table 1, available online only). Additionally, we excluded children enrolled in Medicaid for less than 6 months in the 1-year study period for their state (n=1,076,686) and those for whom the data were missing county of residence or sex (n=99,582).

Variables

We identified children receiving POHS in medical offices using Current Procedural Terminology (CPT) and Current Dental Terminology (CDT) codes for preventive oral health services (listed in Appendix Table 2, available online only), which were primarily codes for application of fluoride and oral evaluation. Procedure codes used for POHS in medical offices in each state Medicaid program were obtained from the American Academy of Pediatrics¹¹ and when necessary supplemented with information from state Medicaid agency payment schedules. Although most state Medicaid agencies reimburse only fluoride varnish applications, several states also pay for oral evaluation and counseling, which is why we broadly refer to these services as POHS. Because some procedure codes are used by both dental and medical providers, we developed an algorithm to identify medical providers delivering POHS. To be identified as a medical provider delivering POHS, the provider had to have <10% of all their procedure codes for dental procedures (D0100-D9999) and <1% of all their procedure codes for dental treatment procedures (D0200-D9999). We then identified children receiving POHS in medical offices by first excluding claims with a type of service

code of dental (09) and then including claims with procedure codes for POHS that had either:

- Type of service code of physician (08) or nurse practitioner services (37), or
- A provider ID flagged as a medical provider delivering POHS based on our algorithm.

We identified POHS in dental offices during the 1-year study period based on presence of a claim with a POHS procedure code listed in Appendix Table 2 and not delivered by a medical provider, as defined using the aforementioned algorithm. Since POHS in medical offices are encouraged to be delivered during well-child medical visits, we also identified well-child visits using procedure codes for a new or established well-child visit (99381, 99382, 99383, 99391, 99392, 99393). The rate of well-child medical visits can be viewed as an upper bound for the percentage of children who could potentially receive POHS in medical offices.

Child characteristics, including enrollees' total months of Medicaid enrollment during the 1-year study period, age (0, 1, 2, 3, and 4–5 years), sex, race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, and other), as well as state and county of residence, were obtained from the MAX files. County-level characteristics were obtained from the Area Health Resource Files (AHRF) and merged to child-level claims using state, county, and year. County rurality was defined based on the 2013 Rural-Urban Continuum Codes (RUCC),³⁴ and also categorized as metropolitan (metro) (RUCC: 1–3), non-metro adjacent to metro (RUCC: 4, 6, and 8), and non-metro not adjacent to metro; (RUCC: 5, 7, and 9), consistent with prior studies.³⁵ Additional covariates included a dichotomous indicator of whether the county was considered a full or partial primary care HPSA or a dental HPSA, the unemployment rate, and the percentage of persons aged 0–17 living in poverty. Information on primary care and dental HPSAs was missing for 2014, so we applied information from 2013.

Analyses

Patient demographics, county characteristics, and health care utilization were summarized for all patients, overall, and stratified by county rurality. Health care utilization was summarized as the proportion of all children with at least 1 visit (ie, POHS in medical offices, POHS in dental offices, and well-child medical visits) during the 1-year study period as well as the total number of visits during the study period. All variables were summarized using weighted means and frequencies to account for the sampling of children in each state and calendar year. We examined rates of POHS in medical offices, POHS in dental offices, and well-child visits for each RUCC code. Continuous variables were compared across county rurality using analysis of variance. Categorical variables were compared using the chi-squared test of independence.

A logistic regression model was fit to estimate the odds that a child received POHS in a medical office during the calendar year. The regression model included patient demographics, county characteristics, state fixed effects, and robust standard errors clustered at the county level. The regression model included weights to account for the sampling of

children in each year. We used the results from this model to calculate adjusted predictions by county rurality. Using the entire estimation sample, we assigned each observation to 1 rurality category, leaving other covariates unchanged to generate for each child a predicted probability of receiving POHS in a medical office. We repeated this process for all 3 levels of county rurality and report the mean predicted probabilities for all 3 levels of county rurality. All analyses were conducted using SAS Enterprise Guide version 7.1 (SAS Institute Inc., Cary, NC) and approved by the corresponding author's Institutional Review Board.

Results

The mean age among children in the sample (n=6,275,456) was 2.2 years, 51.2% were male, 37.6% were white, 22.3% were black, 80.7% resided in metro counties, and 76.0% of children had 12 months of Medicaid eligibility during the year (Table 1).

Patient county-level characteristics varied greatly by county rurality (Table 1). Children in metro counties were more likely to live in a primary care or dental HPSA. In addition, children in metro counties were less likely than children in non-metro counties to live in counties in the highest quartile of poverty and unemployment rates.

Table 2 illustrates children's receipt of well-child medical visits, POHS in medical offices, and POHS in dental offices by the 3-group measure of county rurality. Rates of well-child visits were higher in metro counties (60.0%), followed by non-metro counties adjacent to metro counties (57.4%), and non-metro counties not adjacent to metro counties (51.0%). Rates of POHS in medical offices were much lower, with the percentage of children receiving POHS in medical offices highest in metro counties (8.4%), followed by non-metro counties adjacent to metro counties (5.8%), and non-metro counties not adjacent to metro counties (4.3%). Unlike POHS in medical offices and well-child visits, the percentage of children receiving POHS in dental offices was relatively similar across non-metro counties adjacent to metro counties (37.8%), metro (37.6%), and non-metro counties not adjacent to metro counties (36.1%).

In the multivariate logistic regression model, we found that compared to children living in metro counties, children in non-metro counties adjacent to metro counties (odds ratio [OR] = 0.70; 95% confidence interval [CI]: 0.59–0.82) and in non-metro counties not adjacent to metro counties (OR = 0.79; 95% CI: 0.64–0.99) had significantly lower odds of receiving POHS in medical offices (Table 3). When predicted probabilities were estimated using the results of the model, the average probability of receiving POHS in a medical office was 8.0% (95% CI: 7.5%–8.5%) for children in metro counties, 6.2% (95% CI: 5.4%–6.8%) for children in non-metro counties adjacent to metro counties, and 6.8% (95% CI: 5.7%–7.8%) for children in non-metro counties not adjacent to metro counties.

The odds of receiving POHS in medical offices also varied based on other county and patient characteristics. Children living in counties with the lowest quartile with respect to percentages of persons aged 0–17 years in poverty were less likely to receive POHS in medical offices than residents of other counties. Children aged <1 year were more likely to receive POHS in medical offices than older children. In addition, children who were

Hispanic or other race were more likely to receive POHS in medical offices, compared with non-Hispanic white children. Furthermore, children with less than 12 months of Medicaid enrollment during the year were less likely to receive POHS in medical offices than children with a full 12 months of Medicaid enrollment. A sensitivity analysis was conducted to explore if results we observed for the measures of rurality were driven by differences in length of enrollment in Medicaid; however, the results of the analysis were consistent in magnitude and significance in a sample of children enrolled in Medicaid for 12 months during the study period (results available upon request).

Discussion

This study, the first to our knowledge to use an individual-level, multistate dataset to examine the rate of POHS in medical offices, found low rates among children in non-metro counties. All children had low rates of POHS in dental offices, consistent with prior studies,^{4,10} with children living in the most rural areas (ie, not adjacent to metro counties) having the lowest rate of POHS in dental offices. Medicaid-enrolled children living in the most rural counties encounter barriers to dental care, including a limited dental workforce,²⁰ which is exacerbated for this subpopulation because many general dentists are reluctant to treat young children^{21,22} or accept Medicaid.^{29–31} While substantial numbers of rural children received Medicaid-reimbursed POHS in medical offices, given that less than half of rural children receive any POHS services annually, continuing to increase the integration of oral health care into primary care provides an ongoing opportunity to increase delivery of POHS to young children in rural counties.^{36–39} Additional strategies to do so include using non-traditional settings to deliver POHS (eg, deliver care in Special Supplemental Nutrition Program for Women, Infants and Children [WIC] clinics),⁴⁰ providing Medicaid dental benefits to mothers until their children's fifth birthday,³⁷ and applying incentives and penalties for failing to meet utilization benchmarks to dental plans operating in states with Medicaid managed care.^{37,41}

Annual rates of any medical visits with POHS (4.3%) and counts of medical visits with POHS (0.06 visits) for the most rural children were very low, which is troubling because prior research suggests that multiple applications of fluoride varnish are needed to reduce dental caries.^{18,42} Thus, there is ample opportunity to increase the number of children receiving these services, as demonstrated in Wisconsin.¹² Expanding the delivery of POHS in medical offices offers a convenient option to ensure children with high dental needs can obtain dental visits even in communities with limited dental workforces. For example, children at low risk of developing dental caries could receive POHS in medical offices, while higher-risk children could be referred to dentists—an approach recommended by the American Academy of Pediatrics.⁴³ However, enticing greater medical provider participation is critical to such an approach, and this may require education, training, and multiple efforts to improve oral health⁴⁴ as well as collaborations between medical providers and local dentists.⁴⁵ These efforts may also be useful in reducing the lag between policy implementation and effect on children's utilization¹⁰ and oral health,¹⁹ and future research should help to identify those strategies that may be most useful in reducing this lag in rural areas.

Integration of POHS into medical offices appears to benefit children living in the most impoverished counties. Children living in counties with 18% or more of children living in poverty had significantly greater odds of receiving POHS in medical offices than children living in counties with fewer children living in poverty, with a step-wise relationship between a child's odds of receiving POHS in medical offices and child poverty rates. Pediatricians who treat more than 40% of patients with public health insurance are more likely to report delivering POHS than pediatricians who treat fewer patients with public health insurance,⁴⁶ and impoverished counties are likely to have a greater percentage of Medicaid-enrolled children eligible for services. As most private insurers are now required to cover POHS in medical offices without cost-sharing,⁴⁷ it is possible that there will be even greater growth in the percentage of medical providers delivering POHS.

Annual well-child visits are recommended for all children 6 years and younger, with more frequent visits recommended for children under 2.⁹ Despite these recommendations, only 51% of children living in non-metro counties not adjacent to metro counties had a well-child medical visit during the study period. Analysis of the National Survey of Children's Health also reported lower rates of preventive medical visits in rural areas.⁴ Since POHS in medical offices often occurs during well-child visits, promoting well-child medical visits for rural children may be another effective strategy to increase rates of POHS delivered during medical visits. Strategies recommended for promoting medical visits in rural areas include improving surveillance, as an initial step to document disparities because few data sources allow assessment of rural/urban differences of child health and health care utilization; using non-traditional providers and settings, which may include expanded use of mobile vans and school clinics; and increasing the rural workforce through recruiting and expanding the scope of practice of mid-level providers.^{28,48,49}

Limitations

This study has several limitations. First, our definition of POHS in medical offices may potentially be an overestimate of this service in medical offices because medical and dental providers in some states use the same procedure codes for POHS, in which case we could have potentially misidentified services as POHS in medical offices when they were actually POHS in dental offices. We sought to address this by identifying POHS in medical offices using the type of service code and using an algorithm to identify providers unlikely to be dentists. Our approach led to similar estimates previously published of POHS in medical and dental offices for young Medicaid enrollees.¹⁰ Second, our findings are limited to Medicaid-enrolled children in 39 states, and we do not know to what extent our findings would generalize to Medicaid populations in other states or to commercially insured populations, among whom POHS services may be increasing since most private insurers are now required to cover POHS in medical offices without cost-sharing.⁴⁷ Finally, our data also provide no information about the quality of the POHS services provided, their effects on children's clinical outcomes, nor whether some parents declined POHS services offered for their child—all important topics for future research.

Conclusions

Despite these limitations, our results provide important new information regarding the small number of young Medicaid-enrolled children receiving POHS in medical offices in rural areas and throughout the US. Among the 6.3 million children studied in 39 states providing Medicaid payment for POHS in medical offices, only 7.8% received POHS in a medical office during the study period, with a substantially lower rate for residents of the most remote counties (4.3%). Given that uptake of POHS in medical offices is low across many states and communities, the federal government, states, and communities should work together to implement strategies to increase the number of young children receiving POHS, including integrating oral health care into primary care.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Funding: This study was supported by Grant R01 DE026136-02 from the National Institute of Dental and Craniofacial Research. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of Dental and Craniofacial Research or the National Institutes of Health.

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Table 1:

Child and County Characteristics, by County Rurality

	Total ^a (N = 6,275,456)	County rurality		P value ^b	
		Metro counties (N = 5,066,625)	Non-metro, adjacent to metro counties (N = 730,316)		Non-metro, not adjacent to metro counties (N = 478,516)
County characteristics^c					
Provider supply					
Children living in a full or partial primary care health HPSA, n (%)	5,533,466 (88.2)	4,517,366 (89.2)	606,603 (83.1)	409,498 (85.6)	< .001
Children living in a full or partial dental HPSA, n (%)	5,277,430 (84.1)	4,371,791 (86.3)	558,194 (76.4)	347,444 (72.6)	< .001
Social environment					
Percent of persons aged 0–17 years in poverty (quartiles), n (%)					
Top quartile: 28.4% - 59.6%	1,589,816 (25.3)	1,032,343 (20.4)	350,497 (48.0)	206,976 (43.3)	< .001
Third quartile: 24.9% - 28.3%	1,550,164 (24.7)	1,340,259 (26.5)	146,612 (20.1)	63,293 (13.2)	
Second quartile: 18.0% - 24.8%	1,594,386 (25.4)	1,317,358 (26.0)	149,787 (20.5)	127,240 (26.6)	
Bottom quartile: 3.3% - 17.9%	1,541,091 (24.6)	1,376,664 (27.2)	83,420 (11.4)	81,007 (16.9)	
Unemployment rate (quartiles), n (%)					
Top quartile: 8.6% - 23.6%	1,654,717 (26.4)	1,211,529 (23.9)	269,272 (36.9)	173,916 (36.3)	< .001
Third quartile: 7.3% - 8.5%	1,545,456 (24.6)	1,287,912 (25.4)	168,229 (23.0)	89,315 (18.7)	
Second quartile: 6.1% - 7.2%	1,581,503 (25.2)	1,373,436 (27.1)	151,998 (20.8)	56,068 (11.7)	
Bottom quartile: 0.8% - 6.0%	1,493,781 (23.8)	1,193,748 (23.6)	140,816 (19.3)	159,217 (33.3)	
Child characteristics					
Age in years on January 1, mean (SD)					
Age, n (%)	2.18 (1.88)	2.19 (1.87)	2.16 (1.90)	2.15 (1.91)	< .001
0	1,488,075 (23.7)	1,187,710 (23.4)	180,682 (24.7)	119,683 (25.0)	< .001
1	968,317 (15.4)	786,655 (15.5)	109,455 (15.0)	72,207 (15.1)	
2	983,392 (15.7)	798,644 (15.8)	112,343 (15.4)	72,405 (15.1)	
3	972,277 (15.5)	790,588 (15.6)	110,286 (15.1)	71,403 (14.9)	
4	1,863,396 (29.7)	1,503,027 (29.7)	217,551 (29.8)	142,817 (29.8)	
Sex, n (%)					
Male	3,210,992 (51.2)	2,591,664 (51.2)	375,109 (51.4)	244,219 (51.0)	.261

	County rurality			<i>P</i> value ^b	
	Total ^a (N = 6,275,456)	Metro counties (N = 5,066,625)	Non-metro, adjacent to metro counties (N = 730,316)		Non-metro, not adjacent to metro counties (N = 478,516)
Female	3,064,464 (48.8)	2,474,961 (48.8)	355,207 (48.6)	234,296 (49.0)	< .001
Race/ethnicity, n (%)					
White, non-Hispanic	2,361,865 (37.6)	1,675,416 (33.1)	412,490 (56.5)	273,959 (57.3)	
Black or African American, non-Hispanic	1,397,214 (22.3)	1,209,744 (23.9)	130,770 (17.9)	56,700 (11.8)	
Hispanic	1,026,608 (16.4)	941,472 (18.6)	54,297 (7.4)	30,839 (6.4)	
Other	735,034 (11.7)	593,589 (11.7)	70,472 (9.6)	70,973 (14.8)	
Unknown	754,735 (12.0)	646,404 (12.8)	62,287 (8.5)	46,045 (9.6)	
Months of Medicaid eligibility during year, n (%)					
6–8 months	633,923 (10.1)	506,107 (10.0)	73,863 (10.1)	53,953 (11.3)	
9–11 months	871,203 (13.9)	700,894 (13.8)	98,709 (13.5)	71,599 (15.0)	
12 months	4,770,331 (76.0)	3,859,623 (76.2)	557,744 (76.4)	352,964 (73.8)	

HPSA = health professional shortage area; SD = standard deviation

Notes:

^aThe sample includes all children from 39 states who were aged < 6 years with at least 6 months of Medicaid eligibility during the 1-year study period. The sample was weighted to reflect the sampling of children in each state and calendar year.

^b*P* values were calculated using analysis of variance for continuous variables and the chi-squared test of independence for categorical variables.

^cCounty characteristics were obtained from the Area Health Resource Files based on the county of residence of each child during the study period

Table 2:

Health Care Utilization, by County Rurality

	Total ^a (N = 6,275,456)	County Rurality			P value ^b
		Metro counties (N = 5,066,625)	Non-metro, adjacent to metro counties (N = 730,316)	Non-metro, not adjacent to metro counties (N = 478,516)	
Health care utilization					
Well-child medical visits					
Any visit, n (%)	3,703,107 (59.0)	3,040,389 (60.0)	418,889 (57.4)	243,829 (51.0)	< .001
Total visits, mean (SD)	1.09 (1.35)	1.11 (1.35)	1.09 (1.38)	0.97 (1.35)	< .001
Visits with POHS in medical offices					
Any visit, n (%)	486,886 (7.8)	423,679 (8.4)	42,422 (5.8)	20,786 (4.3)	< .001
Total visits, mean (SD)	0.11 (0.41)	0.11 (0.42)	0.08 (0.36)	0.06 (0.29)	< .001
Visits with POHS in dental offices					
Any visit, n (%)	2,354,346 (37.5)	1,905,704 (37.6)	275,793 (37.8)	172,849 (36.1)	< .001
Total visits, mean (SD)	0.56 (0.83)	0.56 (0.83)	0.55 (0.82)	0.53 (0.81)	< .001

SD = standard deviation; POHS = preventive oral health services

Notes:

^aThe sample includes all children from 39 states who were aged < 6 years with at least 6 months of Medicaid eligibility during the 1-year study period. The sample was weighted to reflect the sampling of children in each state and calendar year.

^bP values were calculated using analysis of variance for continuous variables and the chi-squared test of independence for categorical variables.

Table 3:

Odds of Medicaid-Enrolled Child Receiving Preventive Oral Health Services in a Medical Office

Model covariates	Odds ratio ^a	95% confidence interval
County characteristics		
Physical environment		
Rurality		
Metro (reference group)	-	-
Non-metro, adjacent to metro counties	0.70	(0.59–0.82) *
Non-metro, not adjacent to metro counties	0.79	(0.64–0.99) *
Provider supply		
Children not living in a primary care health HPSA (reference group)	-	-
Children living in a full or partial primary care health HPSA	1.02	(0.85–1.22)
Children not living in a dental HPSA (reference group)	-	-
Children living in a full or partial dental HPSA	0.96	(0.82–1.13)
Social environment		
Percent of persons aged 0–17 years in poverty		
Top quartile, highest child poverty rates (reference group)	0.63	(0.48–0.83) *
Third quartile	0.71	(0.57–0.88) *
Second quartile	0.76	(0.61–0.94) *
Bottom quartile, lowest child poverty rates	-	-
Unemployment rate		
Top quartile, high unemployment rates (reference group)	0.98	(0.73–1.32)
Third quartile	0.99	(0.78–1.24)
Second quartile	0.97	(0.79–1.20)
Bottom quartile, lowest unemployment rates	-	-
Child characteristics		
Age in years on January 1		
0 (reference group)	-	-
1	0.85	(0.76–0.95) *
2	0.33	(0.26–0.41) *
3	0.15	(0.10–0.22) *
4	0.11	(0.06–0.18) *
Sex		
Female (reference group)	-	-
Male	1.01	(1.00–1.02)
Race/ethnicity		
White, non-Hispanic (reference group)	-	-
Black or African American, non-Hispanic	1.02	(0.92–1.14)
Hispanic	1.20	(1.05–1.38) *
Other	1.26	(1.15–1.38) *

Model covariates	Odds ratio ^a	95% confidence interval
Unknown	1.05	(0.95–1.17)
Months of Medicaid eligibility in year		
12 months (reference group)	-	-
10–11 months	0.63	(0.60–0.66) *
8–9 months	0.33	(0.30–0.35) *
N (weighted)^b	6,275,456	

* *P* value < .05; HPSA = health professional shortage area

Notes:

^aOdds ratios were calculated using a weighted logistic regression model controlling for the listed categorical variables and robust standard errors clustered at the county level.

^bThe sample includes all children from 39 states who were aged < 6 years with at least 6 months of Medicaid eligibility during the 1-year study period.