

# Dentist Workforce and Dental Care Utilization in the Rural and Urban U.S.

## KEY FINDINGS

- Generalist dentists comprised 83.9% of the overall dentist workforce in 2021.
- The percentage of generalist dentists in the dentist workforce was higher in rural areas compared to urban areas (91.5% vs. 83.3%, respectively).
- The generalist dentist supply per 100,000 population was lower in rural areas (30.0) compared to urban areas (50.3).
- A higher percentage of urban respondents (36.6%) reported having dental insurance compared to rural respondents (29.0% in micropolitan and 24.0% in noncore).
- A lower percentage of adults in rural areas reported having a dental visit in the past year (56.4%) compared to adults living in urban areas (65.9%,  $p \leq .0001$ ).

## BACKGROUND

Rural communities face challenges in accessing dental care, as highlighted in the Surgeon General's report on Oral Health in America.<sup>1</sup> Compared to urban adults, rural adults have higher rates of poor oral health outcomes, including permanent tooth loss, total tooth loss (edentulism), and dental caries.<sup>2-6</sup> Prior WWAMI RHRC research found that when controlling for multiple sociodemographic determinants, rural adults were more likely to have permanent tooth extraction compared to urban adults.<sup>4</sup>

Over the past two decades, rural adults in the United States (U.S.) have accessed dental care at lower rates than urban adults, particularly for preventive dental care.<sup>4-8</sup> In a nationally representative survey of health care expenditures, rural residents were found to be less likely to receive preventive and diagnostic dental care and more likely to receive restorative or oral surgery services compared with urban residents.<sup>9</sup> Residents of the most remote rural places are the least likely to receive preventive dental care compared to the rural residents closer to urban areas.<sup>9</sup>

Differences in oral health outcomes and dental care access for rural communities are due to many factors, but a key factor is the shortage of dentists in rural communities. Two-thirds of dental health care professional shortage areas are rural, affecting a population of 22.7 million people.<sup>10</sup> Rural communities have fewer dentists per capita than urban communities, with dentist supply being the lowest in the smallest, most remote rural places.<sup>3,4</sup> Studies of some states suggest that a greater proportion of rural dentists are older, and fewer dental school graduates are pursuing rural practice, which may further exacerbate these shortages in future years.<sup>11–13</sup>

Socioeconomic status (SES) also has an impact on access to rural dental care. Lower income is associated with lower rates of having a dental visit in the past year.<sup>8</sup> Rural residents are also less likely to have dental insurance than urban residents.<sup>14</sup> About a quarter (24%) of rural residents rely on Medicaid for health coverage, but Medicaid's coverage of dental care varies by state.<sup>15,16</sup> Additionally, nationally less than 40% of dentists accept Medicaid, and many do not accept new Medicaid patients.<sup>17</sup> Low reimbursement rates and more burdensome administrative requirements are common barriers for dentists participation in Medicaid.<sup>18,19</sup> While more dentists in rural areas accept Medicaid than urban dentists, these barriers create further challenges to rural populations accessing adequate dental care.<sup>20</sup>

The purpose of this study was to examine the rural-urban dentist supply and whether rural adults have lower dental care utilization and higher rates of poor oral outcomes in a national sample. This analysis revisited the relationship of dental supply with dental care utilization and oral health outcomes that was explored in Doescher and Keppel, 2015.<sup>4</sup> We also examined the rural-urban differences in dental care access by socioeconomic status.

## METHODS

### DATA SOURCES

We used the 2019 National Health Interview Survey (NHIS) from the U.S. Centers for Disease Control and Prevention (CDC) National Center for Health Statistics (NCHS). The NHIS is a nationally representative survey of U.S. civilian noninstitutionalized households. Households are sampled for participation, and one adult and child participate per household. In 2019, there were 31,997 adults included in the final NHIS sample from 33,138 households, with a 59.1% adult response rate.<sup>21</sup> Additional information about the NHIS data collection procedures and data can be accessed at <https://www.cdc.gov/nchs/nhis/>. We obtained access to the NHIS restricted state and county data through the Northwest Federal Statistical Research Data Center (RDC).

We used the 2022 American Dental Association (ADA) Masterfile to determine county-level dentist supply. The ADA Masterfile contains information on U.S. dentists including age, sex, race, specialty, and type of practice. We obtained an abridged version of the Masterfile from the ADA that included counts of dentists by county-level Federal Information Processing Standards (FIPS) codes based on their office address. We used population data from the U.S. Census Bureau to calculate the dentist per population ratios at the county level. We obtained county-level socioeconomic characteristics, such as the Urban Influence Codes, and county typology codes from the Area Health Resource File (AHRF) from the Health Resources and Services Administration.<sup>22</sup> We compiled and provided a county-level dataset which included the ADA Masterfile-derived county-level dentist supply and these county-level variables to RDC staff who merged it with the NHIS data.

### STUDY POPULATION

We included all adult participants ages 18 and older from the 2019 NHIS who were not missing information for our three dental outcome variables, or county-location information. The final unweighted analytic sample from the 2019 NHIS included 31,997 individuals.

To determine dentist supply, we included all dentists from the ADA Masterfile in the 50 U.S. states and the District of Columbia (n=290,665). Of these dentists, we included those who were professionally active with full- or part-time employment. We excluded dentists who were not likely to be professionally active, including those who are retired, not currently employed, and those in another occupation unrelated to dentistry (88,738, 30.5%). We also excluded dentists whose clinical practice was unlikely to reflect community dentistry practice, such as dental school faculty, dental school residents, and those working for government agencies (Veterans Administration, Public Health Service, or state and local governments), because our study outcome measures were collected for non-institutionalized civilian U.S. adults (13,957, 4.8%). We also excluded 134 dentists (0.05%) who could not be assigned to a state or county due to missing address information. We included the remaining 187,836 dentists (64.6%) in our dentist supply calculations.

## STUDY VARIABLES

### Outcome Variables

We used the following three questions from the NHIS as outcome measures:

1. "About how long has it been since you last had a dental examination or cleaning?" which was classified as having a dental visit in the past year (yes/no);
2. "During the past 12 months, have you *delayed* getting dental care because of the cost?" (yes/no); and
3. "During the past 12 months, was there any time when you needed dental care, but *did not get it* because of the cost?" (yes/no).

### Independent Variables

The primary independent variable was the rural-urban status of the respondent's residence. For the 2019 NHIS respondents, their rural-urban status was classified using the county-level 2013 Urban Influence Codes (UICs) from the U.S. Department of Agriculture<sup>23</sup> in the following categories: "Urban/Metro" (UICs 1-2), "Micropolitan" (UICs 3, 5, and 8), and "Noncore" (UICs 4, 6, 7, 9-12). A combined overall "Rural/Nonmetro" category included UICs 3-12.

### Control Variables

Other individual-level NHIS measures used in this analysis included the following: age (18-44, 45-64, and 65 years or older); sex (male, female); race and ethnicity (non-Hispanic White, non-Hispanic Black, non-Hispanic Asian, non-Hispanic American Indian and Alaskan Native (AI/AN) only and non-Hispanic AI/AN with any other racial group, Hispanic, other non-Hispanic single race or multiracial – which includes non-Hispanic Native Hawaiian and other Pacific Islanders, other reported races, and all other non-Hispanic multiracial respondents); marital status (married or partnered, not married or partnered); annual household income (less than \$25,000, \$25,000-\$49,999, \$50,000-\$74,999, \$75,000 or greater); education (less than high school degree, high school graduate or equivalent, greater than high school degree); employment status (employed, unemployed, out of the workforce – which includes those who were retired, unable to work, going to school, or taking care of house or family); health insurance (insured, not insured); dental insurance (insured, not insured); health status (excellent or very good, good, poor or fair) and smoking status (never smoked, former smoker, current smoker). Additional county-level contextual variables used in the analysis included persistent poverty county status (yes, no); low employment county status (yes, no); low education county status (yes, no); quartiles of the percent non-White population (% of total county population that is not non-Hispanic White); and county-level category of per capita dentist supply. We used a benchmark of 50 dentists per 100,000 population, based on the estimate that a typical dentist would have a patient panel of 2,000 patients, to categorize each county's per capita dentist supply.<sup>24,25</sup>

## ANALYSIS

We used multivariate logistic regression models for each outcome measure to assess their relationship with rural-urban status using variables from Andersen’s behavioral model of health services access as covariates.<sup>26</sup> These included predisposing (biological and social factors that suggest the likelihood an individual will need care), enabling (resources that aid an individual to access care) and need factors (perceived or evaluated need for care) variables.<sup>26</sup> We included the following variables in our models: predisposing factors (age, sex, race and ethnicity, marital status, education, employment), enabling factors (income, health insurance, dental insurance), need factors (health status, smoking status), and county-level variables (persistent poverty county, low employment county, category of county-level per capita dentist supply, and quartile of county percent non-White population) in our models. We conducted weighted analyses using the weights provided by the CDC to account for the complex survey design and to produce national estimates. We used multiple imputations to adjust for missing responses to household income in the NHIS data, as described by the NCHS.<sup>21</sup> Because our outcome variables were common, we converted the odds ratios from our regression to relative risks using the method described by Zhang and Yu.<sup>27</sup> We conducted chi-square tests and calculated descriptive statistics and 95% confidence intervals (CIs).

We conducted analyses using SAS version 9.4 for Windows and SUDAAN version 11.0.4. The University of Washington Human Subjects Division determined this research was exempt.

## RESULTS

### Dentist supply

Generalist dentists made up 83.9% of the overall dentist workforce and made up a higher percentage of the overall dentist supply in rural counties than urban counties (91.5% vs. 83.3%, Table 1). However, the per capita generalist dentist supply was lower in rural compared to urban counties (30.0 vs. 50.3 dentists per 100,000 population, respectively). Among rural counties, the per capita generalist dentist supply was lower in noncore counties (25.5 dentists per 100,000 population) compared to micropolitan (37.2 dentists per 100,000 population) counties. While 13.9% of the U.S. population in 2021 resided in rural areas, only 8.8% of the generalist dentist supply worked in rural areas in the same year.

**Table 1. Counts and Supply per 100,000 Population of Generalist and Specialty Dentists by Rural-Urban Category, 2022**

	Total	Urban/Metro	Rural/Nonmetro	Rural	
				Micropolitan	Noncore
Counts of dentists (n, row %)	187,836	172,708 (91.9%)	15,128 (8.1%)	10,215 (5.4%)	4,913 (2.6%)
Generalists (n, col %)	157,687 (83.9%)	143,845 (83.3%)	13,842 (91.5%)	9,094 (89.0%)	4,748 (96.6%)
Specialists (n, col %)	30,149 (16.1%)	28,863 (16.7%)	1,286 (8.5%)	1,121 (11.0%)	165 (3.4%)
Population, 2021 (n, row %)	331,884,174	285,811,156 (86.1%)	46,073,018 (13.9%)	27,449,439 (8.3%)	18,623,579 (5.6%)
Dentist supply per 100,000 population					
Total dentists	56.6	60.4	32.8	37.2	26.4
General dentists	47.5	50.3	30.0	33.1	25.5
Specialist dentists	9.1	10.1	2.8	4.1	0.9

Data Sources: American Dental Association (ADA) Masterfile, 2022. U.S. Census Bureau, 2021.

## Respondent and Community Characteristics

Table 2 shows the characteristics of the 250,891,454 adults in the full weighted NHIS sample. Most respondents (n=214,913,084, 85.7%) lived in an urban county, while 14.3% of respondents (n=35,978,370) lived in a rural county. Most rural respondents lived in micropolitan counties (9.0% of all respondents). A greater percentage of rural respondents were 65 years of age or older (26.4% in micropolitan and 28.4% in noncore) compared to urban respondents (20.0%,  $p < .0001$ ). The proportion of respondents with incomes less than \$50,000, less than high school education, and those who were out of the workforce also increased as rurality increased. Almost 10% more urban respondents were employed than rural respondents (66.9% vs. 57.3% respectively,  $p \leq .0001$ ). There was not a significant difference in the proportion of urban and rural respondents with health insurance, but a greater proportion of urban respondents (36.6%) reported having dental insurance compared to rural respondents (29.0% in micropolitan and 24.0% in noncore,  $p < .0001$ ). A greater proportion of rural respondents were former or current smokers, reported poor or fair health, or lived in a persistent poverty or low education county compared to urban respondents (Table 2). One-third (33.1%) of respondents from non-core counties lived where the per capita supply of dentists was less than 25% of the supply benchmark, including 10% who lived in a county without a dentist. Less than 5% of respondents from micropolitan and urban counties lived in counties with this designation.

**Table 2. Weighted Respondent and Community Characteristics by Rural-Urban Category, 2019**

	Urban/Metro N=214,913,084 (85.7%)		Rural/Nonmetro			
			Micropolitan N=22,501,079 (9.0%)		Noncore N=13,477,291 (5.4%)	
	n	Col. %	n	Col. %	n	Col. %
<b>Age***</b>						
18-44	101,048,214	47.1	9,284,230	41.3	4,748,832	35.3
45-64	70,399,964	32.8	7,247,281	32.3	4,888,908	36.3
65 or older	42,950,876	20.0	5,926,399	26.4	3,814,362	28.4
<b>Sex</b>						
Male	103,894,760	48.3	10,821,324	48.1	6,431,435	47.7
Female	110,997,901	51.7	11,679,756	51.9	7,045,856	52.3
<b>Race and ethnicity***</b>						
AI/AN NH	1,847,399	0.9	1,057,597	4.7	618,962	4.6
Asian NH	14,509,475	6.8	202,270	0.9	45,625	0.3
Black NH	27,052,263	12.6	1,065,463	4.7	1,370,309	10.2
Hispanic	39,251,471	18.3	1,866,141	8.3	388,884	2.9
Other single races or multiracial NH	2,638,256	1.2	320,286	1.4	†	†
White NH	129,614,220	60.3	17,989,323	79.9	11,020,208	81.8
<b>Marital status*</b>						
Married or partnered	126,698,271	60.8	14,211,593	64.3	8,397,675	63.9
Not married	81,652,029	39.2	7,902,483	35.7	4,734,708	36.1
<b>Annual household income***</b>						
Less than \$25,000	32,175,187	15.0	4,839,629	21.5	3,244,635	24.1
\$25,000-\$49,999	45,455,282	21.2	5,950,252	26.4	3,658,610	27.1
\$50,000-\$74,999	39,372,469	18.3	4,809,193	21.4	2,659,360	19.7
\$75,000 or greater	97,910,145	45.6	6,902,006	30.7	3,914,685	29.0
<b>Education level***</b>						
Less than high school	25,073,142	11.8	3,523,566	15.8	2,386,518	17.9
High school graduate	55,979,912	26.2	7,562,715	33.8	4,816,983	36.1
More than high school	132,247,832	62.0	11,278,249	50.4	6,135,965	46.0
<b>Employment status***</b>						
Employed	137,690,231	66.9	12,603,878	57.9	7,283,268	56.2
Unemployed	4,247,789	2.1	434,552	2.0	157,954	1.2
Out of workforce	63,816,210	31.0	8,733,158	40.1	5,510,852	42.5

Table 2. continued on next page

Table 2. Weighted Respondent and Community Characteristics by Rural-Urban Category, 2019

	Urban/Metro N=214,913,084 (85.7%)		Rural/Nonmetro			
			Micropolitan N=22,501,079 (9.0%)		Noncore N=13,477,291 (5.4%)	
	n	Col. %	n	Col. %	n	Col. %
<b>Health insurance</b>						
Insured (%)	189,679,564	88.5	19,550,431	87.2	11,637,224	86.8
<b>Dental insurance***</b>						
Insured (%)	77,639,629	36.6	6,474,526	29.0	3,192,040	24.0
<b>Health status***</b>						
Excellent/very good	126,357,364	58.8	11,114,540	49.4	6,536,939	48.5
Good	57,406,738	26.7	6,905,214	30.7	4,133,604	30.7
Poor/fair	30,997,031	14.4	4,471,197	19.9	2,806,748	20.8
<b>Smoking status**</b>						
Never smoked	135,573,806	65.1	12,437,747	56.4	6,701,379	50.9
Former smoker	45,603,346	21.9	5,582,139	25.3	3,666,359	27.8
Current smoker	27,219,013	13.1	4,039,271	18.3	2,801,928	21.3
<b>County variables</b>						
Persistent poverty***	7,888,592	3.7	2,731,607	12.1	3,064,577	22.7
Low employment***	9,169,521	4.3	7,309,783	32.5	6,797,626	50.4
Low education	26,718,103	12.4	2,574,641	11.4	2,033,309	15.1
<b>County percentage of per capita dentist supply benchmark‡</b>						
No dentists	254,468	0.1	§	§	1,439,431	10.7
<25% of benchmark supply	1,694,561	0.8	875,532	3.9	3,019,385	22.4
25% - <50% of benchmark supply	9,731,878	4.5	5,921,731	26.3	3,202,823	23.8
50% - <75% of benchmark supply	30,933,758	14.4	7,937,977	35.3	3,900,927	28.9
75% - < 100% of benchmark supply	62,786,704	29.2	4,616,991	20.5	1,347,951	10.0
100% or greater of benchmark supply	109,511,715	51.0	3,148,847	14.0	566,773	4.2
<b>Quartiles of county non-White population**</b>						
1st quartile (lowest)	5,893,790	2.7	6,687,573	29.7	4,582,849	34.0
2nd quartile	19,553,149	9.1	4,655,412	20.7	3,599,399	26.7
3rd quartile	68,577,748	31.9	7,116,344	31.6	2,555,825	19.0
4th quartile (highest)	120,888,396	56.2	4,041,750	18.0	2,739,217	20.3

Data Source: National Health Interview Survey (2019), National Center for Health Statistics, Centers for Disease Control and Prevention.

Abbreviation: NH – Non-Hispanic; AI/AN – American Indian and Alaska Native.

We weighted counts, percentages, and means to account for the complex survey design of the NHIS.

†Weighted frequency suppressed due to small cell size.

‡Benchmark supply of dentists is 50 dentists per 100,000 population (see methods).

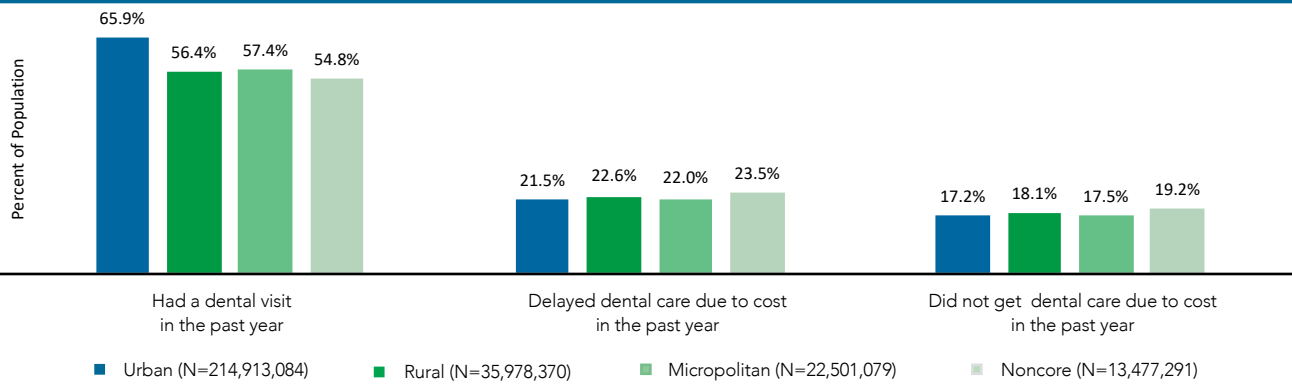
§Weighted frequency and percentage unavailable due to zero respondents in this cell.

Overall chi-square: \*p<.05, \*\*p<.01, \*\*\*p<.0001.

## Dental Care Utilization

Overall, 64.6% of adults in the 2019 NHIS reported having a dental visit in the past year, 21.7% reported delaying dental care due to cost in the past year, and 17.3% reported needing dental care but not getting it due to cost in the past year (Figure 1). Compared to adults residing in urban areas, a lower percentage of adults in rural areas reported having a dental visit in the past year (56.4% rural vs. 65.9% urban,  $p<.0001$ ). The rates of having a dental visit were higher among micropolitan (57.4%) than noncore respondents (54.8%,  $p<.0001$ ). Overall, there were no significant differences between rural and urban respondents in the proportion who delayed dental care due to cost (21.5% vs. 22.6% respectively) or in those who needed dental care but did not get it due to cost in the past year (17.2% vs. 18.1%) (Figure 1).

**Figure 1. Weighted Percentages of Past Year Dental Visit, Past Year Delayed Dental Care Due to Cost, and Past Year Did Not Get Dental Care Due to Cost by Urban-Rural Category, 2019**



Data Source: National Health Interview Survey (2019), National Center for Health Statistics, Centers for Disease Control and Prevention.  
 We weighted counts and percentages to account for the complex survey design of the NHIS.  
 Overall chi-square: \*p<.05, \*\*p<.01, \*\*\*p<.0001.

Table 3 presents both the unadjusted and adjusted relative risk for the three dental outcomes comparing rural micropolitan and noncore adults to urban adults. Compared to urban respondents, unadjusted models suggest that micropolitan respondents were 16% less likely (RR 0.84, 78% CI 0.79-0.89) and noncore respondents were 22% less likely (RR 0.78, 95% CI 0.71-0.86) to report having a dental visit in the past year. After adjusting for sociodemographic and county-level characteristics without including county per capita dental supply, both micropolitan and noncore residents were still significantly less likely to have had a dental visit in the past year compared to urban residents (aRR 0.94 and 0.91, respectively). After controlling for county dental supply, these differences were no longer statistically significant. There were no differences in the likelihood of either of the outcomes ‘delayed care due to cost’ or ‘needed dental care but did not get it due to cost in the past year’ between micropolitan, noncore and urban residents in either the unadjusted or adjusted odds ratios.

**Table 3. Unadjusted and Adjusted Relative Risks for Past Year Dental Visit, Past Year Delayed Dental Care Due to Cost, and Past Year Did Not Get Dental Care Due to Cost for Respondents in Micropolitan and Noncore Compared to Urban Counties, 2019**

Outcome measure	Unadjusted		Adjusted <sup>†</sup>			
	RR	95% Confidence interval	Without category of dentist supply		With category of dentist supply	
	RR	95% Confidence interval	RR	95% Confidence interval	RR	95% Confidence interval
Had a dental visit in the past year (Ref: Urban)						
Micropolitan	0.84	(0.79-0.89)	0.94	(0.89-0.99)	0.95	(0.90-1.01)
Noncore	0.78	(0.71-0.86)	0.91	(0.84-0.99)	0.95	(0.87-1.03)
Delayed dental care due to cost in the past year (Ref: Urban)						
Micropolitan	1.02	(0.92-1.13)	0.93	(0.83-1.03)	0.94	(0.84-1.04)
Noncore	1.09	(0.95-1.23)	0.99	(0.83-1.18)	1.02	(0.84-1.21)
Did not get dental care due to cost in the past year (Ref: Urban)						
Micropolitan	1.01	(0.90-1.14)	0.89	(0.78-1.01)	0.89	(0.78-1.01)
Noncore	1.11	(0.96-1.27)	0.97	(0.79-1.17)	0.96	(0.78-1.18)

Data Source: National Health Interview Survey (2019), National Center for Health Statistics, Centers for Disease Control and Prevention.

<sup>†</sup>Both models adjusted for age, sex, race and ethnicity, marital status, annual household income, education level, employment status, health insurance coverage, dental insurance coverage, general health status, smoking status, and county-level factors, including county persistent poverty typology code, county low employment typology code, county low education typology code, and quartiles of county non-white population. The second adjusted model includes the county percentage of per capita dentist supply benchmark.

Table 4 shows how other respondent characteristics were associated with the three dental outcomes. Respondents with incomes less than \$75,000 and respondents with a high school education or less were less likely to have a dental visit compared with respondents in the highest income and education categories. Compared to respondents who were employed, respondents who were unemployed had an increased likelihood of reporting having a dental visit in the past year (aRR 1.11, 95% CI 1.03-1.18). Respondents who did not have health and dental insurance coverage were less likely to report having a dental visit and more likely to report delaying or not getting dental care compared to those with coverage. Respondents living in a county with a dentist, but less than 50% of the benchmark dentist supply, were less likely to report having a dental visit in the past year. There was not a significant difference between counties without any dentist compared to those at or above the benchmark. There was not a significant association of dentist supply category with the delaying dental care and not getting dental care due to cost. Table 4 shows the full regression models.

**Table 4. Adjusted<sup>†</sup> Relative Risks for Three Dental Outcomes in U.S. Rural Counties (Micropolitan and Noncore) Compared to Urban Counties, 2019**

	Had a dental visit in the past year	Delayed dental care due to cost in the past year	Did not get dental care due to cost in the past year
	RR (95% Confidence interval)	RR (95% Confidence interval)	RR (95% Confidence interval)
<b>Rural-urban status</b>			
Urban	Ref	Ref	Ref
Micropolitan	0.95 (0.90-1.01)	0.94 (0.84-1.04)	0.89 (0.78-1.01)
Noncore	0.95 (0.87-1.03)	1.02 (0.84-1.21)	0.96 (0.78-1.18)
<b>Age</b>			
18-44 years	0.93 (0.80-0.93)	1.34 (1.23-1.46)	1.35 (1.22-1.50)
45-64 years	0.99 (0.91-1.05)	1.38 (1.27-1.50)	1.47 (1.35-1.61)
65 years or older	Ref	Ref	Ref
<b>Sex</b>			
Female	Ref	Ref	Ref
Male	0.87 (0.84-0.90)	0.76 (0.71-0.81)	0.76 (0.71-0.81)
<b>Race and ethnicity<sup>‡</sup></b>			
AI/AN NH	1.02 (0.89-1.14)	0.70 (0.49-0.99)	0.71 (0.49-1.01)
Asian NH	0.97 (0.92-1.02)	0.71 (0.60-0.85)	0.84 (0.69-1.00)
Black NH	0.93 (0.88-0.97)	0.99 (0.89-1.08)	1.11 (0.99-1.22)
Hispanic	0.98 (0.94-1.02)	1.16 (1.08-1.24)	1.27 (1.16-1.38)
White NH	Ref	Ref	Ref
<b>Marital status</b>			
Married or partnered	Ref	Ref	Ref
Not married or partnered	1.01 (0.98-1.04)	0.88 (0.82-0.95)	0.85 (0.79-0.91)
<b>Annual household income</b>			
Less than \$25,000	0.60 (0.55-0.65)	1.69 (1.58-1.80)	1.87 (1.74-2.00)
\$25,000-\$49,000	0.75 (0.70-0.79)	1.64 (1.54-1.75)	1.78 (1.64-1.91)
\$50,000-\$74,999	0.88 (0.84-0.91)	1.59 (1.48-1.71)	1.66 (1.52-1.82)
\$75,000 or greater	Ref	Ref	Ref
<b>Education level</b>			
Less than high school	0.75 (0.69-0.81)	1.00 (0.91-1.08)	1.04 (0.94-1.14)
High school graduate	0.87 (0.83-0.90)	1.03 (0.96-1.10)	1.04 (0.96-1.12)
More than high school	Ref	Ref	Ref
<b>Employment status</b>			
Employed	Ref	Ref	Ref
Unemployed	1.11 (1.03-1.18)	1.05 (0.85-1.25)	1.14 (0.92-1.42)
Out of workforce <sup>§</sup>	1.02 (0.99-1.05)	0.84 (0.77-0.91)	0.85 (0.78-0.93)
<b>Health insurance coverage</b>			
Insured	Ref	Ref	Ref
Uninsured	0.57 (0.52-0.62)	1.50 (1.45-1.54)	1.53 (1.45-1.61)
<b>Dental insurance coverage</b>			
Insured	Ref	Ref	Ref
Uninsured	0.78 (0.75-0.81)	1.30 (1.22-1.38)	1.22 (1.13-1.31)

Table 4. continued on next page

Table 4. continued

Table 4. Adjusted<sup>†</sup> Relative Risks for Three Dental Outcomes in U.S. Rural Counties (Micropolitan and Noncore) Compared to Urban Counties, 2019

	Had a dental visit in the past year	Delayed dental care due to cost in the past year	Did not get dental care due to cost in the past year
	RR (95% Confidence interval)	RR (95% Confidence interval)	RR (95% Confidence interval)
<b>General health status</b>			
Excellent/very good	Ref	Ref	Ref
Good	0.86 (0.83-0.90)	1.31 (1.24-1.40)	1.35 (1.25-1.45)
Poor/fair	0.69 (0.65-0.74)	1.55 (1.47-1.63)	1.69 (1.60-1.78)
<b>Smoking status</b>			
Never smoked	Ref	Ref	Ref
Former smoker	0.88 (0.85-0.91)	1.20 (1.12-1.28)	1.27 (1.17-1.37)
Current smoker	0.77 (0.73-0.80)	1.32 (1.23-1.42)	1.43 (1.34-1.53)
<b>Persistent poverty county</b>			
No	Ref	Ref	Ref
Yes	1.06 (0.98-1.14)	0.79 (0.67-0.94)	0.89 (0.75-1.05)
<b>Low employment county</b>			
No	Ref	Ref	Ref
Yes	0.98 (0.92-1.04)	1.04 (0.92-1.18)	1.11 (0.96-1.27)
<b>Low education county</b>			
No	Ref	Ref	Ref
Yes	0.97 (0.92-1.02)	1.05 (0.94-1.16)	1.03 (0.92-1.15)
<b>Category of county per capita dentist supply</b>			
0% - no dentists	0.96 (0.83-1.08)	0.88 (0.60-1.25)	1.00 (0.72-1.37)
>0 - <25% of benchmark supply	0.86 (0.77-0.95)	0.91 (0.72-1.14)	0.98 (0.76-1.26)
25% - <50% of benchmark supply	0.92 (0.86-0.97)	0.98 (0.85-1.12)	0.94 (0.80-1.11)
50% - <75% of benchmark supply	0.97 (0.92-1.01)	0.98 (0.88-1.08)	0.98 (0.87-1.10)
75% - < 100% of benchmark supply	0.99 (0.96-1.02)	0.98 (0.90-1.06)	0.96 (0.87-1.06)
100% or greater of benchmark supply	Ref	Ref	Ref
<b>Quartiles of county non-White population</b>			
1 <sup>st</sup> quartile (lowest)	1.05 (1.00-1.09)	0.94 (0.80-1.11)	0.91 (0.76-1.08)
2 <sup>nd</sup> quartile	1.03 (0.99-1.07)	1.06 (0.90-1.24)	1.05 (0.89-1.24)
3 <sup>rd</sup> quartile	1.02 (0.97-1.06)	1.05 (0.89-1.23)	1.02 (0.85-1.21)

Data Source: National Health Interview Survey (2019), National Center for Health Statistics, Centers for Disease Control and Prevention.

<sup>†</sup>Adjusted for age, sex, race and ethnicity, marital status, annual household income, education level, employment status, health insurance coverage, dental insurance coverage, general health status, smoking status, and county-level factors, including county persistent poverty typology code, county low employment typology code, county low education typology code, quartiles of county non-white population, and category of county per capita dentist supply.

<sup>‡</sup>Results suppressed for NH other single races or multiracial due to small sample size.

<sup>§</sup>Out of the workforce employment status includes individuals who reported they are retired, unable to work for health reasons/disabled, taking care of house or family, going to school, or unpaid volunteering.

## LIMITATIONS

The findings presented in this report are subject to several limitations. We chose to use data from 2019, prior to the COVID-19 pandemic. Access to medical services declined during the pandemic and may still not have returned to pre-pandemic levels. Thus, current rural-urban differences may be more pronounced than those reported here. Findings also could have been affected by the 59.1% survey response rates. However, the NHIS survey employs post-stratification weights to yield nationally representative estimates. Also, care must be taken in drawing conclusions based on data at the county level, as there is a significant degree of variation in population characteristics within many, particularly geographically large, counties. For example, counties classified as urban may also encompass rural populations. This aggregation may attenuate the observed rural-urban differences in access to care. Another limitation is the use of self-report for oral health care utilization;

however, we do not expect this to differ significantly between rural and urban populations. Finally, we calculated dentist supply using summary data from the ADA Masterfile. Rural-urban dentist supply estimates necessarily excluded dentists who lacked a county identifier (FIPS code). Because there is no reason to suspect that the capture of county FIPS code would vary systematically between rural and urban dentists, the exclusion of those without county FIPS codes would not be expected to influence rural-urban comparisons. We further restricted dentists to those who would likely be providing services to the general population; this resulted in a per capita dentist supply estimate that is lower than dentist supply estimates reported elsewhere.<sup>28</sup> Despite its shortcomings, the ADA Masterfile dataset is the most readily available source of information on dentists for national workforce policy and thus is likely to continue to be used to obtain estimates of geographic access to dental care.

## DISCUSSION

This study sought to update findings from a previous study done by the WWAMI RHRC.<sup>4</sup> Comparing utilization data from 2019 to data from 2006, we observed a decline in the percentage of both urban and rural respondents who reported having a dental visit in the past year (-5.1% vs. -7.6% respectively). Analyses show that after adjusting for socio-demographic and community characteristics, rural residing adults remained less likely to have had a dental visit in the past year. These findings are consistent with our previous work and the work of others.<sup>4,7,14,29</sup> When we included a county-level measure of dentist supply in the model, (percentage of the dental supply benchmark), the rural-urban difference was no longer significant. Including the dental supply variable revealed that in counties where the supply was 50% or less of the benchmark, residents were less likely to have had a previous year dental visit regardless of where they lived. However, we did not see significant differences in counties without any dentist compared to those at or above the benchmark. This was unexpected and may be due to the sample size in these counties.

Another unexpected finding in the regression analysis was the increased likelihood of a past-year dental visit by unemployed survey respondents compared to employed respondents. Respondents who indicated they were unemployed seasonal or contract workers were included in the unemployed group. One possible explanation for this finding is that these respondents did not rely on employer-sponsored dental insurance to access care.

## CONCLUSIONS AND IMPLICATIONS FOR POLICY

Findings from this analysis suggest that rural adults report less frequent dental care utilization compared to urban adults, which is in part attributable to the less-than-optimal dentist supply in rural areas. These findings support the need for policies and interventions to improve the supply of dentists in rural areas. Programs that support the recruitment and retention of dentists in rural areas include rural training programs and loan repayment programs. Programs such as the University of Washington's (UW) Regional Initiatives in Dental Education (RIDE) program provide dental students with 40% of their training in rural communities in Eastern and Central Washington, and the majority of graduates from the UW RIDE program continue to work in rural or underserved communities.<sup>30</sup> Loan repayment programs (LRPs), such as the National Health Service Corps (NHSC) LRP and the Indian Health Service LRP, offer loan repayment assistance to dental professionals who work in rural or underserved areas for a period of time. Dentist alumni of LRPs are more likely to remain employed in an underserved setting compared to other dentists.<sup>31</sup>

## DISCLAIMER

The findings and conclusions in this paper are those of the author(s) and do not necessarily represent the views of the Research Data Center, the National Center for Health Statistics, or the Centers for Disease Control and Prevention.

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