



## Trends in the Provision of Oral Health Services by Federally Qualified Health Centers

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Center for Health Workforce Studies  
School of Public Health  
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## PREFACE

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This report summarizes trends in the direct provision of oral health services by federally qualified health centers (FQHCs) over recent years and factors that predict the likelihood of an FQHC providing direct general and/or specialty oral health services. The analyses use both current and historical data to describe existing oral health service capacity in FQHCs and differences among health centers and across states in direct delivery of oral health services. The results of this study will be useful for policymakers considering strategies to enable access to oral health services for underserved populations, and the study will provide important contributions to the literature describing oral health services access barriers for the underserved.

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## BACKGROUND

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Federally qualified health centers (FQHCs) are safety net providers governed by Section 330 of the Public Health Service Act. In 2009, FQHCs provided oral health services to 3.4 million patients in the United States.<sup>1</sup> By 2014, FQHCs across the US reported providing oral health services to 4.8 million patients annually, a more than 40% increase over 5 years.<sup>2</sup> A number of factors have contributed to increased provision of oral health services by FQHCs, particularly Affordable Care Act (ACA) efforts to expand access to oral health services for children and Medicaid-eligible adults as well as the Health Resources and Services Administration's (HRSA) funding of oral health expansion at FQHCs.

FQHCs provide access to oral health services through a wide variety of configurations depending on state workforce policy, reimbursement opportunities, population need, and dental provider supply. The models used for provision of oral health care through FQHCs include direct service provision to patients in fixed clinics, affiliated mobile and portable oral health programs (especially in schools), and referrals or vouchers for oral health services from local community dentists, who contract with or agree to see FQHC primary care patients.

FQHC approaches to oral health service delivery depend on a variety of factors. Clearly, there are many financial barriers to the direct provision of oral health services at FQHCs, including the high cost of installing dental operatories and the expense of dental supplies, such as restorative and prosthetic materials. However, HRSA has provided substantial financial support to FQHCs interested in directly providing oral health services, awarding more than \$55 million in oral health expansion grants beginning in 2001.<sup>3</sup> In 2016, HRSA awarded an additional \$156 million to FQHCs for expansion of oral health infrastructure.

A number of other factors can influence FQHC decisions to provide oral health services directly, including:

- Difficulty recruiting and retaining oral health professionals to work in safety net settings
- State Medicaid reimbursement policy for the provision of oral health services
- State scope-of-practice laws and regulations for oral health professionals

The hypotheses for the present study were as follows:

- HRSA's funding of oral health expansions at FQHCs has reduced financial barriers and increased the number of FQHCs that directly provide oral health services.
- State Medicaid reimbursement policies related to dental benefits for adults impact decisions by FQHCs regarding the direct provision of oral health services—for example, FQHCs located in states with limited Medicaid dental benefits for adults are less likely than FQHCs in states with more extensive adult Medicaid dental benefits to provide oral health services directly to patients.
- FQHCs in rural areas are more likely than FQHCs in urban areas to directly provide oral health services to patients.
- A state's regulatory climate for oral health professionals, particularly dental hygienists, impacts FQHCs' decisions to directly provide oral health services.

This investigation examined trends in the direct provision of oral health services by FQHCs over time. The results of this study will be useful for policymakers considering strategies to enable access to oral health services for underserved populations, and the study will provide important contributions to the literature describing oral health services access barriers for the underserved.

## METHODS

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This study examined factors that predict the likelihood of an FQHC providing direct general and/or specialty oral health services, including:

- Medicaid coverage policy and reimbursement for FQHC oral health services
- The scope of practice laws that drive state workforce policies for oral health professionals
- Supply of oral health providers
- Population need based on demographic indicators, socioeconomic characteristics, and geography

The analyses use both current and historical data to describe trends in direct provision of oral health services over recent years. The analyses describe existing oral health service capacity in FQHCs and differences among health centers and across states in direct delivery of oral health services. The statistical analyses incorporate population demographic and socioeconomic variables, Medicaid eligibility rates, measures of rurality, supply of dentists and dental hygienists, and numbers of Dental Health Professional Shortage Areas (DHPSAs) in a state, among other factors. The study also assessed geographic<sup>4</sup> differences in FQHC engagement with direct delivery of oral health services.

Researchers analyzed Health Center Grantee Data in HRSA's Uniform Data System (UDS) from 2011 to 2014<sup>5</sup> as well as primary survey data collected by OHWRC through a survey of FQHCs conducted in 2016<sup>6</sup> and state-level secondary data.<sup>7-16</sup> The Center for Health Workforce Studies (CHWS) has been granted access to facility-level dental workforce data in UDS, which was facilitated by project officers at HRSA. Other data elements were gathered from a variety of sources, including the annual survey of Medicaid providers from the Medicaid/Medicare/CHIP Services Dental Association, the American Community Survey, and the Area Health Resource File. Literature describing barriers and facilitators to direct provision of oral health services by FQHCs was reviewed and summarized.

## KEY FINDINGS

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### Proportion of FQHCs providing direct oral health services, 2011-2014

- This study found a slight decline in the proportion of FQHCs nationwide that were directly providing oral health services, from 78.3% in 2011 to 76.1% in 2014 (-2.8% change). However, this finding appears to be a regional issue.
- The proportion of FQHCs in the Midwest (+1.6% change), the Northeast (+6.6% change), and the West (+3.7% change) providing direct oral health services increased over the 4-year period. In contrast, a noticeable decline in the percentage of FQHCs providing direct dental services in the South (-14.8% change), especially in 2 of the 3 divisions within that region, drove the negative trend in the national results.
- One possible explanation for the decline in the South may be related to the presence or absence of an adult dental benefit in state Medicaid programs. Among the 17 states in the South region, 4 states offered no dental benefit for adults in 2014, 6 states had an emergency-only dental benefit for adults, 6 states offered limited dental benefits to adults, and only 1 state in the region offered an extensive dental benefit to adults eligible for Medicaid in that year.
- Regression analysis supported the supposition that the quality of state Medicaid coverage for dental services affected the likelihood that FQHCs provided dental services directly to patients. The odds ratios (OR) computed by region found that FQHCs in the Midwest (OR=1.43), Northeast (OR=1.56), and West (OR=1.82) were significantly or borderline significantly more likely to offer direct dental services in states with an extensive dental benefit compared with those with a limited dental benefit. FQHCs in the South (OR=1.09) were more likely to provide direct dental services in states with a limited Medicaid dental benefit for adults than in states with no dental coverage or an emergency-only dental benefit.
- The study data revealed that FQHCs that provided dental services directly to patients had higher percentages of patients overall with incomes at or below 150% of the federal poverty level (FPL) and higher percentages of patients (including both adults and children) who were eligible for Medicaid than those FQHCs that did not directly provide dental services.

- Regression analysis showed a statistically significant positive association between provision of direct oral health services by FQHCs and percentages of patients with incomes at or below 150% of FPL and percentages of patients 17 years old and younger without medical insurance or on Medicaid/CHIP insurance or other public insurance nationwide.
- Percentages of patients with incomes at or below FPL (OR=1.01) and patients without medical insurance (children, OR=1.10; adults, OR=1.01) were the strongest positive predictors of provision of direct oral health services by FQHCs in the South region. Percentages of patients (children, OR=1.06; adults, OR=1.02) on Medicaid/CHIP insurance were the strongest positive predictors in the Northeast region.

### Proportion of patients receiving direct oral health services in FQHCs, 2011-2014

- The proportion of FQHC patients receiving direct oral health services increased nationwide and in all regions except the South between 2011 and 2014.
  - Nationwide, the proportion of FQHC patients who received any direct oral health service increased between 2011 (25.0% of total patients) and 2014 (25.9% of total patients). However, the magnitude of this trend (+3.6% change) was affected by the data from FQHCs in the South.
  - There was a noticeable increase in the proportion of FQHC patients in the Midwest (+27.5% change) and in the Northeast (+23.5% change) receiving a direct oral health service over the 4-year period. FQHCs in the West showed a positive trend but on a smaller scale, with a 2.7% positive change in the number of FQHC patients receiving a direct oral health service between 2011 and 2014.
  - There was a notable decline in the proportion of FQHC patients in the South (-21.1% change) receiving any direct dental service over the 4-year period; 2 of the 3 geographic divisions within the South region showed a significant decrease.

### Types of direct oral health services provided to patients in FQHCs, 2011-2014

- One of the most positive findings from this study was that the proportion of FQHC patients in the nation receiving preventive oral health services increased (+3.3% change) over the period between 2011 and 2014, while the proportion receiving restorative (-1.3% change), oral surgery (-7.4% change), and emergency dental (-11.7% change) services decreased. This positive trend was promising, although the changes in relative values were small.

- There were prominent differences by region in the types and proportion of patients receiving oral health services. There was an upward trend in the proportion of FQHC patients in the Northeast (+34.7% change) and Midwest (+22.2% change) that received prophylactic services and an increase in the Midwest (+25.6% change), Northeast (+12.3% change), and West (+7.6% change) in the proportion of patients receiving a restorative service.
- The proportion of FQHC patients in the South who received any oral health service—including oral examination (-17.4% change), prophylactic services (-29.9% change), fluoride treatment (-30.6% change), restorative services (-36.7% change), oral surgery services (-14.3% change), rehabilitation services (-26.5% change), and emergency services (-47.2% change)—declined over the 4-year period.

### Types of direct oral health services provided to dental patients in FQHCs, 2011-2014

- When the UDS data were analyzed using only those FQHC patients who actually received any dental service in a year as the denominator, the results were similarly encouraging. The largest absolute increase in type of service provided to dental patients was for preventive/prophylactic services. While the percentage increase was small (+3.3% change) over the period, it was still the largest increase for any dental service. Emergency services exhibited the largest decrease (-18.5% change) among all services provided to patients.
- More than 80% of dental patients in FQHCs providing direct oral health services received an oral examination in 2014, and nearly half (46.2%) received a preventive service. Just over one-quarter (28.3%) received restorative services at an FQHC in that year.
- Another notable finding was that the provision of fluoride treatment services for FQHCs' dental patients decreased nationally (-3.6% change) and regionally in the Northeast (-17.8% change) and the South (-16.0% change). There was an increase in fluoride services in the Midwest (+16.2% change) and the West (+5.5% change).

### Average number of dental visits per dental patient at FQHCs providing direct oral health services, 2011-2014

- The average number of dental visits in 2014 for patients in FQHCs providing direct oral health services was 2.40 visits. The average number of visits per patient was lowest in the South (2.26) and highest in the West (2.56).

- The average number of dental visits per dental patient at FQHCs providing direct oral health services decreased slightly between 2011 and 2014 (-0.4% change). There was an increase in the average number of dental visits per patient in the Northeast (+5.9% change) and in the West (+4.5% change); in contrast, there was a decrease in the average number of dental visits per patient in the Midwest (-7.8% change) and in the South (-4.2% change).
- Data analysis by type of service showed that the highest average number of visits per patient at FQHCs providing direct oral health services was for restorative services (1.86), followed by rehabilitation services including endodontics, periodontics, prosthodontics, and orthodontics (1.77). The lowest averages were for emergency dental visits (1.09) and for preventive visits including fluoride treatments (1.22) and prophylaxis (1.25).
- The study results indicated a per-patient visit increase in the Northeast for all dental services except oral surgery services over the study period. The rate of restorative services in FQHCs providing direct oral health services declined in the West (-3.7% change), in the Midwest (-2.7% change), and in the South (-5.8% change) and increased in the Northeast (+8.4% change).
- Between 2011 and 2014, FQHCs providing direct oral health services in the Northeast experienced the largest increase in the US in the number of dental patients (+43.0% change) and the number of dental visits (+53.3% change). FQHCs providing direct oral health services in the South experienced a 25.4% decline in the number of dental patients and a 27.9% decline in the number of dental visits.

### Oral health staffing ratios in FQHCs providing direct oral health services, 2011-2014

- The data revealed increases in numbers of dental workers in FQHCs in all categories between 2011 and 2014. The number of full-time equivalent (FTE) dentists increased by 9.0% nationally; the numbers of FTE dental hygienists increased by 17.2%, and the number of FTE dental assistants/aides increased by 12.7%.
- Once again, there were regional differences. FQHCs providing direct oral health services in the South experienced a decline in FTE dentists (-22.0% change), dental hygienists (-3.9% change), and dental assistants (-21.3% change). The West showed a decline in dental hygienists over the 4-year period (-12.6% change).
- The average number of dental hygienists per dentist increased from 0.52 in 2011 to 0.60 in 2014 (+15.4% change), and the average number of dental assistants/aides per dentist also increased from 1.85 to 1.91 (+3.2% change).

- Our analyses showed that FQHCs in which more than 23.5% of health center patients received any oral health service within a year had higher average ratios of both dental hygienists (0.60 versus 0.52) and dental assistants/aides (1.95 versus 1.82) per dentist than FQHCs in which fewer than 23.5% of patients received any dental services.
- The proportion of FQHC patients accessing any dental services was positively and significantly associated with oral health staffing ratios in FQHCs in all regions, particularly in the Midwest for the average number of dental hygienists per dentist and in the West for the average number of dental assistants/aides per dentist.
- One notable finding in the regression analyses conducted for this study was that dental hygiene scope of practice in a state was positively and significantly associated with the likelihood of FQHCs providing direct dental care to patients (7% average increase for every 10-point increase in the dental hygiene scope-of-practice index).

### Capacity of FQHCs to provide direct oral health services, 2011-2014

- The average number of patients per FTE oral health provider (dentist or dental hygienist) was significantly lower (414 patients per provider) in FQHCs providing direct oral health services that treated a 23.5% or higher percentage of patients than in those that treated fewer (434 patients per provider).
- There was also a significant difference in the average number of operatories per 1,000 patients at FQHCs providing direct oral health services between FQHCs serving a 23.5% or higher percentage of patients (1.44 operatories) and those serving a lower percentage of patients (0.79 operatories).
- The proportion of FQHC patients accessing any direct dental services was significantly associated with capacity in FQHCs providing direct oral health services in all regions. In the West, it was particularly associated with the average number of patients per FTE oral health provider. In the Northeast, it was particularly associated with the average number of operatories per 1,000 patients.

## Funding and provision of oral health services, 2011-2014

- The funding from ACA Capital Development Grants, including School-Based Health Center Capital Grants, was positively and significantly associated with the likelihood of FQHCs providing direct dental care to patients (1.1% average increase for every \$100,000 increase in the revenue from these federal grants).
- The Midwest region showed a 4.2% average increase in the likelihood of FQHCs providing direct dental care to patients for every \$100,000 increase in the revenue from ACA Capital Development Grants.

## LIMITATIONS

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This study has several limitations. First, the cross-sectional study design did not allow the assessment of causal relationships between the FQHC and state-level characteristics and FQHCs' provision of direct oral health care. Second, secondary data face many challenges and inconsistencies resulting from deviation from standard definitions and standard reporting guidelines and missing, incorrect, or unavailable data. Third, due to the secondary nature of the data used, this study was not able to account for the influence of additional FQHC factors (eg, management or practice characteristics) that are not reported in the UDS or of community-level factors that may have affected the study findings evaluating the contributing factors to the provision of direct oral health services by FQHCs.

## DISCUSSION

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This study examined UDS data for the years 2011-2014 to assess differences among FQHCs in oral health service provision by geography, size, and workforce capacity. The data used in the project analyses also included information obtained from a survey of FQHCs conducted in 2016 by OHWRC for another project funded under its cooperative agreement with HRSA. The findings from these analyses describe increasing infrastructure and rising workforce capacity in FQHCs to provide oral health services in many areas of the US.

In recent years, 2 of the main public strategies to address disparities in population oral health were to increase the supply and improve the capacity of dental safety net providers, especially FQHCs, to provide oral health services and to offer dental benefits in state Medicaid programs for low-income people who access this enhanced safety net for services.<sup>17</sup> If implemented in tandem, these 2 strategies are theoretically synergistic. People will have dental benefits, which is a predictor of utilization, and those people will also have greater access to provider organizations with dental service capacity that accept Medicaid insurance.

This synergy is manifesting itself for children covered by public insurance programs. The mandatory Early and Periodic Screening, Diagnostic, and Treatment (EPSDT) benefit in Medicaid, which includes a comprehensive dental benefit, coupled with a growing number of providers in the safety net serving children insured by Medicaid, has resulted in higher rates of utilization of oral health services among the young across the US.<sup>18</sup> However, persistent disparities for low-income adults in both utilization of services and oral health outcomes suggest that these separate initiatives have not worked as well for adults, perhaps due to state-to-state variation in the Medicaid dental benefit.

The federal government and its agencies designate and fund FQHCs, which are the largest component of the dental safety net in states.<sup>19</sup> Federal funding requirements reduce state-to-state variation among safety net providers that are required to meet federal guidelines to maintain their designations. In recent years, HRSA has awarded significant grants for new or improved oral health infrastructure and to ensure sufficient oral health workforce within community health centers. Between 2001 and 2015, HRSA awarded \$55 million in oral health expansion grants to FQHCs. In 2016, HRSA awarded an additional \$156 million to 420 FQHCs in 47 states for investments in oral health capacity.<sup>19</sup> A federal mandate is also responsible for the universal EPSDT benefit in Medicaid, once again contributing to reduced variation across states in coverage for dental services for children.

Federal law governing Medicaid does not include an adult dental benefit as a minimum requirement for state participation with the program. This leaves states with discretion to provide any adult dental

benefit or to limit the amount, duration, and scope of the services covered if a benefit is provided.<sup>20</sup> In addition, because the essential health benefits described in the ACA do not include adult dental benefits, low-income adults buying insurance on the marketplace would not be assured of dental coverage. These differences between requirements for children and adults introduce significant variation across states in funding for dental services. They also change the trajectory of the 2 main public initiatives in oral health such that they no longer operate in parallel to achieve corresponding results.

FQHCs depend heavily on reimbursement from Medicaid to cover the costs of providing any health services to their patient populations. A large number of patients in FQHCs are Medicaid eligible. In the US in 2014, 48.5% of patients reported incomes below FPL; 21.8% reported incomes below 200% of FPL; and 29.9% of patients' had unknown income levels. In that year, 47.3% of FQHC patients were Medicaid eligible and 27.9% were uninsured.<sup>21</sup> The high proportion of patients with a Medicaid benefit suggest that the absence of an adult dental benefit in a state's Medicaid program might substantially affect an FQHC's decision to supply direct dental services.

The cost of providing dental services is high because dentistry is procedure oriented; equipping a dental operatory is similar in magnitude to equipping a surgical suite for ambulatory medical procedures. In addition, the cost of dental materials, dental instruments, imaging equipment, and sterilization units increase the necessary capital investment.

## CONCLUSIONS

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This study examined data over time describing patient demographics, oral health workforce, and service utilization trends by region. The data analyzed for this study show that FQHC patients in the Midwest, the Northeast, and the West are increasingly accessing oral health services at health centers in their respective regions. Measures of regional differences in capacity to serve patients showed an overall decline among FQHCs in the South in volume, workforce capacity, and ability to provide dental services and, as a result, lower levels of utilization of oral health services by patients in this geographic region. The analyses suggest promising impacts of recent federal funding initiatives to increase the infrastructure and workforce capacity of FQHCs to provide oral health services. It will be important to continue to track growth in this sector of the dental service delivery system to understand the impact of more recent investments by the federal government in oral health grants to these health centers.

# Technical Report

## BACKGROUND

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Federally qualified health centers (FQHCs) are safety net providers governed by Section 330 of the Public Health Service Act. In 2009, FQHCs provided oral health services to 3.4 million patients in the United States.<sup>1</sup> By 2014, FQHCs across the US reported providing oral health services to 4.8 million patients annually, a more than 40% increase over 5 years.<sup>2</sup> A number of factors have contributed to increased provision of oral health services by FQHCs, particularly Affordable Care Act (ACA) efforts to expand access to oral health services for children and Medicaid-eligible adults as well as the Health Resources and Services Administration's (HRSA) funding of oral health expansion at FQHCs.

FQHCs provide access to oral health services through a wide variety of configurations depending on state workforce policy, reimbursement opportunities, population need, and dental provider supply. The models used for provision of oral health care through FQHCs include direct service provision to patients in fixed clinics, affiliated mobile and portable oral health programs (especially in schools), and referrals or vouchers for oral health services from local community dentists, who contract with or agree to see FQHC primary care patients.

FQHCs' approaches to oral health service delivery depend on a variety of factors. Clearly, there are many financial barriers to the direct provision of oral health services at FQHCs, including the high cost of installing dental operatories and the expense of dental supplies, such as restorative and prosthetic materials. However, HRSA has provided substantial financial support to FQHCs interested in directly providing oral health services, awarding more than \$55 million in oral health expansion grants between 2001 and 2015.<sup>3</sup> In 2016, HRSA awarded an additional \$156 million to FQHCs for expansion of oral health infrastructure.

A number of other factors can influence FQHC decisions to provide oral health services directly, including:

- Difficulty recruiting and retaining oral health professionals to work in safety net settings
- State Medicaid reimbursement policy for the provision of oral health services
- State scope-of-practice laws and regulations for oral health professionals

The hypotheses for the present study were as follows:

- HRSA’s funding of oral health expansions at FQHCs has reduced financial barriers and increased the number of FQHCs that directly provide oral health services.
- State Medicaid reimbursement policies related to dental benefits for adults impact decisions by FQHCs regarding the direct provision of oral health services—for example, FQHCs located in states with limited Medicaid dental benefits for adults are less likely than FQHCs in states with more extensive adult Medicaid dental benefits to provide oral health services directly to patients.
- FQHCs in rural areas are more likely than FQHCs in urban areas to directly provide oral health services to patients.
- A state’s regulatory climate for oral health professionals, particularly dental hygienists, impacts FQHCs’ decisions to directly provide oral health services.

This investigation examined trends in the direct provision of oral health services by FQHCs over time. The results of this study will be useful for policymakers considering strategies to enable access to oral health services for underserved populations, and the study will provide important contributions to the literature describing oral health services access barriers for the underserved.

## METHODS

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This study examined factors that predict the likelihood of an FQHC providing direct general and/or specialty oral health services, including:

- Medicaid coverage policy and reimbursement for FQHC oral health services
- The scope of practice laws that drive state workforce policies for oral health professionals
- Supply of oral health providers
- Population need based on demographic indicators, socioeconomic characteristics, and geography

The analyses use both current and historical data to describe trends in direct provision of oral health services over recent years. The analyses describe existing oral health service capacity in FQHCs and differences among health centers and across states in direct delivery of oral health services.

The statistical analyses incorporate population demographic and socioeconomic variables, Medicaid eligibility rates, measures of rurality, supply of dentists and dental hygienists, and numbers of dental care Health Professional Shortage Areas (HPSAs) in a state, among other factors. The study also assessed geographic differences in FQHC engagement with direct delivery of oral health services.

Researchers analyzed Health Center Grantee Data in HRSA's Uniform Data System (UDS) as well as primary survey data collected by OHWRC through a survey of FQHCs conducted in 2016. The Center for Health Workforce Studies (CHWS) was granted access to facility-level dental workforce data in UDS, which was facilitated by project officers at HRSA. Other data elements were gathered from a variety of sources, including the annual survey of Medicaid providers from the Medicaid/Medicare/CHIP Services Dental Association, the American Community Survey, and the Area Health Resource File. Literature describing barriers and facilitators to direct provision of oral health services by FQHCs was reviewed and summarized.

The Uniform Data System (UDS)<sup>5</sup> is a standardized set of data reported by HRSA-designated health center programs:

- Section 330-funded grantees
  - Community Health Center (CHC) grantees
  - Health Care for the Homeless (HCH) grantees
  - Migrant Health Center (MHC) grantees
  - Public Housing Primary Care Program (PHPC) grantees
- Health center program look-alikes
- HRSA Bureau of Health Workforce primary care clinics

UDS data are collected and reviewed annually and are used to:

- Ensure compliance with legislative and regulatory requirements
- Improve health center performance and operations
- Report overall program accomplishments
- Identify trends over time
- Enable HRSA to:
  - Establish or expand targeted programs
  - Identify effective services and interventions to improve the health of underserved communities and vulnerable populations
- Compare with national data regarding the US population at large
- Inform health center programs, partners, and communities about the patients served by health centers

UDS information is organized in 12 tables that contain clinical, operational, and financial data that can be compared with other national and state data and trended over time. The information reported includes:

- Patients served according to their demographic and socioeconomic characteristics
  - Age, gender, race, Hispanic/Latino ethnicity, income (percent of poverty level)
  - Primary third-party medical insurance source, managed care utilization

- Special populations such as migratory, seasonal, homeless, etc
- Staffing and tenure for selected health center staff
  - Full-time equivalent (FTE) staff by position
  - Tenure by full/part time and locum tenens, on call, etc (persons and months)
- Type and amount of services provided
  - Visits by provider type
  - Patients by service type
- Selected diagnoses and services provided, quality-of-care measures, and health outcomes measures by race and ethnicity
- Financial costs of providing services, revenue sources
- Health center electronic health record (EHR) capabilities and quality recognition

US Census Bureau regions and divisions<sup>4</sup> used in this analysis are as follows:

- Northeast region
  - New England division: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
  - Mid-Atlantic division: New Jersey, New York, Pennsylvania
- Midwest region
  - East North Central division: Illinois, Indiana, Michigan, Ohio, Wisconsin
  - West North Central division: Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota
- South region
  - South Atlantic division: Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia
  - East South Central division: Alabama, Kentucky, Mississippi, Tennessee
  - West South Central division: Arkansas, Louisiana, Oklahoma, Texas

- West region
  - Mountain division: Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming
  - Pacific division: Alaska, California, Hawaii, Oregon, Washington

## Data Sources

### FQHC-level data

#### *UDS data for 2011-2014 provided by HRSA*

The UDS is a standardized set of data reported annually by HRSA-designated health center programs. UDS data is comprised of individual tables which include information about patients, staffing, clinical outcomes, and financial data.<sup>5</sup>

#### *Number of dental operatories (2014)*

The 2014 FQHC data on the number of dental operatories was extracted from the Survey of Federally Qualified Health Centers to Understand Participation With Dental Residency Programs and Student Externship Rotations conducted by CHWS in 2016.<sup>6</sup>

### State-level data

#### *Medicaid coverage policy (2011-2014)*

Information about state Medicaid coverage of dental benefits for adults (no dental benefits, emergency-only dental benefits, limited dental benefits, or extensive dental benefits) in 2011-2014 was extracted from various published literature.<sup>7-9</sup>

#### *Medicaid reimbursement rates for dental services (2013-2014)*

The Medicaid fee-for-service (FFS) reimbursement as a percentage of private dental benefits charges for children and adult dental services in each state in 2013-2014 was extracted from American Dental Association (ADA) Health Policy Institute data estimates.<sup>10</sup>

#### *Health insurance coverage (2013-2014)*

The percentage of the population with Medicaid, Medicare, other public insurance coverage, or no health insurance coverage in each state in 2013 and 2014 was extracted from Kaiser Family Foundation estimates based on the US Census Bureau's March 2014 and March 2015 Current Population Survey.<sup>11</sup>

### ***Number of Dental Care HPSAs (2016)***

The HPSA designations are used to identify areas and population groups within the US that are experiencing a shortage of health professionals. The number of dental care HPSAs in each state as of December 2016 was extracted from the HRSA Bureau of Health Workforce.<sup>12</sup>

### ***Percentage of population living in urban/rural areas (2010)***

The US Census Bureau's 2010 estimates of population distribution by urban and rural classification of geographical areas, released in 2012, were used to ascertain the level of urbanization as the percentage of the state population living in urban areas.<sup>13</sup>

### ***Per capita personal income (2012)***

The 2012 data on per capita personal income in each state were extracted from the Bureau of Economic Analysis, US Department of Commerce.<sup>14</sup>

### ***Population on community water systems receiving fluoridated water (2012)***

Information on access to fluoridated water, measured as the percentage of the state population on community water systems receiving fluoridated water, was extracted from the 2012 data released by the Centers for Disease Control and Prevention.<sup>15</sup>

### ***Workforce policies regarding scope-of-practice laws for oral health professionals (2014)***

The information on the numerical scope-of-practice scale (Dental Hygiene Professional Practice Index [DHPPI]) for 2014 was extracted for each state from a study conducted by CHWS and published in 2016.<sup>16</sup>

## **Statistical Analyses**

### **1. Provision of oral health services at FQHCs by geography was evaluated using the following measure (2011-2014):**

- **Proportion of FQHCs delivering direct oral health services**
  - Percentage of FQHCs with dentist and/or dental hygienist FTEs who provided dental services to at least 1 patient

**2. Patients' access to oral health services at FQHCs by geography was evaluated using the following measures (2011-2014):**

- **Proportion of patients accessing dental services**
  - Percentage of patients with any dental visit(s) among all patients at FQHC
  - Percentage of patients with specific dental visit(s) among all patients at FQHC
    - Oral exams
    - Preventive services
      - Prophylaxis (adult or child)
      - Fluoride treatment (adult or child)
    - Restorative services
    - Oral surgery (extractions and other surgical procedures)
    - Rehabilitation services (endodontics, periodontics, prosthodontics, orthodontics)
    - Emergency services
  - Percentage of patients with specific dental visit(s) among patients at FQHC with any dental visits
    - Oral exams
    - Preventive services
      - Prophylaxis (adult or child)
      - Fluoride treatment (adult or child)
    - Restorative services
    - Oral surgery (extractions and other surgical procedures)
    - Rehabilitation services (endodontics, periodontics, prosthodontics, orthodontics)
    - Emergency services

### 3. Patients' utilization of oral health services at FQHCs by geography was evaluated using the following measures (2011-2014):

- **Continuity of care**—visits per patient at FQHC
  - Average number of any dental visits per patient
  - Average number of specific dental visits per patient
    - Oral exams
    - Preventive services
      - Prophylaxis (adult or child)
      - Sealants
      - Fluoride treatment (adult or child)
    - Restorative services
    - Oral surgery (extractions and other surgical procedures)
    - Rehabilitation services (endodontics, periodontics, prosthodontics, orthodontics)
    - Emergency services

Continuity-of-care estimates that were beyond the 99th percentile value of the data (ie, more than 3 standard deviations from the mean) were considered outliers and were replaced with the 99th percentile value.

### 4. Predictor factors measurement

#### FQHC-level factors were evaluated using the following measures (2011-2014):

- **Staffing ratios**—level of support per dentist provider FTE at FQHC
  - Average number of dental hygienist provider FTEs per dentist provider FTE
  - Average number of dental assistant, aide, and technician provider FTEs per dentist provider FTE
- **Panel size**—patients per provider FTE at FQHC
  - Average number of patients with 1 or more dental visits per dental provider FTE

- **Provider productivity**—visits per provider FTE at FQHC
  - Average number of dental visits per dental provider FTE
  - Average number of dental visits per dentist provider FTE
  - Average number of dental visits per dental hygienist provider FTE

Staffing ratios, panel size, and provider productivity estimates that were beyond the 99th percentile value of the data (ie, more than 3 standard deviations from the mean) were considered outliers and were replaced with the 99th percentile value.

- Patient base—demographic and socioeconomic characteristics of all patients at FQHC
  - Prevalence of patients' age groups, health insurance status, and special population groups as a percentage of the total patients who received any service
- Revenue—income received by FQHCs from federal grants
  - ACA Capital Development Grants, including School-Based Health Center Capital Grants
  - American Recovery and Reinvestment Act (ARRA) Capital Improvement Project (CIP) and Facility Investment Program (FIP)
- Capacity—number of dental operatories per patient at FQHC
  - Average number of dental operatories per 1,000 patients who received any service
  - Average number of clinical dental operatories per dentist

Capacity estimates that were beyond the 95th percentile value of the data were considered outliers and were replaced with the 95th percentile value.

**State-level factors were evaluated using the following measures:**

- **Medicaid coverage policy (2011-2014)**
  - Medicaid coverage of dental benefits for adults in the state
    - No dental benefits; emergency-only dental benefits; limited dental benefits; or extensive dental benefits

- **Medicaid reimbursement rates for dental services (2013-2014)**
  - Medicaid FFS reimbursement as a percentage of private dental benefit plan charges in the state
    - Child dental services (2013); adult dental services (2014)
- **Health insurance coverage (2014)**
  - Population with Medicaid, Medicare, other public insurance, commercial coverage, or no health insurance coverage as a percentage of the total population in the state
- **Dental Care Health Professional Shortage Areas (HPSAs) (2016)**
  - Number of HPSAs for dental care in the state
- **Population living in urban/rural areas (2010)**
  - Population living in urban/rural areas as a percentage of the total population in the state
- **Per capita personal income (2012)**
  - Per capita personal income in each state
- **Population on community water systems receiving fluoridated water (2012)**
  - Access to fluoridated water measured as the percentage of the state population on community water systems receiving fluoridated water
- **Workforce policies regarding the scope-of-practice laws for oral health professionals (2014)**
  - Expanded scope of practice for dental hygienists: numerical scope-of-practice scale (DHPPI)

## 5. Evaluation of predictor factors' impact on FQHCs providing direct oral health care

The temporal distribution of FQHC outcomes and predictor factors was analyzed by computing the percent change or difference between 2011 and 2014 and by estimating the annual percent change (trend slopes using simple linear regression) nationwide, by region, and by division.

The *t* test was used to test the statistical significance of differences in predictor means between FQHCs that provided direct oral health services and those that did not provide direct oral health services during the study period. FQHCs providing direct oral health services were defined as FQHCs with any dentist and/or dental hygienist FTEs who provided dental services to at least 1 patient. The *t* test was also used to test the statistical significance of differences in predictor means between FQHCs that provided direct oral health care to  $\geq 23.5\%$  patients and those that provided direct oral health care to  $< 23.5\%$  patients.

Generalized linear mixed models, specifically Poisson regression models with robust variance estimation, were used to estimate rate ratios (RR) and 95% confidence intervals for associations between the proportion of patients accessing any dental services at FQHCs and FQHC staffing ratios, panel size, and capacity (dental operatories) nationwide and by region in 2011-2014.

Logistic regression models were used to estimate odds ratios (OR) and 95% confidence intervals for associations between FQHCs providing direct dental services and FQHC patients' socioeconomic characteristics and federal grant revenue nationwide and by region in 2011-2014. Logistic regression models were also used to estimate odds ratios (OR) and 95% confidence intervals for associations between FQHCs providing direct dental services and state-level characteristics.

Statistical significance was defined as  $P < .05$  using 2-tailed tests. Analyses were conducted using SAS v9.4 (SAS Institute Inc., Cary, North Carolina).

## Definitions used in UDS data

**FTEs:** Reported for employees, contract personnel (not paid by unit of service), volunteers, and residents based on hours worked. FTEs are adjusted for part-time work or for part-year employment but are not reduced for vacation, continuing medical education, meetings, paid leave, holidays, etc. "1.00 FTE" is defined as being the equivalent of 1 person working full time for 1 year.

**Patients:** A patient is counted only once in the Dental Services category regardless of the number of visits.

**Visits:** Dental visits are provided by dentists, dental therapists, and dental hygienists only. Dental visits include visits provided by paid and volunteer staff; those provided by a third party and paid for in full by a health center, including paid managed care referrals or voucher program visits; and those performed by staff rounding on health center patients in hospital. A provider counts only 1 visit with a patient during a day regardless of the number of services provided to that patient.

**Medicaid:** Includes patients covered by Medicaid and CHIP as well as those who have both Medicaid and another type of coverage, such as dual eligibles who are also covered by Medicare.

**Medicare:** Includes patients covered by Medicare and Medicare Advantage as well as those who have Medicare and another type of non-Medicaid coverage where Medicare is the primary payer. Excludes those with Medicare Part A coverage only and those covered by Medicare and Medicaid (dual eligibles).

**Other Public:** Includes patients covered under the military or Veterans Affairs.

**Uninsured:** Includes patients without health insurance and those who have coverage under the Indian Health Service only.

## FINDINGS

### Provision of oral health services at FQHCs by geography (2011-2014)

#### Proportion of FQHCs providing direct oral health services (percentage of FQHCs with dentist and/or dental hygienist FTEs that provided any dental services)

The proportion of FQHCs providing direct oral health services increased in the Midwest, Northeast, and West regions from between 75.7% and 78.0% in 2011 to between 78.5% and 83.2% in 2014; however, the increasing trend was not statistically significant (Table 1). In contrast, the proportion of FQHCs providing direct oral health services in the South region decreased significantly from 80.9% in 2011 to 68.9% in 2014 (-14.8% change); the 4-year trend estimate indicated that the proportion decreased by 4.3%, on average, for each year ( $P=.030$ ). Nationwide, there was a slight reduction in the proportion of FQHCs providing direct oral health services from 78.3% in 2011 to 76.1% in 2014 (-2.8% change), decreasing by 0.5%, on average, each year ( $P=.399$ ).

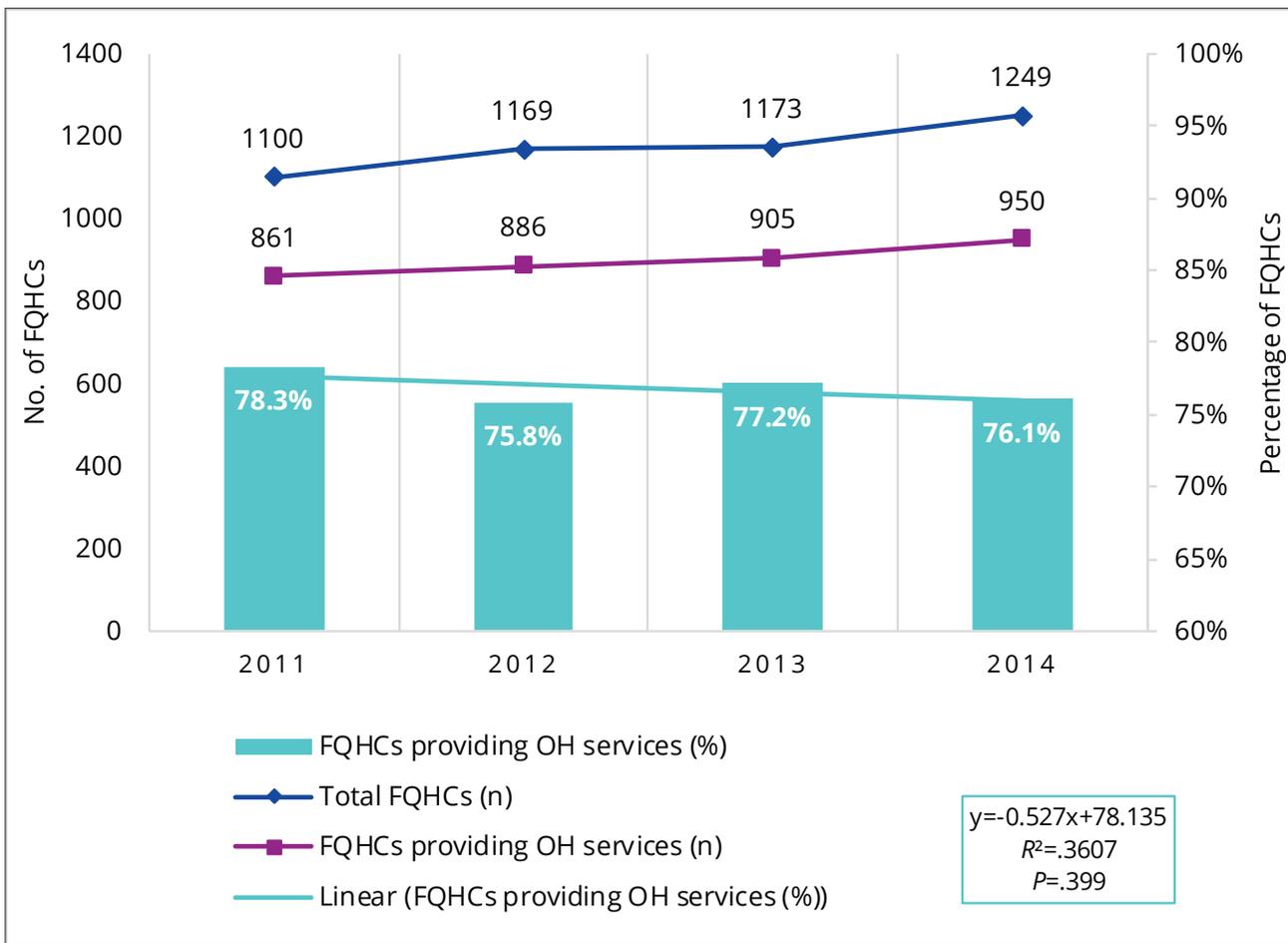
**Table 1. Proportion of FQHCs With Dentist and/or Dental Hygienist FTEs Providing Oral Health Services to At Least 1 Patient by Region and Nationwide, 2011-2014**

Region	2011	2012	2013	2014	% Change 2014-2011	Annual % Change	P Value for Trend
Midwest	77.4%	71.3%	79.3%	78.6%	1.6%	1.2%	0.583
Northeast	78.0%	77.6%	83.4%	83.2%	6.6%	2.1%	0.132
South	80.9%	76.5%	70.0%	68.9%	-14.8%	-4.3%	0.030
West	75.7%	76.9%	80.6%	78.5%	3.7%	1.2%	0.269
Nationwide	78.3%	75.8%	77.2%	76.1%	-2.8%	-0.5%	0.399

Figures 1 through 5 show the 4-year trend of all FQHCs and of FQHCs providing direct oral health services between 2011 and 2014 nationwide and by region.

Nationwide, the total number of FQHCs increased from 1,100 in 2011 to 1,249 in 2014. However, the number (proportion) of FQHCs providing direct oral health services slightly decreased from 861 (78.3%) in 2011 to 950 (76.1%) in 2014 (Figure 1). The decreasing trend in the proportion of FQHCs providing direct oral health services was not statistically significant.

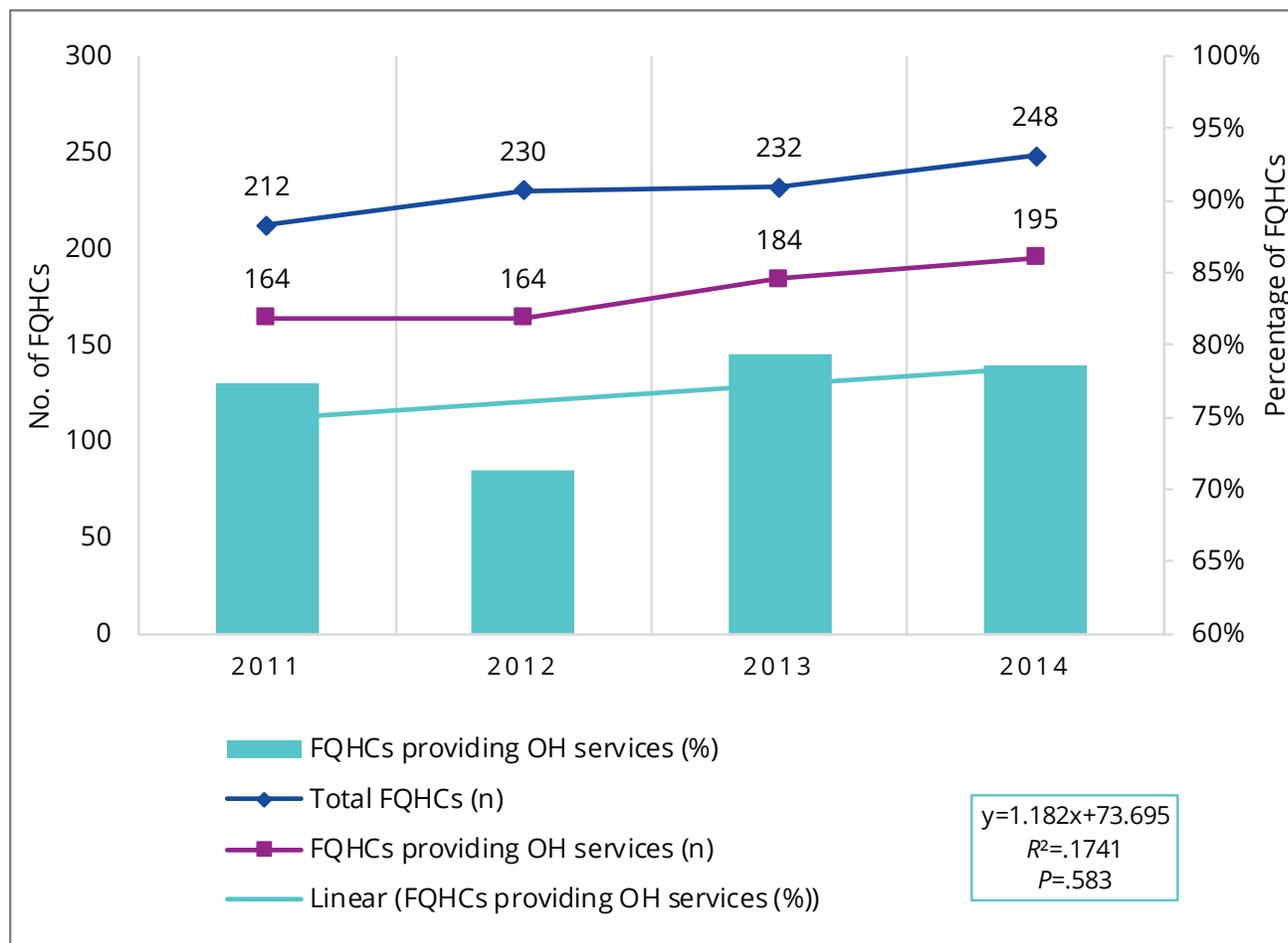
**Figure 1. Four-Year Trend of All FQHCs and FQHCs With Dentist and/or Dental Hygienist FTEs Providing Oral Health Services to At Least 1 Patient Nationwide, 2011-2014**



FQHC, federally qualified health center; OH, oral health.

In the Midwest region, the total number of FQHCs as well as the number (proportion) of FQHCs providing direct oral health services slightly increased from 212 and 164 (77.4%) in 2011 to 248 and 195 (78.6%) in 2014, respectively (Figure 2). The increasing trend in the proportion of FQHCs providing direct oral health services was not statistically significant.

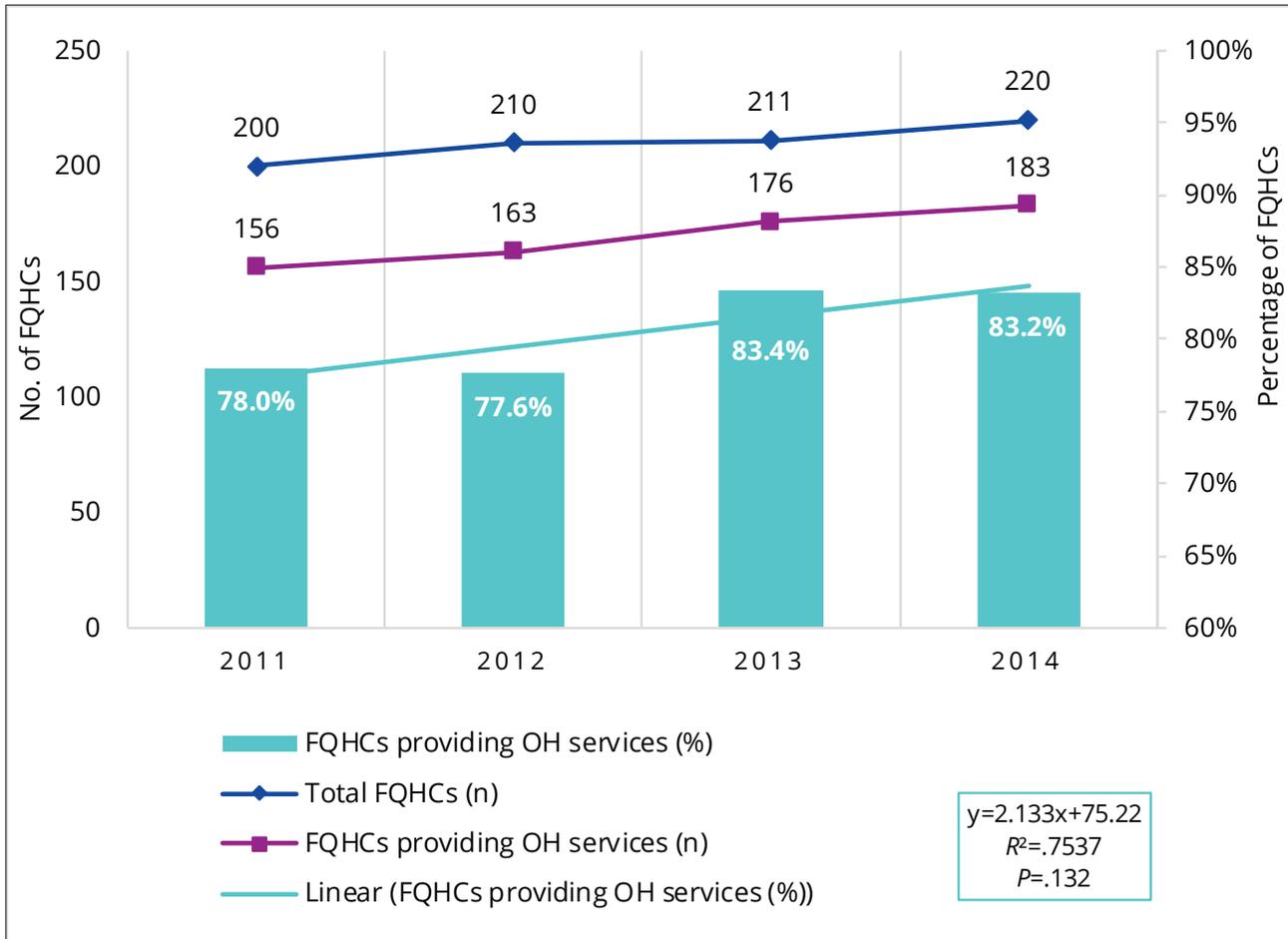
**Figure 2. Four-Year Trend of All FQHCs and FQHCs With Dentist and/or Dental Hygienist FTEs Providing Oral Health Services to At Least 1 Patient in the Midwest Region, 2011-2014**



FQHC, federally qualified health center; OH, oral health.

In the Northeast region, the total number of FQHCs as well as the number (proportion) of FQHCs providing direct oral health services slightly increased from 200 and 156 (78.0%) in 2011 to 220 and 183 (83.2%) in 2014, respectively (Figure 3). The increasing trend in the proportion of FQHCs providing direct oral health services was not statistically significant.

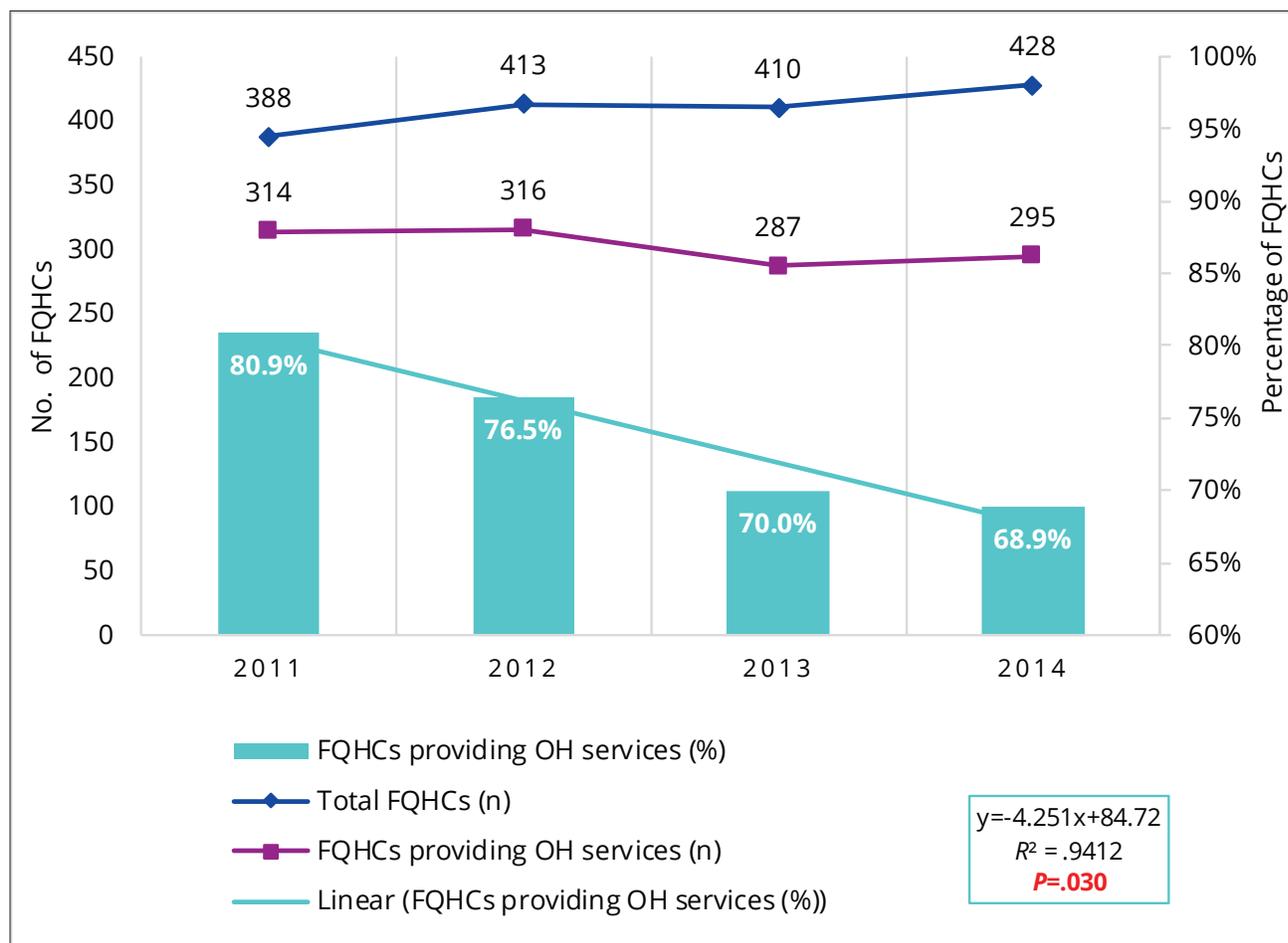
**Figure 3. Four-Year Trend of All FQHCs and FQHCs With Dentist and/or Dental Hygienist FTEs Providing Oral Health Services to At Least 1 Patient in the Northeast Region, 2011-2014**



FQHC, federally qualified health center; OH, oral health.

In the South region, the total number of FQHCs increased from 388 in 2011 to 428 in 2014. In contrast, the number (proportion) of FQHCs providing direct oral health services decreased from 314 (80.9%) in 2011 to 295 (68.9%) in 2014 (Figure 4). The decreasing trend in the proportion of FQHCs providing direct oral health services was statistically significant ( $P=.030$ ).

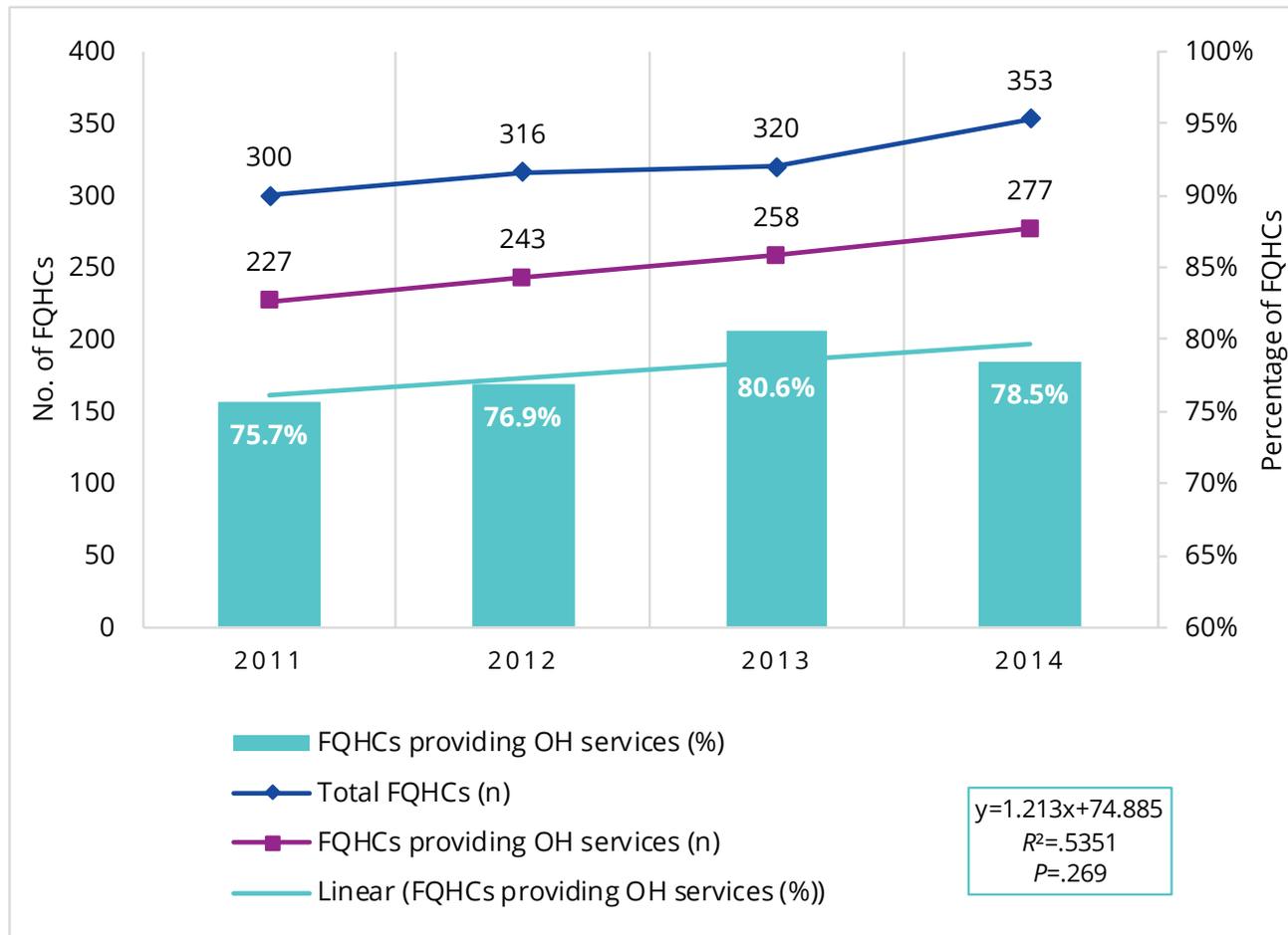
**Figure 4. Four-Year Trend of All FQHCs and FQHCs With Dentist and/or Dental Hygienist FTEs Providing Oral Health Services to At Least 1 Patient in the South Region, 2011-2014**



FQHC, federally qualified health center; OH, oral health.

In the West region, the total number of FQHCs as well as the number (proportion) of FQHCs providing direct oral health services slightly increased from 300 and 227 (75.7%) in 2011 to 353 and 277 (78.5%) in 2014, respectively (Figure 5). The increasing trend in the proportion of FQHCs providing direct oral health services was not statistically significant.

**Figure 5. Four-Year Trend of All FQHCs and FQHCs With Dentist and/or Dental Hygienist FTEs Providing Oral Health Services to At Least 1 Patient in the West Region, 2011-2014**



FQHC, federally qualified health center; OH, oral health.

Over the 4-year study period, there was an increase in the proportion of FQHCs providing direct oral health services in the New England division of the Northeast region (+13.3% change, increasing on average by 3.5% each year;  $P=.030$ ) and the West North Central division of the Midwest region (+17.6% change, increasing on average by 4.8% each year;  $P=.054$ ) (Table 2). The increasing trend in the proportion of FQHCs providing direct oral health services was statistically significant in the New England division and only borderline significant in the West North Central division.

In contrast, over the 4-year study period, there was a decrease in the proportion of FQHCs providing direct oral health services in the East South Central division (-24.3% change, decreasing on average by 7.1% each year;  $P=.048$ ) and the South Atlantic division (-18.7% change, decreasing on average by 5.8% each year;  $P=.081$ ) of the South region (Table 2). The decreasing trend in the proportion of FQHCs providing direct oral health services was statistically significant in the East South Central division and only borderline significant in the South Atlantic division. There was a not significant decreasing trend in the access of patients to oral health services in the West South Central (-2.1% change) and East North Central (-6.6% change) divisions.

**Table 2. Proportion of FQHCs With Dentist and/or Dental Hygienist FTEs Providing Oral Health Services to At Least 1 Patient by Division and Nationwide, 2011-2014**

Division	2011	2012	2013	2014	% Change 2014-2011	Annual % Change	P Value for Trend
Midwest							
East North Central	80.6%	70.3%	77.4%	75.3%	-6.6%	-0.9%	0.737
West North Central	71.8%	72.9%	82.6%	84.4%	17.6%	4.8%	0.054
Northeast							
Middle Atlantic	82.2%	78.6%	84.6%	83.5%	1.5%	1.0%	0.519
New England	73.1%	76.3%	81.9%	82.8%	13.3%	3.5%	0.030
South							
East South Central	81.8%	73.5%	62.2%	61.9%	-24.3%	-7.1%	0.048
South Atlantic	81.4%	77.1%	64.9%	66.2%	-18.7%	-5.8%	0.081
West South Central	79.5%	77.6%	83.7%	77.9%	-2.1%	0.1%	0.943
West							
Mountain	77.8%	78.7%	83.7%	79.8%	2.6%	1.1%	0.449
Pacific	74.8%	76.1%	79.3%	77.9%	4.2%	1.3%	0.180

## Patients' access to oral health services at FQHCs by geography (2011-2014)

### Proportion of patients receiving direct oral health services in FQHCs among health center patients (percentage of patients with any dental visit[s] among all patients)

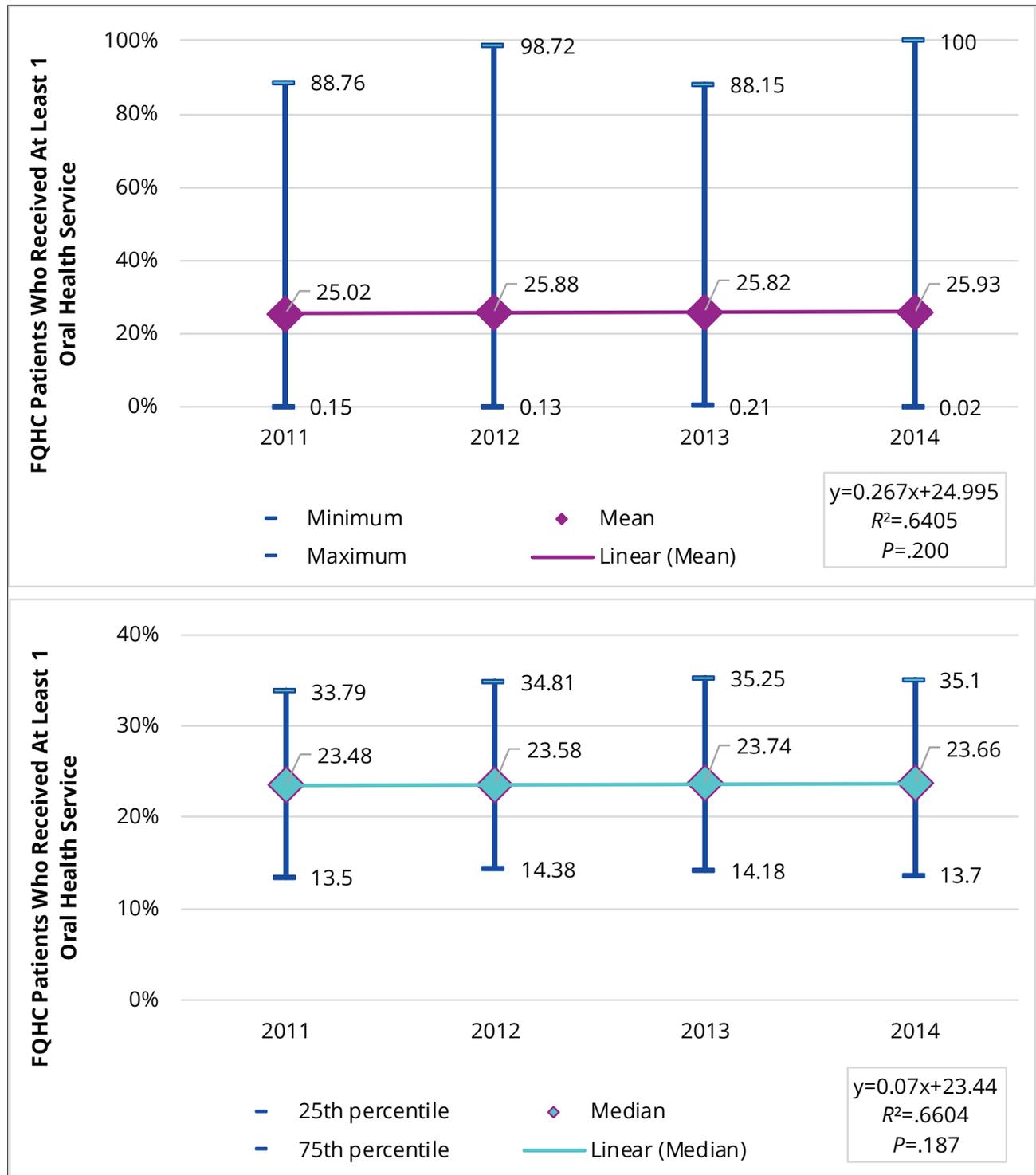
The proportion of FQHC patients receiving any direct oral health services increased in the Midwest, Northeast, and West regions from between 23.0% and 25.5% in 2011 to between 25.4% and 32.6% in 2014; the increasing trend was borderline significant in the Midwest and Northeast regions (Table 3). In contrast, the proportion of FQHC patients receiving any direct oral health services in the South region decreased from 25.9% in 2011 to 20.5% in 2014 (-21.1% change); the 4-year trend estimate indicated a borderline significant decrease by 2.2%, on average, for each year ( $P=.097$ ). Nationwide, there was a slight increase in the proportion of FQHC patients who received any direct oral health services, from 25.0% in 2011 to 25.9% in 2014 (+3.6% change), increasing by 0.3%, on average, each year ( $P=.200$ ).

**Table 3. Proportion of Patients Who Received At Least 1 Oral Health Service at FQHCs With Dentist and/or Dental Hygienist FTEs by Region and Nationwide, 2011-2014**

Region	2011	2012	2013	2014	% Change 2014-2011	Annual % Change	P Value for Trend
Midwest	25.5%	27.0%	33.3%	32.6%	27.5%	2.7%	0.094
Northeast	23.0%	26.4%	28.6%	28.4%	23.5%	1.8%	0.084
South	25.9%	25.7%	20.4%	20.5%	-21.1%	-2.2%	0.097
West	24.8%	25.0%	24.6%	25.4%	2.7%	0.2%	0.433
Nationwide	25.0%	25.9%	25.8%	25.9%	3.6%	0.3%	0.200

The proportion of FQHC patients who received any oral health services increased from 2011 to 2014 nationally (Figure 6). The 4-year trend estimates indicated a small, nonsignificant increase in the mean value (0.3% each year;  $P=.200$ ) and the median value (0.1% each year;  $P=.187$ ). In 2014, the proportion of FQHC patients who received any oral health services varied from 0.02% to 100%, with a mean value of 25.9% and a median value of 23.7%. The 25th-to-75th-percentiles distribution showed that 25% of FQHCs provided oral health services to less than 13.7% of patients, 50% of FQHCs provided oral health services to 13.7% to 35.1% of patients, and 25% of FQHCs provided oral health services to more than 35.1% of patients.

Figure 6. Four-Year Trend of Proportion (Mean, Median, Range) of Patients Who Received At Least 1 Oral Health Service at FQHCs With Dentist and/or Dental Hygienist FTEs Nationwide, 2011-2014

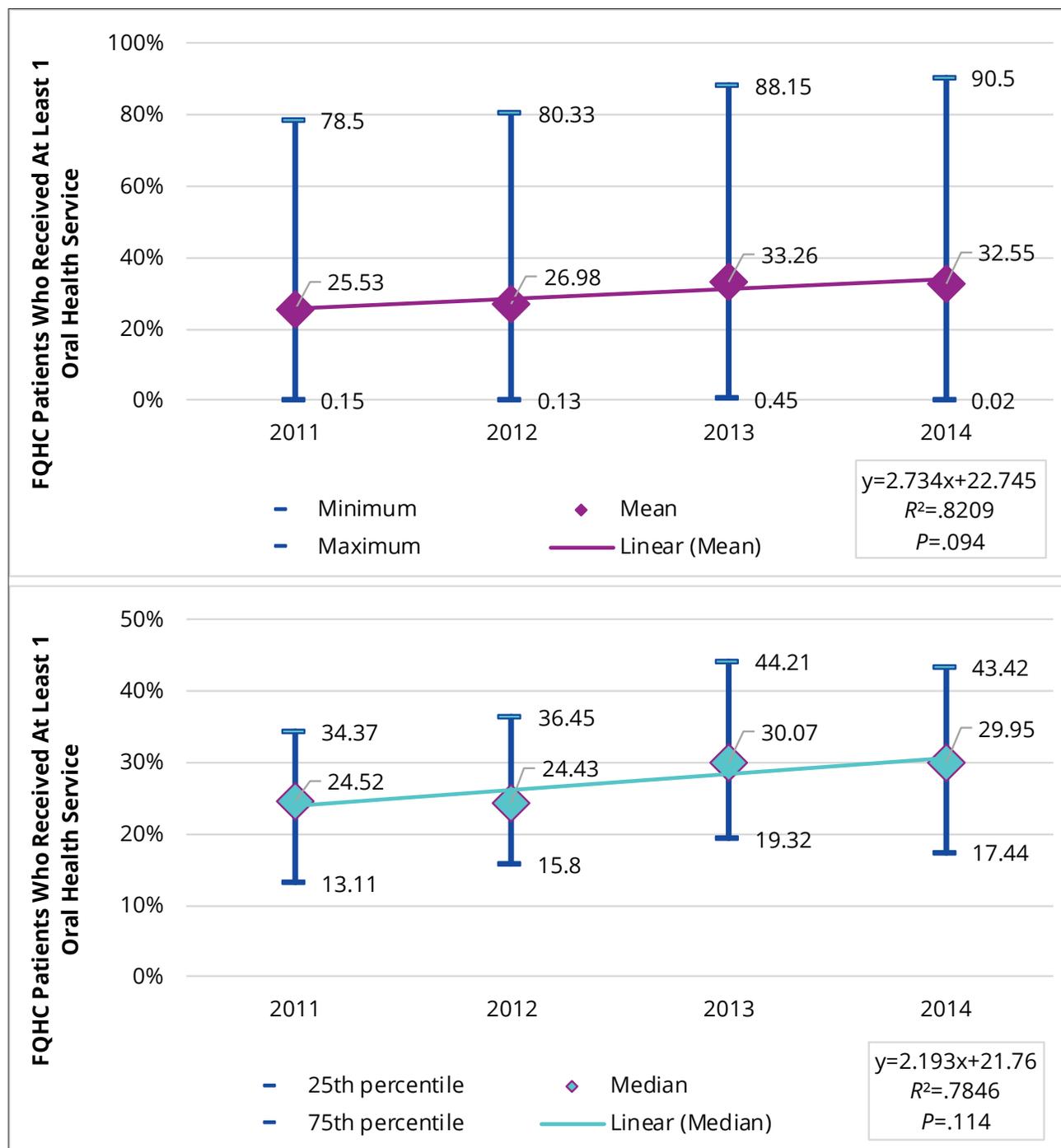


FQHC, federally qualified health center.

In the Midwest region, the proportion of FQHC patients who received any oral health services increased over the 4-year study period (Figure 7). The 4-year trend estimates indicated a borderline significant increase in the mean value (2.7% each year;  $P=.094$ ) and a smaller, nonsignificant increase in the median

value (2.2% each year;  $P=.114$ ). In 2014, the proportion of FQHC patients who received any oral health services varied from 0.02% to 90.5%, with a mean value of 32.6% and a median value of 30.0%. The 25th-to-75th-percentiles distribution showed that 25% of FQHCs provided oral health services to less than 17.4% patients, 50% of FQHCs provided oral health services to 17.4% to 43.4% patients, and 25% of FQHCs provided oral health services to more than 43.4% patients.

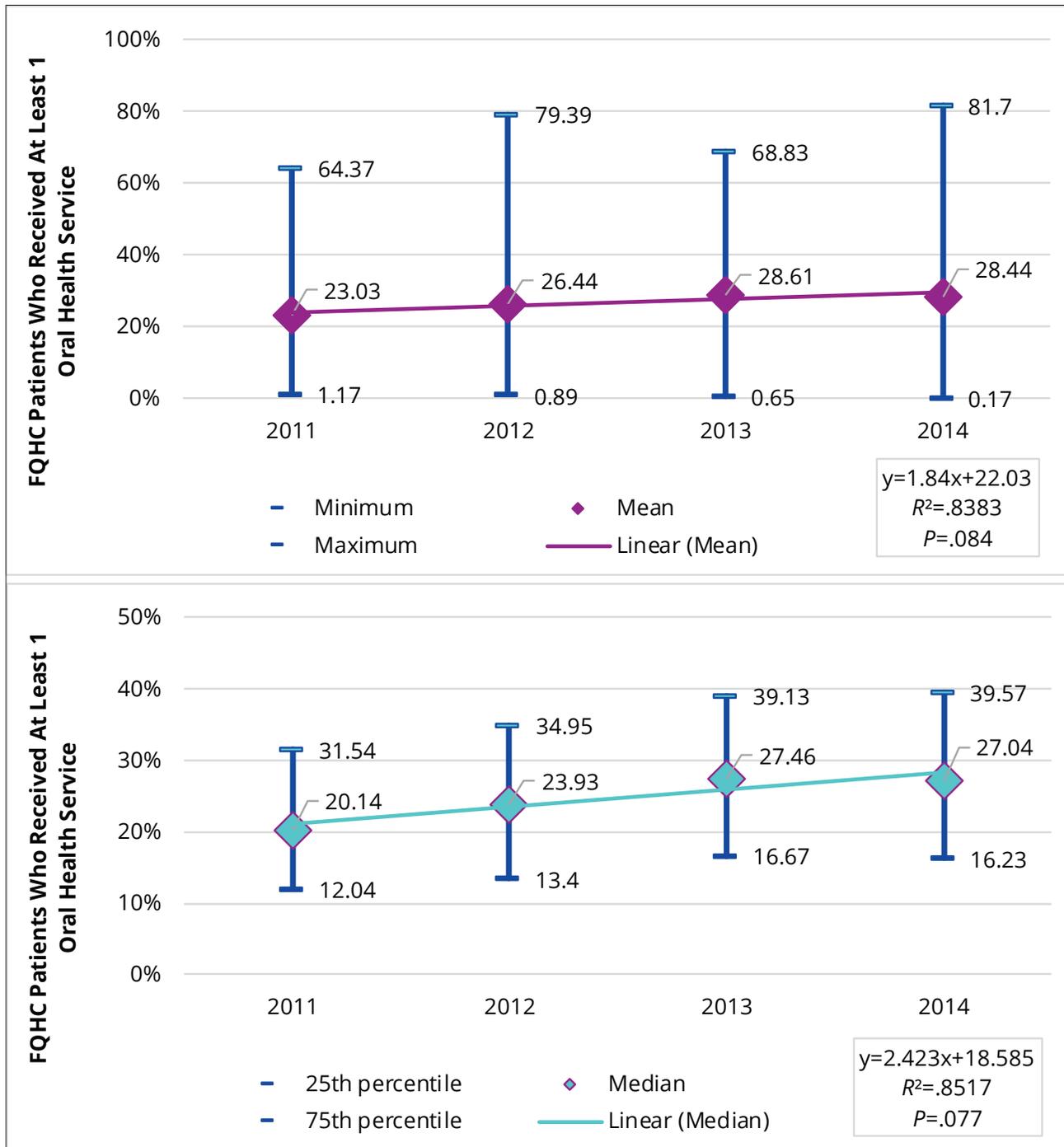
**Figure 7. Four-Year Trend of Proportion (Mean, Median, Range) of Patients Who Received At Least 1 Oral Health Service at FQHCs With Dentist and/or Dental Hygienist FTEs in the Midwest Region, 2011-2014**



FQHC, federally qualified health center.

In the Northeast region, the proportion of FQHC patients who received any oral health services increased over the 4-year study period (Figure 8). The 4-year trend estimates indicated a borderline significant increase in the mean value (1.8% each year;  $P=.084$ ) and the median value (2.4% each year;  $P=.077$ ). In 2014, the proportion of FQHC patients who received any oral health services varied from 0.2% to 81.7%, with a mean value of 28.4% and a median value of 27.0%. The 25th-to-75th-percentiles distribution showed that 25% of FQHCs provided oral health services to less than 16.2% patients, 50% of FQHCs provided oral health services to 16.2% to 39.6% patients, and 25% of FQHCs provided oral health services to more than 39.6% patients.

Figure 8. Four-Year Trend of Proportion (Mean, Median, Range) of Patients Who Received At Least 1 Oral Health Service at FQHCs With Dentist and/or Dental Hygienist FTEs in the Northeast Region, 2011-2014

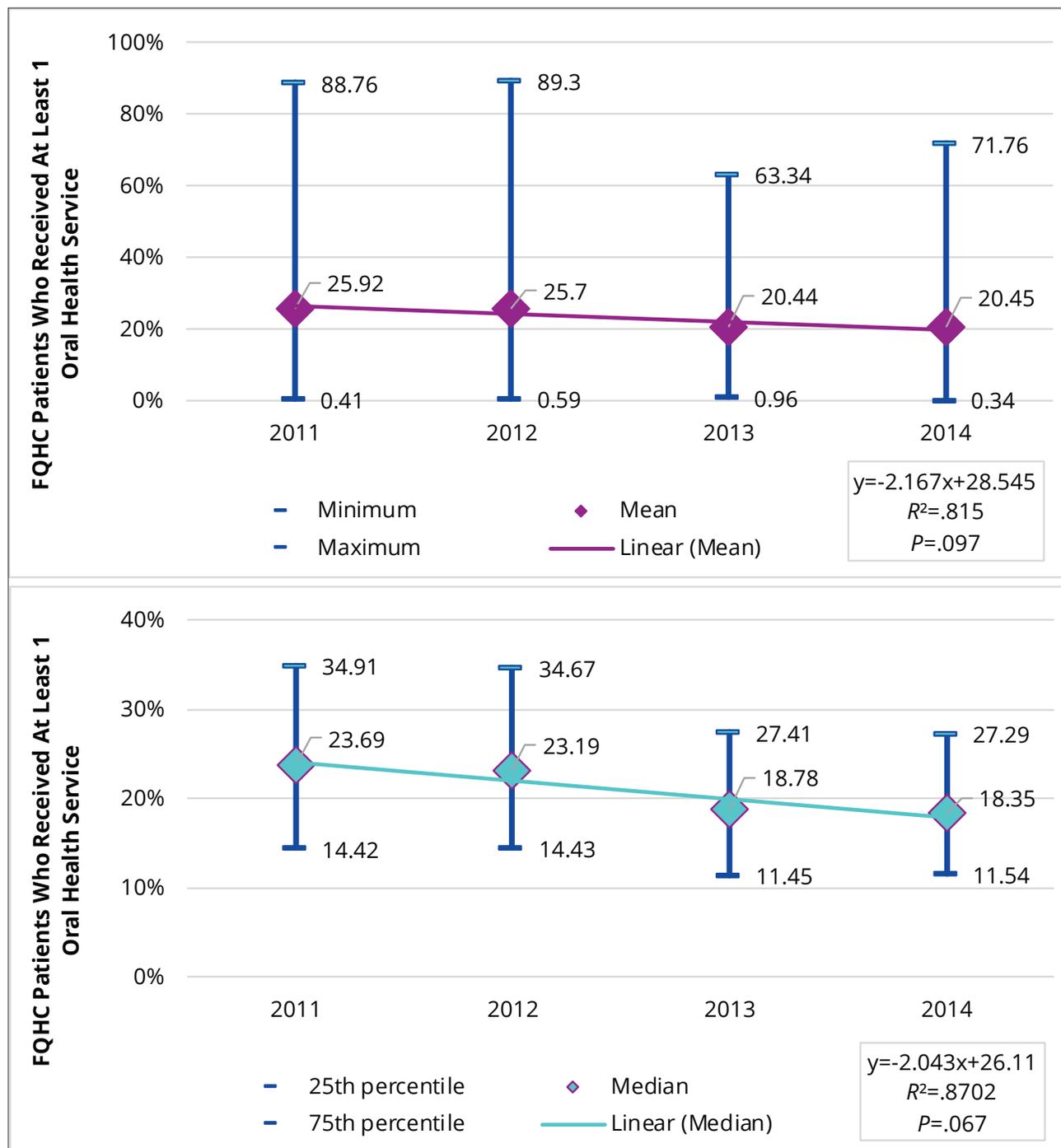


FQHC, federally qualified health center.

In the South region, the proportion of FQHC patients who received any oral health services decreased over the 4-year study period (Figure 9). The 4-year trend estimates indicated a borderline significant decrease in the mean value (-2.2% each year;  $P=.097$ ) and the median value (-2.0% each year;  $P=.067$ ). In 2014, the proportion of FQHC patients who received any oral health services varied from 0.3% to 71.8%, with a mean value of 20.5% and a median value of 18.4%. The 25th-to-75th-percentiles distribution showed

that 25% of FQHCs provided oral health services to less than 11.5% patients, 50% of FQHCs provided oral health services to 11.5% to 27.3% patients, and 25% of FQHCs provided oral health services to more than 27.3% patients.

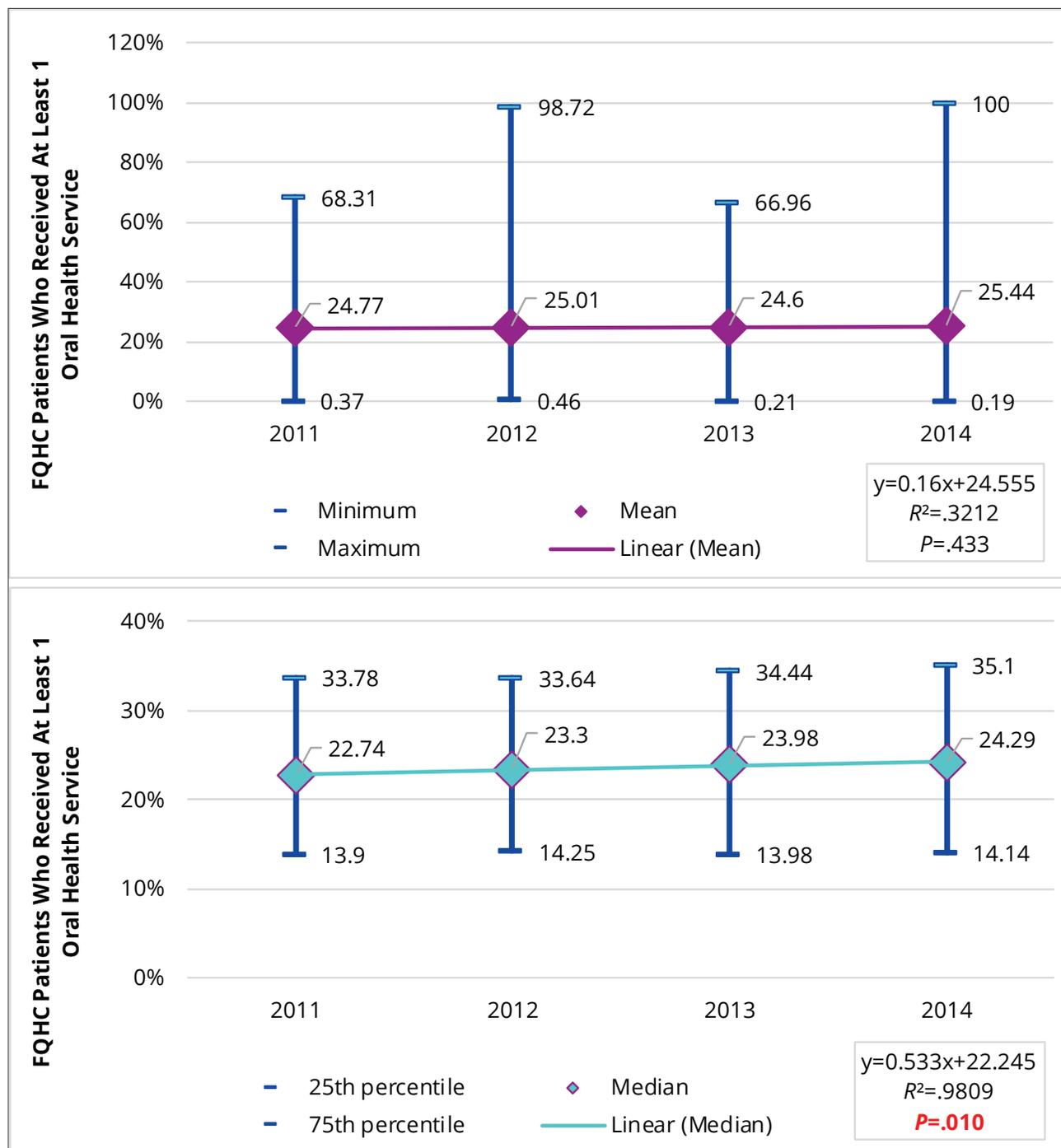
**Figure 9. Four-Year Trend of Proportion (Mean, Median, Range) of Patients Who Received At Least 1 Oral Health Service at FQHCs With Dentist and/or Dental Hygienist FTEs in the South Region, 2011-2014**



FQHC, federally qualified health center.

In the West region, the proportion of FQHC patients who received any oral health services increased over the 4-year study period (Figure 10). The 4-year trend estimates indicated a nonsignificant increase in the mean value (0.2% each year;  $P=.433$ ) and a significant increase in the median value (0.5% each year;  $P=.010$ ). In 2014, the proportion of FQHC patients who received any oral health services varied from 0.2% to 100%, with a mean value of 25.4% and a median value of 24.3%. The 25th-to-75th-percentiles distribution showed that 25% of FQHCs provided oral health services to less than 14.1% patients, 50% of FQHCs provided oral health services to 14.1% to 35.1% patients, and 25% of FQHCs provided oral health services to more than 35.1% patients.

Figure 10. Four-Year Trend of Proportion (Mean, Median, Range) of Patients Who Received At Least 1 Oral Health Service at FQHCs With Dentist and/or Dental Hygienist FTEs in the West Region, 2011-2014



FQHC, federally qualified health center.

Over the 4-year study period, there was a significant increase in the proportion of FQHC patients receiving any oral health services in the Pacific division of the West region (+7.1% change, increasing on average by 0.6% each year;  $P=.048$ ) and a borderline increase in the New England division of the Northeast region (+20.2% change, increasing on average by 1.7% each year;  $P=.093$ ) (Table 4). The prevalence of access to oral health services at FQHCs also increased over the study period in the East

North Central (+16.1% change), West North Central (+46.9% change), and Middle Atlantic (+26.1% change) divisions; however, the 4-year increasing trend was not statistically significant.

In contrast, there was a borderline significant decrease in the proportion of FQHC patients receiving any oral health services in the East South Central division (-27.6% change, decreasing on average by 2.7% each year;  $P=.073$ ) and a nonsignificant decrease in the South Atlantic division (-23.2% change, decreasing on average by 1.7% each year;  $P=.073$ ) of the South region (Table 4). There was a nonsignificant decreasing trend in the access of patients to oral health services in the West South Central (-14.1% change) and Mountain (-6.9% change) divisions.

**Table 4. Proportion of Patients Who Received At Least 1 Oral Health Service at FQHCs With Dentist and/or Dental Hygienist FTEs by Division, 2011-2014**

Division	2011	2012	2013	2014	% Change 2014-2011	Annual % Change	P Value for Trend
Midwest							
East North Central	25.9%	28.9%	31.2%	30.1%	16.1%	1.5%	.157
West North Central	24.8%	23.9%	36.6%	36.4%	46.9%	4.8%	.127
Northeast							
Middle Atlantic	23.0%	27.4%	28.7%	29.0%	26.1%	1.9%	.103
New England	23.1%	25.2%	28.5%	27.8%	20.2%	1.7%	.093
South							
East South Central	25.8%	23.5%	18.2%	18.7%	-27.6%	-2.7%	.073
South Atlantic	26.6%	26.6%	20.1%	20.4%	-23.2%	-2.5%	.117
West South Central	24.9%	25.7%	22.0%	21.4%	-14.1%	-1.4%	.128
West							
Mountain	25.7%	26.1%	23.6%	23.9%	-6.9%	-0.8%	.191
Pacific	24.4%	24.6%	25.1%	26.1%	7.1%	0.6%	.048

**Proportion of patients receiving specific dental visits at FQHC among health center patients  
(percentage of patients with any dental visit[s] among all patients)**

Table 5 presents the proportion of FQHC patients receiving oral health services by category of service nationwide between 2012 and 2014. The 2011 data were excluded from the analysis because of anomalies in data reported by category of dental service in that year. Nationwide, among all patients at FQHCs in 2014, 20.9% received at least 1 oral exam, 12.5% received at least 1 prophylaxis service, and 7.3% received at least 1 fluoride treatment. In addition, about 8% received restorative services, 5% received oral surgery services, 3.4% received rehabilitation services, and 1.3% received emergency services.

The proportion of FQHC patients receiving oral health services increased for oral exams (+3.0% change), prophylaxis (+3.3% change), and rehabilitation (+3.0% change) services. In contrast, the proportion of FQHC patients receiving oral health services decreased for fluoride treatment (-2.7% change), restorative services (-1.3% change), oral surgery (-7.4% change), and emergency services (-11.6% change).

**Table 5. Proportion of Patients Who Received At Least 1 Oral Health Service at FQHCs With Dentist and/or Dental Hygienist FTEs by Category of Service Nationwide, 2012-2014**

Service Category	2012	2013	2014	% Change 2014-2012
Oral exams	20.3%	20.8%	20.9%	3.0%
Prophylaxis (adult or child)	12.1%	12.5%	12.5%	3.3%
Fluoride treatment (adult or child)	7.5%	5.9%	7.3%	-2.7%
Restorative services	8.0%	7.9%	7.9%	-1.3%
Oral surgery (extractions and other surgical procedures)	5.4%	5.3%	5.0%	-7.4%
Rehabilitation services (endo, perio, prostho, ortho)	3.3%	3.3%	3.4%	3.0%
Emergency services	1.5%	1.4%	1.3%	-11.6%

endo, endodontics; ortho, orthodontics; perio, periodontics; prostho, prosthodontics.

Table 6 presents the proportion of FQHC patients receiving oral health services by category of service and region between 2012 and 2014.

In 2014, FQHC patients in the Midwest and Northeast regions had access to proportionally more oral exams, prophylaxis services, and rehabilitation services than FQHC patients in the South and West regions or nationwide. The Midwest region also had the highest proportion of FQHC patients receiving fluoride treatment, restorative services, and oral surgery, while the Northeast region had the highest proportion of FQHC patients receiving emergency services.

The 2012-2014 percent change in the proportion of FQHC patients receiving dental services by category of service is noted below for values above/below +/-9% change:

- The proportion of FQHC patients receiving oral exams increased by nearly one-third in the Midwest (+32.7% change) but decreased in the South (-17.4% change).
- The proportion of FQHC patients receiving prophylaxis services increased notably in the Northeast (+34.7% change) and Midwest (+22.2% change) but decreased in the South (-29.9% change).
- The proportion of FQHC patients receiving fluoride treatment increased substantially in the Midwest (+46.2% change) but decreased in the South (-30.6% change) and Northeast (-19.0% change).
- The proportion of FQHC patients receiving restorative services increased by one-fourth in the Midwest (+25.6% change) but decreased by about one-third in the South (-36.7% change).
- The proportion of FQHC patients receiving oral surgery increased in the Midwest (+25.5% change) and Northeast (+12.3% change) but decreased in the Northeast (-23.5% change), South (-14.3% change), and West (-11.3% change).
- The proportion of FQHC patients receiving rehabilitation services increased in the West (+31.3% change) and Northeast (+12.9% change) but decreased in the South (-26.5% change).
- The proportion of FQHC patients receiving oral surgery more than doubled in the Northeast (+126.5% change) but decreased substantially in the South (-47.2% change), West (-22.2% change), and Midwest (-18.9% change).

**Table 6. Proportion of Patients Who Received At Least 1 Oral Health Service at FQHCs With Dentist and/or Dental Hygienist FTEs by Category of Service and Region, 2012-2014**

Service Category and Region	2012	2013	2014	% Change 2014-2012
<b>Oral exams</b>				
Midwest	20.5%	28.0%	27.2%	32.7%
Northeast	20.9%	22.5%	22.0%	5.3%
South	20.1%	16.6%	16.6%	-17.4%
West	20.1%	19.2%	20.2%	0.5%
<b>Prophylaxis (adult or child)</b>				
Midwest	13.5%	17.4%	16.5%	22.2%
Northeast	12.4%	17.0%	16.7%	34.7%
South	11.7%	8.1%	8.2%	-29.9%
West	11.5%	10.9%	11.6%	0.9%
<b>Fluoride treatment (adult or child)</b>				
Midwest	7.8%	9.7%	11.4%	46.2%
Northeast	7.9%	4.6%	6.4%	-19.0%
South	7.2%	3.9%	5.0%	-30.6%
West	7.3%	6.3%	7.5%	2.7%
<b>Restorative services</b>				
Midwest	8.2%	10.6%	10.3%	25.6%
Northeast	8.1%	9.8%	9.1%	12.3%
South	7.9%	5.0%	5.0%	-36.7%
West	7.9%	8.0%	8.5%	7.6%
<b>Oral surgery (extractions and other surgical procedures)</b>				
Midwest	5.5%	7.2%	6.9%	25.5%
Northeast	5.1%	4.0%	3.9%	-23.5%
South	5.6%	5.2%	4.8%	-14.3%
West	5.3%	4.8%	4.7%	-11.3%
<b>Rehabilitation services (endo, perio, prosth, ortho)</b>				
Midwest	3.4%	4.0%	3.7%	8.8%
Northeast	3.1%	3.7%	3.5%	12.9%
South	3.4%	2.5%	2.5%	-26.5%
West	3.2%	3.5%	4.2%	31.3%
<b>Emergency services</b>				
Midwest	1.5%	1.2%	1.2%	-18.9%
Northeast	1.0%	2.4%	2.3%	126.5%
South	1.8%	1.2%	1.0%	-47.2%
West	1.4%	1.0%	1.1%	-22.2%

endo, endodontics; ortho, orthodontics; perio, periodontics; prosth, prosthodontics.

**Proportion of patients receiving specific dental visits at FQHC among dental patients (percentage of patients with any dental visit[s] among patients with any dental visits)**

Table 7 presents the proportion of FQHC patients with any dental visits receiving a specific category of service nationwide between 2012 and 2014.

Nationwide, among all dental patients at FQHCs in 2014, 80.2% received at least 1 oral exam, 46.3% received at least 1 prophylaxis service, and 26.5% received at least 1 fluoride treatment. In addition, more than one-quarter received restorative services (28.3%), about one-fifth received oral surgery services (19.8%), 13% received rehabilitation services, and about 5% received emergency services.

There was an increase in the proportion of FQHC dental patients receiving oral exams (+2.0% change), prophylaxis services (+3.3% change), and rehabilitation services (+1.3% change). In contrast, there was a reduction in the proportion of FQHC dental patients receiving fluoride treatment (-3.6% change), restorative services (-4.0% change), oral surgery (-6.5% change), and emergency services (-18.5% change).

**Table 7. Proportion of Dental Patients Who Received At Least 1 Oral Health Service at FQHCs With Dentist and/or Dental Hygienist FTEs by Category of Service Nationwide, 2012-2014**

Service Category	2012	2013	2014	% Change 2014-2012
Oral Exams	78.6%	80.3%	80.2%	2.0%
Prophylaxis (adult or child)	44.8%	46.1%	46.3%	3.3%
Fluoride treatment (adult or child)	27.5%	22.0%	26.5%	-3.6%
Restorative services	29.5%	29.1%	28.3%	-4.0%
Oral surgery (extractions and other surgical procedures)	21.2%	20.7%	19.8%	-6.5%
Rehabilitation services (endo, perio, prosth, ortho)	12.8%	12.8%	13.0%	1.3%
Emergency Services	5.8%	5.3%	4.8%	-18.5%

endo, endodontics; ortho, orthodontics; perio, periodontics; prosth, prosthodontics.

Table 8 presents the proportion of FQHC patients with any dental visits receiving a specific category of service by region between 2012 and 2014.

In 2014, FQHC dental patients in the Midwest and Northeast regions had access to proportionally more oral exams and prophylaxis services than FQHC dental patients in the South and West regions or nationwide. The Midwest region also had the highest proportion of FQHC dental patients receiving fluoride treatment, while the South region had the highest proportion of FQHC dental patients receiving oral surgery and emergency services and the West region had the highest proportion of FQHC dental patients receiving restorative and rehabilitation services.

The 2012-2014 percent change in the proportion of FQHC dental patients receiving dental services by category of service is noted below for values above/below +/-9% change:

- The proportion of FQHC dental patients receiving oral exams increased in the Midwest by nearly 10% (+9.4% change).
- The proportion of FQHC dental patients receiving prophylaxis services increased by almost one-third in the Northeast (+30.1% change) but decreased in the South (-9.1% change).
- The proportion of FQHC dental patients receiving fluoride treatment increased in the Midwest (+16.2% change) but decreased in the Northeast (-17.8% change) and South (-16.0% change).
- The proportion of FQHC dental patients receiving restorative services decreased in the South (-18.2% change).
- The proportion of FQHC dental patients receiving oral surgery increased in the South (+11.8% change) but decreased in the Northeast (-34.2% change) and West (-16.8% change).
- The proportion of FQHC dental patients receiving rehabilitation services increased in the West (+17.7% change) and Northeast (+15.4% change) but decreased in the Midwest (-11.5% change) and South (-10.7% change).
- The proportion of FQHC dental patients receiving oral surgery increased substantially in the Northeast (+73.7% change) but decreased in the South (-45.4% change), Midwest (-26.9% change), and West (-20.1% change).

**Table 8. Proportion of Dental Patients Who Received At Least 1 Oral Health Service at FQHCs With Dentist and/or Dental Hygienist FTEs by Category of Service and Region, 2012-2014**

Service Category and Region	2012	2013	2014	% Change 2014-2012
<b>Oral exams</b>				
Midwest	75.8%	84.6%	82.9%	9.4%
Northeast	79.9%	78.5%	77.0%	-3.6%
South	78.2%	81.2%	81.8%	4.6%
West	80.3%	77.4%	78.8%	-1.8%
<b>Prophylaxis (adult or child)</b>				
Midwest	48.2%	50.7%	48.2%	0.1%
Northeast	44.9%	58.8%	58.5%	30.1%
South	43.7%	39.0%	39.8%	-9.1%
West	43.9%	42.0%	43.7%	-0.3%
<b>Fluoride treatment (adult or child)</b>				
Midwest	27.2%	27.5%	31.6%	16.2%
Northeast	28.7%	17.1%	23.6%	-17.8%
South	27.4%	18.3%	23.0%	-16.0%
West	27.1%	25.6%	28.6%	5.5%
<b>Restorative services</b>				
Midwest	29.3%	30.4%	29.3%	-0.3%
Northeast	28.4%	32.8%	30.3%	6.8%
South	29.8%	24.3%	24.3%	-18.2%
West	30.1%	31.1%	30.7%	2.0%
<b>Oral surgery (extractions and other surgical procedures)</b>				
Midwest	20.0%	21.5%	21.3%	6.1%
Northeast	20.2%	13.5%	13.3%	-34.2%
South	21.6%	25.5%	24.2%	11.8%
West	21.9%	19.5%	18.2%	-16.8%
<b>Rehabilitation services (endo, perio, prosthodontics, ortho)</b>				
Midwest	12.7%	11.3%	11.3%	-11.5%
Northeast	10.7%	13.1%	12.3%	15.4%
South	13.9%	12.3%	12.4%	-10.7%
West	13.0%	14.3%	15.3%	17.7%
<b>Emergency services</b>				
Midwest	4.6%	3.1%	3.4%	-26.9%
Northeast	4.5%	8.1%	7.8%	73.7%
South	7.3%	5.2%	4.0%	-45.4%
West	5.6%	5.0%	4.5%	-20.1%

endo, endodontics; ortho, orthodontics; perio, periodontics; prosthodontics, prosthodontics.

## Patients' utilization of oral health services (continuity of care) at FQHCs by geography (2011-2014)

### Average number of any dental visits per dental patient (patients with at least 1 oral health service)

Table 9 presents the average number of dental visits per FQHC patient with any dental visits by region and nationwide between 2011 and 2014.

Over the 4-year period, there was an increase in the average number of dental visits per FQHC patient from 2.39 to 2.53 (+5.9% change) in the Northeast and from 2.45 to 2.56 (+4.5% change) in the West. In contrast, there was a decrease in the average number of dental visits per FQHC patient from 2.44 to 2.25 (-7.8% change) in the Midwest and from 2.36 to 2.26 (-4.2% change) in the South. Nationwide, the average number of dental visits per FQHC patient decreased only slightly, from 2.41 in 2011 to 2.40 in 2014 (-0.4% change).

**Table 9. Average Number of Dental Visits per Patient at FQHCs With Dentist and/or Dental Hygienist FTEs by Region and Nationwide, 2011-2014**

Region	2011	2012	2013	2014	% Change 2014-2011
Midwest	2.44	2.34	2.28	2.25	-7.8%
Northeast	2.39	2.31	2.53	2.53	5.9%
South	2.36	2.41	2.29	2.26	-4.2%
West	2.45	2.44	2.52	2.56	4.5%
Nationwide	2.41	2.39	2.4	2.4	-0.4%

## Average number of specific dental visits per patient

Table 10 presents the average number of dental visits per FQHC patient with any dental visits by category of service nationwide between 2012 and 2014.

Over the 3-year period, the average number of dental visits per FQHC patient increased from 1.31 to 1.33 (+1.5% change) for oral exams, from 1.24 to 1.25 (+0.8% change) for prophylaxis services, from 1.84 to 1.86 (+1.1% change) for restorative services, and from 1.74 to 1.77 (+1.7% change) for rehabilitation services. In contrast, there was a decrease in the average number of dental visits per FQHC patient from 1.38 to 1.31 (-5.1% change) for sealants, from 1.23 to 1.22 (-0.8% change) for fluoride treatment, and from 1.10 to 1.09 (-0.9% change) for emergency services.

**Table 10. Average Number of Dental Visits per Patient at FQHCs With Dentist and/or Dental Hygienist FTEs by Category of Service, 2012-2014**

Service Category	2012	2013	2014	% Change 2014-2012
Oral exams	1.31	1.3	1.33	1.5%
Prophylaxis (adult or child)	1.24	1.26	1.25	0.8%
Sealants	1.38	1.34	1.31	-5.1%
Fluoride treatment (adult or child)	1.23	1.18	1.22	-0.8%
Restorative services	1.84	1.87	1.86	1.1%
Oral surgery (extractions and other surgical procedures)	1.36	1.36	1.36	0.0%
Rehabilitation services (endo, perio, prostho, ortho)	1.74	1.72	1.77	1.7%
Emergency services	1.10	1.09	1.09	-0.9%

endo, endodontics; ortho, orthodontics; perio, periodontics; prostho, prosthodontics.

Table 11 presents the average number of dental visits per FQHC patient with any dental visits by category of service nationwide between 2012 and 2014.

Over the 3-year period, FQHCs in the Northeast region exhibited the greatest increase in the average number of dental visits per patient for all categories of dental services except for oral. In contrast, FQHCs in the Midwest region had the greatest decrease in the average number of dental visits per patient for prophylaxis, sealants, fluoride treatment, and restorative services. FQHCs in the South region exhibited the greatest decrease in the average number of dental visits per patient for rehabilitation and emergency services, while those in the West region had the greatest decrease for oral surgery.

**Table 11. Average Number of Dental Visits per Patient at FQHCs With Dentist and/or Dental Hygienist FTEs by Category of Service and Region, 2012-2014**

Service Category and Region	2012	2013	2014	% Change 2014-2012
<b>Oral exams</b>				
Midwest	1.29	1.26	1.28	-0.8%
Northeast	1.29	1.33	1.38	7.0%
South	1.32	1.32	1.33	0.8%
West	1.33	1.30	1.32	-0.8%
<b>Prophylaxis (adult or child)</b>				
Midwest	1.27	1.22	1.22	-3.9%
Northeast	1.22	1.26	1.29	5.7%
South	1.22	1.26	1.27	4.1%
West	1.25	1.28	1.23	-1.6%
<b>Sealants</b>				
Midwest	1.36	1.19	1.20	-11.8%
Northeast	1.30	1.41	1.37	5.4%
South	1.39	1.40	1.31	-5.8%
West	1.44	1.32	1.35	-6.2%
<b>Fluoride treatment (adult or child)</b>				
Midwest	1.23	1.17	1.18	-4.1%
Northeast	1.20	1.19	1.22	1.7%
South	1.24	1.16	1.22	-1.6%
West	1.23	1.21	1.24	0.8%
<b>Restorative services</b>				
Midwest	1.83	1.80	1.78	-2.7%
Northeast	1.79	1.90	1.94	8.4%
South	1.84	1.83	1.80	-2.2%
West	1.88	1.96	1.95	3.7%
<b>Oral surgery (extractions and other surgical procedures)</b>				
Midwest	1.34	1.32	1.35	0.7%
Northeast	1.36	1.35	1.34	-1.5%
South	1.34	1.42	1.40	4.5%
West	1.39	1.33	1.34	-3.6%
<b>Rehabilitation services (endo, perio, prosthodontics, ortho)</b>				
Midwest	1.70	1.60	1.65	-2.9%
Northeast	1.68	1.96	1.96	16.7%
South	1.71	1.58	1.61	-5.8%
West	1.83	1.81	1.90	3.8%
<b>Emergency services</b>				
Midwest	1.08	1.05	1.06	-1.9%
Northeast	1.06	1.14	1.16	9.4%
South	1.12	1.10	1.07	-4.5%
West	1.11	1.08	1.08	-2.7%

endo, endodontics; ortho, orthodontics; perio, periodontics; prosthodontics, prosthodontics.

## Predictor factors measurement

### FQHC-level predictor factors, 2011-2014

Table 12 shows oral health staffing, patients, and patient visits at FQHCs that provided direct oral health care nationwide and by region between 2011 and 2014.

Over the 4-year study period, there was an increase in the average number of oral health staff as well as patients and patient visits at FQHCs in the Northeast, followed by FQHCs in the Midwest and West regions, with the exception of dental hygienist FTEs in the West. In contrast, the average number of oral health staff, patients, and patient visits at FQHCs decreased in the South region.

**Table 12. Oral Health Staffing, Patients, and Patient Visits at FQHCs With Dentist and/or Dental Hygienist FTEs Nationwide and by Region, 2011-2014**

Average Number at FQHC Nationwide and by Region	2011	2012	2013	2014	% Change 2014-2012
<b>Dentist FTEs</b>	<b>3.44</b>	<b>3.55</b>	<b>3.7</b>	<b>3.75</b>	<b>9.0%</b>
Midwest	3.38	3.51	3.66	3.59	6.2%
Northeast	3.11	3.35	4.72	4.62	48.6%
South	3.46	3.62	2.64	2.7	-22.0%
West	3.66	3.61	4.24	4.4	20.2%
<b>DH FTEs</b>	<b>1.57</b>	<b>1.68</b>	<b>1.78</b>	<b>1.84</b>	<b>17.2%</b>
Midwest	1.48	1.95	2.24	2.33	57.4%
Northeast	1.48	1.48	2.4	2.32	56.8%
South	1.53	1.63	1.46	1.47	-3.9%
West	1.75	1.69	1.33	1.53	-12.6%
<b>DA/aide/tech FTEs</b>	<b>6.71</b>	<b>6.93</b>	<b>7.38</b>	<b>7.56</b>	<b>12.7%</b>
Midwest	6.72	7.33	7.56	7.48	11.3%
Northeast	5.59	6.67	7.68	7.65	36.9%
South	6.98	6.75	5.26	5.49	-21.3%
West	7.09	7.07	9.46	9.79	38.1%
<b>OH provider FTEs</b>	<b>11.44</b>	<b>11.83</b>	<b>12.56</b>	<b>12.92</b>	<b>12.9%</b>
Midwest	11.36	12.44	13.38	13.32	17.3%
Northeast	9.97	11.12	14.41	14.43	44.7%
South	11.72	11.73	9.17	9.53	-18.7%
West	12.14	12.05	14.5	15.26	25.7%
<b>OH patients</b>	<b>4,491</b>	<b>4,596</b>	<b>4,717</b>	<b>4,772</b>	<b>6.3%</b>
Midwest	4,324	4,750	5,197	5,096	17.9%
Northeast	4,037	4,235	5,776	5,774	43.0%
South	4,668	4,643	3,449	3,484	-25.4%
West	4,679	4,675	5,062	5,254	12.3%
<b>OH patient visits</b>	<b>11,016</b>	<b>11,265</b>	<b>11,700</b>	<b>11,911</b>	<b>8.1%</b>
Midwest	10,847	11,513	11,996	11,652	7.4%
Northeast	9,767	10,278	14,870	14,975	53.3%
South	11,297	11,255	8,122	8,150	-27.9%
West	11,607	11,770	13,307	14,076	21.3%

DA, dental assistant; DH, dental hygienist; FQHC, federally qualified health center; FTE, full-time equivalent; OH, oral health.

Table 13 presents oral health staffing ratios, panel size, and productivity at FQHCs that provided direct dental care nationwide between 2011 and 2014.

Over the 4-year period, the ratio of dental hygienists to dentist FTEs increased from 0.52 to 0.60 (+15.4% change), and the ratio of dental assistants/aides/techs to dentist FTEs increased from 1.85 to 1.91 (+3.2% change).

Over the same period, there was a decrease in panel size and provider productivity. The average number of dental patients per oral health provider FTE decreased from 443 to 402 (-9.1% change). Similarly, the average number of dental patient visits per oral health provider FTE decreased from 990 to 918 (-7.2% change), the average number of dental patient visits per dentist FTE decreased from 2,541 to 2,446 (-3.7% change), and the average number of patient visits per dental hygienist FTE decreased from 1,315 to 1,205 (-8.3% change).

**Table 13. Oral Health Staffing Ratios, Panel Size, and Productivity at FQHCs With Dentist and/or Dental Hygienist FTEs Nationwide, 2011-2014**

Oral Health Staffing Ratios, Panel Size, and Productivity	2011	2012	2013	2014	% Change 2014-2011
Staffing ratios					
Ratio of DH to dentist FTEs at FQHC	0.52	0.56	0.57	0.6	15.4%
Ratio of DA/other to dentist FTEs at FQHC	1.85	1.87	1.91	1.91	3.2%
Panel size					
Average number of OH patients per OH provider FTE at FQHC	443	433	413	403	-9.1%
Provider productivity					
Average number of patient visits per OH provider FTE at FQHC	990	970	938	919	-7.2%
Average number of patient visits per dentist FTE at FQHC	2,540	2,542	2,462	2,446	-3.7%
Average number of patient visits per DH FTE at FQHC	1,315	1,283	1,268	1,205	-8.3%

DA, dental assistant; DH, dental hygienist; FQHC, federally qualified health center; FTE, full-time equivalent; OH, oral health.

Table 14 shows oral health staffing ratios, panel size, and productivity at FQHCs with dentist and/or dental hygienist FTEs by region between 2011 and 2014.

Over the 4-year study period, there was an increase in the ratio of dental hygienist to dentist FTEs at FQHCs in the Midwest region, followed by the Northeast and South regions, and a decrease in the West region. The ratio of dental assistants/aides/techs to dentist FTEs at FQHCs increased in the West and Midwest and decreased in the Northeast.

The panel size (average number of oral health patients per oral health provider FTE at FQHCs) decreased in all regions, particularly in the South and Midwest.

Provider productivity (average number of patient visits per provider) decreased for dentists primarily in the South and for dental hygienists and oral health providers in general primarily in the Midwest and South.

**Table 14. Oral Health Staffing Ratios, Panel Size, and Productivity at FQHCs With Dentist and/or Dental Hygienist FTEs by Region, 2011-2014**

Service Category and Region	2011	2012	2013	2014	% Change 2014-2012
<b>Ratio of DH to dentist FTEs at FQHC</b>					
Midwest	0.46	0.60	0.66	0.72	56.5%
Northeast	0.55	0.59	0.66	0.67	21.8%
South	0.53	0.53	0.59	0.61	15.1%
West	0.53	0.55	0.41	0.45	-15.1%
<b>Ratio of DA/other to dentist FTEs at FQHC</b>					
Midwest	1.89	1.95	2.04	2.03	7.4%
Northeast	1.73	1.95	1.62	1.62	-6.4%
South	1.92	1.84	1.88	1.91	-0.5%
West	1.82	1.82	2.04	2.02	11.0%
<b>Average number of OH patients per OH provider FTE at FQHC</b>					
Midwest	439	422	406	393	-10.4%
Northeast	464	439	421	435	-6.3%
South	449	431	410	401	-10.8%
West	421	438	415	389	-7.6%
<b>Average number of patient visits per dentist FTE at FQHC</b>					
Midwest	2,557	2,515	2,512	2,491	-2.6%
Northeast	2,434	2,614	2,363	2,414	-0.8%
South	2,596	2,528	2,377	2,318	-10.7%
West	2,523	2,530	2,586	2,571	1.9%
<b>Average number of patient visits per DH FTE at FQHC</b>					
Midwest	1,339	1,275	1,204	1,123	-16.1%
Northeast	1,330	1,193	1,463	1,401	5.3%
South	1,281	1,293	1,176	1,123	-12.3%
West	1,331	1,335	1,278	1,220	-8.4%
<b>Average number of patient visits per OH provider FTE at FQHC</b>					
Midwest	995	934	892	862	-13.4%
Northeast	1,012	955	1,017	1,045	3.2%
South	992	979	888	865	-12.8%
West	969	993	973	933	-3.7%

DA, dental assistant; DH, dental hygienist; FQHC, federally qualified health center; FTE, full-time equivalent; OH, oral health.

In 2014, the number of dental operatories per 1,000 patients who received any services at FQHCs that provided direct oral health services ranged from 0.02 to 3.27, with a mean of 1.13 and a median of 0.91 (Table 15). The 25th-to-75th-percentiles distribution showed that 25% of FQHCs that provided direct oral health services had less than 0.55 dental operatories per 1,000 total patients, 50% of FQHCs had 0.55 to 1.38 dental operatories per 1,000 total patients, and 25% of FQHCs had more than 1.38 dental operatories per 1,000 total patients.

In 2014, the number of clinical dental operatories per dentist at FQHCs that provided direct oral health services ranged from 0.25 to 16.67, with a mean of 5.22 and a median of 4.00 (Table 15). The 25th-to-75th-percentiles distribution showed that 25% of FQHCs that provided direct oral health services had less than 3.07 dental clinical operatories per dentist, 50% of FQHCs had 3.07 to 6.00 clinical dental operatories per dentist, and 25% of FQHCs had more than 6.00 clinical dental operatories per dentist.

**Table 15. Capacity at FQHCs With Dentist and/or Dental Hygienist FTEs Nationwide, 2014**

Oral Health Staffing Ratios, Panel Size, and Productivity	Mean	Minimum	25th Percentile	Median	75th Percentile	Maximum
Number of dental operatories per 1,000 patients who received any services at FQHCs	1.13	0.02	0.55	0.91	1.38	3.27
Number of clinical dental operatories per dentist at FQHCs	5.22	0.25	3.07	4.00	6.00	16.67

FQHC, federally qualified health center.

Table 16 shows the capacity (dental operatories) at the FQHCs that provided direct oral health services by region in 2014. The number of dental operatories per 1,000 patients who received any services at FQHCs was the highest in the Midwest (mean, 1.26; median, 1.11) and West (mean, 1.29; median, 1.03) regions, while the number of clinical dental operatories per dentist at FQHCs was the highest in the South region (mean, 6.04; median, 5.30).

**Table 16. Capacity at FQHCs With Dentist and/or Dental Hygienist FTEs by Region, 2014**

Oral Health Staffing Ratios, Panel Size, and Productivity	Mean	Minimum	25th Percentile	Median	75th Percentile	90th Percentile
Number of dental operatories per 1,000 patients who received any services at FQHCs						
Midwest	1.26	0.02	0.71	1.11	1.74	2.07
Northeast	0.90	0.06	0.42	0.81	1.11	2.00
South	0.99	0.10	0.49	0.80	1.15	2.04
West	1.29	0.17	0.64	1.03	1.81	2.72
Number of clinical dental operatories per dentist at FQHCs						
Midwest	4.93	0.26	3.42	3.96	5.42	9.17
Northeast	4.92	0.25	2.83	3.33	5.78	9.33
South	6.04	1.48	3.25	5.30	7.50	11.91
West	4.91	0.60	3.00	3.98	5.81	8.07

FQHC, federally qualified health center.

Table 17 presents socioeconomic characteristics of patients and selected federal grant revenues at FQHCs nationwide between 2011 and 2014.

In 2014, FQHCs' patient base was as follows: 48.5% patients with income at or below the federal poverty level (FPL), 26.7% uninsured adults, 22.1% adults on Medicaid insurance, 18.4% children on Medicaid insurance, and served 73.5% adults.

In 2014, FQHCs' revenue was \$288,538 from ACA Capital Development Grants, including School-Based Health Center Capital Grants, and \$108,617 from ARRA CIP and FIP.

Over the 4-year period, there was a decrease in FQHC patients with income at or below FPL (-6.4% change), uninsured children (-35.8% change) and adults (-18.2% change), children (-46.2% change) and adults (-32.8% change) on public insurance other than Medicaid/CHIP or Medicare, children on private insurance (-17.5% change), children in general (-14.0% change), and homeless (-14.0% change). On the other hand, there was an increase in FQHC patients with unknown income (+12.6% change) and adults on Medicaid (+47.5% change), Medicare (+13.3% change), and private insurance (+20.5% change).

Over the 4-year period, FQHCs' revenue from federal grants decreased from an average of \$1,051,809 to \$288,538 (-72.6% change) for ACA Capital Development Grants, including School-Based Health Center Capital Grants, and from \$606,424 to \$108,617 (-82.1% change) for ARRA CIP and FIP.

**Table 17. Patient Base and Revenue From Federal Grants at FQHCs Nationwide, 2011-2014**

Patient Base and Revenue	2011	2012	2013	2014	% Change 2014-2011
<b>Patients' income as percent of FPL</b>					
At or below FPL	51.8%	51.2%	50.1%	<b>48.5%</b>	<b>-6.4%</b>
101% to 150% of FPL	10.9%	11.0%	11.0%	10.9%	-0.1%
151% to 200% of FPL	5.2%	5.2%	5.1%	5.0%	-4.2%
Over 200% of FPL	5.9%	5.9%	5.7%	5.8%	-2.2%
Unknown	26.5%	27.3%	28.3%	29.9%	<b>12.6%</b>
<b>Patients' principal third-party medical insurance source</b>					
<b>None/uninsured</b>					
Children (0 to 17 years)	6.5%	6.0%	4.7%	4.2%	<b>-35.8%</b>
Adults (18 years and older)	32.6%	32.8%	33.1%	<b>26.7%</b>	<b>-18.2%</b>
<b>Medicaid/CHIP</b>					
Children (0 to 17 years)	19.3%	19.1%	18.4%	<b>18.4%</b>	-4.8%
Adults (18 years and older)	15.0%	15.3%	16.3%	<b>22.1%</b>	<b>47.5%</b>
<b>Medicare</b>					
Adults (18 years and older)	8.7%	9.0%	9.4%	9.8%	<b>13.3%</b>
<b>Other public insurance</b>					
Children (0 to 17 years)	0.9%	1.0%	0.7%	0.5%	<b>-46.2%</b>
Adults (18 years and older)	1.2%	1.2%	1.3%	0.8%	<b>-32.8%</b>
<b>Private insurance</b>					
Children (0 to 17 years)	4.4%	4.3%	3.7%	3.6%	<b>-17.5%</b>
Adults (18 years and older)	12.0%	11.9%	12.8%	14.4%	<b>20.5%</b>
<b>Children/adult patients</b>					
Children (0 to 17 years)	30.9%	30.2%	27.3%	26.6%	<b>-14.0%</b>
Adults (18 years and older)	69.1%	69.8%	72.7%	<b>73.5%</b>	6.3%
<b>Special population patients</b>					
Homeless	9.2%	8.7%	8.4%	7.9%	<b>-14.0%</b>
School-based health center patients	2.5%	2.5%	2.4%	2.5%	0.0%
Veterans	1.7%	1.6%	1.7%	1.8%	4.7%
<b>Revenue from federal grants</b>					
ACA Capital Development Grants, including School-Based Health Center Capital Grants	\$1,051,809	\$394,685	\$360,411	<b>\$288,538</b>	<b>-72.6%</b>
ARRA CIP and FIP	\$606,424	\$352,183	\$134,095	\$108,617	<b>-82.1%</b>

ACA, Affordable Care Act; ARRA, American Recovery and Reinvestment Act; CIP, Capital Improvement Project; FIP, Facility Investment Program; FPL, federal poverty level.

Table 18 shows socioeconomic characteristics of patients and selected federal revenues at FQHCs by region between 2011 and 2014.

Over the 4-year period, there was a decrease in the proportion of FQHC patients with low income income (101% to 150% of FPL) in all regions, primarily in the Northeast and Midwest, except for the proportion of patients with income 101% to 150% of FPL, which increased in the West. The proportion of patients (children and adults) without medical insurance decreased in all regions except the South, where the proportion of FQHC patients 18 years and older without medical insurance increased (+3.7% change). The proportion of patients on Medicaid/CHIP insurance decreased for children in all regions except the Midwest and increased for adults in all regions except the South.

Over the 4-year period, FQHCs' revenue from federal grants decreased in all regions, mainly in the Northeast and South for ACA Capital Development Grants, including School-Based Health Center Capital Grants, and in the Midwest and West for ARRA CIP and FIP. Between 2012 and 2014, there was an increase in FQHCs' revenue from ACA Capital Development Grants in the South (+161.5% change) and Northeast (+2.1% change).

**Table 18. Selected Socioeconomic Characteristics of Patients and Revenue From Federal Grants at FQHCs by Region, 2011-2014**

Patient Base and Revenue	2011	2012	2013	2014	% Change 2014-2011
<b>Patients with income at or below FPL</b>					
Midwest	52.5%	49.6%	49.1%	47.6%	-9.4%
Northeast	54.0%	54.0%	47.3%	47.1%	-12.8%
South	51.9%	51.6%	50.8%	50.7%	-2.4%
West	51.7%	52.0%	54.1%	51.4%	-0.6%
<b>Patients with income 101% to 150% of FPL</b>					
Midwest	11.3%	12.6%	11.5%	10.8%	-5.1%
Northeast	10.6%	10.9%	10.1%	9.9%	-6.9%
South	11.4%	10.8%	11.1%	11.3%	-0.7%
West	11.4%	11.3%	12.0%	12.3%	7.8%
<b>Patients 0-17 years old without insurance</b>					
Midwest	6.5%	6.0%	4.7%	4.4%	-32.4%
Northeast	6.4%	6.7%	3.3%	3.1%	-51.3%
South	6.8%	6.0%	5.9%	5.2%	-24.4%
West	6.7%	6.4%	5.1%	4.5%	-33.9%
<b>Patients 18+ years old without insurance</b>					
Midwest	31.3%	30.8%	31.6%	25.0%	-20.2%
Northeast	32.4%	33.8%	20.7%	16.8%	-48.0%
South	33.5%	33.1%	39.9%	34.8%	3.7%
West	32.8%	32.7%	34.1%	25.1%	-23.6%
<b>Patients 0-17 years old with Medicaid/CHIP insurance</b>					
Midwest	20.6%	20.4%	23.5%	23.1%	12.1%
Northeast	20.5%	19.9%	18.5%	18.6%	-9.2%
South	20.3%	20.0%	17.2%	17.8%	-12.0%
West	19.6%	20.5%	19.0%	19.3%	-1.4%
<b>Patients 18+ years old with Medicaid/CHIP insurance</b>					
Midwest	15.2%	16.6%	18.3%	23.3%	53.3%
Northeast	16.0%	15.0%	25.3%	29.2%	82.6%
South	15.0%	15.1%	11.1%	13.4%	-10.8%
West	14.7%	15.5%	15.9%	25.8%	75.3%
<b>ACA Capital Development Grants, including School-Based Health Center Capital Grants</b>					
Midwest	\$1,169,298	\$563,913	\$478,265	\$372,872	-68.1%
Northeast	\$1,078,595	\$189,777	\$197,911	\$193,676	-82.0%
South	\$1,189,574	\$135,317	\$339,295	\$353,908	-70.2%
West	\$618,502	\$614,683	\$650,319	\$426,505	-31.0%
<b>ARRA CIP and FIP</b>					
Midwest	\$595,260	\$164,871	\$187,661	\$47,869	-92.0%
Northeast	\$917,085	\$528,130	\$221,227	\$205,528	-77.6%
South	\$445,873	\$316,713	\$129,647	\$180,962	-59.4%
West	\$501,614	\$213,174	\$96,407	\$50,343	-90.0%

ACA, Affordable Care Act; ARRA, American Recovery and Reinvestment Act; CIP, Capital Improvement Project; FIP, Facility Investment Program; FPL, federal poverty level.

## State-level predictor factors, 2011-2014

Table 19 shows the Medicaid dental coverage policy for adults nationwide in 2014. Most states had a limited (33%) or extensive (29%) Medicaid dental benefit; however, more than one-quarter (27%) had an emergency-only dental benefit, and 5 states had no dental benefit for adults on Medicaid. Most FQHCs were located in states with an extensive dental benefit, while about one-quarter were located in states with a limited dental benefit and one-quarter in states with an emergency-only dental benefit for adults with Medicaid insurance.

**Table 19. Medicaid Dental Coverage Policy for Adults Nationwide, 2014**

State Medicaid Dental Coverage Policy for Adults, 2014	Number (%) of States	Number (%) of FQHCs
Extensive	15 (29%)	496 (39.7%)
Limited	17 (33%)	339 (27.1%)
Emergency only	14 (27%)	335 (26.8%)
No dental benefits	5 (10%)	79 (6.3%)
All	51 (100%)	1,249 (100.0%)

FQHC, federally qualified health center.

Table 20 shows the Medicaid dental coverage policy for adults by region in 2014. Of the states with an extensive Medicaid dental benefit, only 1 was located in the South, and most of the states with a limited dental benefit were located in the Midwest and South. States with emergency-only benefits for adults with Medicaid insurance were most likely to be found in the South and West, while those with no dental benefits were predominantly located in the South.

Most FQHCs located in states with an extensive dental benefit for adults on Medicaid were in the West region (50.6%), and most of those in states with a limited dental benefit were located in the Midwest region (43.4%). The majority of FQHCs located in states with an emergency-only dental benefit (65.1%) or no dental benefit (75.9%) for adults on Medicaid were located in the South.

Medicaid coverage policy for adults by state is presented in Appendix A.

**Table 20. Medicaid Coverage Policy for Adults by Region, 2014**

State Medicaid Coverage Policy for Adults, 2014	Number of States	Number of FQHCs	% of FQHCs
<b>Extensive</b>			
Midwest	4	74	14.9%
Northeast	5	137	27.6%
South	1	34	6.9%
West	5	251	<b>50.6%</b>
<b>Limited</b>			
Midwest	7	147	<b>43.4%</b>
Northeast	2	53	15.6%
South	6	116	34.2%
West	2	23	6.8%
<b>Emergency only</b>			
Midwest	1	27	8.1%
Northeast	2	30	9.0%
South	6	218	<b>65.1%</b>
West	5	60	17.9%
<b>No dental benefits</b>			
Midwest	0	0	0.0%
Northeast	0	0	0.0%
South	4	60	<b>75.9%</b>
West	1	19	24.1%

FQHC, federally qualified health center.

Table 21 presents the state-level predictors as follows:

- The proportion of the population by health insurance coverage ranged in 2014 as follows: from 4% in Massachusetts to 17% in Texas for uninsured; from 9% in North Dakota and Virginia to 29% in West Virginia for Medicaid insured; from 8% in Alaska and the District of Columbia to 17% in Arkansas, Florida, Kentucky, and West Virginia for Medicare insured; and from 42% in New Mexico to 67% in North Dakota, Utah, and Wyoming for the privately insured population.
- Medicaid fee-for-service reimbursement as a percentage of private dental benefit plan charges ranged from 26.7% in Minnesota to 81.1% in Delaware for children in 2013 and from 13.8% in Illinois to 60.5% in Arkansas for adults in 2014.
- The number of dental care HPSAs in 2016 ranged from 8 in Delaware to 424 in California.
- The percentage of the population living in rural areas in 2010 varied from 0% in the District of Columbia to 61.3% in Maine.
- The per capita personal income in 2012 ranged from \$33,073 in Mississippi to \$74,710 in the District of Columbia.
- The percentage of the population on community water systems receiving fluoridated water in 2012 ranged from 10.0% in the District of Columbia to 99.9% in Kentucky.
- The Dental Hygiene Professional Practice Index in 2014 ranged from 18 in Alabama to 98 in Maine.

State-level predictors are presented for each state in Appendix B.

**Table 21. Distribution of State-level Predictor Variables**

State Predictors	Minimum	Maximum
Percentage of health insurance coverage of the total population, 2014		
Uninsured	4.0%	17.0%
Medicaid	9.0%	29.0%
Medicare	8.0%	17.0%
Other public insurance	0.0%	7.0%
Private insurance	42.0%	67.0%
Medicaid fee-for-service reimbursement as a percentage of private dental benefit plan charges		
Child dental services, 2013	26.7%	81.1%
Adult dental services, 2014	13.8%	60.5%
Number of dental care health professional shortage areas, 2016	8	424
Percentage of population living in rural areas, 2010	0%	61.3%
Per capita personal income, 2012	\$33,073	\$74,710
Percentage of population on community water systems receiving fluoridated water, 2012	10.0%	99.9%
Dental Hygiene Professional Practice Index, 2014	18	98

## Evaluation of predictor factors' impact on FQHCs providing direct oral health care

### Impact of FQHCs' supply of oral health providers (staffing ratios, panel size, and capacity) on patients' access to oral health services at FQHCs

Table 22 shows the distribution of oral health staffing ratios, panel size, and capacity at FQHCs that provided direct oral health care by the proportion of patients accessing any dental services nationwide between 2011 and 2014. FQHCs that provided direct oral health care to 23.5% or more of their total patients had, on average, higher ratios of dental hygienists to dentist FTEs and dental assistants/aides/techs to dentist FTEs as well as a greater number of dental operatories per 1,000 patients than FQHCs that provided direct oral health care to less than 23.5% of their total patients. In contrast, FQHCs that provided direct oral health care to proportionally more patients had a lower average number of dental patients per oral health provider FTE than those that provided direct oral health care to proportionally fewer patients.

**Table 22. Distribution of Oral Health Staffing Ratios, Panel Size, and Capacity at FQHCs With Dentist and/or Dental Hygienist FTEs by the Proportion of Patients Accessing Any Dental Services Nationwide, 2011-2014**

FQHC Staffing Ratios, Panel Size, and Capacity	≥23.5% of Patients Accessing OH Services	Mean	Minimum	25th Percentile	Median	75th Percentile	90th Percentile
Ratio of DH to dentist FTEs at FQHC	No	0.52	0	0.11	0.45	0.79	1.03
	Yes	0.6	0	0.3	0.55	0.84	1.09
Ratio of DA/other to dentist FTEs at FQHC	No	1.82	0	1.25	1.75	2.27	2.87
	Yes	1.95	0	1.41	1.88	2.31	2.92
Number of OH patients per OH provider FTE	No	433.98	12	280.9	366.41	476.64	689
	Yes	413.98	93.88	306.21	376.71	473.91	588.57
Number of dental operatories per 1,000 patients	No	0.79	0.02	0.42	0.63	0.98	2.25
	Yes	1.44	0.23	0.9	1.22	1.87	3.25

DA, dental assistant; DH, dental hygienist; FQHC, federally qualified health center; FTE, full-time equivalent; OH, oral health.

Table 23 shows the statistical significance of mean differences in oral health staffing ratios, panel size, and capacity at FQHCs that provided direct dental care by the FQHCs' proportion of patients accessing any dental services nationwide between 2011 and 2014. FQHCs that provided direct oral health care to 23.5% or more patients had significantly higher mean ratios of dental hygienists to dentist FTEs (0.60 versus 0.52) and dental assistants/aides/techs to dentists FTEs (1.95 versus 1.82) as well as a higher mean number of dental operatories per 1,000 patients (1.44 versus 0.79) compared with FQHCs that provided direct oral health care to proportionally fewer patients. FQHCs that provided direct oral health care to 23.5% or more patients had a significantly lower mean number of dental patients per oral health provider FTE (414 versus 434) compared with FQHCs that provided direct oral health care to proportionally fewer patients.

**Table 23. Statistical Significance of Mean Differences in Oral Health Staffing Ratios, Panel Size, and Capacity at FQHCs With Dentist and/or Dental Hygienist FTEs by the FQHCs' Proportion of Patients Accessing Any Dental Services Nationwide, 2011-2014**

Oral Health Staffing Ratios, Panel Size, and Capacity	Mean	95% Confidence Interval		P Value <sup>a</sup>
		Lower Limit	Upper Limit	
Ratio of DH to dentist FTEs at FQHC				
FQHCs with <23.5% dental patients	0.52	0.49	0.54	
FQHCs with ≥23.5% dental patients	0.60	0.58	0.62	
Weighted difference	0.08	-0.05	-0.11	<.001
Ratio of DA/aide/tech to dentist FTEs at FQHC				
FQHCs with <23.5% dental patients	1.82	1.78	1.86	
FQHCs with ≥23.5% dental patients	1.95	1.92	1.99	
Weighted difference	0.13	-0.08	-0.18	<.001
Number of dental patients per OH provider FTE				
FQHCs with <23.5% dental patients	434	420.8	447.1	
FQHCs with ≥23.5% dental patients	414	405.5	422.5	
Weighted difference	-20	-35.66	-4.34	0.012
Number of dental operatories per 1,000 patients who received any services				
FQHCs with <23.5% dental patients	0.79	0.67	0.92	
FQHCs with ≥23.5% dental patients	1.44	1.30	1.59	
Weighted difference	0.65	0.46	0.84	<.001

<sup>a</sup>t test was used to test the statistical significance of differences in predictor means between FQHCs that provided direct oral health care to ≥23.5% patients and those that provided direct oral health care to <23.5% patients.

DA, dental assistant; DH, dental hygienist; FQHC, federally qualified health center; FTE, full-time equivalent; OH, oral health.

Table 24 shows linear regression predictions of associations between the proportion of patients accessing dental services and oral health staffing ratios, panel size, and capacity at FQHCs with dentist and/or dental hygienist FTEs nationwide in 2011-2014, as follows:

- The proportion of FQHC patients accessing any dental services significantly increased by 17.9% for every unit increase in the ratio of dental hygienists to dentist FTEs at the FQHC
- The proportion of FQHC patients accessing any dental services significantly increased by 8.3% for every unit increase in the ratio of dental assistants/aides/techs to dentist FTEs at the FQHC
- The proportion of FQHC patients accessing any dental services significantly decreased by 0.19% for every 10-patient increase in the average number of dental patients per oral health provider FTE
- The proportion of FQHC patients accessing any dental services significantly increased by 44.6% for every unit increase in the average number of dental operatories per 1,000 patients

**Table 24. Association Between Proportion of Patients Accessing Any Dental Services and Oral Health Staffing Ratios, Panel Size, and Capacity at FQHCs With Dentist and/or Dental Hygienist FTEs Nationwide, 2011-2014**

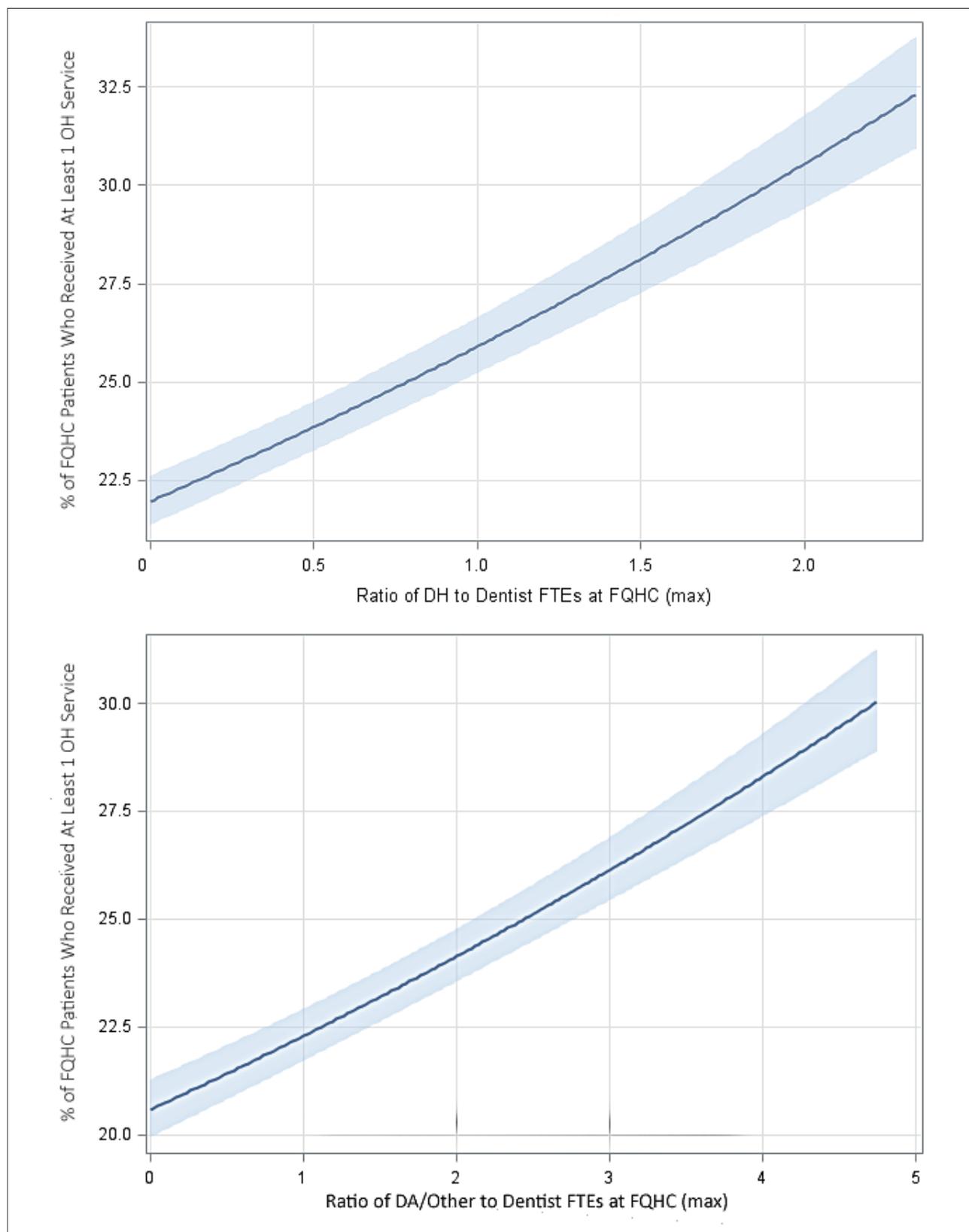
Oral Health Staffing Ratios, Panel Size, and Capacity	Rate Ratio	95% Confidence Interval		P Value <sup>a</sup>
		Lower Limit	Upper Limit	
<b>Staffing ratios</b>				
Ratio of DH to dentist FTEs at FQHC	1.179	1.156	1.203	<.001
Ratio of DA/aide/tech to dentist FTEs at FQHC	1.083	1.071	1.095	<.001
<b>Panel size</b>				
Number of dental patients per OH provider FTE	0.99981	0.99978	0.99985	<.001
<b>Capacity</b>				
Number of dental operatories per 1,000 patients who received any services	1.446	1.407	1.485	<.001

<sup>a</sup>Separate Poisson regression models with robust variance estimation were used to estimate rate ratios and 95% confidence intervals for associations between the proportion of patients accessing any dental services at FQHCs as a continuous variable and oral health staffing ratios, panel size, and capacity at FQHCs.

DA, dental assistant; DH, dental hygienist; FQHC, federally qualified health center; FTE, full-time equivalent; OH, oral health.

The proportion of FQHC patients who received any dental services was significantly and positively associated with the ratio of dental hygienists to dentist FTEs and the ratio of dental assistants/aides/techs to dentist FTEs (Figure 11).

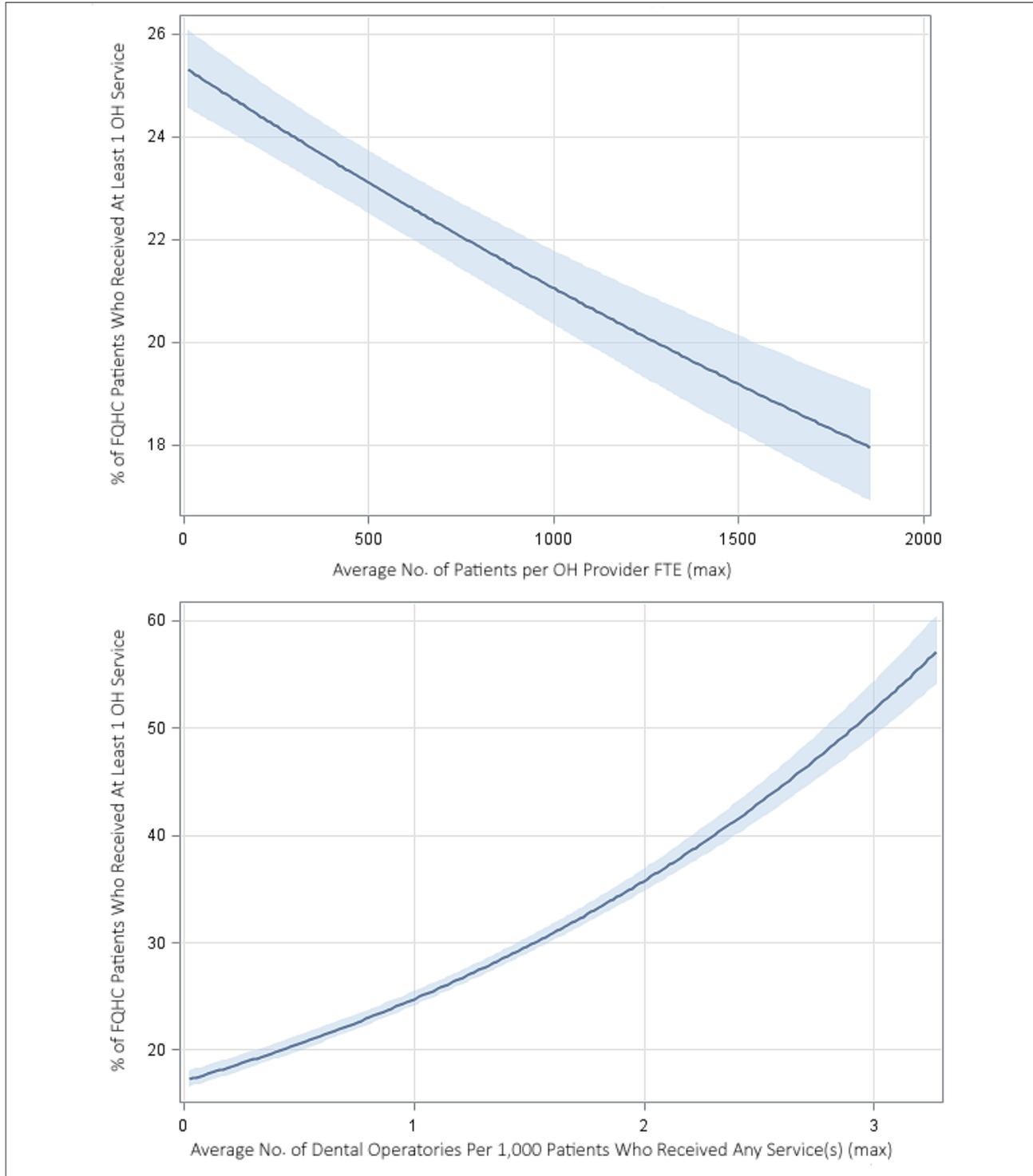
**Figure 11. Linear Regression Predictions for the Association Between Prevalence of Patients Accessing Any Dental Services at FQHCs With Dentist and/or Dental Hygienist FTEs and Staffing Ratios Nationwide, 2011-2014**



DA, dental assistant; DH, dental hygienist; FQHC, federally qualified health center; FTE, full-time equivalent; OH, oral health. Shading indicates 95% confidence limit.

The proportion of FQHC patients who received any dental services was significantly and negatively associated with the average number of dental patients per oral health provider FTE and positively associated with the average number of dental operatories per 1,000 patients (Figure 12).

**Figure 12. Linear Regression Predictions for the Association Between Prevalence of Patients Accessing Any Dental Services at FQHCs With Dentist and/or Dental Hygienist FTEs, Panel Size, and Capacity Nationwide, 2011-2014**



FQHC, federally qualified health center; FTE, full-time equivalent; OH, oral health. Shading indicates 95% confidence limit.

Table 25 shows linear regression predictions of associations between the proportion of patients accessing dental services and oral health staffing ratios, panel size, and capacity at FQHCs with dentist and/or dental hygienist FTEs by region in 2011-2014, as follows:

- The proportion of FQHC patients accessing any dental services significantly increased with increasing ratios of dental hygienists to dentist FTEs in all regions, particularly in the Midwest (41.9%), followed by the West (20.1%), Northeast (8.8%), and South (4.2%).
- The proportion of FQHC patients accessing any dental services significantly increased with increasing ratios of dental assistants/aides/techs to dentist FTEs in all regions, particularly in the West (15.9%), followed by the South (8.3%), Northeast (4.1%), and Midwest (4.0%).
- The proportion of FQHC patients accessing any dental services significantly decreased with increasing average number of dental patients per oral health provider FTE in all regions except the Northeast. For every 10-patient increase in the average number of patients per oral health provider FTE, there was a slight decrease in the proportion of patients accessing dental services in the West (0.46%), Midwest (0.24%), and South (0.11%), and a slight increase in the Northeast (0.09%).
- The proportion of FQHC patients accessing any dental services significantly increased with increasing number of dental operatories per 1,000 patients in all regions, particularly in the Northeast (53.8%), followed by the Midwest (47.0%), South (43.1%), and West (34.6%).

**Table 25. Association Between Proportion of Patients Accessing Any Dental Services and Oral Health Staffing Ratios, Panel Size, and Capacity at FQHCs With Dentist and/or Dental Hygienist FTEs by Region, 2011-2014**

Oral Health Staffing Ratios, Panel Size, and Capacity	Rate Ratio	95% Confidence Interval		P Value <sup>a</sup>
		Lower Limit	Upper Limit	
<b>Staffing ratios</b>				
<b>Ratio of DH to dentist FTEs at FQHC</b>				
Midwest	1.419	1.357	1.483	<.001
Northeast	1.088	1.045	1.133	<.001
West	1.201	1.152	1.252	<.001
South	1.042	1.004	1.081	0.029
<b>Ratio of DA/other to dentist FTEs at FQHC</b>				
Midwest	1.040	1.015	1.065	0.002
Northeast	1.041	1.014	1.070	0.003
West	1.159	1.136	1.182	<.001
South	1.083	1.063	1.103	<.001
<b>Panel size</b>				
<b>Number of OH patients per OH provider FTE</b>				
Midwest	0.99976	0.99967	0.99985	<.001
Northeast	1.00009	1.00001	1.00018	0.034
West	0.99954	0.99947	0.99961	<.001
South	0.99989	0.99982	0.99995	0.001
<b>Capacity</b>				
<b>Average number of dental operatories per 1,000 patients who received any services</b>				
Midwest	1.470	1.398	1.545	<.001
Northeast	1.538	1.431	1.653	<.001
West	1.346	1.284	1.411	<.001
South	1.431	1.347	1.521	<.001

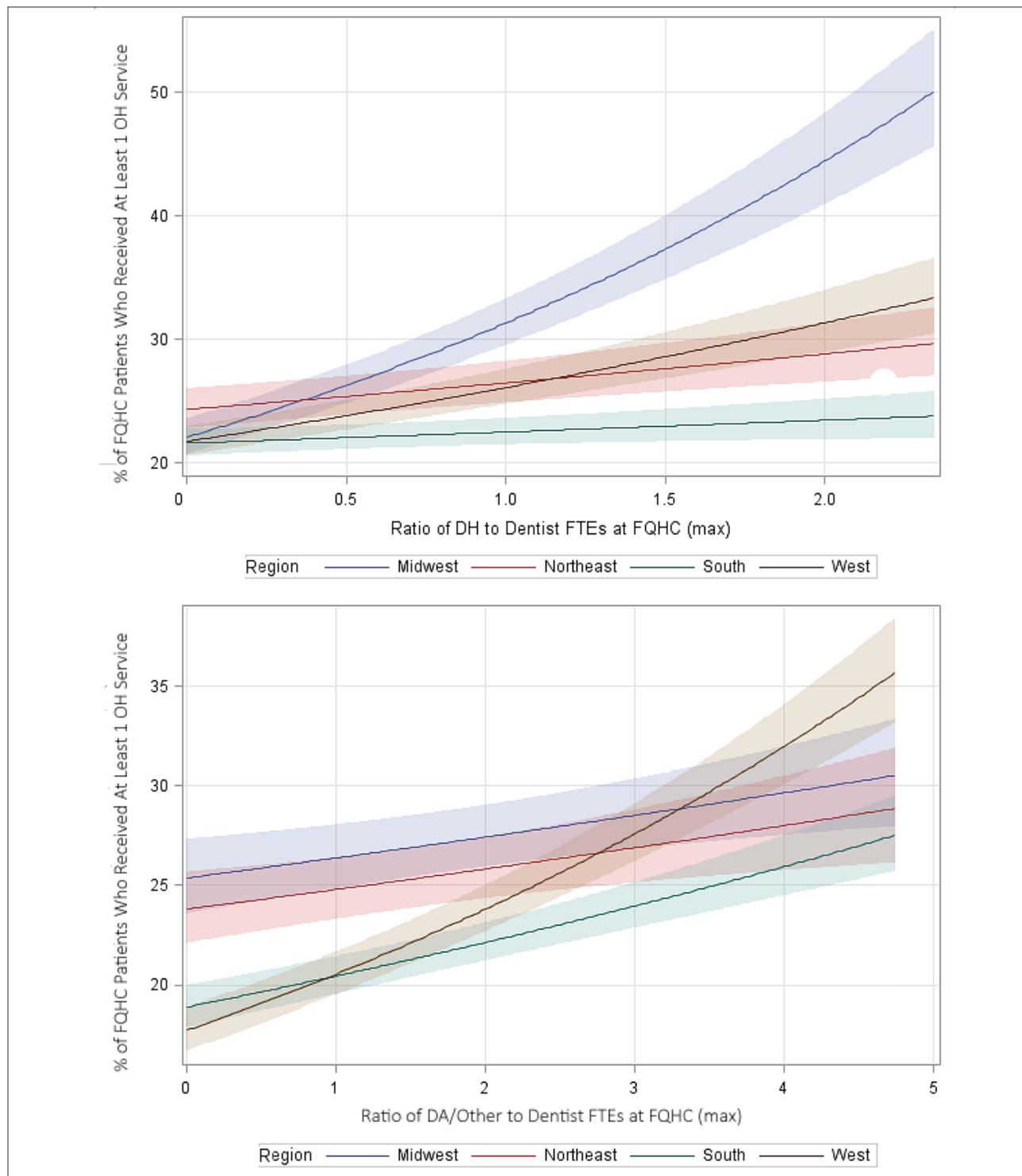
<sup>a</sup> Poisson regression models with robust variance estimation were used to estimate rate ratios and 95% confidence intervals for associations between proportion of patients accessing any dental services at FQHCs and FQHC-level predictors.

DA, dental assistant; DH, dental hygienist; FQHC, federally qualified health center; FTE, full-time equivalent; OH, oral health.

The proportion of FQHC patients who received any dental services was significantly and positively associated with the ratio of dental hygienists to dentist FTEs and the ratio of dental assistants/aides/techs

to dentist FTEs in all regions, particularly in the Midwest for dental hygienist-to-dentist ratio and in the West for dental assistant/aide/tech-to-dentist ratio (Figure 13).

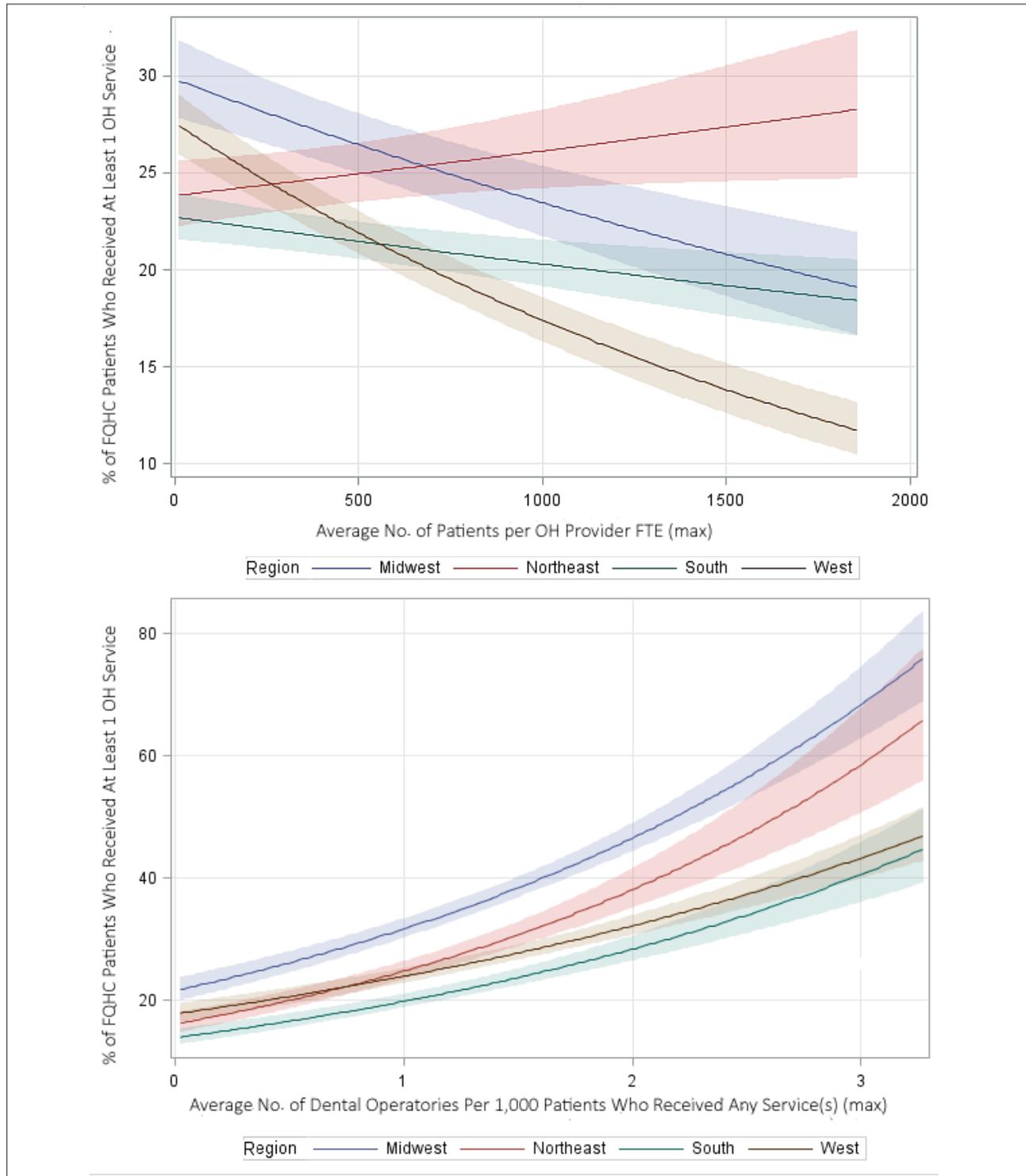
**Figure 13. Linear Regression Predictions for the Association Between Prevalence of Patients Accessing Any Dental Services at FQHCs With Dentist and/or Dental Hygienist FTEs and Staffing Ratios by Region, 2011-2014**



DA, dental assistant; DH, dental hygienist; FQHC, federally qualified health center; FTE, full-time equivalent; OH, oral health. Shading indicates 95% confidence limit.

The proportion of FQHC patients who received any dental services was significantly and negatively associated with panel size (average number of patients per dental provider FTE at the FQHC) in all regions except the Northeast and was significantly and positively associated with the FQHCs' capacity (dental operatories) in all regions (Figure 14).

**Figure 14. Linear Regression Predictions for the Association Between Prevalence of Patients Accessing Any Dental Services at FQHCs With Dentist and/or Dental Hygienist FTEs, Panel Size, and Capacity by Region, 2011-2014**



## Impact of FQHCs' patient base (socioeconomic characteristics) and federal grant revenue on patients' access to oral health services at FQHCs

Table 26 shows the distribution of patients' socioeconomic characteristics at FQHCs that provided direct oral health care by the provision of direct dental services at FQHCs nationwide in 2011-2014. FQHCs that provided direct oral health care had higher proportions of patients with income at or below FPL, patients with income 101% to 150% of FPL, children on Medicaid/CHIP insurance, and adults on Medicaid/CHIP insurance compared with FQHCs that did not provide direct oral health care services.

**Table 26. Distribution of Patients' Socioeconomic Characteristics by the Provision of Direct Dental Services at FQHCs Nationwide, 2011-2014**

Socioeconomic characteristics of FQHCs patients	FQHCs providing direct OH services	Mean	10th Percentile	25th Percentile	Median	75th Percentile	Maximum
% of FQHC patients with income at or below FPL	No	48.19	13.51	26.32	47.87	69.00	100.00
	Yes	51.21	20.04	34.17	51.69	69.71	100.00
% of FQHC patients with income 101% to 150% of FPL	No	9.82	2.25	5.05	8.54	13.34	52.04
	Yes	11.23	3.18	6.43	10.42	14.68	91.27
% of FQHC patients 0-17 years old with Medicaid/CHIP insurance	No	15.58	2.53	6.89	12.80	22.87	74.22
	Yes	19.82	5.86	11.86	18.99	27.35	81.66
% of FQHC patients 18+ years old with Medicaid/CHIP insurance	No	17.06	3.71	7.54	13.33	22.03	97.56
	Yes	17.55	5.37	8.81	14.96	23.79	86.84

FPL, federal poverty level; FQHC, federally qualified health center; OH, oral health.

Table 27 shows the statistical significance of mean differences in selected socioeconomic characteristics of FQHCs' patients by the FQHCs' provision of direct oral health services nationwide in 2011-2014. FQHCs that provided direct oral health care had a significantly higher average prevalence of patients with income at or below FPL (51.21% versus 48.19%), patients with income 101% to 150% of FPL (11.23% versus 9.82%), and patients 0-17 years old with Medicaid/CHIP insurance (19.82% versus 15.58%) compared with FQHCs that did not provide direct oral health care. There was no statistically significant difference in the prevalence of patients 18+ years old with Medicaid insurance at FQHCs that provided direct oral health care and those that did not.

**Table 27. Statistical Significance of Mean Differences in Selected Socioeconomic Characteristics of FQHC Patients by the FQHCs' Provision of Direct Oral Health Care Nationwide, 2011-2014**

Oral Health Staffing Ratios, Panel Size, and Capacity	Mean	95% Confidence Interval		P Value <sup>a</sup>
		Lower Limit	Upper Limit	
% of FQHC patients with income at or below FPL				
FQHCs not providing direct OH services	48.19	46.65	49.74	
FQHCs providing direct OH services	51.21	50.46	51.95	
Weighted difference	3.01	1.42	4.61	<.001
% of FQHC patients with income 101-150% of FPL				
FQHCs not providing direct OH services	9.82	9.39	10.24	
FQHCs providing direct OH services	11.23	10.99	11.46	
Weighted difference	1.41	0.92	1.90	<.001
% of FQHC patients 0-17 years old with Medicaid/CHIP insurance				
FQHCs not providing direct OH services	15.58	14.88	16.29	
FQHCs providing direct OH services	19.82	19.46	20.17	
Weighted difference	4.23	3.48	4.99	<.001
% of FQHC patients 18+ years old with Medicaid/CHIP insurance				
FQHCs not providing direct OH services	17.06	16.24	17.87	
FQHCs providing direct OH services	17.55	17.18	17.93	
Weighted difference	0.50	-0.32	1.31	0.235

<sup>a</sup> t test was used to test the statistical significance of differences in predictor means between FQHCs that provided direct oral health care and those that did not provide direct oral health care.

FPL, federal poverty level; FQHC, federally qualified health center; OH, oral health.

Table 28 shows logistic regression predictions of associations between FQHCs' provision of direct dental care with socioeconomic characteristics of patients and revenue from federal grants at FQHCs nationwide in 2011-2014, as follows:

- The likelihood of FQHCs providing direct dental care significantly increased by 0.5% for every 1% increase in the prevalence of FQHC patients with income at or below FPL and by 3.1% for every 1% increase in the prevalence of FQHC patients with income 101% to 150% of FPL.
- The likelihood of FQHCs providing direct dental care significantly increased by 5.1% for every 1% increase in the prevalence of child patients without insurance, by 3.7% for every 1% increase in the prevalence of child patients with Medicaid/CHIP insurance, by 7.4% for every 1% increase in the prevalence of child patients on other public insurance. The likelihood of FQHCs providing direct dental care significantly decreased with increasing prevalence of FQHC patients 18 years and older with Medicare insurance and with increasing prevalence of FQHC patients with commercial insurance.
- The likelihood of FQHCs providing direct dental care significantly increased with increasing prevalence of FQHC child patients in general and decreased with increasing prevalence of FQHC patients 18 years and older.
- The likelihood of FQHCs providing direct dental care significantly increased with increasing prevalence of school-based health center patients and decreased with increasing prevalence of homeless patients.
- The likelihood of FQHCs providing direct dental care significantly increased by 1.1% for every \$100,000 increase in revenue from ACA Capital Development Grants, including School-Based Health Center Capital Grants.

**Table 28. Association Between Provision of Direct Oral Health Care at FQHCs With Socioeconomic Characteristics of Patients and Revenue From Federal Grants at FQHCs Nationwide, 2011-2014**

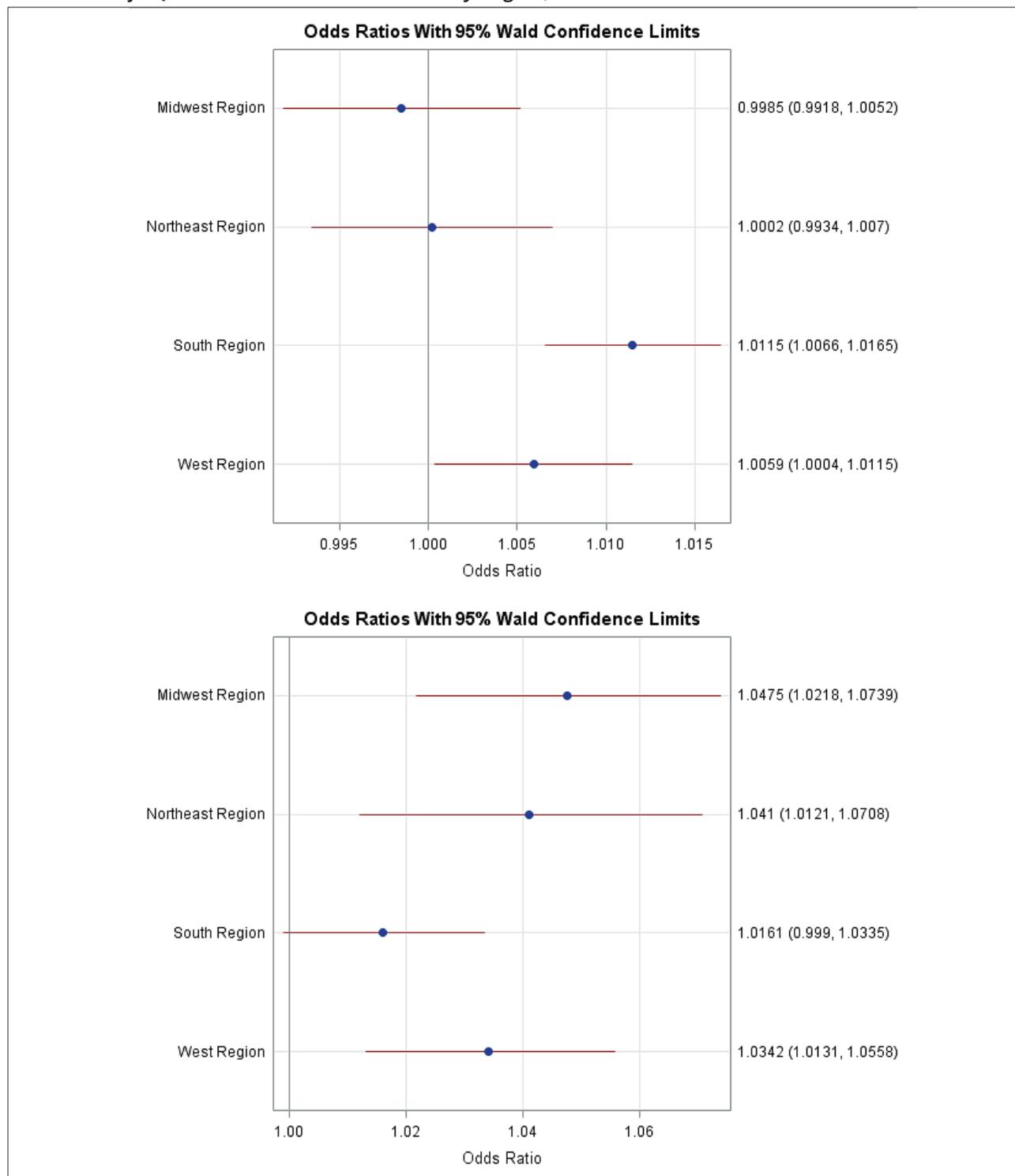
Patient Base and Revenue from Federal Grants	Odds Ratio	95% Confidence Interval		P Value <sup>a</sup>
		Lower Limit	Upper Limit	
% of patients with income				
At or below FPL	1.005	1.003	1.008	<.001
101% to 150% of FPL	1.031	1.020	1.041	<.001
151% to 200% of FPL	1.004	0.991	1.018	0.525
Over 200% of FPL	1.008	0.999	1.017	0.089
% of patients with/without insurance				
None/uninsured				
Children (0 to 17 years)	1.051	1.034	1.069	<.001
Adults (18 years and older)	0.999	0.996	1.003	0.678
Medicaid/CHIP				
Children (0 to 17 years)	1.037	1.030	1.043	<.001
Adults (18 years and older)	1.003	0.998	1.009	0.235
Medicare adults				
Adults (18 years and older)	0.944	0.934	0.953	<.001
Other public insurance				
Children (0 to 17 years)	1.074	1.018	1.133	0.008
Adults (18 years and older)	1.004	0.983	1.026	0.689
Private insurance				
Children (0 to 17 years)	0.968	0.952	0.984	<.001
Adults (18 years and older)	0.972	0.966	0.978	<.001
% of children/adult patients				
Children (0 to 17 years)	1.031	1.026	1.037	<.001
Adults (18 years and older)	0.970	0.964	0.975	<.001
% of special population patients				
Homeless	0.995	0.993	0.998	0.002
School-based health center patients	1.014	1.003	1.026	0.016
Veterans	0.999	0.973	1.026	0.952
Revenue from grants (\$100,000 unit)				
ACA Capital Development Grants, including School-Based Health Center Capital Grants	1.011	1.000	1.021	0.049
ARRA CIP and FIP	0.995	0.987	1.002	0.143

<sup>a</sup> Logistic regression models were used to estimate odds ratios and 95% confidence intervals for associations between FQHCs providing direct oral health services (yes versus no) and socioeconomic characteristics of patients and federal grant revenue at FQHCs.

ACA, Affordable Care Act; ARRA, American Recovery and Reinvestment Act; CIP, Capital Improvement Project; FIP, Facility Investment Program; FPL, federal poverty level.

The likelihood of FQHCs providing direct dental care was significantly and positively associated with the proportion of FQHC patients with income at or below FPL in the South and West regions and with the proportion of FQHC patients with income 101% to 150% of FPL in the Midwest, Northeast, and West regions (Figure 15).

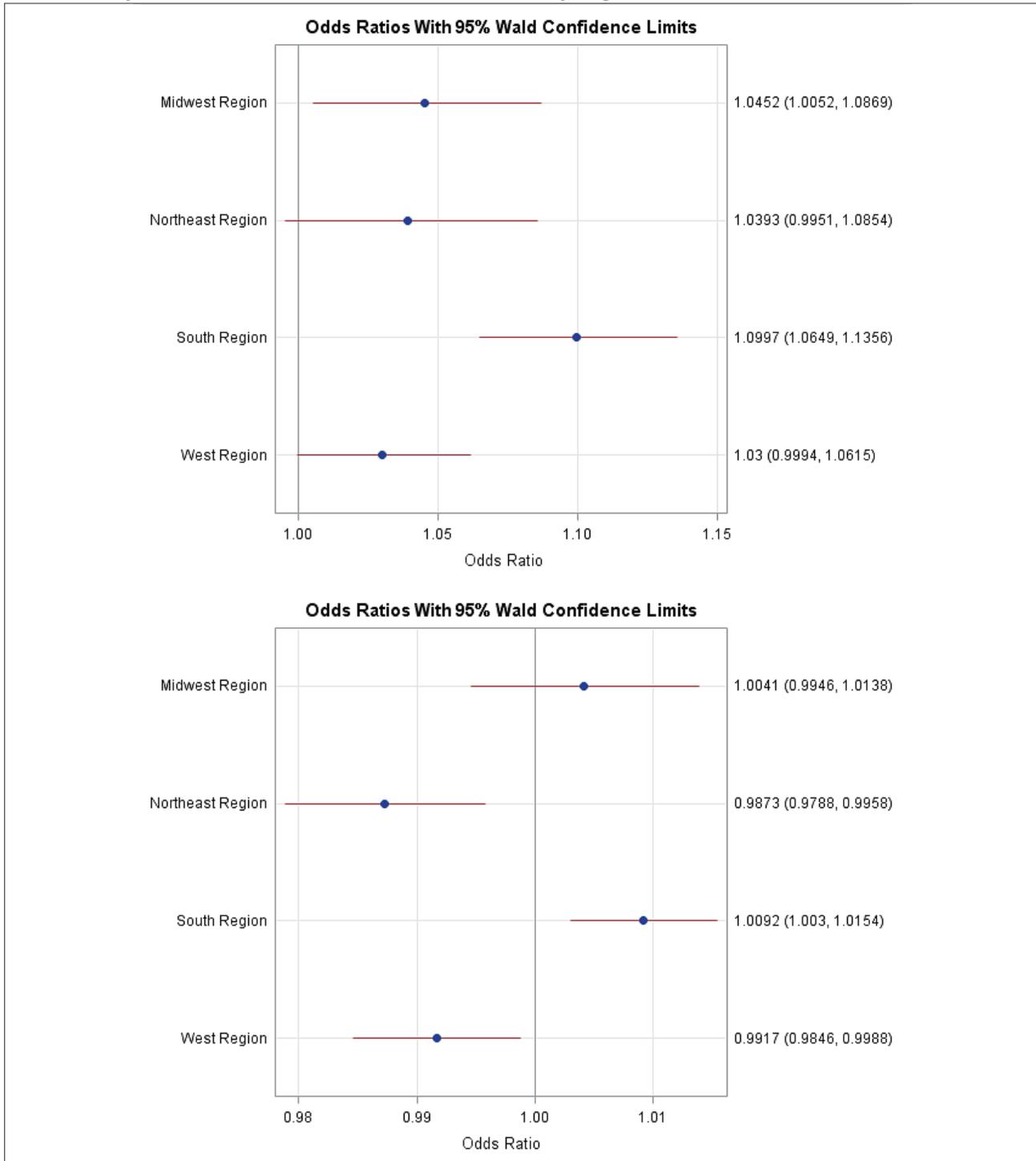
**Figure 15. Odds Ratios for the Association Between Provision of Direct Dental Services by FQHCs and Prevalence of FQHC Patients With Low Income by Region, 2011-2014**



FPL, federal poverty level; FQHC, federally qualified health center.

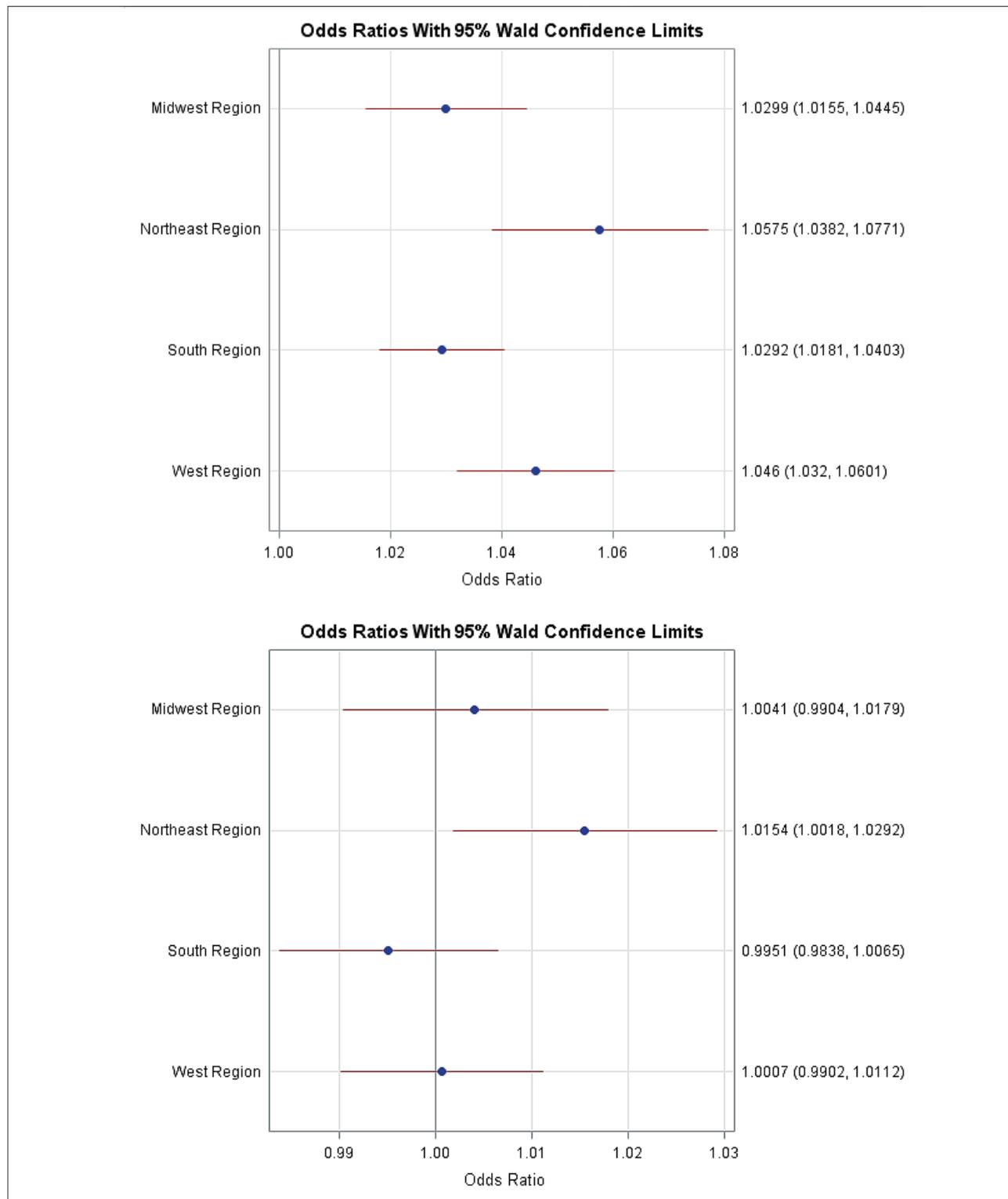
The likelihood of FQHCs providing direct dental care was significantly and positively associated with the proportion of FQHC child patients without insurance in the Midwest and South regions and with the proportion of FQHC adult patients without insurance in the South region (Figure 16). There was a significant negative association between the likelihood of FQHCs providing direct dental care and the proportion of FQHC adult patients without insurance in the Northeast and West regions.

**Figure 16. Odds Ratios for the Association Between Provision of Direct Dental Services by FQHCs and Prevalence of FQHC Patients Without Medical Insurance by Region, 2011-2014**



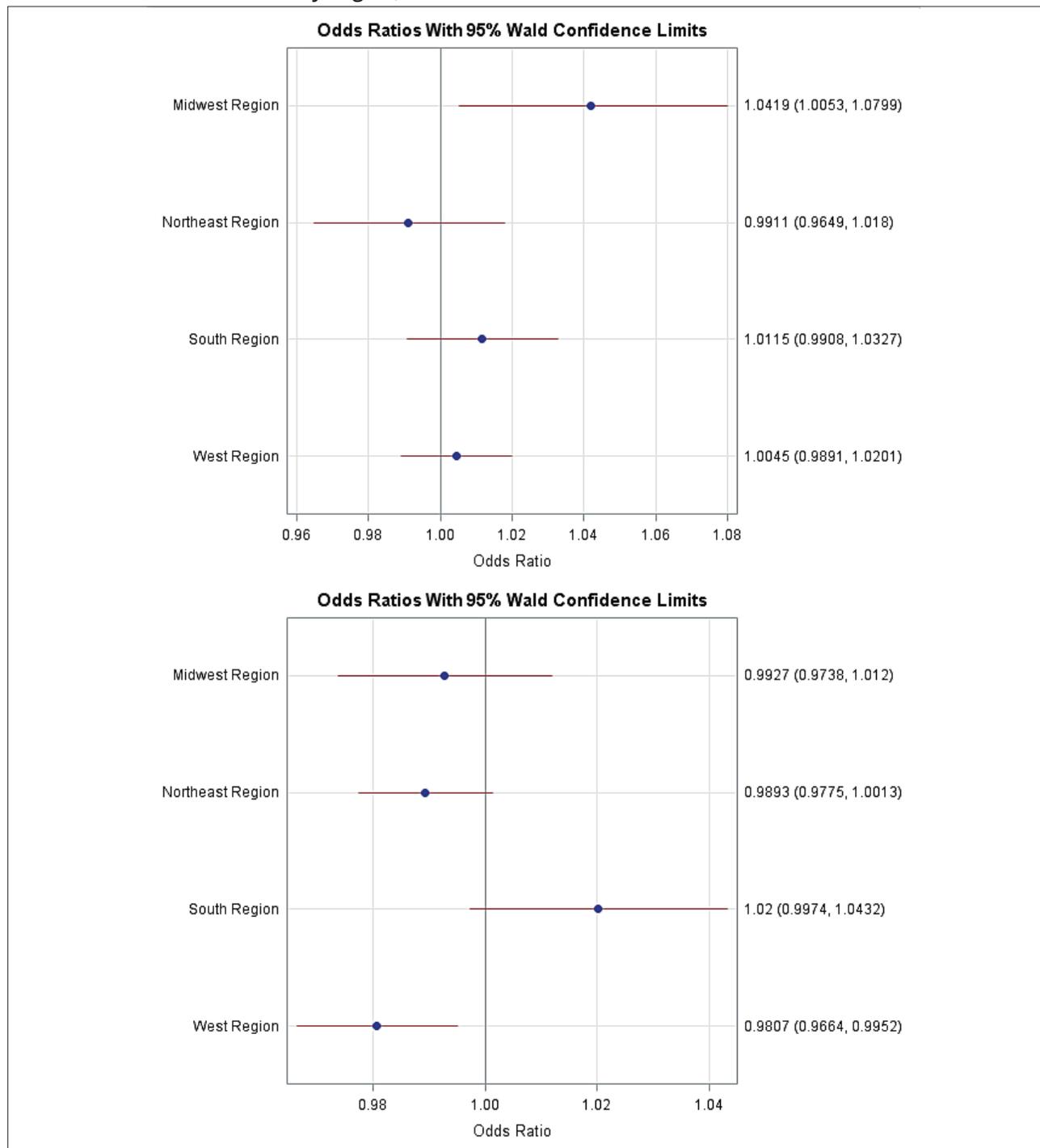
The likelihood of FQHCs providing direct dental care was significantly and positively associated with the proportion of FQHC child patients on Medicaid/CHIP insurance in all regions and with the proportion of FQHC patients 18 years and older on Medicaid/CHIP in the Northeast region (Figure 17).

**Figure 17. Odds Ratios for the Association Between Provision of Direct Dental Services by FQHCs and Prevalence of FQHC Patients With Medicaid/CHIP Insurance by Region, 2011-2014**



The likelihood of FQHCs providing direct dental care was significantly and positively associated with the magnitude of revenue from ACA Capital Development Grants in the Midwest region; the association was also positive but not statistically significant in the South and West regions (Figure 18). There was a significant negative association between the likelihood of FQHCs providing direct dental care and revenue from ARRA CIP and FIP in the West region.

**Figure 18. Odds Ratios for the Association Between Provision of Direct Dental Services by FQHCs and FQHC Revenue From Federal Grants by Region, 2011-2014**



ACA, Affordable Care Act; ARRA, American Recovery and Reinvestment Act; CIP, Capital Improvement Project; FIP, Facility Investment Program.

## Impact of state-level factors on provision of direct oral health services at FQHCs

Table 29 shows logistic regression predictions of associations between FQHCs' provision of direct dental care with state characteristics nationwide in 2011-2014, as follows:

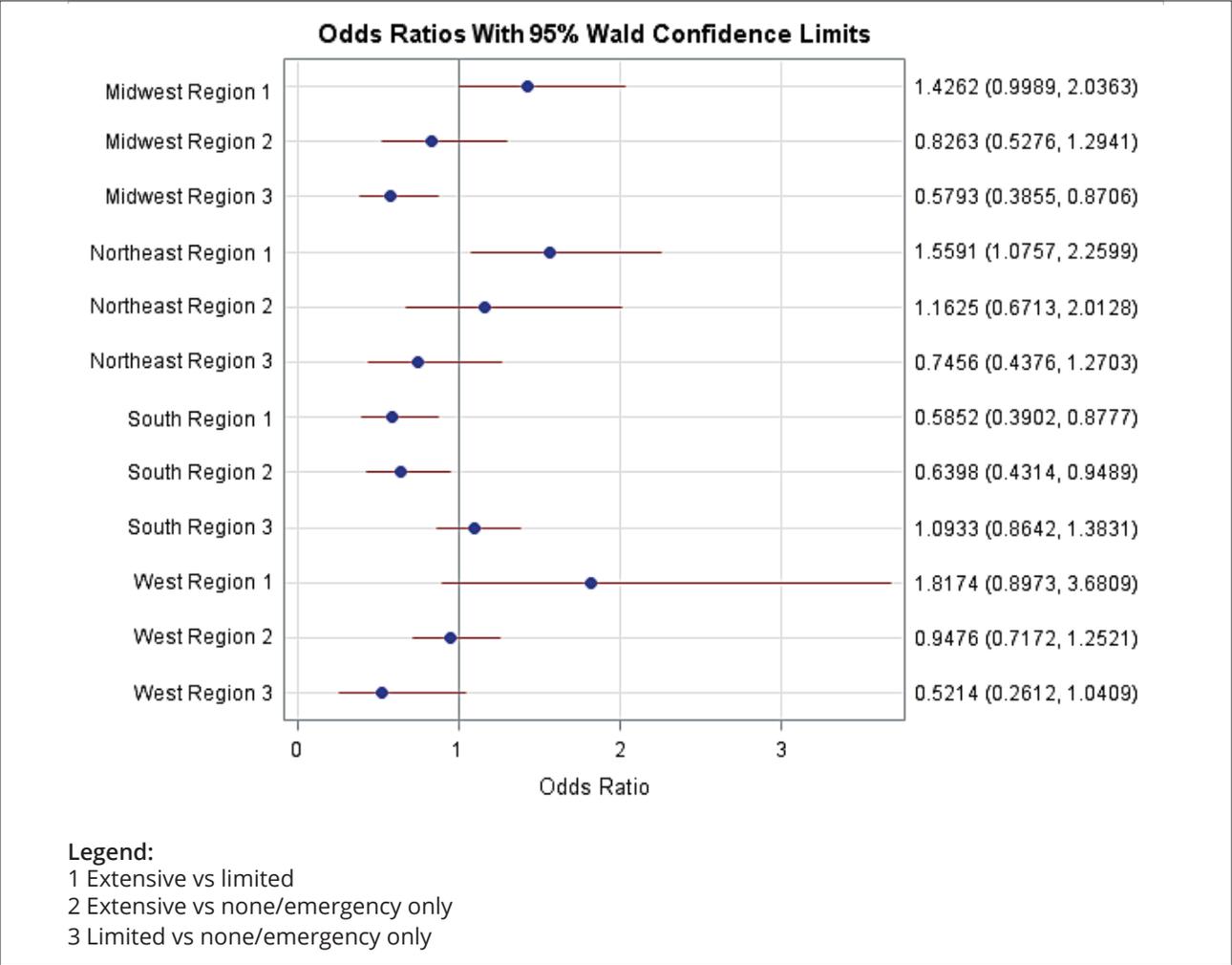
- The likelihood of FQHCs providing direct dental care was significantly higher in states with an extensive Medicaid dental benefit (72.1%), a limited Medicaid dental benefit (40.1%), and an emergency-only Medicaid dental benefit (69.7%) compared with states without a Medicaid dental benefit for adults. The likelihood of FQHCs providing direct dental care was also significantly higher in states with an extensive dental benefit than in those with a limited dental benefit (22.9%).
- The likelihood of FQHCs providing direct dental care increased with increasing proportions of the state population on Medicaid, other public insurance, and private insurance and decreased with increasing proportions of uninsured and Medicare-insured patients. However, these findings were not statistically significant.
- The likelihood of FQHCs providing direct dental care was not associated with state Medicaid reimbursement of dental services for children, the number of dental care HPSAs, the percentage of the population living in rural areas, per capita income, or the percentage of the population on community water systems receiving fluoridated water. The likelihood of FQHCs providing direct dental care was significantly lower in states with higher Medicaid reimbursement of dental services for adults.
- The likelihood of FQHCs providing direct dental care significantly increased by 7% for every 10-point increase in the DHPPI.

**Table 29. Association Between Provision of Direct Oral Health Care at FQHCs and State Characteristics Nationwide, 2011-2014**

Patient Base and Revenue from Federal Grants	Odds Ratio	95% Confidence Interval		P Value
		Lower Limit	Upper Limit	
Medicaid coverage policy for adults, 2011-2014				
Emergency only versus none	1.697	1.240	2.322	<.001
Limited versus none	1.401	1.022	1.920	0.036
Extensive versus none	1.721	1.246	2.376	0.001
Extensive versus limited	1.229	1.026	1.471	0.025
Percentage of health insurance coverage of the total population, 2014				
Uninsured	0.974	0.936	1.013	0.191
Medicaid	1.023	0.993	1.054	0.130
Medicare	0.954	0.902	1.008	0.096
Other public insurance	1.049	0.953	1.155	0.326
Private insurance	1.007	0.981	1.034	0.609
Medicaid fee-for-service reimbursement as a percentage of private dental benefit plan charges				
Child dental services, 2013	0.990	0.978	1.001	0.073
Adult dental services, 2014	0.983	0.970	0.998	0.022
Number of dental care health professional shortage areas, 2016	1.000	0.999	1.002	0.471
Percentage of population living in rural areas, 2010	0.996	0.987	1.007	0.490
Per capita personal income, 2012 (\$1,000 unit)	0.985	0.964	1.006	0.165
Percentage of population on community water systems receiving fluoridated water, 2012	0.995	0.989	1.002	0.148
Dental Hygiene Professional Practice Index, 2014	1.007	1.001	1.013	0.018

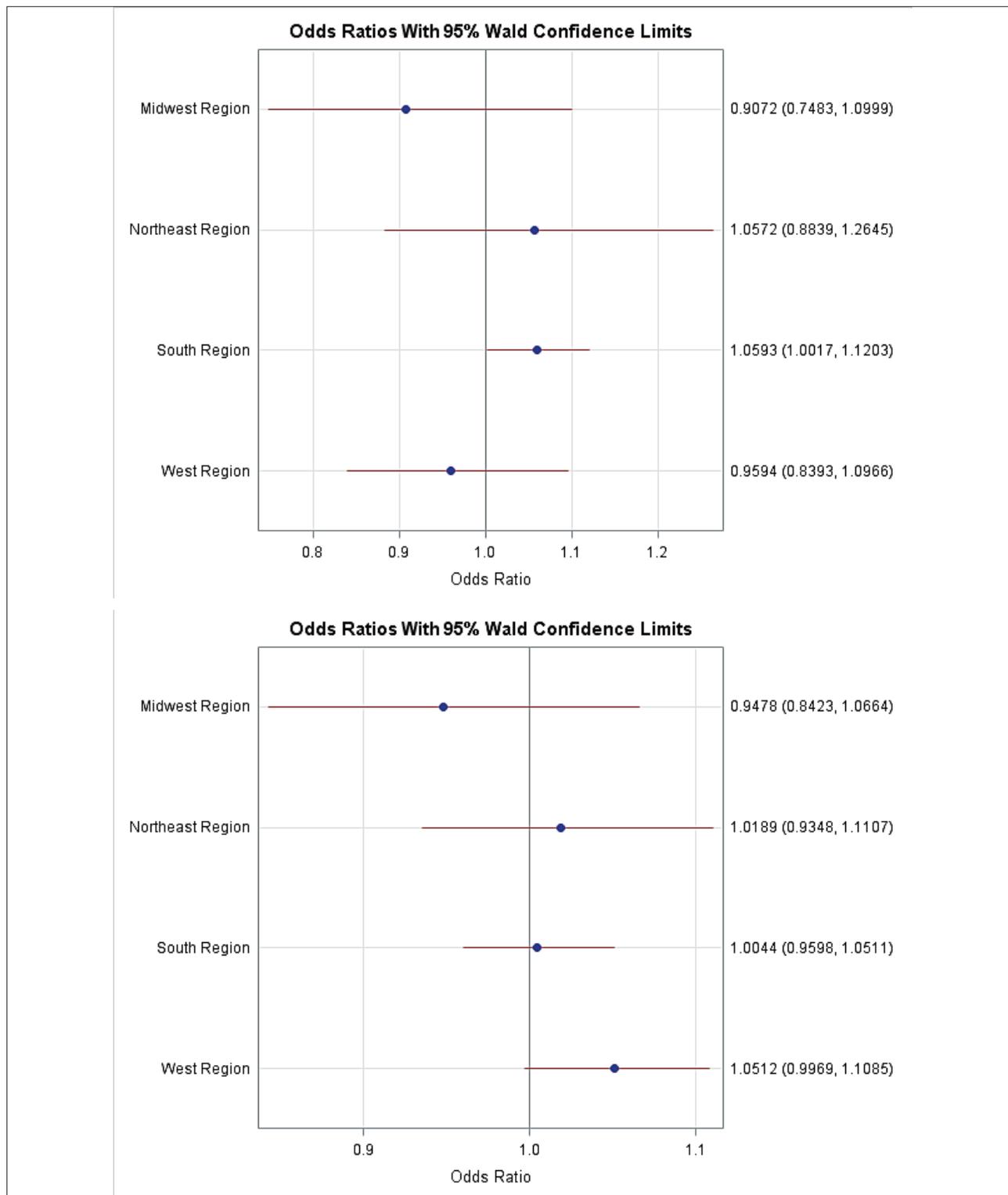
For the regional analysis, the states without a dental benefit for adults were combined with the states with an emergency-only dental benefit, as only a small number of states had no dental benefit for adults and most were in the South region. The likelihood of FQHCs providing direct dental care was significantly higher in states with an extensive dental benefit than in states with a limited dental benefit in the Northeast, and was borderline significantly higher in the Midwest (Figure 19). The likelihood of FQHCs providing direct dental care was significantly lower in states with a limited dental benefit than in states without a dental benefit or with an emergency-only benefit in the Midwest. Only 1 state in the South (North Carolina) offered an extensive dental benefit for adults; thus, this analysis was based on a small number of observations, and the results may not be accurate.

**Figure 19. Odds Ratios for the Association Between Provision of Direct Dental Services by FQHCs and State Medicaid Coverage Policy for Adults by Region, 2011-2014**



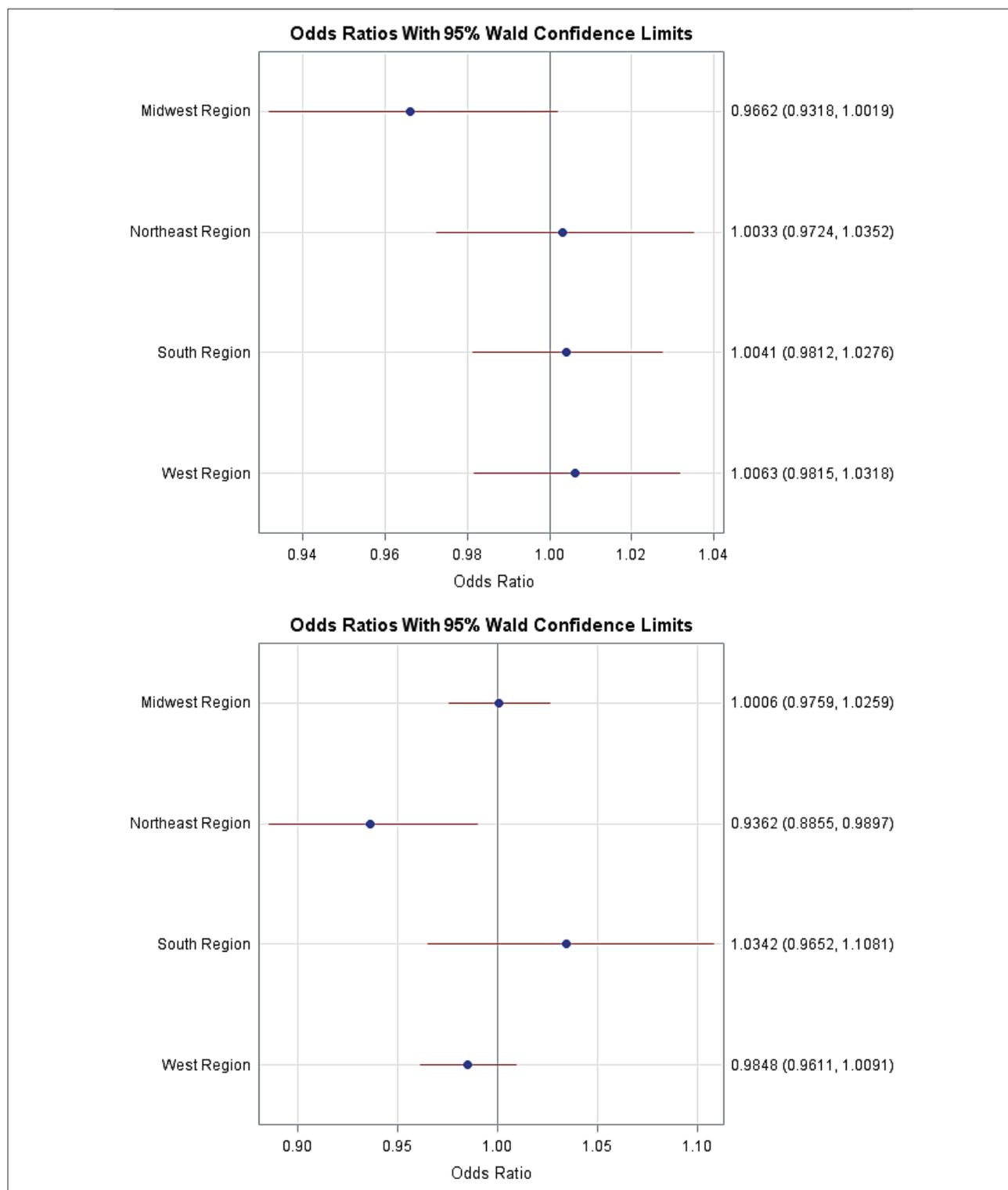
The likelihood of FQHCs providing direct dental care significantly increased with increasing prevalence of the uninsured population in the South region and borderline significantly increased with increasing prevalence of the state population on Medicaid insurance in the West region (Figure 20).

**Figure 20. Odds Ratios for the Association Between Provision of Direct Dental Services by FQHCs and State Percentage of Health Insurance Coverage of the Total Population by Region, 2014**



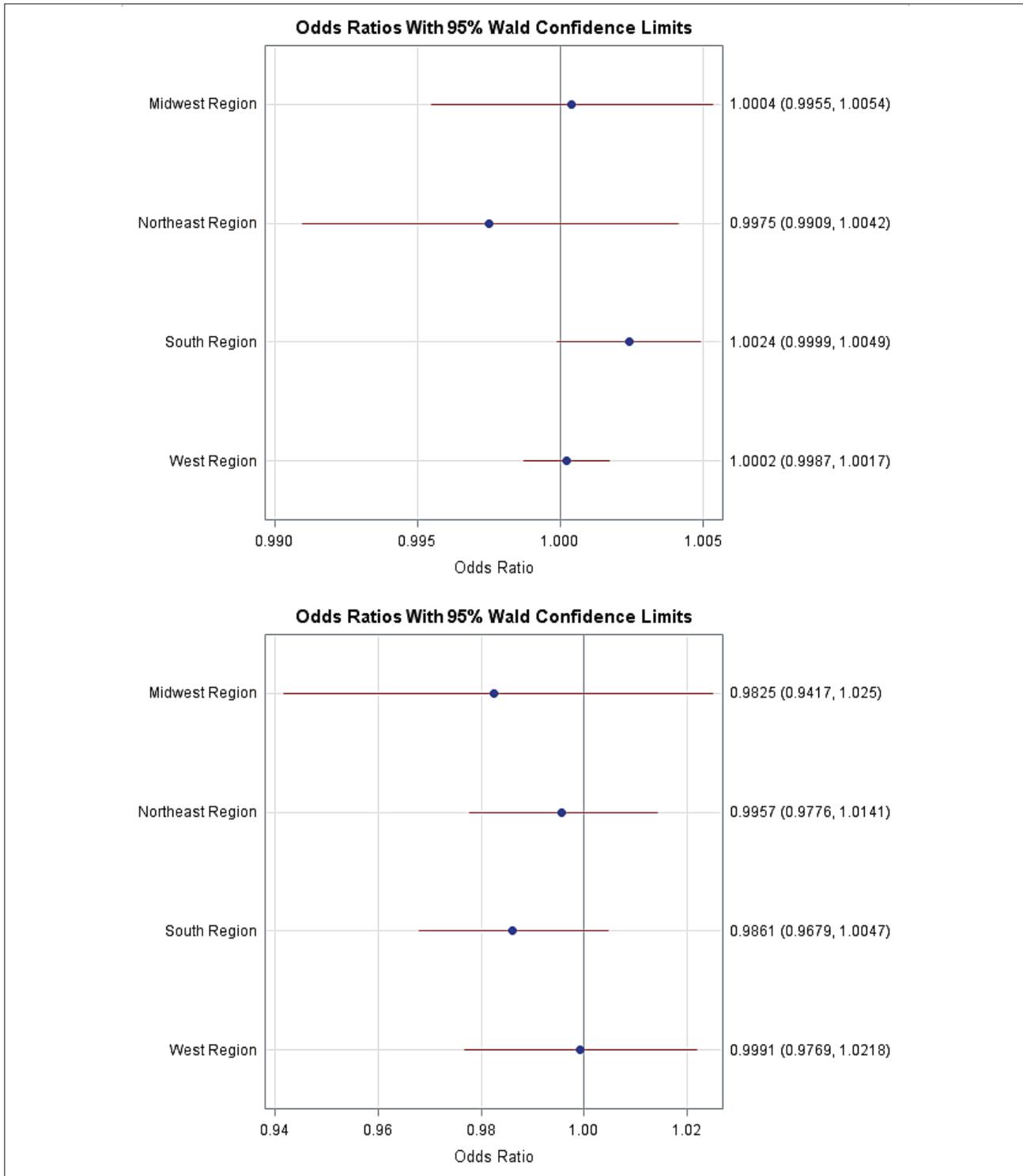
The likelihood of FQHCs providing direct dental care was borderline significantly lower in states with higher Medicaid reimbursement of dental services for children in the Midwest region and higher Medicaid reimbursement of dental services for adults in the Northeast region (Figure 21).

**Figure 21. Odds Ratios for the Association Between Provision of Direct Dental Services by FQHCs and State Medicaid Fee-for-Service Reimbursement as a Percentage of Private Dental Benefit Plan Charges by Region, 2013-2014**



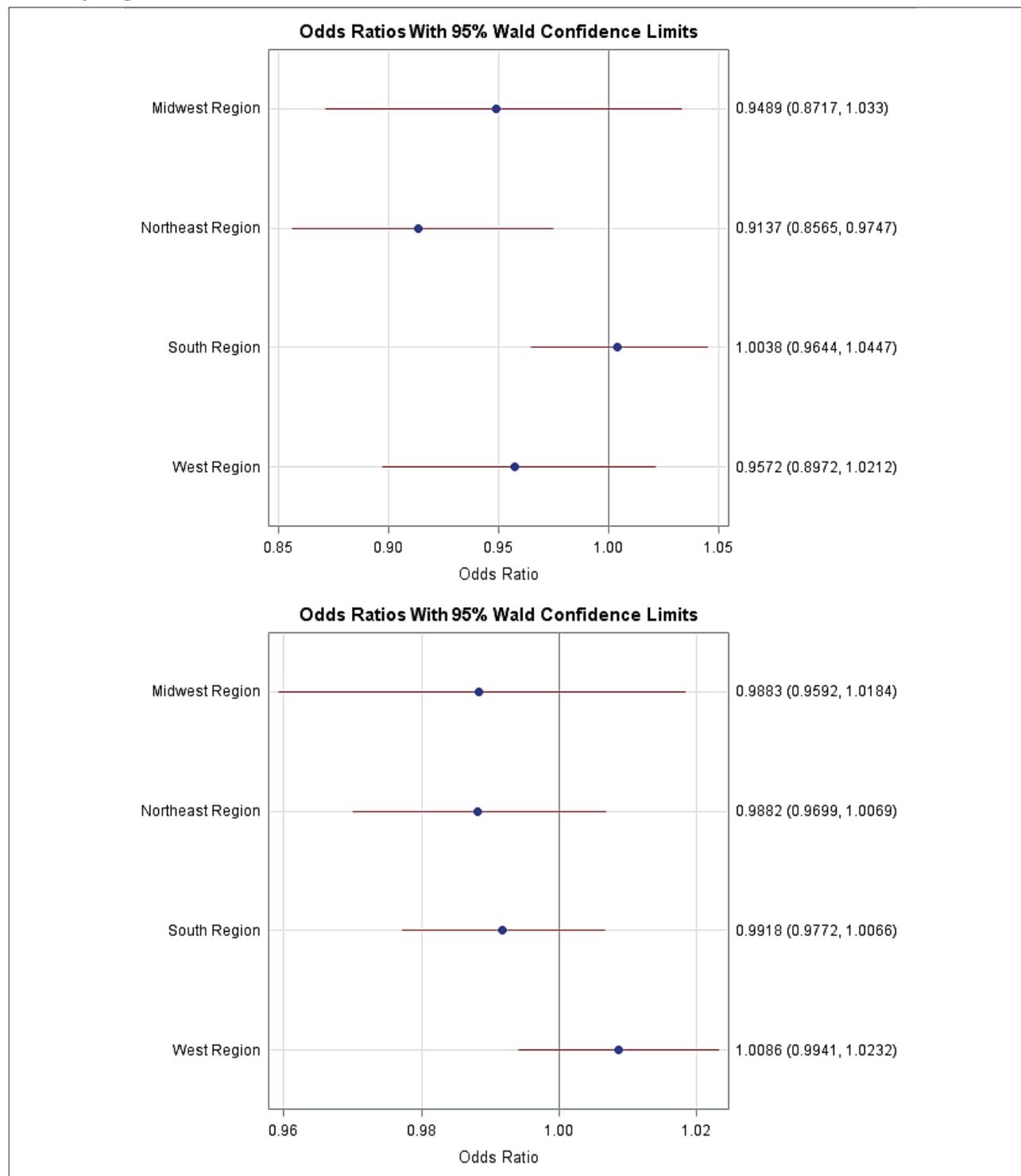
The likelihood of FQHCs providing direct dental care was borderline significantly higher with a higher number of dental care HPSAs in states in the South region (Figure 22). The likelihood of FQHCs providing direct dental care was not significantly associated with the percentage of the state population living in rural areas in any of the 4 regions.

**Figure 22. Odds Ratios for the Association Between Provision of Direct Dental Services by FQHCs, State Number of Dental Care HPSAs, and Percentage of Population Living in Rural Areas by Region, 2011, 2014**



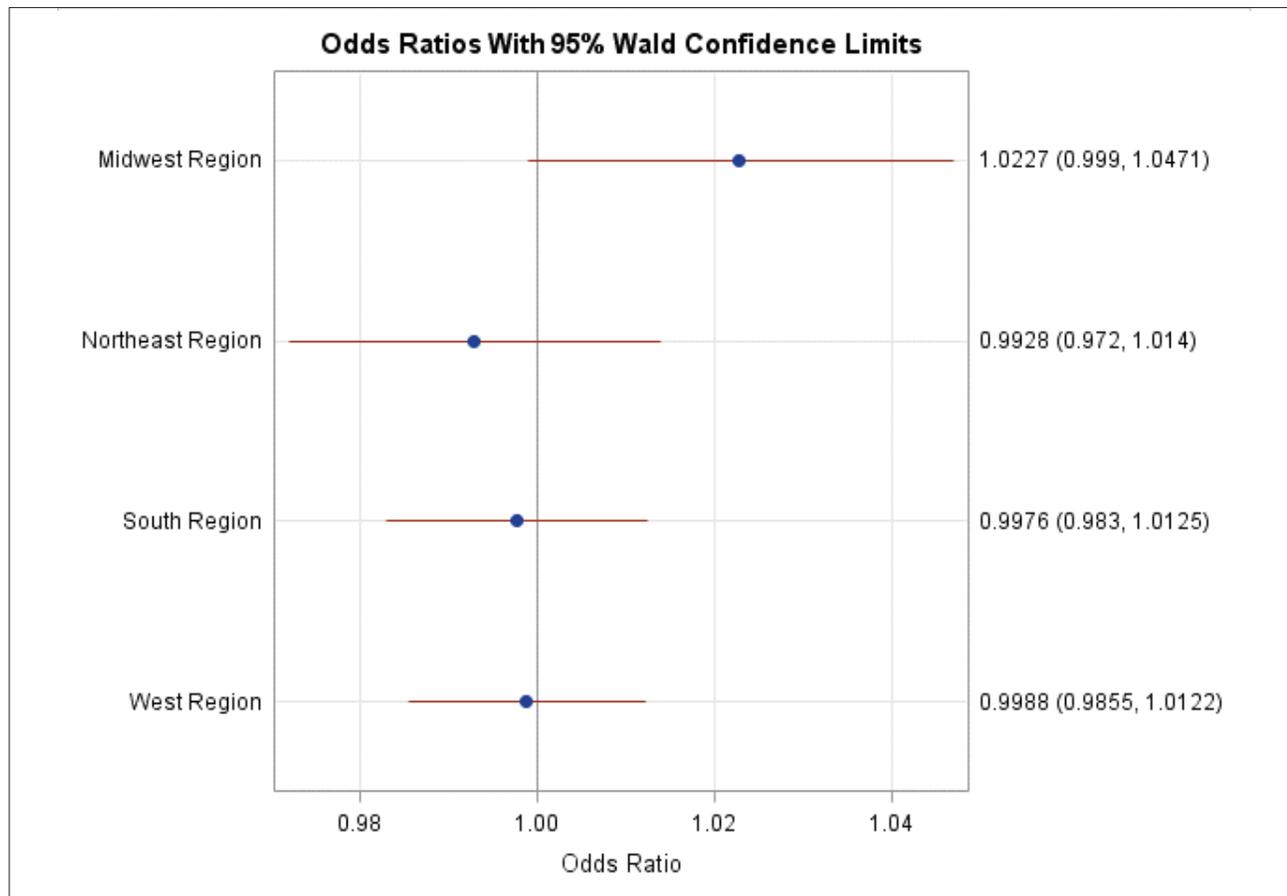
The likelihood of FQHCs providing direct dental care was significantly lower in states with higher per capita personal income in the Northeast region (Figure 23). The likelihood of FQHCs providing direct dental care was not significantly associated with the state percentage of the population on community water systems receiving fluoridated water in any of the 4 regions.

**Figure 23. Odds Ratios for the Association Between Provision of Direct Dental Services by FQHCs, State Per Capita Personal Income, and Percentage of Population on Community Water Systems Receiving Fluoridated Water by Region, 2011-2012**



The likelihood of FQHCs providing direct dental care borderline significantly increased by 2.3% for every 10-point increase in the DHPPI in the Midwest region (Figure 24).

**Figure 24. Odds Ratios for the Association Between Provision of Direct Dental Services by FQHCs and State DHPPI by Region, 2014**



## LIMITATIONS

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This study has several limitations. First, the cross-sectional study design did not allow the assessment of causal relationships between the FQHC and state-level characteristics and FQHCs' provision of direct oral health care. Second, secondary data face many challenges and inconsistencies resulting from deviation from standard definitions and standard reporting guidelines and missing, incorrect, or unavailable data. Third, due to the secondary nature of the data used, this study was not able to account for the influence of additional FQHC factors (eg, management or practice characteristics) that are not reported in the UDS or of community-level factors that may have affected the study findings evaluating the contributing factors to the provision of direct oral health services by FQHCs. Finally, the UDS data do not contain information on the quality of dental care provided by the FQHCs. A rapid expansion could lead to an increased patient load and lower quality of oral health services. Providing greater access to oral health care for vulnerable populations is important; however, an adequate level of quality of dental care is essential for improving the health status of these populations. A new quality-of-dental-care measure (dental sealants performance measure) was introduced to the UDS in 2015 to capture the percentage of children between 6 and 9 years of age at moderate to high caries risk who received a dental sealant on a first permanent molar during the measurement period.

## DISCUSSION

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This study examined UDS data for the years 2011-2014 to assess differences among FQHCs in oral health service provision by geography, size, and workforce capacity. The data used in the project analyses also included information obtained from a survey of FQHCs conducted in 2016 by OHWRC for another project funded under its cooperative agreement with HRSA. The findings from these analyses describe increasing infrastructure and rising workforce capacity in FQHCs to provide direct oral health services in many areas of the US.

In recent years, 2 of the main public strategies to address disparities in population oral health were to increase the supply and improve the capacity of dental safety net providers, especially FQHCs, to provide oral health services and to offer dental benefits in state Medicaid programs for low-income people who access this enhanced safety net for services.<sup>17</sup> If implemented in tandem, these 2 strategies are theoretically synergistic. People will have dental benefits, which is a predictor of utilization, and those people will also have greater access to provider organizations with dental service capacity that accept Medicaid insurance.

This synergy is manifesting itself for children covered by public insurance programs. The mandatory Early and Periodic Screening, Diagnostic, and Treatment (EPSDT) benefit in Medicaid, which includes a comprehensive dental benefit, coupled with a growing number of providers in the safety net serving children insured by Medicaid, has resulted in higher rates of utilization of oral health services among the young across the US.<sup>18</sup> However, persistent disparities for low-income adults in both utilization of services and oral health outcomes suggest that these separate initiatives have not worked as well for adults, perhaps due to state-to-state variation in the Medicaid dental benefit.

The federal government and its agencies designate and fund FQHCs, which are the largest component of the dental safety net in states.<sup>19</sup> Federal funding requirements reduce state-to-state variation among safety net providers that are required to meet federal guidelines to maintain their designations. In recent years, HRSA has awarded significant grants for new or improved oral health infrastructure and to ensure sufficient oral health workforce within community health centers. Between 2001 and 2015, HRSA awarded \$55 million in oral health expansion grants to FQHCs. In 2016, HRSA awarded an additional \$156 million to 420 FQHCs in 47 states for investments in oral health capacity.<sup>19</sup> A federal mandate is also responsible for the universal EPSDT benefit in Medicaid, once again contributing to reduced variation across states in coverage for dental services for children.

Federal law governing Medicaid does not include an adult dental benefit as a minimum requirement for state participation with the program. This leaves states with discretion to provide any adult dental benefit

or to limit the amount, duration, and scope of the services covered if a benefit is provided.<sup>20</sup> In addition, because the essential health benefits described in the ACA do not include adult dental benefits, low-income adults buying insurance on the marketplace would not be assured of dental coverage. These differences between requirements for children and adults introduce significant variation across states in funding for dental services. They also change the trajectory of the 2 main public initiatives in oral health such that they no longer operate in parallel to achieve corresponding results.

FQHCs depend heavily on reimbursement from Medicaid to cover the costs of providing any health services to their patient populations. A large number of patients in FQHCs are Medicaid eligible. In the US in 2014, 48.5% of patients reported incomes below FPL; 21.8% reported incomes below 200% of FPL; and 29.9% of patients' had unknown income levels. In that year, 47.3% of FQHC patients were Medicaid eligible and 27.9% were uninsured.<sup>21</sup> The high proportion of patients with a Medicaid benefit suggest that the absence of an adult dental benefit in a state's Medicaid program might substantially affect an FQHC's decision to supply direct dental services.

The cost of providing dental services is high because dentistry is procedure oriented; equipping a dental operatory is similar in magnitude to equipping a surgical suite for ambulatory medical procedures. In addition, the cost of dental materials, dental instruments, imaging equipment, and sterilization units increase the necessary capital investment.

### **Findings on the proportion of FQHCs providing direct oral health services, 2011-2014**

Although the significant funding provided by HRSA in recent years for oral health infrastructure in the safety net would suggest a concomitant increase in the percentage of FQHCs providing oral health services directly to patients, current data analyses suggest that this is perhaps simplistic logic. This study actually found a slight decline in the proportion of FQHCs nationwide that were directly providing oral health services during the period from 2011 to 2014.

This finding appears to be a regional issue rather than a national trend. The proportion of FQHCs in the Midwest (+1.6%), the Northeast (+6.6%), and the West (+3.7%) providing direct oral health services increased over the 4-year period. However, a noticeable decline in the percentage of FQHCs providing direct dental services in the South (-14.8%), especially in 2 of the 3 divisions within that region, drove the negative trend in the national results.

One possible explanation for this decline in the South was that there had been growth in the number of FQHCs in that region that outpaced the number of health centers providing dental services. An FQHC is designated based on primary health care need in a catchment area. FQHCs might develop a dental service delivery system only after the health center had become sustainable in the primary health care market.

Thus, it would be expected that newer designees in the period between 2011 and 2014 might not yet be providing dental services. This would explain the negative trend in the proportion of health centers in the South directly offering oral health services.

However, a review of growth in the number of facilities by region showed more growth in the number of designated FQHC facilities during the 4-year period in the West (+17.7%) and in the Midwest (+17.7%) than in the South (+10.3%). There was a similar rate of growth in the number of designated facilities in the Northeast (+10.0%) as in the South. Nevertheless, the Northeast region experienced 6.6% growth in the proportion of FQHCs directly providing dental services as opposed to a 6.1% decline in the proportion of designated facilities in the South providing these services over the same period.

The explanation for the decline may be related instead to the presence or absence of an adult dental benefit in state Medicaid programs in the South. States continue to struggle with the growing numbers of patients on Medicaid and the burgeoning costs of providing health services. Legislatures approach the adult dental benefit in the Medicaid program as a negotiable item and may eliminate or reduce the benefit to balance state budgets. As a result, several state Medicaid programs offer no dental benefit or provide coverage only for emergency dental services. This dampens demand for oral health services in the safety net that serves many Medicaid-eligible patients. This circumstance also makes it especially difficult for FQHCs that predominately treat low-income people to offer dental services cost effectively. An FQHC operating in a state with no adult dental benefit in Medicaid would be limited to collecting fees from patients on a sliding fee scale keyed to income that would likely not approach the cost of providing services.

Among the 17 states in the South region, 4 states offered no dental benefit for adults in 2014; 6 states had an emergency-only dental benefit for adults; 6 states offered limited dental benefits for adults; and only 1 state in the region offered an extensive dental benefit to adults eligible for Medicaid in that year. These circumstances may explain the decline in the proportion of FQHCs in the South directly providing dental services to their patients.

In 2014, the FQHCs with the highest percentages of their patient populations with incomes at or below FPL were generally in the South (50.7% of patients in the FQHCs) and West (51.4%), while those with the lowest percentages were generally in the Midwest (47.6%) and Northeast (47.1%). High percentages of patients eligible for Medicaid benefits (those at or below FPL or at or below 138% of FPL in Medicaid expansion states) that do not include dental coverage would discourage provision of oral health services because of the high cost of providing them and the inability to charge patients enough to cover expenditures for equipment and workforce.

An analysis of FQHCs by location and type of Medicaid dental coverage for patients in the state found that 75.9% of FQHCs located in states with no dental benefits were in the South region and 24.1% were in the West region. Sixty-five percent of the FQHCs in states with an emergency-only dental benefit were in the South, while 17.9% were in the West. Forty-three percent of FQHCs in states with a limited Medicaid dental benefit were in the Midwest, with 34.2% in the South. Nearly 51% of FQHCs in states with an extensive dental benefit for adults with Medicaid were located in the West, and 27.6% were in the Northeast region.

Regression analysis of the UDS data supported the supposition that the quality of state Medicaid coverage for dental services affected the likelihood that FQHCs provided dental services directly to patients. The odds ratios computed by region found that FQHCs in the Midwest (OR=1.4262), Northeast (OR=1.5591), and West (OR=1.8174) were significantly more likely to offer direct dental services in states with an extensive dental benefit. The likelihood of providing services in states with an extensive dental benefit did not increase for FQHCs in the South (OR=0.5852). The reason for the inverse finding was likely that only 1 of the 17 states in the South region provided a comprehensive dental benefit to Medicaid-eligible adults. FQHCs in the South were more likely to provide direct dental services in states with a limited Medicaid dental benefit for adults than in states with no dental coverage or an emergency-only dental benefit.

Another concern for FQHCs are the uninsured, many of whom would qualify to pay for services obtained at the FQHC on a sliding fee scale. These payments for services would likely not cover the cost of providing them, especially if the patient is not only uninsured but also low income. Eleven of the 17 states located in the South region did not expand Medicaid eligibility to 138% of FPL under the provisions of the ACA. Thus, those with incomes above FPL without other health insurance would remain ineligible for Medicaid enrollment.

In fact, FQHCs in the South (11.3%) and West (12.3%) had higher percentages of patients in the income range between 101% and 150% of FPL than did FQHCs in the Midwest (10.8%) and Northeast (9.9%). A review of national data on the insurance status of states' populations found that, in 2014, the percentage of uninsured people in each state was lowest in Massachusetts in the Northeast region (4%) and highest in Texas in the South region (17%). In the same year, the percentage of a state's population covered by Medicaid was lowest in North Dakota in the Midwest region (9%) and Virginia in the South region (9%) and highest in West Virginia in the South region (29%) (see Appendix B).

The study data revealed, however, that FQHCs that provided dental services directly to patients had higher percentages of patients overall with incomes at or below 150% of FPL and higher percentages of patients (including both adults and children) who were eligible for Medicaid than those FQHCs that did not directly provide dental services.

## Findings on the proportion of patients receiving direct oral health services in FQHCs, 2011-2014

This study analyzed the proportion of all FQHC patients—many of whom receive mainly primary care services at an FQHC—who also received direct dental services between 2011 and 2014. The number of total patients receiving any health services at FQHCs increased from 20.2 million patients in 2011 to 22.9 million in 2014.<sup>21</sup> In all regions except the South, the proportion of FQHC patients receiving any direct oral health service in FQHCs increased over the 4-year period. Nationwide, the proportion of FQHC patients who received any direct oral health service increased between 2011 (25.0% of patients) and 2014 (25.9% of patients). However, the magnitude of this trend was, once again, affected by the data from FQHCs in the South.

While there was a noticeable increase in the proportion of FQHC patients in the Midwest (+27.5%) and Northeast (+23.5%) receiving direct oral health services over the 4-year period, there was a similarly notable decline in the proportion of FQHC patients in the South (-21.1%) receiving any direct dental service. FQHCs in the West showed a positive trend but on a smaller scale, with a 2.7% increase in the number of FQHC patients receiving an oral health service between 2011 and 2014. During that time, the proportion of FQHC patients in the South receiving any direct oral health service declined from 25.9% in 2011 to 20.5% in 2014. As with previous findings, 2 of the 3 geographic divisions within the South region showed a significant decrease. The National Center for Health Statistics reported that in 2014 the percentage of 18- to 64-year-olds in the general population having a dental visit in the previous year was lower in the South (56.7%) than in the West (63.1%), Midwest (64.4%), or Northeast (69.2%).<sup>20</sup>

According to the Behavioral Risk Factor Surveillance System (a national survey), in 2014, 64.4% of adults aged 18 years or older in the US visited a dental office or clinic at least once in the previous year.<sup>22</sup> An analysis by the ADA's Health Policy Institute of the Medical Expenditure Panel Survey (MEPS) found that 43.6% of adults aged 19 to 64 years had a dental visit in 2014.<sup>23</sup> In that year, just 25.9% of FQHC patients received any oral health service at an FQHC.

Comparisons of the health center data with national surveillance or cost data are made difficult by differences in sample design and reporting. The data describing the proportion of FQHC patients with a dental visit each year includes both children and adults, confounding comparisons with these other sources that separate the population by age groups. In addition, some FQHC patients may seek only primary care or behavioral health services at the FQHC and obtain their dental care within the local community, which would reduce the proportion receiving oral health services at a health center. The relatively low proportion of all FQHC patients receiving any dental service at a health center does, however, suggest that there is potential to increase the number of primary care patients who also receive

dental services. Efforts to improve the population's oral health literacy through education and referral might result in even greater utilization of the dental clinics sponsored by health centers.

### **Types of direct oral health services provided to patients in FQHCs, 2011-2014**

One of the most positive findings from this study was that the proportion of FQHC patients in the nation receiving preventive oral health services increased over the study period, while the proportion receiving restorative, oral surgery, and emergency dental services decreased. This suggests that patients who are receiving oral health care at an FQHC are increasingly establishing dental homes within those health centers and are complying with preventive care recommendations more frequently than in the past. However, the magnitude of these changes was not large. The positive trend in the percent change was promising, although the change in relative values was small. Regardless, the shifting trend in service provision is encouraging.

Once again, there were prominent differences by region in the proportion of patients who received direct oral health services and the types of services received. There was an upward trend in the proportion of FQHC patients in the Northeast and Midwest who received prophylactic services and an increase in the Midwest, Northeast, and West in the proportion of patients receiving a restorative service. The proportion of FQHC patients in the South who received any oral health service (including oral examination, preventive services, restorative services, oral surgery services, etc) declined over the 4-year period. The Midwest region was notable in that there were increases in the proportion of patients receiving preventive (+22.2%), restorative (+25.6%), oral surgery (+25.5%), and rehabilitative (+8.8%) services over this period and a decrease in those receiving emergency services (-18.9%). The Midwest was the only region that showed a proportionate increase in the number of patients receiving any oral surgery services.

### **Types of direct oral health services provided to dental patients in FQHCs, 2011-2014**

When the UDS data were analyzed using only those FQHC patients who actually received any direct dental service in a year as the denominator, the results were similarly encouraging. The greatest absolute increase in type of service provided to dental patients was for preventive/prophylactic services. While the percentage increase was small (+3.3%) over the period, it was still the largest increase for any dental service. Emergency services exhibited the largest decrease (-18.5%) among all services provided to patients. This suggests that FQHC dental clinics are now the dental homes for some patients. More than 80% of dental patients in FQHCs received an oral examination in 2014, and nearly half (46.2%) received a preventive service. Just over one-quarter (28.3%) received restorative services at an FQHC in that year. In 2005, oral examinations and prophylaxis represented the largest proportion of dental services (78%) provided in private dental practices in the US (more recent data were unavailable).<sup>24</sup> It is encouraging that the predominant services in FQHC dental clinics currently mirror those in private dental practices.

Previous case studies of FQHCs conducted by the OHWRC<sup>25</sup> using a qualitative methodology found that patients sometimes view the dental center at the FQHC as an urgent or emergency dental clinic rather than as a dental home. FQHCs in those case studies reported that patients more often failed to show for preventive appointments than for restorative or treatment services. Many of these health centers hoped that, over time, patients would obtain a better understanding of the need to maintain good oral health through routine preventive care. These findings suggest that, in fact, this may be happening.

Another notable finding was that the provision of fluoride treatment services for FQHCs' dental patients decreased nationally (-3.6%) and regionally in the Northeast (-17.8%) and the South (-16.0%). There was an increase in the provision of fluoride services in the Midwest (+16.2%) and the West (+5.5%). While the reason for the decrease in the South might be attributed, once again, to the overall decline in capacity and utilization of services in that region, the reason for the decline in the Northeast is unknown. One possible explanation is an increase in community water fluoridation in public water systems in that region, making fluoride treatment unnecessary. However, this cannot be verified without further research that is beyond the scope of this report.

### **Average number of dental visits per dental patient at FQHCs providing direct oral health services, 2011-2014**

There has been ongoing national commentary accompanied by concern that the average number of annual dental visits by patients has declined in recent years, beginning just before but especially since the most recent economic recession in the US. Vujcic and colleagues recently conducted a review of data that showed that the decline in dental service utilization that began around 2003 appears to have slowed. As evidence, the authors comment on a steady rate of dental services utilization among working-age adults and children in 2012 and 2013.<sup>23</sup>

According to the Health Policy Institute of the ADA, the number of total dental visits in the US decreased by 7% between 2006 and 2012, at the same time that the nation's population increased by 5.3% and the supply of dentists grew by 9.4%.<sup>26</sup> One interesting finding by the Institute was that dental visits to dental offices declined by 9.1% during this period, while dental visits to FQHCs increased by 73.9%, from 6 million visits in 2006 to 10 million in 2012.<sup>3</sup>

The average number of dental visits per dental patient at FQHCs providing direct oral health services in the US decreased slightly between 2011 and 2014 (-0.4%). However, the average number of annual dental visits per patient remained high compared with national data for the US population. The most recent available data on the number of dental visits per patient in the US reported a decline in the average number of dental visits per patient from 2.05 in 1996 to 1.91 in 2009.<sup>27</sup> The findings from the

analyses for this study found that the average number of dental visits for patients in FQHC dental clinics in the US in 2014 was 2.4 visits.

The average number of visits per patient was lowest in the South (2.26) and highest in the West (2.56). When the numbers of dental visits per patient were analyzed by type of service, the highest average number of visits was for restorative services (1.86), followed by rehabilitation services including endodontics, periodontics, prosthodontics, and orthodontics (1.77). The lowest average numbers were for emergency dental visits (1.09) and for preventive visits including fluoride treatments (1.22) and prophylaxis (1.25). As preventive protocols indicate the importance of having 2 preventive visits annually, the latter rates remain below suggested levels.

These data suggest that dental patients in FQHCs may have higher restorative needs than in the general population. However, there were also promising results relative to restorative care. The rate of provision of restorative services in FQHCs declined between 2011 and 2014 in the West (-3.7%), the Midwest (-2.7%), and the South (-5.8%) and increased in the Northeast (+8.4%). The data indicated a per-patient visit increase in the Northeast for all dental services over the period except for oral surgery services.

### **Oral health staffing ratios in FQHCs providing direct oral health services, 2011-2014**

The data revealed increases in numbers of dental workers in FQHCs providing direct oral health services in all categories between 2011 and 2014. The number of FTE dentists increased by 9.0% nationally, while the numbers of FTE dental hygienists increased by 17.2% and of dental assistants and other aides and technicians increased by 12.7%. Once again, there were regional differences. FQHCs providing direct oral health services in the South experienced a decline in FTE dentists (-22.0%), dental hygienists (-3.9%), and dental assistants (-21.3%) over the 4-year period, and the West showed a decline in dental hygienists over this period (-12.6%).

The average number of dental hygienists per dentist in the US increased from 0.52 in 2011 to 0.60 in 2014 (15.4% increase), and the average number of dental assistants and aides per dentist increased from 1.85 to 1.91 (3.2% increase). The ratio of dental hygienists to dentists in FQHCs is well below the average in private dental practice. In 2012, private-practice dentists who responded to a survey conducted by the ADA reported, on average, 1.8 dental hygienists per dentist and 1.7 chairside assistants per dentist.<sup>28</sup> This low ratio may indicate still-lower-than-average demand for preventive services in FQHCs. One notable finding in the regression analyses conducted for this study was that the dental hygiene scope of practice in a state was positively and significantly associated with the likelihood of FQHCs providing direct dental care to their patients (7% average increase for every 10-point increase in the dental hygiene scope-of-practice index).

## Capacity of FQHCs to provide direct oral health services, 2011-2014

Our analyses showed that FQHCs in which more than 23.5% of health center patients received any direct oral health service in a year also had higher average ratios of both dental hygienists and dental assistants/aides per dentist than FQHCs in which fewer than 23.5% of patients received any direct dental services. In addition, the average number of patients per FTE oral health provider (dentist or dental hygienist) was lower in FQHCs providing direct oral health services that treated a higher percentage of patients (414 patients per provider) than in those that treated fewer (434 patients per provider). There was also a significant difference in the average number of operatories between FQHCs serving a higher percentage of patients (1.44 operatories) and those serving a lower percentage of patients (0.8 operatories). These findings obviously suggested that greater workforce and operatory capacity in an FQHC is linked to increased utilization of oral health services by patients.

Between 2011 and 2014, FQHCs providing direct oral health services in the Northeast experienced the largest increase in the US in the number of dental patients (+43.0%) and the number of dental visits (+53.3%). FQHCs providing direct oral health services in the South experienced a 25.4% decline in the number of dental patients and a 27.9% decline in the number of dental visits.

## Funding and provision of oral health services, 2011-2014

The funding from ACA Capital Development Grants, including School-Based Health Center Capital Grants, was positively and significantly associated with the likelihood of FQHCs providing direct dental care to their patients (1.1% average increase for every \$100,000 increase in revenue from these federal grants), mainly in the Midwest region (4.2% average increase for every \$100,000 increase in this revenue).

## CONCLUSIONS

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This study examined data over time describing patient demographics, oral health workforce, and service utilization trends by region. The data analyzed for this study show that FQHC patients in the Northeast, the Midwest, and the West are increasingly accessing oral health services at health centers in their respective regions. Measures of regional differences in capacity to serve patients showed an overall decline among FQHCs in the South in volume, workforce capacity, and ability to provide dental services and, as a result, lower levels of utilization of oral health services by patients in this geographic region. The analyses suggest promising impacts of recent federal funding initiatives to increase the infrastructure and workforce capacity of FQHCs to provide oral health services. It will be important to continue to track growth in this sector of the dental service delivery system to understand the impact of more recent investments by the federal government in oral health grants to these health centers.



# Appendix A

## APPENDIX A

*Medicaid Dental Benefit for Adults by State and Geographic Area, 2011-2014*

Geographic Area	Medicaid Dental Benefit for Adults			
	2011	2012	2013	2014
Midwest region				
East North Central division				
Illinois	Emergency only	Emergency only	Emergency only	Limited
Indiana	Limited	Limited	Limited	Limited
Michigan	Limited	Limited	Limited	Limited
Ohio	Extensive	Extensive	Extensive	Extensive
Wisconsin	Extensive	Extensive	Extensive	Extensive
West North Central division				
Iowa	Extensive	Extensive	Extensive	Extensive
Kansas	Limited	Limited	Limited	Limited
Minnesota	Limited	Limited	Limited	Limited
Missouri	Emergency only	Emergency only	Emergency only	Emergency only
Nebraska	Limited	Limited	Limited	Limited
North Dakota	Extensive	Extensive	Extensive	Extensive
South Dakota	Extensive	Limited	Limited	Limited
Northeast region				
Middle Atlantic division				
New Jersey	Limited	Limited	Limited	Extensive
New York	Extensive	Extensive	Extensive	Extensive
Pennsylvania	Limited	Limited	Limited	Limited
New England division				
Connecticut	Extensive	Extensive	Extensive	Extensive
Maine	Emergency only	Emergency only	Emergency only	Emergency only
Massachusetts	Limited	Limited	Limited	Extensive
New Hampshire	Emergency only	Emergency only	Emergency only	Emergency only
Rhode Island	Extensive	Extensive	Extensive	Extensive
Vermont	Limited	Limited	Limited	Limited

**Medicaid Dental Benefit for Adults by State and Geographic Area, 2011-2014 (Cont.)**

Geographic Area	Medicaid Dental Benefit for Adults			
	2011	2012	2013	2014
<b>South region</b>				
East South Central division				
Alabama	No dental benefits	No dental benefits	No dental benefits	No dental benefits
Kentucky	Limited	Limited	Limited	Limited
Mississippi	Emergency only	Emergency only	Emergency only	Emergency only
Tennessee	No dental benefits	No dental benefits	No dental benefits	No dental benefits
South Atlantic division				
Delaware	No dental benefits	No dental benefits	No dental benefits	No dental benefits
District of Columbia	Limited	Limited	Limited	Limited
Florida	Limited	Limited	Limited	Emergency only
Georgia	Limited	Limited	Limited	Emergency only
Maryland	Limited	Limited	Limited	No dental benefits
North Carolina	Extensive	Extensive	Extensive	Extensive
South Carolina	Emergency only	Emergency only	Emergency only	Limited
Virginia	Limited	Limited	Limited	Limited
West Virginia	Emergency only	Emergency only	Emergency only	Emergency only
West South Central division				
Arkansas	Limited	Limited	Limited	Limited
Louisiana	Limited	Limited	Limited	Limited
Oklahoma	Emergency only	Emergency only	Emergency only	Emergency only
Texas	Emergency only	Emergency only	Emergency only	Emergency only
<b>West region</b>				
Mountain division				
Arizona	Emergency only	Emergency only	Emergency only	No dental benefits
Colorado	Emergency only	Emergency only	Emergency only	Limited
Idaho	Emergency only	Emergency only	Emergency only	Emergency only
Montana	Emergency only	Emergency only	Emergency only	Emergency only
Nevada	Emergency only	Emergency only	Emergency only	Emergency only
New Mexico	Extensive	Extensive	Extensive	Extensive
Utah	Emergency only	Emergency only	Emergency only	Emergency only
Wyoming	Limited	Limited	Limited	Limited
Pacific division				
Alaska	Extensive	Extensive	Extensive	Extensive
California	Emergency only	Emergency only	Emergency only	Extensive
Hawaii	Emergency only	Emergency only	Emergency only	Emergency only
Oregon	Extensive	Extensive	Extensive	Extensive
Washington	Emergency only	Emergency only	Emergency only	Extensive





**Distribution of State-Level Predictor Variables**

State	Medicaid Coverage Policy for Adults, 2014	% of Health Insurance Coverage of the Total Population, 2014					Medicaid FFS Reimbursement as a % of Private Dental Benefit			No. of Dental Care Health Professional Shortage Areas, 2016	% of Population Living in Rural Areas, 2010	Per Capita Personal Income, 2012 (\$)	% of Population Receiving Fluoridated Water, 2012	Dental Hygiene Professional Practice Index, 2014
		Uninsured	Medicaid	Medicare	Other Public Insurance	Private Insurance	Children, 2013	Adults, 2014						
Alabama	No dental benefits	11%	19%	15%	3%	52%	53.6%		63	41.0%	\$35,625	78.4%	18	
Alaska	Extensive	14%	19%	8%	5%	54%	61.5%	58.4%	62	34.0%	\$46,778	52.9%	54	
Arizona	No dental benefits	12%	25%	14%	0%	48%	54.7%		177	10.2%	\$35,979	57.8%	75	
Arkansas	Limited	10%	22%	17%	3%	49%	67.2%	60.5%	82	43.8%	\$34,723	66.9%	60	
California	Extensive	10%	25%	10%	2%	53%	29.0%	29.0%	424	5.0%	\$44,980	63.7%	95	
Colorado	Limited	11%	20%	12%	4%	53%	45.1%	36.6%	97	13.8%	\$45,135	72.4%	97	
Connecticut	Extensive	7%	15%	12%	1%	64%	66.8%	34.2%	36	12.0%	\$58,908	90.3%	83	
Delaware	No dental benefits	7%	18%	15%	3%	57%	81.1%		8	16.7%	\$41,940	86.3%	36	
District of Columbia	Limited	6%	25%	8%	0%	60%	58.4%	51.9%	11	0.0%	\$74,710	10.0%	41	
Florida	Emergency only	15%	19%	17%	2%	47%	36.6%		232	8.8%	\$40,344	78.0%	41	
Georgia	Emergency only	16%	16%	12%	3%	53%	54.0%		189	24.9%	\$36,869	96.3%	24	
Hawaii	Emergency only	5%	17%	15%	7%	56%	47.1%		19	8.1%	\$44,024	10.8%	39	
Idaho	Emergency only	11%	17%	11%	2%	59%	44.8%		95	29.4%	\$33,749	36.1%	45	
Illinois	Limited	9%	19%	14%	1%	58%	32.5%	13.8%	166	11.5%	\$44,815	98.5%	39	
Indiana	Limited	11%	17%	15%	0%	56%	55.7%	48.6%	55	27.6%	\$36,902	94.8%	42	
Iowa	Extensive	6%	17%	14%	2%	61%	41.8%	43.6%	120	36.0%	\$42,126	92.0%	51	
Kansas	Limited	11%	15%	13%	0%	58%	47.2%		133	25.8%	\$41,835	63.6%	63	
Kentucky	Limited	7%	23%	17%	0%	52%	44.0%	41.4%	100	41.6%	\$35,041	99.9%	53	
Louisiana	Limited	13%	23%	11%	3%	50%	61.0%		112	26.8%	\$39,413	43.4%	40	

**Distribution of State-Level Predictor Variables (Cont.)**

State	Medicaid Coverage Policy for Adults, 2014	% of Health Insurance Coverage of the Total Population, 2014							Medicaid FFS Reimbursement as a % of Private Dental Benefit			No. of Dental Care Health Professional Shortage Areas, 2016	% of Population Living in Rural Areas, 2010	Per Capita Personal Income, 2012 (\$)	% of Population Receiving Fluoridated Water, 2012	Dental Hygiene Professional Practice Index, 2014
		Uninsured	Medicaid	Medicare	Other Public Insurance	Private Insurance	Children, 2013	Adults, 2014								
Maine	Emergency only	9%	20%	16%	2%	52%	43.6%		75	61.3%	\$39,481	79.4%	98			
Maryland	No dental benefits	6%	14%	12%	2%	66%	47.8%		42	12.8%	\$51,971	97.2%	49			
Massachusetts	Extensive	4%	24%	13%	0%	58%	57.9%	43.7%	61	8.0%	\$54,687	70.4%	82			
Michigan	Limited	7%	20%	14%	1%	58%	32.5%	20.3%	270	25.4%	\$37,497	90.2%	54			
Minnesota	Limited	7%	15%	13%	1%	65%	26.7%	27.1%	126	26.7%	\$46,227	98.8%	85			
Mississippi	Emergency only	12%	26%	13%	4%	45%	47.6%		110	50.6%	\$33,073	58.2%	18			
Missouri	Emergency only	9%	15%	15%	2%	60%	40.2%		184	29.6%	\$39,049	76.4%	74			
Montana	Emergency only	13%	13%	15%	3%	56%	52.9%	54.1%	85	44.1%	\$37,370	32.0%	89			
Nebraska	Limited	10%	14%	14%	3%	60%	43.0%		80	26.9%	\$43,143	71.2%	77			
Nevada	Emergency only	13%	18%	13%	5%	52%	48.4%		65	5.8%	\$37,361	73.5%	78			
New Hampshire	Emergency only	7%	12%	15%	0%	65%	39.5%		23	39.7%	\$47,058	46.0%	69			
New Jersey	Extensive	11%	17%	13%	1%	59%	68.8%	17.8%	38	5.3%	\$53,628	14.6%	40			
New Mexico	Extensive	12%	28%	15%	3%	42%	49.3%	49.8%	82	22.6%	\$35,079	77.0%	87			
New York	Extensive	8%	25%	12%	1%	55%	37.1%	37.1%	139	12.1%	\$52,095	71.8%	57			
North Carolina	Extensive	12%	18%	14%	3%	54%	48.2%	45.8%	140	33.9%	\$37,049	87.5%	33			
North Dakota	Extensive	9%	9%	13%	2%	67%	62.7%	60.2%	36	40.1%	\$51,893	96.7%	36			
Ohio	Extensive	7%	21%	16%	1%	54%	40.5%	41.5%	134	22.1%	\$39,289	92.2%	43			
Oklahoma	Emergency only	16%	17%	14%	2%	50%	54.5%		162	33.8%	\$39,006	70.1%	49			
Oregon	Extensive	8%	21%	16%	2%	53%	32.6%	33.4%	102	19.0%	\$38,786	22.6%	96			
Pennsylvania	Limited	8%	17%	15%	1%	59%	42.8%	43.1%	164	21.3%	\$43,616	54.6%	71			
Rhode Island	Extensive	5%	18%	13%	0%	63%	27.9%	29.2%	17	9.3%	\$44,990	83.9%	40			

**Distribution of State-Level Predictor Variables (Cont.)**

State	Medicaid Coverage Policy for Adults, 2014	% of Health Insurance Coverage of the Total Population, 2014					Medicaid FFS Reimbursement as a % of Private Dental Benefit				No. of Dental Care Health Professional Shortage Areas, 2016	% of Population Living in Rural Areas, 2010	Per Capita Personal Income, 2012 (\$)	% of Population Receiving Fluoridated Water, 2012	Dental Hygiene Professional Practice Index, 2014
		Uninsured	Medicaid	Medicare	Other Public Insurance	Private Insurance	Children, 2013	Adults, 2014	Dental Benefit						
									Medicaid	Private Insurance					
South Carolina	Limited	13%	20%	15%	2%	50%	52.5%	51.6%	83	33.7%	\$34,266	93.8%	51		
South Dakota	Limited	9%	12%	15%	2%	62%	51.3%		64	43.3%	\$43,659	93.6%	53		
Tennessee	No dental benefits	10%	16%	15%	0%	56%	53.9%		145	33.6%	\$37,678	89.7%	43		
Texas	Emergency only	17%	18%	10%	2%	53%	59.5%		309	15.3%	\$41,471	79.6%	42		
Utah	Emergency only	12%	10%	10%	1%	67%	42.5%		52	9.4%	\$34,601	51.7%	48		
Vermont	Limited	6%	21%	13%	2%	59%	49.7%	54.1%	28	61.1%	\$42,994	56.1%	47		
Virginia	Limited	10%	9%	13%	6%	62%	47.4%	43.6%	87	24.5%	\$47,082	96.0%	68		
Washington	Extensive	9%	22%	12%	2%	55%	40.9%	28.7%	114	15.9%	\$45,413	63.6%	94		
West Virginia	Emergency only	6%	29%	17%	1%	47%	69.9%		99	51.3%	\$34,477	91.1%	70		
Wisconsin	Extensive	7%	17%	14%	0%	61%	31.5%	29.6%	124	29.8%	\$40,537	89.4%	58		
Wyoming	Limited	10%	10%	11%	2%	67%	61.2%	52.5%	29	35.2%	\$48,670	43.6%	42		

FFS, fee-for-service.

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