



## Evaluating the Impact of Dentists' Personal Characteristics on Workforce Participation

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Center for Health Workforce Studies  
School of Public Health  
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**December 2021**



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## PREFACE

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The Oral Health Workforce Research Center (OHWRC) at the Center for Health Workforce Studies (CHWS) at the University at Albany's School of Public Health completed a research project to understand the changing demographic characteristics of dentists, with a special emphasis on the impact of gender on dentistry. The goal of the study was to understand differences by gender in personal and family characteristics that might impact practice patterns and the availability of dental services over time.

This report was prepared for OHWRC by Margaret Langelier, Simona Surdu, Sai Sindhura Gundavarapu, and Shabnam Seyedzadeh Sabounchi, with layout design by Leanne Keough.

The OHWRC is supported by the Health Resources and Services Administration (HRSA) of the US Department of Health and Human Services (HHS) as part of an award totaling \$449,915 with 0% financed with non-governmental sources. The content of this report are those of the authors and do not necessarily represent the official views of, nor an endorsement by, HRSA, HHS, or the US government. For more information, please visit [HRSA.gov](https://www.hrsa.gov).

The mission of OHWRC is to provide accurate and policy-relevant research on the impact of the oral health workforce on oral health outcomes. The research conducted by OHWRC informs strategies designed to increase access to oral health services for vulnerable populations. OHWRC is based at CHWS at the School of Public Health, University at Albany, State University of New York (SUNY), and is the only HRSA-sponsored research center with a unique focus on the oral health workforce.

The views expressed in this report are those of OHWRC and do not necessarily represent positions or policies of the School of Public Health, University at Albany, SUNY.

*December 2021*

# ACKNOWLEDGMENTS

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## Institutional Review Board

The plan for this study was reviewed and designated exempt from further review by the Institutional Review Board of the New York State Department of Health (Study No. 1604765-1).

### *Suggested Citation:*

Langelier M, Surdu S, Gundavarapu SS, Sabounchi SS. *Evaluating the Impact of Dentists' Personal Characteristics on Workforce Participation*. Rensselaer, NY: Oral Health Workforce Research Center, Center for Health Workforce Studies, School of Public Health, SUNY Albany; December 2021.

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# EXECUTIVE SUMMARY

## BACKGROUND

The oral health workforce is increasing with a growing supply of new professionals and the development of novel workforce models, including expanded practice dental hygiene and dental therapy. As educational and employment opportunities have developed for previously disenfranchised groups, the dental workforce has changed dimensionally through diversification by gender, race, and ethnicity. A health workforce that is representative of the population is important for many reasons, including the availability of culturally and linguistically competent clinicians reflective of the diverse communities they serve.

Research has demonstrated that health care providers with diverse backgrounds, culture, and language are more likely to serve communities of diverse backgrounds and origins.<sup>1</sup> Although women have always been well represented in the health workforce, constituting a majority of allied health professionals and nurses in the US, until recently, women were underrepresented in higher-paying health professions. The feminist movement, economic drivers, developments in science and technology, and expanded educational opportunities have opened gateways for females to historically male health professions in medicine, dentistry, and veterinary medicine.

Internationally, dentists are commonly female.<sup>2,3</sup> Although that has not been the situation in the US, recent increases in female admissions to and graduations from dental school have substantially shifted their representation within the profession. Currently, approximately 50% of dental students in US dental education programs are women.<sup>4</sup> This changing gender mix within dentistry has generated questions about variation in practice patterns by gender that might affect the distribution of the dental workforce and its capacity to meet the needs of the patient population. Assessing workforce adequacy is complicated because of the many considerations that influence

the necessary size and distribution of the workforce<sup>5</sup> and the myriad endogenous and exogenous structural factors that impact demand.

The literature discussing gender differences among practicing clinicians in medicine and dentistry suggests some variation in practice choices by gender. A literature review conducted by Pallavi et al<sup>6</sup> to describe the professional practice of female dentists found in the collective literature that female dentists were more likely to work part-time due to family or domestic commitments. This review also concluded that gender segregation within the practice of dentistry exists based on specialty choices of women; female dentists exhibited preferences for practice in pediatric or general dentistry rather than in other dental specialties, which would affect income. Another study found that female dentists in private practice were significantly more likely than male dentists to serve children younger than 18 years of age and were more likely to treat patients covered by public insurance programs.<sup>7</sup> Surdu and coauthors found that female solo practitioners who were practice owners were 1.2 times more likely than male dentists to treat children and 1.8 times more likely to treat patients covered by public dental benefit programs.<sup>8</sup>

A survey of members of the National Dental Practice-Based Research Network (PBRN) found that female dentists used preventive therapies at earlier stages of dental caries development more often than did their male counterparts for both adult and pediatric patients.<sup>9</sup> An early study of practice patterns among dentists in Australia found that rates of preventive services were lower among male than among female dentists but were higher for younger dentists overall (aged 20-29 years) than for dentists with more practice experience.<sup>10</sup> The latter finding may suggest a generational trend. Another study found that female dentists were more likely than male dentists to refer potentially complex patients to specialty dentists.<sup>11</sup>

personal characteristics including age, gender, race/ethnicity, and nativity. Employment characteristics include business ownership, weeks worked during the past 12 months, usual hours worked per week, work setting, practice location, commuting time to work, health insurance, and wages or salary income. The data also include family characteristics such as marital status, number of children, household size, partner's education/occupation, and household income.

We restricted the original sample to an analytic sample consisting of actively practicing dentists in the US to ensure that study data described clinicians working in dentistry. Two criteria were used for inclusion in the final sample: (1) dentists must have worked between 8 and 50 hours per week, and (2) dentists must have worked between 40 and 52 weeks per year. This weighted sample consisted of 407,100 individuals, including dentists ( $n=148,878$  dentists) and family/household members.

### Data Analysis

Analysis was conducted using descriptive statistical methods (chi-square tests for categorical variables and  $t$  tests for continuous ones) to study gender differences in personal, employment, and household characteristics.

We used multivariable statistical methods to assess the association of dentists' personal and household characteristics with their practice choices (ie, employed vs owner, part-time vs full-time work hours) and income levels (low vs high). Multilevel Poisson regressions (prevalence ratios and 95% confidence intervals) were used to estimate the association of 3 different outcome variables with the gender of dentists by age cohort, adjusting for dentists' personal, practice, and family characteristics (Level 2) and household identifier (Level 1). Fixed effects for the state where the practice was located and the year of data collection were also included in the regression. Study findings were considered statistically significant at a  $P$  value of  $<.05$ . All analyses were conducted in Stata SE 15 (StataCorp LLC).

## KEY FINDINGS

### Demographics Characteristics

- Among the 148,878 active dentists who met the active practice criteria for inclusion in the analytic sample, 31.1% were female. The mean age of female dentists, 43.3 years, was significantly lower than that of male dentists (52.2 years).
- Female dentists were more likely to be racially/ethnically diverse than were male dentists. Just 59.6% of female dentists were White, non-Hispanic, in contrast to 77.6% of male dentists.
- Female dentists were more likely to be foreign born (33.0%) and bilingual (35.5%) than male dentists (18.5% and 19.8%, respectively), suggesting diversification by language and culture.

### Practice Patterns

- Most dentists (94.6%) worked in a dentist or physician office. Female dentists were more likely to work in other health care settings (2.4%) than were male dentists (1.1%).
- Female dentists were more likely to report employee status (54.6% vs 33.7%) and working less than 30 hours per week (13.3% vs 9.2%) than male dentists.
- Male dentists were more likely to practice in the Midwest Region (20.5%) than female dentists (18.3%). Proportionally more female dentists were located in the Pacific Division (22.2%) than male dentists (18.8%).
- Female dentists were more likely to spend more time commuting to work than male dentists (ie,  $>45$  minutes, 10.1% vs 8.0%).

### Personal Annual Income

- Dentists' average personal annual income (wages from employment and/or self-employment) was \$193,722.
- Female dentists reported a significantly lower average annual income (\$157,509) than male dentists (\$210,097). Proportionally more female dentists earned \$100,000 or less compared with male dentists (37.3% vs 25.4%).

### Household Characteristics

- Female dentists were less likely than male dentists to be married (72.4% vs 83.7%) but were more likely to have children under age 18 in their households (49.9% vs 38.1%).
- Nine in 10 dentists had no dependents older than 65 in their households, but male dentists were significantly more likely to report having 1 or more older dependents (9.8%) in residence than were female dentists (7.5%).
- Female dentists were more likely than male dentists to have a spouse/partner who was also a dentist (13.2% vs 6.3%) or who had a graduate education in another field (30.4% vs 24.1%).

### Associations Between Dentists' Characteristics and Their Practice Patterns

- The adjusted association findings suggest that being female and 35 years of age or older, being Black or African American, being foreign born, practicing in the West Region, and having a commute >15 minutes to work were predictive of being employed vs owning a dental practice. In contrast, having 2 or more children was associated with a *lower* likelihood of being employed vs owning a dental practice.

- Female dentists under the age of 65 were more likely than male dentists to work part-time. Dentists working somewhere other than a dentist's or physician's office, commuting >45 minutes to work, having 2 or more children or older dependents, and having household incomes >\$100,000 were more likely to work part-time than others. Having a spouse/partner without a graduate education was associated with a *lower* likelihood of working part-time.
- Female dentists over 35 years of age were more likely than male dentists to have a lower income. Black/African American and "other" non-Hispanic dentists and those with older dependents were also more likely to have a lower income than dentist counterparts. Dentists having >3 children and a spouse/partner who is not a dentist were *less* likely to have a lower income than dentists without children or a spouse or partner.

## DISCUSSION

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### Demographics and Personal Characteristics

Diversification of the dental workforce by gender, race, and ethnicity is occurring, although the workforce continues to be predominantly male (69.5%) and White, non-Hispanic (72.3%). The ADA Health Policy Institute indicates that in 2018, approximately 28% of dentists were from racial/ethnic minorities, which represented a 22% increase from 2008 data.<sup>12</sup>

Female dentists, as described in the ACS data, are more diverse than their male counterparts, with 40.4% of females indicating race/ethnicity other than White, non-Hispanic, and only 22.4% of male dentists indicating a similar background. In addition, 33.0% of female dentists were foreign born and 35.5% were bilingual, in contrast to male dentists, among whom 18.5% were foreign born and 19.8% were bilingual. Each of these differences was statistically significant.

Adams posits that the gender shift in the dental industry is partly influenced by immigration,<sup>13</sup> especially from Eastern European and Asian countries, where the number of women in the dental profession is also rising. Immigration would also explain fluency in other languages.

Diversification of the dental profession is a widely embraced goal. It is encouraging that change in the gender composition of the profession is accompanied by other dimensions of diversity that directly reflect trends in the US population. One desirable outcome from efforts to diversify the profession is that dentistry is increasingly representative of the patient community.

### *Work Hours*

Female dentists under age 65 were significantly more likely to work part-time than male dentists, with the biggest difference found among those aged 45 to 54, who were 5.4 times more likely to work part-time. Nevertheless, 9 in 10 dentists in the ACS data set indicated full-time work status (88.4% of female dentists and 92.1% of male dentists). In a literature review conducted by the ADA in the early part of this decade, the authors noted that 20% of female dentists and 12% of male dentists worked less than 30 hours per week.<sup>14</sup> The ACS data assessed in this study indicated that 13.3% of female dentists and 9.2% of male dentists currently work less than 30 hours per week.

The impact of having children on dental professionals' choice to work part-time is extensively discussed in the existing literature. Two studies of dental students found that female dental students were more likely than males to be involved in childcare.<sup>15,16</sup> Our study found that the likelihood of working part-time among all dentists increased with increases in the number of children in the household; those with 2 children were 1.5 times as likely, and those with 3 or more children nearly twice as likely, to work part-time as dentists without children.

It is difficult to evaluate the impact of the growing contingent of female dentists, some of whom work part-time, on the capacity of the dental care delivery system to meet demand for services. The National Center for Health Statistics reported that the percentage of the population aged 18 to 64 who had accessed a dental service in the past year was 64.1% in 1997 and 65.9% in 2018.<sup>17</sup> The long term stability in the percentage of the population utilizing dental services, which is a lower than desirable rate, may support the availability of part-time work in the marketplace, enabling flexible options for dentists wishing to control their hours in clinical practice. Until elasticity in demand for dental services decreases with better financing of oral health services, recognition that dental care is an essential health service, and increased oral health literacy in the population, the ability to work part-time appears to be an attractive option for both clinician and employer.

### *Employment vs Practice Ownership*

Findings from our previous studies<sup>7,8</sup> as well as the current study indicate indisputable differences in employment and practice ownership by gender. In the present study, female dentists were more likely than male dentists to report employee status (54.6% vs 33.7%) and less likely to report practice ownership (45.4% vs 66.3%). A study early in the millennium by Atchison and colleagues discussed this trend.<sup>11</sup> At that time, female dentists were also less likely than male dentists to be practice owners (61.2% vs 85.4%). Scarbecz and Ross surveyed dental students to understand gender differences in motivation to pursue a dental career. Female first-year dental students rated business ownership as a less important reason for attending dental school (4.22 on a 5-point Likert scale) than did their male peers (4.56).<sup>18</sup>

The multivariable regression analysis found that being female and 35 years of age or older, being Black or African American, being foreign born, working in the West Region, and commuting more than 15 min-

utes to work were predictive of being employed vs owning a dental practice. In contrast, dentists with 2 or more children were less likely to be employed by others and more likely to be practice owners.

Prior research discusses the attractiveness of workplace flexibility, described as providing the opportunity to work part-time or fewer hours, offering scheduling flexibility within the workday, and increasing the ability to adjust work schedules to address personal and family needs.<sup>19</sup> Employment status may offer more flexible options to the dentist, including minimal administrative duties, the ability to work longer or shorter days, and the ability to work fewer or more days per week without concerns for patient coverage. Walton et al remark that one of the reasons why women may select dentistry as a profession is that it provides more control over working patterns and provides the option for part-time workforce participation to a greater extent than do some other professions.<sup>10,20</sup>

It is not possible to ascertain whether the high rate of employment among female dentists is driven by a desire for workplace flexibility or whether it is due to the changing practice structures within the delivery system that make employment increasingly available and attractive. Dental service organizations and group practice management models have increased in number in concert with the entry of many female dentists into the delivery system.<sup>21,22</sup> Thus, the opportunities for employment rather than practice ownership have also increased.

### *Wages*

One of the most concerning findings of the study was the income gap between female and male dentists, which cannot be explained by controlling for personal and work characteristics. The mean personal annual income among dentists in the data set was \$193,722. Female dentists reported significantly lower average personal annual income (\$157,509) than

male dentists (\$210,097). Furthermore, multivariable regression analysis found that female dentists aged 35 or older were more likely to report a lower personal annual income (\$100,000 or less) than male dentists in the respective cohort. For instance, female dentists aged 35 to 44 were 1.7 times more likely to have lower incomes than male dentists in the same age group.

Wage differentials by gender in dentistry and other high-paying professions were noted by Goldin and Katz, who evaluated the “cost” of workplace flexibility in those professions.<sup>22</sup> The authors suggested that women are penalized to varying degrees for job interruptions, part-time workforce participation, and other amenities afforded to higher-paying professions. Their work found that women in the health professions, including dentists and surgeons, were “taxed” with lower incomes more than were women in other professions. Essentially, lower incomes may be the cost of the attractive attribute of flexibility inherent in professional clinical practice.

## **LIMITATIONS**

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The ACS PUMS data allow access to only a 1% sample of all ACS surveys, although the data can be analyzed as representative of the population as a whole using the provided replicate weights. This study was unable to accomplish a granular geographic analysis; it is possible that geography would impact some findings. In addition, the data do not describe the dental specialty of survey respondents. Certain specialties in dentistry, as in medicine, would provide higher personal incomes that might affect the wage gap. However, since approximately 80% of dentists practice general dentistry, specialty type would likely only partially explain the large gap in annual incomes by gender.

## CONCLUSIONS

There is little evidence that the gradual gender shift within dentistry is substantially altering professional practice. It is not possible to disentangle the impact of environmental factors such as generational preferences, changes in the structures of dental service delivery, and the effect of consumer preferences on demand for services from the changing gender composition of the workforce in order to definitively describe causative factors for particular practice patterns or preferences. It is important to consider that differences in practice choices may affect dental delivery, but change is endemic to health care and, at least to date, the oral health delivery system has adapted to both clinician needs and patient demand.

Differences in practice by gender, while significant statistically, appear to be relatively small in magnitude. As dentists age, practice patterns by gender diverge such that, for example, dentists of both genders are more likely to be practice owners and older dentists are more likely than younger dentists to work part-time. Current literature suggests that gender differences may, in fact, be advantageous due to practice complementarities between male and female dentists that are beneficial to patients and to the delivery system. The literature suggests, for instance, that female dentists treat more children and more publicly insured patients, generally, than do male dentists. Other research discusses specialty mix, finding that general dentistry and pediatric dentistry practice is favored by female dentists, who are more likely to suggest early prevention strategies rather than the restorative interventions preferred by their male peers. Thus, the growth in numbers of women in dentistry may benefit the capacity of the delivery system to meet the full spectrum of needs within the population and the growing and changing demand for services.

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# TECHNICAL REPORT

## BACKGROUND

The oral health workforce is increasing with a growing supply of new professionals and the development of novel workforce models, including expanded practice dental hygiene and dental therapy. As educational and employment opportunities have developed for previously disenfranchised groups, the dental workforce has changed dimensionally through diversification by gender, race, and ethnicity. A health workforce that is representative of the population is important for many reasons, including the availability of culturally and linguistically competent clinicians reflective of the diverse communities they serve.

Research has demonstrated that health care providers with diverse backgrounds, culture, and language are more likely to serve communities of diverse backgrounds and origins.<sup>1</sup> Although women have always been well represented in the health workforce, constituting a majority of allied health professionals and nurses in the US, until recently, women were underrepresented in higher-paying health professions. The feminist movement, economic drivers, developments in science and technology, and expanded educational opportunities have opened gateways for females to historically male health professions in medicine, dentistry, and veterinary medicine.

Internationally, dentists are commonly female.<sup>2,3</sup> Although that has not been the situation in the US, recent increases in female admissions to and graduations from dental school have substantially shifted their representation within the profession. Currently, approximately 50% of dental students in US dental education programs are women.<sup>4</sup> This changing gender mix within dentistry has generated questions about variation in practice patterns by gender that might affect the distribution of the dental workforce and its capacity to meet the needs of the patient population. Assessing workforce adequacy is complicated because of the many considerations that influence

the necessary size and distribution of the workforce<sup>5</sup> and the myriad endogenous and exogenous structural factors that impact demand.

The literature discussing gender differences among practicing clinicians in medicine and dentistry suggests some variation in practice choices by gender. A literature review conducted by Pallavi et al<sup>6</sup> to describe the professional practice of female dentists found in the collective literature that female dentists were more likely to work part-time due to family or domestic commitments. This review also concluded that gender segregation within the practice of dentistry exists based on specialty choices of women; female dentists exhibited preferences for practice in pediatric or general dentistry rather than in other dental specialties, which would affect income. Another study found that female dentists in private practice were significantly more likely than male dentists to serve children younger than 18 years of age and were more likely to treat patients covered by public insurance programs.<sup>7</sup> Surdu and coauthors found that female solo practitioners who were practice owners were 1.2 times more likely than male dentists to treat children and 1.8 times more likely to treat patients covered by public dental benefit programs.<sup>8</sup>

A survey of members of the National Dental Practice-Based Research Network (PBRN) found that female dentists used preventive therapies at earlier stages of dental caries development more often than did their male counterparts for both adult and pediatric patients.<sup>9</sup> An early study of practice patterns among dentists in Australia found that rates of preventive services were lower among male than among female dentists but were higher for younger dentists overall (aged 20-29 years) than for dentists with more practice experience.<sup>10</sup> The latter finding may suggest a generational trend. Another study found that female dentists were more likely than male dentists to refer potentially complex patients to specialty dentists.<sup>11</sup>

The present study expands upon prior work by the Oral Health Workforce Research Center (OHWRC) completed in 2019<sup>7</sup> discussing gender diversification in dentistry. That study found that although the proportions of male and female dentists who worked full-time in practice were quite similar overall, in all age cohorts, female dentists were proportionally more likely to work part-time than male dentists. This finding raises questions about the impact of part-time work on the capacity within the oral health care delivery system to meet the needs of the growing, diversifying, and aging patient population, especially considering the pace of gender diversification within the dental profession. The 2019 study also found that both male and female dentists exhibited preferences for practice in suburban/metropolitan/urban areas; at the same time, male dentists were somewhat more likely to practice in rural areas.<sup>7</sup> This finding of gender differences in geography of practice may indicate a further shift from rural practice in the future.

The 2019 study used secondary data from the American Dental Association's (ADA) Masterfile and 2017 Survey of Dental Practice to evaluate differences in practice characteristics between male and female dentists. These data sets contained limited demographic information about dentists, which narrowed the research findings to differences in practice preferences, hours worked, and patients served. Questions arose during the analysis of the study data about the impact of personal characteristics on the choices of both male and female dentists relative to ownership of or employment in dental practices, hours spent at work, and income.

The present study used data from the US Census Bureau's American Community Survey (ACS) Public Use Microdata Sample (PUMS) for 2014-2018 to describe the personal, practice, and family characteristics of dentists by gender and to discuss observed differences in employment participation that might impact service delivery over time. The study evaluated differences in employment/ownership status, hours

worked, and wages or salary income across gender and age cohorts among dentists in the US as well as the impact of commuting and location of work, disability status, marital status, spouse education/occupation, household income, having children, and other family characteristics.

## METHODS

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### Research Questions

The proposed study questions included the following:

1. What is the impact of age, race/ethnicity, nativity, and disability on dentists' practice choices?
2. How do spouse/partner status and the presence or absence of children or parents in the household impact the characteristics of dentists' practices?
3. What is the impact of spouse/partner occupation and household income on the career choices of dentists?
4. Does geographic distance of the personal residence from the work location or commuting time impact workforce participation?

### Data Source

A nationally representative sample of dentists was extracted from the ACS PUMS for 2014-2018. The 5-year ACS provides both individual- and household-level replicate weights to ensure that the data are representative of the population; these weights were used in our analyses. The data comprise information on personal characteristics including age, gender, race/ethnicity, nativity, and disability status. Employment characteristics include business ownership, weeks worked during the past 12 months, usual hours worked per week during the past 12 months, work setting, practice location, commuting time to work, health insurance, and wages or salary income for the

past 12 months. The person- and household-level observations variously include data on family characteristics such as marital status, number of children, number of household residents, partner's education/occupation, and household income.

We used the person-level component of the 5-year ACS to identify dentists using the Standard Occupational Classification code system. Next, dentists were matched within the person-level data with their family members and any other members of their household using the identifier unique to each household in the ACS. Data from the household component were used to verify our results and to extract household weights for regression analysis. Once extracted, these data were combined to form our original sample, which consisted of 9,993 dentists (unweighted); the weighted sample was 186,771 dentists. Inclusion of all household members brought the total sample to 27,099 individuals (unweighted). The data were appropriately weighted, resulting in 520,925 individuals (dentists and family/household members living with dentists).

We restricted the original sample to an analytic sample consisting of actively practicing dentists in the US to ensure that study data described clinicians working in dentistry. Two criteria were used for inclusion in the final sample: (1) dentists must have worked between 8 and 50 hours per week, and (2) dentists must have worked between 40 and 52 weeks per year. This reduced the unweighted analytical sample to 7,879 dentists, resulting in a weighted sample of 148,878 dentists determined to be in active practice based on our criteria. With household members included, our total unweighted analytic sample consisted of 21,485 individuals. Once weighted appropriately, the total analytic sample consisted of 407,100 individuals, including dentists and family/household members.

## Measurement of Outcomes and Predictor Factors

### Outcomes

The first outcome of interest was dentists' employment status (ie, employed vs owner), where "employed" was defined as an employee of a private for-profit or not-for-profit/charitable business or a government employee at the local, state, or federal level. "Owners" were defined as those who were self-employed in their own incorporated or non-incorporated business or professional practice and those who were working in a family business without pay.

The second outcome variable was dentists' work hours (ie, part-time vs full-time), with "part-time" defined as working between 40 and 52 weeks per year and between 350 and 1,299 hours annually. "Full-time" was defined as working between 40 and 52 weeks per year and between 1,300 and 2,550 hours annually. These parameters were chosen in order to eliminate those who worked seasonally or episodically, since our analysis focused on the active practice of dentistry.

The third outcome variable was dentists' income level (ie, low vs high income), with "low income" defined as personal annual income less than or equal to \$100,000 and "high income" defined as personal annual income exceeding \$100,000. The income variable included only wages and self-employment income. Dentists' income was adjusted for inflation and is reported here in 2018 dollars.

### Predictor Factors

Personal characteristics of dentists included gender, age, race/ethnicity, nativity status (foreign, native born), bilingual status (bilingual, only English), and disability status (with disability, without disability).

Dental practice characteristics included work setting (dentist/physicians' offices, other settings), weeks worked per year, usual hours worked per week, practice location (geographic region, division), commuting time to work, and health insurance.

Family characteristics of dentists included in data analyses were household size, marital status, number of children, number of older dependents, partner's education/occupation, and annual household income. The household income was adjusted for inflation to 2018 dollars.

## Data Analysis

Analysis was conducted using descriptive statistical methods (chi-square tests for categorical variables and *t* tests for continuous ones) to study gender differences in personal, employment, and household characteristics.

We used multivariable statistical methods to assess the association of dentists' personal and household characteristics with their practice choices (ie, employed vs owner, part-time vs full-time work hours) and income levels (low vs high). Multilevel Poisson regressions (prevalence ratios and 95% confidence intervals) were used to estimate the association of 3 different outcome variables with the gender of dentists by age cohort, adjusting for dentists' personal, practice, and family characteristics (Level 2) and household identifier (Level 1). Fixed effects for the state where the practice was located and the year of data collection were also included in the regression. Study findings were considered statistically significant at a *P* value of <.05. All analyses were conducted in Stata SE 15 (StataCorp LLC).

# FINDINGS FROM THE LITERATURE REVIEW

## Introduction

Dentists are needed to deliver dental care and are an essential element in the oral health care system. The global dental workforce consists of about 1.5 million dentists.<sup>12</sup> Oral and general health are related, and both can be improved by regular dental visits.<sup>13</sup> The issue of dentist workforce adequacy is complicated, and various factors influence the adequate number of providers and their distribution.<sup>5</sup> Policies and strategies to promote equity in access to primary oral health care can lead to better maintenance of tooth structure and oral health.<sup>14</sup> Of course, issues of equity in access are not limited to the dental profession; similar concerns arise around access to other health professions as well.<sup>15</sup>

According to workforce planning projections in various countries, extra capacity exists in the oral health workforce in the United States, Australia, and Israel.<sup>16,17</sup> The ratio of dentists to population is sometimes used as a metric to evaluate the availability of dental services, but accurate and formal workforce planning is more complex than these sometimes arbitrary ratios.<sup>18</sup> One of the concerns that arises when using only the dentist-to-population ratio to assess capacity is the potential to overlook other influential factors, including the characteristics of individual dentists and their service productivity.<sup>19,20,21</sup>

Given the critical role of dentists in the provision of oral health care and the connection between oral health and general health, this study evaluates several factors with the potential to influence dental workforce patterns in the US. Because there is evidence of an association between dental providers' individual characteristics and productivity, this structured review analyzes available published peer-reviewed research related to the dental workforce. Two research

goals framed the analysis: (1) to describe the patterns of sociodemographic characteristics of active dental providers in the US, and (2) to examine the association between dental providers' characteristics and their work choices.

## Methods

### *Resources and Search*

An extensive structured search was performed in the following databases: PubMed (1946 to July 15, 2020) and CINAHL (EBSCO) (1937 to July 15, 2020). A specific and detailed algorithm was developed for searching MEDLINE for relevant studies: (dentist OR dentistry OR (dental provider) OR (oral health) OR dentistry) AND (factors OR characteristics OR correlation OR influence OR association) AND ((working hours) OR (practice patterns)) AND ((labor market) OR (labor market) OR (human resources) OR manpower OR workforce). The search algorithm was modified within each database to account for differences in the vocabulary, truncations, Boolean operators, and syntax rules.

These search terms were selected after conducting several preliminary searches to retrieve peer-reviewed publications for this review. The primary search results and the content of review articles were examined in order to comprehensively describe articles reporting practice patterns and factors affecting the number of working hours.<sup>22</sup> After identifying relevant articles, bibliographic mining was performed through scanning reference lists of highly relevant articles to discover any additional literature. The references were imported into reference manager software (EndNote Basic, Clarivate Analytics).

### *Study Selection and Data Collection*

All articles published in peer-reviewed journals up to and including July 15, 2020, were included in the review. For comprehensiveness, quantitative and

mixed-methods studies were considered; commentary and review study designs were excluded. Included studies were required to have investigated dentists' characteristics or their practice and geographical location patterns. Data were summarized from the selected publications and incorporated into an evidence table.\* At the same time, a thematic analysis for each study was conducted according to its content.<sup>23</sup> The evidence table consists of multiple columns providing such information as publication title, authors, journal, year published, article type, geographical location, aim of study, and study participants, along with major findings.

## Findings

The electronic search strategy resulted in 349 articles, of which 129 were more fully reviewed based on title and abstract. The full text of selected papers was then reviewed; 48 papers were selected for inclusion based on their relatedness to our study objectives. After further searching of the bibliographies of selected articles, 5 additional articles were retrieved and added, making the final number 53.\* Some literature relative to the physician workforce was also included, as the professions of dentistry and medicine are considered similar.

The earliest peer-reviewed article on the dental workforce was published in 1978; the authors surveyed American and Swedish dental students regarding their dental career choices.<sup>24</sup> The countries with the highest number of publications included the United States, the United Kingdom, Australia, and New Zealand with 20, 11, 7, and 6 articles, respectively. This was not a surprising finding, as more than one-third of global dentists (35%) are based in the American Region of the World Health Organization, followed by the European Region (30%), Western Pacific Region (16%), South-East Asian Region (10.3%), and Eastern

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\* The annotated bibliography is published separately and available on the OHWRC website.

Mediterranean Region (7.2%).<sup>25</sup> The thematic analysis yielded the following 5 major themes:

- Influence of family/household, including marital status and having children
- Gender, age, and race/ethnicity
- Geography or urban/rural practice location
- Working hours or practice patterns (full-time/part-time)
- Private/solo practice vs group practice

### *Influence of family/household, including marital status and having children*

Tarquinio, who is a female critical care physician and researcher, states that based on her own experience of family life and work responsibilities, “improvement in work–life balance comes from having a conducive work atmosphere and a customized approach to individual needs on an institutional level of understanding and support.”<sup>26</sup> Balancing family demands with demanding and increasing workloads is a factor that contributes to the development of burnout and emotional exhaustion in physicians.<sup>27</sup> In public dental clinics in Sweden, the working conditions—including job demands, task resources, interpersonal relations, leadership resources, strain, and work-related attitudes—had significantly greater effects on dentists compared with dental nurses and dental hygienists.<sup>28</sup>

According to the literature, female dentists constitute a greater proportion of the dental workforce worldwide than male dentists.<sup>2,3,29</sup> One of the major reasons women choose dentistry as a profession is that it provides them with more control over their working patterns and provides the option to work part-time.<sup>21,30</sup>

One of the motivations for choosing dentistry, according to dental students and dental practitioners, is the flexibility of working fewer hours when other priorities in life arise, such as caring for children and family.<sup>31,32,33</sup> In a study of fourth-year dental students

by AlSharif and colleagues, female students were more likely to be involved in childcare. More than 28% of the study participants stated an intention to take time off from work to care for their children during the preschool years.<sup>34</sup>

### *Gender, age, and race/ethnicity*

Some researchers have studied the effects of age and gender of dentists on practice patterns. A study of annual working hours among Australian dentists showed stable work hours among all age groups except those aged 65 years or older, who worked fewer hours. However, overall, the number of working hours was higher for male dentists compared with female dentists.

Underrepresented minority (URM) dentists comprise approximately 9% of the US dental workforce.<sup>19</sup> Researchers in the US developed a specific survey of URM dental providers in the ADA Masterfile to understand their distribution and practice characteristics, recognizing that the population is diversifying and that a representative dental workforce is important. In total, the 2009 ADA Masterfile included 12,983 active URM dentists who indicated their practice settings: 430 American Indian or Alaska Native dentists; 5,024 Hispanic or Latino dentists; and 5,744 African American dentists.<sup>1</sup> The survey found that URM dentists served a disproportionate share of URM patients compared with the racial and ethnic makeup of the counties in which they practiced.

Among Hispanic or Latino (H/L) dentists who participated in the survey research, the response rate was 34%. Many of the H/L dentists were aged 45 to 54 (38.5%) and male (63.1%), were married or in domestic partnerships (77.0%), and had children under the age of 18 (51.3%). Half of the H/L dentists were born in the US. The H/L dentists worked an average of 40.1 hours per week, and earnings among male H/L dentists were higher than those of female dentists of the same ethnicity.<sup>35</sup>

The majority of Black dentists who responded to a 2012 survey were male (54.6%), married or with a partner (68.0%), born in the US (84.6%), and raised in a city (69.3%). In this survey, Black dentists reported that, on average, 44% of their patient caseloads consisted of Black patients, with 40% reporting that more than 50% of their caseloads comprised Black patients.<sup>36</sup>

### *Geography or urban/rural practice location*

There is limited access to dental care in many rural and inner-city regions in the US, due in part to inadequate dental insurance coverage, limited transportation options, and a shortage of providers.<sup>37</sup> Researchers in Canada and Australia found similar geographical disparities in access to oral health care.<sup>38,39</sup>

Emami and coworkers examined and mapped dental practice locations and practice types for all active dental providers in Quebec, Canada.<sup>40</sup> Approximately 90% of the dental providers practiced in urban areas compared with only 0.3% in non-metropolitan-influenced zones (rural areas). In a systematic review, Godwin and colleagues studied factors that might influence dental providers to move to rural and remote areas.<sup>41</sup> Reasons for practicing in rural locations were financial and based on recruitment contracts. A rural background was also found to be a strong predictor for medical doctors to become practitioners in rural areas rather than urban locations.<sup>42</sup> Growing up in a rural town was favorable to developing adaptive skills among professionals, leading to greater retention in rural areas and building a successful professional and social life.<sup>43</sup> Among dental providers, previous familiarity with living in rural environments exerted significant influence on the choice of a rural location for practice.<sup>44,45</sup> However, other research specific to the dental workforce and the influence of a rural background on practice choices showed mixed results; some studies stated that rural background did not have much effect on long-term retention in rural areas.<sup>46,47</sup>

The most influential and persistent retention factor for practicing in rural areas was a personal reason.<sup>41</sup> In several studies, the key factors in retaining health workers in rural practice for longer periods were found to be engagement with the community and enjoying life.<sup>44,46</sup> Successful involvement with the community and with family was also one of the most important factors for retention of foreign-trained dental practitioners in rural areas.<sup>48</sup> When individuals became lonely or isolated without close support networks, they left, regardless of any financial incentives.

There is abiding interest in the international migration of health personnel at both a national and global level.<sup>12</sup> Australia is one of the countries that has served as a migration center for many dentists. The characteristics and practice profiles of migrant dentist groups were studied in a national survey by Balasubramanian et al.<sup>49</sup> Among the dentists in the study population, 26.6% were between 35 and 44 years of age, and 51.5% worked between 35 and 44 hours per week. More than 75% practiced in major cities; 88.4% mainly provided services in private clinics. The high proportions of female dentists among migrant dentists could influence dentist practice activity patterns in Australia. A study of dentists in the United Kingdom showed that non-UK-trained dentists provided more treatment at the start of their practice in the UK than did UK-trained dentists; however, after nearly 2 years, the treatment rates became similar.<sup>50</sup>

### *Working hours or practice patterns (full-time/part-time)*

According to a study conducted among the members of the World Dental Federation, there is an increasing trend among the dental workforce in developed countries toward limiting working hours and preferring to work part-time.<sup>51</sup>

In cross-sectional national survey data collected from 1979 through 1999 in the US, male dentists worked more hours per week (>42) and were less likely to



work part-time than their female counterparts.<sup>21</sup> In another study of general and specialist dentists in Lithuania, specialty dentists tended to practice more often in cities and to work overtime (>40 hours per week) compared with general dentists.<sup>30</sup> In both groups, the majority of dentists worked full-time or part-time in private practices, and less than 25% of all dentists were employed in public clinics. Over a 10-year period, dental providers in the UK showed interesting changes in their work patterns.<sup>52</sup> There was an increase in part-time work (defined as <37.5 hours per week), mainly among male dentists, 34% of whom worked part-time in 2006; this increased to 82% in 2016. However, this number does not account for dentists working across 2 (or more) practices, so it may be that current dentists are choosing different patterns of working.<sup>52</sup>

### *Private/solo practice vs group practice*

The number of dental firms in the US grew from 105,833 in 1992 to 121,048 in 2007. Larger practices (10 or more employees) accounted for 25.8% of total receipts for dental services in 1992; by 2007, this had increased to 41.9% of total receipts.<sup>53</sup> Female dentists, those with fewer years of dental experience, and those younger than 35 years of age were more likely to work in large dental firms, according to ADA surveys from 2008 to 2010.

Nontraditional dental practices constituted 3.1% of all dental practices in 2013 in Texas.<sup>54</sup> However, they had a disproportionate impact on the marketplace, as the average number of staff and annual revenue were twice as large as those of traditional practices. There were differences in the sociodemographic characteristics (education, age, race/ethnicity, and income) of patient populations that received dental services from traditional vs nontraditional practices. Patients visiting nontraditional practices had higher income levels and education and were also slightly younger and more often Hispanic.<sup>54</sup>

## Gaps in the Literature

The current structured review identified valuable data on the characteristics of dental providers globally. Although past studies have addressed various aspects of the dental workforce—including sociodemographic characteristics, family/household characteristics, urban/rural practice locations, practice settings and configurations, and service productivity—that can assist with dental workforce planning, oral health disparities persist.<sup>55,56</sup> Therefore, accurate and comprehensive dental workforce planning is required to better enable equity in access to dental care. One major limitation of dental workforce studies in the US is that they are not longitudinal or consistent. Most of the surveys described in the literature are self-administered, and response rates are low. Developing a surveillance system for all active dental providers in the country would facilitate the monitoring of the dental workforce by policymakers, workforce planners, and health services researchers.



# FINDINGS FROM THE STUDY

## Study Sample

The following tables describe the analysis of the 5 years of data on dentists in the US. The weighted data from the ACS described more than 186,000 dentists in the US, 30.5% of whom were female. About 4 in 10 dentists were 55 years of age or older, and 7 in 10 were White, non-Hispanic (Table 1).

For purposes of the current research, an analytic sample was drawn from the universe of dentists described in the ACS. The analytic sample comprised currently “active” dentists—those who indicated on the census survey that they worked in dentistry at least 40 weeks per year for a minimum of 350 hours per year. The elimination of dentists who did not meet these criteria for inclusion was important to ensure an accurate description of the characteristics of active dentists. The analytic sample included 148,878 dentists; this sample resembled the original sample in both demographic and practice characteristics (ie, <1% differences for all characteristics except age, where differences were <4.5%), although small differences were statistically significant due to the very large sample size (Table 1).

**TABLE 1. Characteristics of Dentists in the Original Sample and the Analytic Sample, 2014-2018**

Dentist characteristics <sup>a</sup>	Original sample		Analytic sample (active dentists)	
	n	%	n	%
<b>Gender</b>				
Female	56,966	30.5	46,359	31.1
	129,805			68.9
<b>Total</b>	<b>186,771</b>	<b>100.0</b>	<b>148,878</b>	<b>100.0</b>
<b>Age, y</b>				
<35	30,929			16.0
35–44	40,733	21.8	35,808	24.0
45–54	37,039			21.6
55–64	44,295	23.7	36,617	24.6
≥65	33,775			13.8
<b>Total</b>	<b>186,771</b>	<b>100.0</b>	<b>148,878</b>	<b>100.0</b>
<b>Race/ethnicity</b>				
White, non-Hispanic	135,106			72.0
Black, non-Hispanic	5,825	3.1	4,796	3.2
Asian	30,585			16.6
Other, non-Hispanic	3,991	2.1	3,316	2.2
Hispanic	11,264			6.0
<b>Total</b>	<b>186,771</b>	<b>100.0</b>	<b>148,878</b>	<b>100.0</b>
<b>Employment status<sup>b</sup></b>				
Employee	76,604			40.2
Owner	110,167	59.0	88,976	59.8
<b>Total</b>	<b>186,771</b>			<b>100.0</b>
<b>Part-time/full-time status<sup>c</sup></b>				
Part-time	—	—	13,420	9.0
Full-time	—	—		91.0
<b>Total</b>	<b>—</b>	<b>—</b>	<b>148,878</b>	<b>100.0</b>

<sup>a</sup> Sample differences were statistically significant at  $P<.001$  for gender, age, and employment status, and significant at  $P=.047$  for race/ethnicity.

<sup>b</sup> “Employee” was defined as: employee of a private for-profit company or business, or employee of a private for-profit; employee of a private not-for-profit or charitable organization; local government employee; state government employee; or federal government employee. “Owner” was defined as: self-employed in own unincorporated business, professional practice; self-employed in own incorporated business, professional practice; or working without pay in family business (unweighted  $n=15$ , weighted  $n=200$ ).

<sup>c</sup> “Part-time” was defined as 350-1,299 hours/year of work; “full-time” was defined as 1,300-2,550 hours/year of work.

Source: ACS data, 2014-2018.

## Personal Characteristics

### Demographics

Among the 148,878 active dentists in the file, 31.1% were female. The mean age of female dentists, 43.3 years, was significantly lower than that of male dentists (52.2 years) (Table 2).

**TABLE 2. Age of Dentists by Gender, 2014-2018**

Age, y <sup>a</sup>	Female dentists		Male dentists		All dentists	
	n	%	n	%	n	%
Mean (range)	43.3 (24-85)		52.2 (21-94)		49.4 (21-94)	
<35	12,238	26.4	11,539	11.3	23,777	15.9
35-44	14,589	31.5	21,219	20.7	35,808	24.1
45-54	10,805	23.3	21,397	20.9	32,202	21.6
55-64	7,554	16.3	29,063	28.3	36,617	24.6
≥65	1,173	2.5	19,301	18.8	20,474	13.8
Total	<b>46,359</b>	<b>100.0</b>	<b>102,519</b>	<b>100.0</b>	<b>148,878</b>	<b>100.0</b>

<sup>a</sup> Gender difference in age was statistically significant at  $P<.001$ .

Source: ACS data, 2014-2018.

Female dentists were significantly more likely to be racially/ethnically diverse than were male dentists (Table 3). Just 59.6% of female dentists were White, non-Hispanic, in contrast to 77.6% of male dentists. The proportion of female dentists reporting being Black, Asian Indian, or from Southeast Asia was more than twice that of male dentists.

**TABLE 3. Race/Ethnicity of Dentists by Gender, 2014-2018**

Race/ethnicity <sup>a</sup>	Female dentists		Male dentists		All dentists	
	n	%	n	%	n	%
White, non-Hispanic	27,618	59.6	79,564	77.6	107,182	72.0
Black, non-Hispanic	2,496	5.4	2,300	2.2	4,796	3.2
Asian						
Indian subcontinent	3,665	7.9	3,134	3.1	6,799	4.6
Southeast Asia	3,201	6.9	3,172	3.1	6,373	4.3
Korea	1,615	3.5	2,610	2.5	4,225	2.8
Japan	458	1.0	833	0.8	1,291	0.9
China and Taiwan	1,902	4.1	3,468	3.4	5,370	3.6
Other	306	0.6	317	0.3	623	0.4
Other, non-Hispanic	1,385	3.0	1,931	1.9	3,316	2.2
Hispanic	3,713	8.0	5,190	5.1	8,903	6.0
Total	<b>46,359</b>	<b>100.0</b>	<b>102,519</b>	<b>100.0</b>	<b>148,878</b>	<b>100.0</b>

<sup>a</sup> Gender difference in race/ethnicity was statistically significant at  $P<.001$ . Source: ACS data, 2014-2018.

## Nativity and Bilingual Status

Female dentists were significantly more likely to be foreign born (33.0%) than male dentists (18.5%), suggesting diversification by language and culture along with gender diversification (Table 4). More than one-third (35.5%) of female dentists indicated that they were bilingual compared with 19.8% of male dentists; differences in language competency were significant.

**TABLE 4. Nativity Status of Dentists by Gender, 2014-2018**

Nativity and bilingual status <sup>a</sup>	Female dentists		Male dentists		All dentists	
	n	%	n	%	n	%
<b>Nativity status<sup>b</sup></b>						
Native born	31,072	67.0	83,541	81.5	114,613	77.0
Foreign born	15,287	33.0	18,978	18.5	34,265	23.0
<b>Total</b>	<b>46,359</b>	<b>100.0</b>	<b>102,519</b>	<b>100.0</b>	<b>148,878</b>	<b>100.0</b>
<b>Bilingual status</b>						
Only English	29,909	64.5	82,179	80.2	112,088	75.3
Bilingual	16,450	35.5	20,340	19.8	36,790	24.7
<b>Total</b>	<b>46,359</b>	<b>100.0</b>	<b>102,519</b>	<b>100.0</b>	<b>148,878</b>	<b>100.0</b>

<sup>a</sup> Gender differences in nativity and bilingual status were statistically significant at  $P < .001$ .

<sup>b</sup> "Native born" was defined as anyone who is a US citizen at birth; "foreign born" was defined as anyone who is not a US citizen at birth. Source: ACS data, 2014-2018.

## Disability Status

Male dentists were significantly more likely to have a disability (3.4%) than were female dentists (1.4%) (Table 5). This may be, at least in part, a function of the older mean age of the male dentists in the sample. Overall, just 2.8% of dentists indicated some disability (ie, hearing, visual, cognitive, ambulatory, or related to self-care or independent living).

**TABLE 5. Disability Status of Dentists by Gender, 2014-2018**

Disability status <sup>a</sup>	Female dentists		Male dentists		All dentists	
	n	%	n	%	n	%
With disability <sup>b</sup>	661	1.4	3,516	3.4	4,177	2.8
Without disability	45,698	98.6	99,003	96.6	144,701	97.2
<b>Total</b>	<b>46,359</b>	<b>100.0</b>	<b>102,519</b>	<b>100.0</b>	<b>148,878</b>	<b>100.0</b>

<sup>a</sup> Gender difference in disability status was statistically significant at  $P < .001$ .

<sup>b</sup> Covers 6 disability types: hearing, visual, cognitive, ambulatory, self-care, and independent living difficulty. Source: ACS data, 2014-2018.

## Practice Characteristics

### Work Settings

Most dentists (94.6%) worked in a dentist or physician office (Table 6). Although gender differences in work setting were small, they were statistically significant. Of note, female dentists were significantly more likely to indicate that they worked in other health care settings (2.4%) than were male dentists (1.1%).

**TABLE 6. Work Setting of Dentists by Gender, 2014-2018**

Work setting <sup>a</sup>	Female dentists		Male dentists		All dentists	
	n	%	n	%	n	%
Dentist/physician office	42,966	92.7	97,844	95.4	140,810	94.6
Hospital	1,070	2.3	1,483	1.5	2,553	1.8
Administration	593	1.3	869	0.9	1,462	1.0
Educational institution	242	0.5	389	0.4	631	0.4
Other health care setting <sup>b</sup>	1,128	2.4	1,174	1.1	2,302	1.5
Military organization	183	0.4	554	0.5	737	0.5
Other	177	0.4	206	0.2	383	0.3
Total	<b>46,359</b>	<b>100.0</b>	<b>102,519</b>	<b>100.0</b>	<b>148,878</b>	<b>100.0</b>

<sup>a</sup> Gender difference by work setting was statistically significant at  $P < .001$ .

<sup>b</sup> Includes Federally Qualified Health Centers (FQHCs) and other public settings.

Source: ACS data, 2014-2018.

### Employment Status and Work Hours

Female dentists were significantly more likely to report employee status (54.6% vs 33.7%) and significantly less likely to report practice ownership (45.4% vs 66.3%) than male dentists (Table 7). Female dentists were also significantly more likely to work part-time (11.6% vs 7.9%) or less than 30 hours per week (13.3% vs 9.2%) than male dentists, although mean differences by gender were small (ie, 1.1 hours/week). Average annual work hours for female dentists were 1,824 vs 1,883 hours for male dentists (data not shown).

**TABLE 7. Employment Status and Work Hours of Dentists by Gender, 2014-2018**

Employment status and work hours <sup>a</sup>	Female dentists		Male dentists		All dentists	
	n	%	n	%	n	%
<b>Employment status<sup>b</sup></b>						
Employee	25,324	54.6	34,578	33.7	59,902	40.2
Owner	21,035	45.4	67,941	66.3	88,976	59.8
Total	<b>46,359</b>	<b>100.0</b>	<b>102,519</b>	<b>100.0</b>	<b>148,878</b>	<b>100.0</b>
<b>Weeks worked/year</b>						
Mean (range)	49.9 (44-51)		50.0 (44-51)		50.0 (44-51)	
50-52	36,972	79.7	81,379	79.4	118,351	79.5
48-49	3,972	8.6	11,318	11.0	15,290	10.3
40-47	5,415	11.7	9,822	9.6	15,237	10.2
Total	<b>46,359</b>	<b>100.0</b>	<b>102,519</b>	<b>100.0</b>	<b>148,878</b>	<b>100.0</b>
<b>Usual hours worked/week</b>						
Mean (range)	36.5 (8-50)		37.6 (8-50)		37.2 (8-50)	
<30	6,187	13.3	9,407	9.2	15,594	10.5
≥30	40,172	86.7	93,112	90.8	133,284	89.5
Total	<b>46,359</b>	<b>100.0</b>	<b>102,519</b>	<b>100.0</b>	<b>148,878</b>	<b>100.0</b>
<b>Part-time/full-time status<sup>c</sup></b>						
Part-time	5,365	11.6	8,055	7.9	13,420	9.0
Full-time	40,994	88.4	94,464	92.1	135,458	91.0
Total	<b>46,359</b>	<b>100.0</b>	<b>102,519</b>	<b>100.0</b>	<b>148,878</b>	<b>100.0</b>

<sup>a</sup> Gender differences in employment status, weeks worked/year, usual hours worked/week, and part-time/full-time status were statistically significant at  $P < .001$ .

<sup>b</sup> "Employee" was defined as: employee of a private for-profit company or business, or employee of a private for-profit; employee of a private not-for-profit or charitable organization; local government employee; state government employee; or federal government employ-

ee. “Owner” was defined as: self-employed in own unincorporated business, professional practice; self-employed in own incorporated business, professional practice; or working without pay in family business (unweighted n=15, weighted n=200).

c “Part-time” was defined as 350-1,299 hours/year of work; “full-time” was defined as 1,300-2,550 hours/year of work.

Source: ACS data, 2014-2018.

## Geography

One-third of dentists were located in the South Region, which comprises the largest number of states among the US Census Regions (Table 8). Differences by gender in the regional distribution of dentists’ practice locations were small but statistically significant. Male dentists were more likely to practice in the Midwest Region (20.5%) than female dentists (18.3%).

**TABLE 8. Practice Location (US Census Region) of Dentists by Gender, 2014-2018**

US Census Region <sup>a</sup>	Female dentists		Male dentists		All dentists	
	n	%	n	%	n	%
Northeast	9,466	20.4	19,872	19.4	29,338	19.7
Midwest	8,483	18.3	21,009	20.5	29,492	19.8
South	15,559	33.6	33,500	32.7	49,059	33.0
West	12,851	27.7	28,138	27.4	40,989	27.5
Total	<b>46,359</b>	<b>100.0</b>	<b>102,519</b>	<b>100.0</b>	<b>148,878</b>	<b>100.0</b>

<sup>a</sup> Gender difference in practice location (region) was statistically significant at  $P<.001$ .

Source: ACS data, 2014-2018.

Differences in the distribution of dentists by gender across the US Census Divisions were also small but statistically significant (Table 9). Proportionally more female dentists were located in the Pacific Division (22.2%) than male dentists (18.8%).

**TABLE 9. Practice Location (US Census Division) of Dentists by Gender, 2014-2018**

US Census Division <sup>a</sup>	Female dentists		Male dentists		All dentists	
	n	%	n	%	n	%
<b>Northeast Region</b>						
New England	3,190	6.9	5,610	5.5	8,800	5.9
Middle Atlantic	6,276	13.5	14,262	13.9	20,538	13.8
<b>Midwest Region</b>						
East North Central	6,136	13.2	14,641	14.3	20,777	14.0
West North Central	2,347	5.1	6,368	6.2	8,715	5.9
<b>South Region</b>						
South Atlantic	8,905	19.2	17,495	17.1	26,400	17.7
East South Central	1,993	4.3	5,550	5.4	7,543	5.0
West South Central	4,661	10.1	10,455	10.2	15,116	10.2
<b>West Region</b>						
Mountain	2,544	5.5	8,825	8.6	11,369	7.6
Pacific	10,307	22.2	19,313	18.8	29,620	19.9
Total	<b>46,359</b>	<b>100.0</b>	<b>102,519</b>	<b>100.0</b>	<b>148,878</b>	<b>100.0</b>

<sup>a</sup> Gender difference in practice location (division) was statistically significant at  $P<.001$ .

Source: ACS data, 2014-2018.

## Commuting Time

Female dentists were significantly more likely to spend more time commuting to work than male dentists (ie, >45 minutes, 10.1% vs 8.0%), although mean differences were small (Table 10). The higher percentage of female dentists indicating employment rather than ownership may partly explain the longer commuting times.

**TABLE 10. Commuting Time of Dentists by Gender, 2014-2018**

Travel time to work, min <sup>a</sup>	Female dentists		Male dentists		All dentists	
	n	%	n	%	n	%
Mean (range)	25.8 (1-155)		23.2 (1-157)		24.0 (1-157)	
≤15	17,324	39.0	46,881	47.2	64,205	44.7
16-30	16,717	37.7	33,355	33.6	50,072	34.8
31-45	5,859	13.2	11,084	11.2	16,943	11.8
>45	4,485	10.1	7,966	8.0	12,451	8.7
Total <sup>b</sup>	<b>44,385</b>	<b>100.0</b>	<b>99,286</b>	<b>100.0</b>	<b>143,671</b>	<b>100.0</b>

<sup>a</sup> Gender difference in travel time to work was statistically significant at  $P < .001$ .

<sup>b</sup> Totals vary from other tables because not all ACS respondents reported commuting time.

Source: ACS data, 2014-2018.

## Health Insurance Source

Female dentists were significantly more likely to indicate that their health insurance was sourced through an employer (60.7% vs 41.4%), while male dentists were more likely to report having their own private insurance (36.0% vs 31.3%) (Table 11). This is likely a corollary to the variation in employment vs practice ownership, with female dentists more often being employees and male dentists more often being practice owners.

**TABLE 11. Health Insurance Status of Dentists by Gender, 2014-2018**

Health insurance status <sup>a</sup>	Female dentists		Male dentists		All dentists	
	n	%	n	%	n	%
Insured through employer	28,124	60.7	42,459	41.4	70,583	47.4
Own private insurance	14,524	31.3	36,919	36.0	51,443	34.6
Public insurance <sup>b</sup>	1,863	4.0	19,423	18.9	21,286	14.3
Other source	734	1.6	1,801	1.8	2,535	1.7
No insurance	1,114	2.4	1,917	1.9	3,031	2.0
Total	<b>46,359</b>	<b>100.0</b>	<b>102,519</b>	<b>100.0</b>	<b>148,878</b>	<b>100.0</b>

<sup>a</sup> Gender difference in insurance status was statistically significant at  $P < .001$ .

<sup>b</sup> Includes Medicare.

Source: ACS data, 2014-2018.

## Income of Dentists

Dentists' average personal annual income (wages from employment and/or self-employment) was \$193,722 (Table 12). Female dentists reported a significantly lower average annual income (\$157,509) than male dentists (\$210,097). Proportionally more female dentists earned \$100,000 or less compared with male dentists (37.3% vs 25.4%).

**TABLE 12. Personal Annual Income of Dentists by Gender, 2014-2018**

Personal annual income <sup>a,b</sup>	Female dentists		Male dentists		All dentists	
	n	%	n	%	n	%
Mean (range)	\$157,509 (\$1-\$902,215)		\$210,097 (\$1-\$1,093,079)		\$193,722 (\$1-\$1,093,079)	
≤\$100,000	17,296	37.3	26,092	25.4	43,388	29.1
\$100,001-\$150,000	11,815	25.5	19,973	19.5	31,788	21.4
\$150,001-\$200,000	7,112	15.3	14,302	14.0	21,414	14.4
\$200,001-\$250,000	3,040	6.6	9,289	9.1	12,329	8.3
>\$250,000	7,096	15.3	32,863	32.0	39,959	26.8
Total	<b>46,359</b>	<b>100.0</b>	<b>102,519</b>	<b>100.0</b>	<b>148,878</b>	<b>100.0</b>

<sup>a</sup> Gender difference in personal annual income was statistically significant at  $P < .001$ .

<sup>b</sup> Annual income constituted wages from employment and/or self-employment and was adjusted to 2018 dollars. Any values below \$1 were set equal to \$1 to avoid excluding observations.

Source: ACS data, 2014-2018.

The significant variation in average annual income by gender persisted when the data were analyzed using reported income from dentists who worked full-time (Table 13). The gap in average annual income was substantial, with full-time female dentists reporting an average personal income of \$165,385 vs \$217,916 reported by full-time male dentists.

**TABLE 13. Personal Annual Income of Full-time Dentists by Gender, 2014-2018**

Personal annual income <sup>a,b</sup>	Female dentists		Male dentists		All dentists	
	n	%	n	%	n	%
Mean (range)	\$165,385 (\$1-\$902,215)		\$217,916 (\$1-\$1,093,079)		\$202,018 (\$1-\$1,093,079)	
≤\$100,000	13,804	33.7	21,168	22.4	34,972	25.8
\$100,001-\$150,000	10,800	26.3	18,815	19.9	29,615	21.9
\$150,001-\$200,000	6,772	16.5	13,618	14.4	20,390	15.1
\$200,001-\$250,000	2,870	7.0	8,954	9.5	11,824	8.7
>\$250,000	6,748	16.5	31,909	33.8	38,657	28.5
Total	<b>40,994</b>	<b>100.0</b>	<b>94,464</b>	<b>100.0</b>	<b>135,458</b>	<b>100.0</b>

<sup>a</sup> Gender difference in personal annual income was statistically significant at  $P < .001$ .

<sup>b</sup> Annual income constituted wages from employment and/or self-employment and was adjusted to 2018 dollars. Any values below \$1 were set equal to \$1 to avoid excluding observations.

Source: ACS data, 2014-2018.



## Family Characteristics

Female dentists were significantly more likely than male dentists to live in a larger household consisting of 3 or 4 people (45.8% vs 35.5%) but were also more likely to live in a single-person household (13.7% vs 10.5%) (Table 14).

**TABLE 14. Household Size of Dentists by Gender, 2014-2018**

Household size <sup>a</sup>	Female dentists		Male dentists		All dentists	
	n	%	n	%	n	%
1 person <sup>b</sup>	6,366	13.7	10,760	10.5	17,126	11.5
2 persons	13,327	28.7	40,376	39.4	53,703	36.1
3-4 persons	21,210	45.8	36,437	35.5	57,647	38.7
≥5 persons	5,456	11.8	14,946	14.6	20,402	13.7
Total	<b>46,359</b>	<b>100.0</b>	<b>102,519</b>	<b>100.0</b>	<b>148,878</b>	<b>100.0</b>

<sup>a</sup> Gender difference in household size was statistically significant at  $P < .001$ .

<sup>b</sup> "1 person" implies dentist in household by themselves.

Source: ACS data, 2014-2018.

Female dentists were significantly less likely than male dentists to be married (72.4% vs 83.7%) (Table 15) but were more likely to have children under age 18 in their households (49.9% vs 38.1%) (data not shown).

**TABLE 15. Marital Status and Number of Children of Dentists by Gender, 2014-2018**

Marital status and number of children <sup>a</sup>	Female dentists		Male dentists		All dentists	
	n	%	n	%	n	%
<b>Marital status</b>						
Married	33,558	72.4	85,771	83.7	119,329	80.2
Not married (single, separated, divorced, widowed)	12,801	27.6	16,748	16.3	29,549	19.8
Total	<b>46,359</b>	<b>100.0</b>	<b>102,519</b>	<b>100.0</b>	<b>148,878</b>	<b>100.0</b>
<b>Number of children<sup>b</sup></b>						
Mean (range)	0.9 (0-8)		0.8 (0-8)		0.8 (0-8)	
None	23,249	50.1	63,428	61.9	86,677	58.2
1 child	8,221	17.7	11,373	11.1	19,594	13.2
2 children	11,120	24.1	16,642	16.2	27,762	18.6
≥3 children	3,769	8.1	11,076	10.8	14,845	10.0
Total	<b>46,359</b>	<b>100.0</b>	<b>102,519</b>	<b>100.0</b>	<b>148,878</b>	<b>100.0</b>

<sup>a</sup> Gender differences in marital status and number of children were statistically significant at  $P < .001$ .

<sup>b</sup> Number of children <18 years of age in the household, including biological children, adopted children, stepchildren, and foster children.

Source: ACS data, 2014-2018.

Nine in 10 dentists had no dependents older than 65 in their households, but male dentists were significantly more likely to report having 1 or more older dependents (9.8%) in residence than were female dentists (7.5%) (Table 16).

**TABLE 16. Older Dependents by Gender of Dentists, 2014-2018**

Older dependents <sup>a,b</sup>	Female dentists		Male dentists		All dentists	
	n	%	n	%	n	%
None	42,896	92.5	92,482	90.2	135,378	90.9
1 or more	3,463	7.5	10,037	9.8	13,500	9.1
<b>Total</b>	<b>46,359</b>	<b>100.0</b>	<b>102,519</b>	<b>100.0</b>	<b>148,878</b>	<b>100.0</b>

<sup>a</sup> Gender difference in older dependents was statistically significant at  $P < .001$ .

<sup>b</sup> "Older dependents" was defined as individuals  $\geq 65$  years of age who are out of the labor force and living in the same household with dentist.

Source: ACS data, 2014-2018.

Female dentists were significantly more likely to indicate no spouse/partner (25.1%) than their male counterparts (15.4%) (Table 17). Female dentists were also significantly more likely than male dentists to have a spouse/partner who was also a dentist (13.2% vs 6.3%) or who had a graduate education in a field other than dentistry (30.4% vs 24.1%). Male dentists were significantly more likely than female dentists to have a spouse/partner without a graduate degree (54.2% vs 31.3%).

**TABLE 17. Spouse/Partner's Education by Gender of Dentists, 2014-2018**

Spouse/partner's education <sup>a,b</sup>	Female dentists		Male dentists		All dentists	
	n	%	n	%	n	%
No spouse/partner	11,620	25.1	15,764	15.4	27,384	18.4
Spouse/partner is a dentist	6,116	13.2	6,406	6.3	12,522	8.4
Spouse/partner with graduate education (other than dentist)	14,100	30.4	24,702	24.1	38,802	26.1
Spouse/partner without graduate education	14,523	31.3	55,647	54.2	70,170	47.1
<b>Total</b>	<b>46,359</b>	<b>100.0</b>	<b>102,519</b>	<b>100.0</b>	<b>148,878</b>	<b>100.0</b>

<sup>a</sup> Gender difference in partner education was statistically significant at  $P < .001$ .

<sup>b</sup> "Spouse/partner" was defined as either spouse or unmarried partner of the dentist living in the same household with dentist.

Source: ACS data, 2014-2018.

Average annual household income, excluding dentists' wages and self-employment, was significantly higher for female dentists (\$120,210) than for male dentists (\$67,858) (Table 18). Overall, nearly three-quarters of dentists had annual household incomes of \$100,000 or less, suggesting that their wage was the main source of household income. Proportionally more male dentists than female dentists (79.2% vs 57.9%) reported household incomes of \$100,000 or less.

**TABLE 18. Annual Household Income Exclusive of Dentist's Income by Gender, 2014-2018**

Annual household income <sup>a,b</sup>	Female dentists		Male dentists		All dentists	
	n	%	n	%	n	%
Mean (range)	\$120,210 (\$1-\$1,150,816)		\$67,858 (\$1-\$1,650,401)		\$84,160 (\$1-\$1,650,401)	
≤\$100,000	26,859	57.9	81,215	79.2	108,074	72.6
\$100,001-\$150,000	6,704	14.5	9,808	9.6	16,512	11.1
\$150,001-\$200,000	4,210	9.1	3,580	3.5	7,790	5.2
\$200,001-\$250,000	2,797	6.0	2,661	2.6	5,458	3.7
>\$250,000	5,789	12.5	5,255	5.1	11,044	7.4
Total	<b>46,359</b>	<b>100.0</b>	<b>102,519</b>	<b>100.0</b>	<b>148,878</b>	<b>100.0</b>

<sup>a</sup> Gender difference in household income was statistically significant at  $P < .001$ .

<sup>b</sup> Annual household income was calculated as the sum of income from all sources for all members of the household, excluding the dentist's wage or self-employment income, and adjusted to 2018 dollars. Any values below \$1 were set equal to \$1 to avoid excluding observations.

Source: ACS data, 2014-2018.

## Associations Between Dentists' Characteristics and Their Practice Patterns

### Adjusted Associations of Dentists' Employment Status With Personal and Family Characteristics

The multivariable regression analysis found that being female and 35 years of age or older, being Black or African American, being foreign born, practicing in the West Region, and having a commute to work of more than 15 minutes were predictive of being employed vs owning a dental practice (Table 19). In contrast, having 2 or more children was associated with a *lower* likelihood of being employed vs owning a dental practice.

**TABLE 19. Associations of Dentists' Employment Status (Employed vs Practice Owner) With Personal and Family Characteristics, 2014-2018**

Characteristics of dentists <sup>a</sup>	Employed <sup>b</sup> (vs practice owner)			
	Prevalence ratio	95% Confidence interval		P
		Lower limit	Upper limit	
<b>Personal characteristics</b>				
Female age, y ( <i>reference: male age</i> )				<b>&lt;.001</b>
<35	1.04	0.97	1.13	.30
35-44	1.44	1.27	1.63	<b>&lt;.001</b>
45-54	1.34	1.14	1.57	<b>&lt;.001</b>
55-64	1.31	1.08	1.58	<b>.005</b>
≥65	1.61	1.13	2.31	<b>.009</b>
Race/ethnicity ( <i>reference: White, non-Hispanic</i> )				<b>.006</b>
Black or African American, non-Hispanic	1.32	1.10	1.58	<b>.003</b>
Asian, non-Hispanic	1.00	0.90	1.10	.98
All other non-Hispanic	1.20	0.98	1.47	.08
Hispanic	1.13	0.98	1.30	.09
Nativity status ( <i>reference: native born<sup>c</sup></i> )				
Foreign born	1.16	1.04	1.29	<b>.008</b>
Disability status ( <i>reference: without disability</i> )				
With disability <sup>d</sup>	1.12	0.89	1.41	.30
Bilingual status ( <i>reference: speaks only English</i> )				
Bilingual	0.95	0.86	1.05	.30
<b>Practice characteristics</b>				
Practice location ( <i>reference: South Region</i> )				<b>.030</b>
Northeast	1.45	0.82	2.57	.20
Midwest	1.05	0.68	1.64	.80
West	2.24	1.23	4.07	<b>.008</b>
Commuting time, min ( <i>reference: ≤15 min</i> )				<b>&lt;.001</b>
16-30	1.18	1.09	1.27	<b>&lt;.001</b>
31-45	1.35	1.23	1.48	<b>&lt;.001</b>
>45	1.33	1.20	1.48	<b>&lt;.001</b>
<b>Family characteristics</b>				
Children <sup>e</sup> ( <i>reference: no children</i> )				<b>&lt;.001</b>
1 child	0.95	0.86	1.04	.30
2 children	0.84	0.76	0.92	<b>&lt;.001</b>
3 or more children	0.75	0.65	0.86	<b>&lt;.001</b>
Older dependents <sup>f</sup> ( <i>reference: no older dependents</i> )				
1 or more	1.13	0.99	1.29	.07
Spouse/partner <sup>g</sup> ( <i>reference: no spouse/partner</i> )				.30
Spouse/partner is a dentist	0.99	0.85	1.15	.90
Spouse/partner with graduate education (other than dentist)	0.92	0.84	1.01	.09
Spouse/partner without graduate education	0.94	0.86	1.03	.20
Annual household income <sup>h</sup> ( <i>reference: ≤\$100,000</i> )				.70
\$100,001-\$150,000	1.04	0.94	1.15	.40
\$150,001-\$200,000	1.01	0.88	1.16	.80
\$200,001-\$250,000	0.92	0.78	1.09	.30
>\$250,000	0.96	0.84	1.09	.90

<sup>a</sup> Multilevel Poisson regression model estimated the effect of gender by age cohorts, adjusting for dentists' race/ethnicity, nativity, disability, bilingual status, practice location, commuting time to workplace, number of children, presence of older dependents, partner's education, and annual household income (Level 2), and household indicator (Level 1). Fixed effects for the state where the practice was

<sup>a</sup> Multilevel Poisson regression model estimated the effect of gender by age cohorts, adjusting for dentists' race/ethnicity, nativity, disability, bilingual status, practice location, commuting time to workplace, number of children, presence of older dependents, partner's education, and annual household income (Level 2), and household indicator (Level 1). Fixed effects for the state where the practice was located and the year of data collection were also included in the regression.

<sup>b</sup> "Employee" was defined as: employee of a private for-profit company or business, or employee of a private for-profit; employee of a private not-for-profit or charitable organization; local government employee; state government employee; or federal government employee. "Owner" was defined as: self-employed in own unincorporated business, professional practice; self-employed in own incorporated business, professional practice; or working without pay in family business (unweighted n=15, weighted n=200).

<sup>c</sup> "Native born" was defined as anyone who is a US citizen at birth; "foreign born" was defined as anyone who is not a US citizen at birth.

<sup>d</sup> Covers 6 disability types: hearing, visual, cognitive, ambulatory, self-care, and independent living difficulty.

<sup>e</sup> Number of children <18 years of age in the household, including biological children, adopted children, stepchildren, and foster children.

<sup>f</sup> "Older dependents" was defined as individuals ≥65 years of age who are out of the labor force and living in the same household with dentist.

<sup>g</sup> "Spouse/partner" was defined as either spouse or unmarried partner of the dentist living in the same household with dentist.

<sup>h</sup> Annual household income was calculated as the sum of income from all sources for all members of the household, excluding the dentist's wage or self-employment income, and adjusted to 2018 dollars. Any values below \$1 were set equal to \$1 to avoid excluding observations.

Source: ACS data, 2014-2018.

### Adjusted Associations of Dentists' Work Hours With Personal and Family Characteristics

Female dentists under the age of 65 were significantly more likely than male dentists to work part-time, while female dentists aged 65 or older were *less* likely to work part-time than male dentists in the same age group (Table 20). Dentists working somewhere other than a dentist's or physician's office or commuting more than 45 minutes to their place of work were more likely to work part-time. With respect to family characteristics, dentists with 2 or more children or with older dependents in the household were more likely to work part-time. Dentists with a spouse or unmarried partner without a graduate education were significantly less likely to work part-time. Having a household income higher than \$100,000 was also predictive of working part-time. Of note is the finding that dentists with a household income higher than \$200,000 were more than twice as likely to work part-time as those with a household income at or below \$100,000.

**TABLE 20. Associations of Dentists' Work Hours (Part-time vs Full-time) With Personal and Family Characteristics, 2014-2018**

Characteristics of dentists <sup>a</sup>	Part-time <sup>b</sup> (vs full-time)			P
	Prevalence ratio	95% Confidence interval		
		Lower limit	Upper limit	
<b>Personal characteristics</b>				
Female age, y ( <i>reference: male age</i> )				<b>&lt;.001</b>
<35	5.17	2.16	12.38	<b>&lt;.001</b>
35-44	5.16	2.89	9.23	<b>&lt;.001</b>
45-54	5.35	3.20	8.92	<b>&lt;.001</b>
55-64	1.53	1.11	2.12	<b>.010</b>
≥65	0.49	0.25	0.98	<b>.040</b>
Race/ethnicity ( <i>reference: White, non-Hispanic</i> )				.30
Black or African American, non-Hispanic	0.62	0.36	1.07	.09
Asian, non-Hispanic	0.80	0.58	1.11	.20
All other non-Hispanic	0.71	0.36	1.36	.30
Hispanic	0.74	0.45	1.23	.20
Nativity status ( <i>reference: native born<sup>c</sup></i> )				
Foreign born	1.14	0.82	1.59	.40
Disability status ( <i>reference: without disability</i> )				
With disability <sup>d</sup>	1.20	0.80	1.80	.40
Bilingual status ( <i>reference: speaks only English</i> )				
Bilingual	0.87	0.64	1.18	.40
<b>Practice characteristics</b>				
Work setting ( <i>reference: dentist/physician office</i> )				
Other <sup>e</sup>	1.35	1.15	1.60	<b>&lt;.001</b>
Practice location ( <i>reference: South Region</i> )				.07
Northeast	1.53	0.63	3.71	.30
Midwest	1.53	0.38	6.16	.50
West	0.44	0.17	1.13	.09
Commuting time, min ( <i>reference: ≤15 min</i> )				<b>.010</b>
16-30	0.94	0.79	1.13	.50
31-45	1.02	0.79	1.31	.90
>45	1.51	1.15	1.99	<b>.003</b>
<b>Family characteristics</b>				
Children <sup>f</sup> ( <i>reference: no children</i> )				<b>.002</b>
1 child	1.05	0.76	1.45	.80
2 children	1.46	1.08	1.97	<b>.010</b>
3 or more children	1.97	1.37	2.84	<b>&lt;.001</b>
Older dependents <sup>g</sup> ( <i>reference: no older dependents</i> )				
1 or more	1.37	1.13	1.67	<b>.002</b>
Spouse/partner <sup>h</sup> ( <i>reference: no spouse/partner</i> )				<b>.003</b>
Spouse/partner is a dentist	1.07	0.74	1.54	.70
Spouse/partner with graduate education (other than dentist)	0.81	0.61	1.07	.10
Spouse/partner without graduate education	0.70	0.54	0.90	<b>.005</b>
Annual household income <sup>i</sup> ( <i>reference: ≤\$100,000</i> )				<b>&lt;.001</b>
\$100,001-\$150,000	1.42	1.13	1.78	<b>.002</b>
\$150,001-\$200,000	1.67	1.23	2.26	<b>.001</b>
\$200,001-\$250,000	2.03	1.41	2.91	<b>&lt;.001</b>
>\$250,000	2.13	1.67	2.71	<b>&lt;.001</b>

<sup>a</sup> Multilevel Poisson regression model estimated the effect of gender by age cohorts, adjusting for dentists' race/ethnicity, nativity, disability, bilingual status, work setting, practice location, commuting time to workplace, number of children, presence of older dependents, partner's education, and annual household income (Level 2), and household indicator (Level 1). Fixed effects for the state where the practice was located and the year of data collection were also included in the regression.

<sup>b</sup> "Part-time" was defined as 350-1,299 hours/year of work; "full-time" was defined as 1,300-2,550 hours/year of work.

<sup>c</sup> "Native born" was defined as anyone who is a US citizen at birth; "foreign born" was defined as anyone who is not a US citizen at birth.

<sup>d</sup> Covers 6 disability types: hearing, visual, cognitive, ambulatory, self-care, and independent living difficulty.

<sup>e</sup> Includes Federally Qualified Health Centers (FQHCs) and other public settings.

<sup>f</sup> Number of children <18 years of age in the household, including biological children, adopted children, stepchildren, and foster children.

<sup>g</sup> "Older dependents" was defined as individuals ≥65 years of age who are out of the labor force and living in the same household with dentist.

<sup>h</sup> "Spouse/partner" was defined as either spouse or unmarried partner of the dentist living in the same household with dentist.

<sup>i</sup> Annual household income was calculated as the sum of income from all sources for all members of the household, excluding the dentist's wage or self-employment income, and adjusted to 2018 dollars. Any values below \$1 were set equal to \$1 to avoid excluding observations.

Source: ACS data, 2014-2018.

### Adjusted Associations of Dentists' Annual Income With Personal and Family Characteristics

Female dentists over 35 years of age were significantly more likely to have a lower personal income than male dentists in that age group. Black/African American and "other" non-Hispanic dentists were more likely to have a lower personal income than their White, non-Hispanic counterparts (Table 21). As would be expected, working more weeks per year or more hours per week was associated with a decreased likelihood of earning a lower income. In addition, dentists having 3 or more children were less likely to have a lower income than those with no children, and dentists with a spouse or unmarried partner who is not a dentist were less likely to have a lower income than those without a spouse or partner. In contrast, the presence of 1 or more older dependents in the household was predictive of having a lower income.

**TABLE 21.** Prevalence Ratios for Dentists' Annual Income (Lower Income vs Higher Income) in Association With Personal, Employment, and Family Characteristics, 2014-2018

Characteristics of dentists <sup>a</sup>	Annual income <sup>b</sup> ≤\$100,000 (vs >\$100,000)			
	Prevalence ratio	95% Confidence interval		P
		Lower limit	Upper limit	
<b>Personal characteristics</b>				
Female age, y ( <i>reference</i> : male age)				<b>&lt;.001</b>
<35	1.21	0.99	1.48	.06
35-44	1.70	1.38	2.10	<b>&lt;.001</b>
45-54	1.50	1.21	1.86	<b>&lt;.001</b>
55-64	1.38	1.15	1.66	<b>.001</b>
≥65	1.43	1.04	1.98	<b>.030</b>
Race/ethnicity ( <i>reference</i> : White, non-Hispanic)				<b>.010</b>
Black or African American, non-Hispanic	1.39	1.11	1.73	<b>.004</b>
Asian, non-Hispanic	1.07	0.92	1.25	.40
All other non-Hispanic	1.37	1.02	1.84	<b>.040</b>
Hispanic	1.09	0.90	1.32	.40
Nativity status ( <i>reference</i> : native born <sup>c</sup> )				
Foreign born	1.06	0.91	1.24	.50

**TABLE 21. Prevalence Ratios for Dentists' Annual Income (Lower Income vs Higher Income) in Association With Personal, Employment, and Family Characteristics, 2014-2018 (cont.)**

Characteristics of dentists <sup>a</sup>	Annual income <sup>b</sup> ≤\$100,000 (vs >\$100,000)			
	Prevalence ratio	95% Confidence interval		P
		Lower limit	Upper limit	
Disability status ( <i>reference</i> : without disability)				
With disability <sup>d</sup>	1.11	0.91	1.36	.30
Bilingual status ( <i>reference</i> : speaks only English)				
Bilingual	1.08	0.93	1.26	.30
<b>Practice characteristics</b>				
Work setting ( <i>reference</i> : dentist/physician office)				
Other <sup>e</sup>	1.03	0.94	1.13	.60
Weeks worked per year ( <i>reference</i> : 40-47 weeks)				<b>.001</b>
48-49	0.75	0.64	0.88	<b>&lt;.001</b>
50-52	0.84	0.75	0.94	<b>.003</b>
Usual hours worked per week	0.97	0.97	0.98	<b>&lt;.001</b>
Practice location ( <i>reference</i> : South Region)				.10
Northeast	0.89	0.55	1.44	.60
Midwest	1.48	0.77	2.81	.20
West	0.53	0.25	1.11	.09
Commuting time, min ( <i>reference</i> : ≤15 min)				.30
16-30	1.07	0.97	1.18	.20
31-45	0.94	0.82	1.09	.40
>45	1.01	0.88	1.17	.90
<b>Family characteristics</b>				
Children <sup>f</sup> ( <i>reference</i> : no children)				<b>.040</b>
1 child	0.91	0.79	1.06	.20
2 children	0.85	0.73	1.00	.05
3 or more children	0.76	0.62	0.93	<b>.008</b>
Older dependents <sup>g</sup> ( <i>reference</i> : no older dependents)				
1 or more	1.25	1.10	1.42	<b>.001</b>
Spouse/partner <sup>h</sup> ( <i>reference</i> : no spouse/partner)				<b>.001</b>
Spouse/partner is a dentist	0.95	0.78	1.15	.70
Spouse/partner with graduate education (other than dentist)	0.80	0.70	0.91	<b>.001</b>
Spouse/partner without graduate education	0.81	0.72	0.92	<b>.001</b>
Annual household income <sup>i</sup> ( <i>reference</i> : ≤\$100,000)				.10
\$100,001-\$150,000	0.92	0.80	1.05	.20
\$150,001-\$200,000	0.83	0.69	1.01	.06
\$200,001-\$250,000	0.94	0.75	1.18	.60
>\$250,000	0.85	0.71	1.01	.06

<sup>a</sup> Multilevel Poisson regression model estimated the effect of gender by age cohorts, adjusting for dentists' race/ethnicity, nativity, disability, bilingual status, work setting, weeks worked per year, usual hours worked per week, practice location, commuting time to workplace, number of children, presence of older dependents, partner's education, and annual household income (Level 2), and household indicator (Level 1). Fixed effects for the state where the practice was located and the year of data collection were also included in the regression.

<sup>b</sup> Annual income constituted wages from employment and/or self-employment and was adjusted to 2018 dollars. Any values below \$1 were set equal to \$1 to avoid excluding observations.

<sup>c</sup> "Native born" was defined as anyone who is a US citizen at birth; "foreign born" was defined as anyone who is *not* a US citizen at birth.

<sup>d</sup> Covers 6 disability types: hearing, visual, cognitive, ambulatory, self-care, and independent living difficulty.

<sup>e</sup> Includes Federally Qualified Health Centers (FQHCs) and other public settings.



<sup>f</sup> Number of children <18 years of age in the household, including biological children, adopted children, stepchildren, and foster children.

<sup>g</sup> “Older dependents” was defined as individuals  $\geq 65$  years of age who are out of the labor force and living in the same household with dentist.

<sup>h</sup> “Spouse/partner” was defined as either spouse or unmarried partner of the dentist living in the same household with dentist.

<sup>i</sup> Annual household income was calculated as the sum of income from all sources for all members of the household, excluding the dentist’s wage or self-employment income, and adjusted to 2018 dollars. Any values below \$1 were set equal to \$1 to avoid excluding observations.

Source: ACS data, 2014-2018.

## DISCUSSION

This study examined the personal and household characteristics of dentists and the association of those characteristics with practice choices. Differences in practice noted in this study may not be entirely attributable to gender; some may reflect generational preferences regardless of gender. However, there are notable variations by gender that warrant discussion.

### Demographics

Diversification of the dental workforce by gender, race, and ethnicity is occurring, although the workforce continues to be predominantly male (69.5%) and White, non-Hispanic (72.3%). The ADA Health Policy Institute indicates that in 2018, approximately 28% of dentists were from racial/ethnic minorities, which represented a 22% increase from 2008 data.<sup>57</sup> The American Dental Education Association found that in 2016, 24.5% of first-time enrolled dental students were Asian; 9.1% were Hispanic/Latino; 5.0% were Black/African American; 3.4% were 2 or more races; 0.3% were American Indian/Alaska Native, Native Hawaiian, or other Pacific Islander; and 6.5% were nonresident aliens.<sup>58</sup>

Female dentists, as described in the ACS data, are more diverse than their male counterparts, with 40.4% of females indicating race/ethnicity other than White, non-Hispanic, and only 22.4% of male dentists indicating a similar background. In addition, 33.0% of female dentists were foreign born and 35.5% were

bilingual, in contrast to male dentists, among whom 18.5% were foreign born and 19.8% were bilingual. Each of these differences was statistically significant. Adams posits that the gender shift in the dental industry is partly influenced by immigration,<sup>59</sup> especially from Eastern European and Asian countries, where the number of women in the dental profession is also rising. Immigration would also explain fluency in other languages.

Diversification of the dental profession is a widely embraced goal. It is encouraging that change in the gender composition of the profession is accompanied by other dimensions of diversity that directly reflect trends in the US population. One desirable outcome from efforts to diversify the profession is that dentistry is increasingly representative of the patient community. Concordance of race/ethnicity between providers and patients has been shown to be beneficial to access. Mertz and colleagues found that more than 4 in 10 Black dentists indicated that their case-loads consisted of more than 50% Black patients; on average, Black dentists described their patient mix as including 44% Black patients.<sup>36</sup> Black female dentists were more likely to work in a safety net setting (13.8%) or in a corporate setting (7.5%) than were Black male dentists (8.3% and 2.9%, respectively).

## Household Characteristics

Our study found that female dentists were significantly more likely to be unmarried (27.6%) than male dentists (16.3%) but also significantly more likely to have 1 or more children under 18 years of age in their household (49.9% vs 38.1%). Female dentists were also significantly more likely than male dentists to live in a larger household consisting of 3 or 4 people; conversely, they were also more likely to live in a single-person household. The younger average age of female dentists (43.3 years) vs male dentists (52.2 years) may account for these findings. A higher percentage of female dentists than male dentists were single parents (4.4% vs 1.2%).

## Work Hours

Female dentists under age 65 were significantly more likely to work part-time than male dentists, with the biggest difference found among those aged 45 to 54, who were 5.4 times more likely to work part-time. Nevertheless, 9 in 10 dentists in the ACS data set indicated full-time work status (88.4% of female dentists and 92.1% of male dentists). Average annual work hours for female dentists were 1,824 vs 1,883 hours for male dentists. Similar trends were noted in our previous work<sup>77</sup> and in other research.<sup>21</sup> In a literature review conducted by the ADA in the early part of this decade, the authors noted that 20% of female dentists and 12% of male dentists worked less than 30 hours per week.<sup>60</sup> The ACS data assessed in this study indicated that 13.3% of female dentists and 9.2% of male dentists currently work less than 30 hours per week.

A study conducted by the World Dental Federation found an increasing trend toward limiting working hours and working part-time among the dental workforce generally in developed countries.<sup>51</sup> In a cross-sectional national survey from 1979 to 1999 in the US, male dentists worked more hours per week (>42 hours) and were less likely to work part-time

than their female counterparts, while older dentists worked fewer hours than younger dentists.<sup>21</sup> This historical trend seems consistent with current practice patterns described in our study. On average, compared with female dentists, male dentists worked more hours per week (37.6 vs 36.5 hours) and were less likely to work part-time (7.9% vs 11.6%). Female dentists under the age of 55 were over 5 times more likely to work part-time than male dentists in their age cohort. However, this gender gap decreased for dentists aged 55 to 64, with female dentists being only 1.5 times more likely to work part-time than their male counterparts. Moreover, among dentists 65 years or older, females were significantly *less* likely to work part-time than male dentists.

The impact of having children on dental professionals' choice to work part-time is extensively discussed in the existing literature. Gallagher and colleagues conducted a survey of dental students in the UK and found that more than 80% of respondents indicated that one of the reasons they selected dentistry as a career was the opportunity for work-life balance. Female students were more likely than their male peers to indicate that childcare commitments could have an impact on their future work capacity.<sup>61</sup> In a later study, Gallagher et al remarked that a motivator for choosing dentistry is that the profession offers flexibility to work less when other priorities, such as childcare, take precedence.<sup>31,32,33</sup> AlSharif and coworkers conducted a study of fourth-year dental students and found that female dental students were more likely than males to be involved in childcare. More than 28% of the study participants indicated that they would take time from work to care for children during the preschool years.<sup>34</sup> Our study found that the likelihood of working part-time among all dentists increased with increases in the number of children in the household; those with 2 children were 1.5 times as likely, and those with 3 or more children nearly twice as likely, to work part-time as dentists without children.

It is difficult to evaluate the impact of the growing contingent of female dentists, some of whom work part-time, on the capacity of the dental care delivery system to meet demand for services. The National Center for Health Statistics reported that the percentage of the population aged 18 to 64 who had accessed a dental service in the past year was 64.1% in 1997 and 65.9% in 2018.<sup>62</sup> The long-term relative stability in the proportion of the adult population accessing dental services combined with growth in the number and diversity of clinical providers as the population has increased suggests that the delivery system is experiencing general equilibrium between the supply of providers and the availability of services for those who can afford to access care and in geographic areas where dentists are practicing. Under prevailing conditions and absent noticeable changes in utilization, delivery of care to meet demand should not be problematic. However, it is important to remember that access to oral health services is a significant and abiding issue for many Americans without the means to obtain care and for those lacking availability of services in rural and urban areas.

Lower-than-desired utilization rates may support the availability of part-time work in the marketplace, enabling flexible options for dentists wishing to control their hours in clinical practice. Until elasticity in demand for dental services decreases with better financing of oral health services, recognition that dental care is an essential health service, and increased oral health literacy in the population, the ability to work part-time appears to be an attractive option for both clinician and employer. Efforts to increase consumers' awareness of the necessity of oral health services could increase utilization, but absent substantial changes in the financing of oral health services, demand is unlikely to exceed workforce supply. However, trends in part-time practice participation must be monitored on an ongoing basis to alert the delivery system to any necessary increases in the oral health workforce pipeline.

### *Employment vs Practice Ownership*

Most dentists (94.6%) worked in the offices of dentists or physicians. While the differences in work setting by gender were small, they were statistically significant. Female dentists were significantly more likely to indicate that they worked in other health care settings (2.4%) than were male dentists (1.1%).

Findings from our previous studies<sup>7,8</sup> as well as the current study indicate indisputable differences in employment and practice ownership by gender. In the present study, female dentists were significantly more likely than male dentists to report employee status (54.6% vs 33.7%) and significantly less likely to report practice ownership (45.4% vs 66.3%). A study early in the millennium by Atchison and colleagues discussed this trend.<sup>11</sup> At that time, female dentists were also less likely than male dentists to be practice owners (61.2% vs 85.4%). Scarbecz and Ross surveyed dental students to understand gender differences in motivation to pursue a dental career. Female first-year dental students rated business ownership as a less important reason for attending dental school (4.22 on a 5-point Likert scale) than did their male peers (4.56).<sup>63</sup>

The multivariable regression analysis found that being female and 35 years of age or older, being Black or African American, being foreign born, working in the West Region, and commuting more than 15 minutes to work were predictive of being employed vs owning a dental practice. In contrast, dentists with 2 or more children were less likely to be employed by others and more likely to be practice owners.

Prior research discusses the attractiveness of workplace flexibility, described as providing the opportunity to work part-time or fewer hours, offering scheduling flexibility within the workday, and increasing the ability to adjust work schedules to address personal and family needs.<sup>64</sup> Employment status may offer more flexible options to the dentist, including mini-

mal administrative duties, the ability to work longer or shorter days, and the ability to work fewer or more days per week without concerns for patient coverage. Walton et al remark that one of the reasons why women may select dentistry as a profession is that it provides more control over working patterns and provides the option for part-time workforce participation to a greater extent than do some other professions.<sup>10,30</sup>

It is not possible to ascertain whether the high rate of employment among female dentists is driven by a desire for workplace flexibility or whether it is due to the changing practice structures within the delivery system that make employment increasingly available and attractive. Dental service organizations and group practice management models have increased in number in concert with the entry of many female dentists into the delivery system.<sup>65,66</sup> Thus, the opportunities for employment rather than practice ownership have also increased.

### *Wages*

One of the most concerning findings of the study was the income gap between female and male dentists, which cannot be explained by controlling for personal and work characteristics. The mean personal annual income among dentists in the data set was \$193,722. Female dentists reported significantly lower average personal annual income (\$157,509) than male dentists (\$210,097). The significant variation in average personal annual income by gender persisted when the data were analyzed using reported personal annual income only from dentists who worked full-time. The gap in average annual income among full-time clinicians was substantial, with full-time female dentists reporting an average of \$165,385 and full-time male dentists reporting an average of \$217,916. Furthermore, multivariable regression analysis found that female dentists aged 35 or older were more likely to report a lower personal annual income (\$100,000 or less) than male dentists in their age group. For in-

stance, female dentists aged 35 to 44 were 1.7 times more likely to have lower incomes than male dentists in the same age group.

Wage differentials by gender in dentistry and other high-paying professions were noted by Goldin and Katz, who evaluated the “cost” of workplace flexibility in those professions.<sup>66</sup> The authors suggested that women are penalized to varying degrees for job interruptions, part-time workforce participation, and other amenities afforded to higher-paying professions. Their work found that women in the health professions, including dentists and surgeons, were “taxed” with lower incomes more than were women in other professions. Essentially, lower incomes may be the cost of the attractive attribute of flexibility inherent in professional clinical practice.

Hu<sup>67</sup> used ACS data to evaluate work hours and income differences between spouses/partners who were both physicians and found that the female spouse/partner experienced a wage reduction greater than that of the male spouse/partner; the female spouse/partner was making work hour, work location, and work specialty choices to accommodate spousal/partner career choices that could result in lower pay for the female partner. It is possible that the same patterns are present in dentistry when both partners are dental professionals, but it is unlikely that this would explain the large salary gap for female dentists. While 13% of female dentists report that their partner is also a dentist, this percentage is too small to have a substantial impact on the mean income of all female dentists. The factors that might explain the substantial variation in income by gender will be the subject of more in-depth analysis by the authors of this study in a future research paper.

## **LIMITATIONS**

The ACS PUMS data allow access to only a 1% sample of all ACS surveys, although the data can be analyzed

as representative of the population as a whole using the provided replicate weights. As with all sample survey data, the ACS is subject to sampling and nonsampling errors. Sampling errors occur due to the usage of probability sampling, and the PUMS data have additional sampling error because they are composed of a subset of the full ACS sample, as mentioned above. Nonsampling errors refer to any errors that may be randomly introduced during the complex operations involved in collecting and processing survey data (eg, data entry from questionnaires).

This study was unable to accomplish a granular geographic analysis because the PUMS data do not provide information on locality for each dentist. It is possible that geography would impact some findings, including those relative to wages. In addition, the data do not describe the dental specialty of survey respondents. Certain specialties in dentistry, as in medicine, would provide higher personal incomes that might affect the wage gap, especially as many higher-paying dental specialties—with the exception of pediatric dentistry—are predominately male. However, since approximately 80% of dentists practice general dentistry, specialty type would likely only partially explain the large gap in annual incomes by gender.

## CONCLUSIONS

There is little evidence that the gradual gender shift within dentistry is substantially altering professional practice. It is not possible to disentangle the impact of environmental factors such as generational preferences, changes in the structures of dental service delivery, and the effect of consumer preferences on demand for services from the changing gender composition of the workforce in order to definitively describe causative factors for particular practice patterns or preferences. It is important to consider that differences in practice choices may affect dental delivery, but change is endemic to health care and, at least to date, the oral health delivery system has adapted to both clinician needs and patient demand.

Differences in practice by gender, while significant statistically, appear to be relatively small in magnitude. As dentists age, practice patterns by gender diverge such that, for example, dentists of both genders are more likely to be practice owners and older dentists are more likely than younger dentists to work part-time. Current literature suggests that gender differences may, in fact, be advantageous due to practice complementarities between male and female dentists that are beneficial to patients and to the delivery system. The literature suggests, for instance, that female dentists treat more children and more publicly insured patients, generally, than do male dentists. Other research discusses specialty mix, finding that general dentistry and pediatric dentistry practice is favored by female dentists, who are more likely to suggest early prevention strategies rather than the restorative interventions preferred by their male peers. Thus, the growth in numbers of women in dentistry may benefit the capacity of the delivery system to meet the full spectrum of needs within the population and the growing and changing demand for services.







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