By Margaret Langelier, Tracey Continelli, Jean Moore, Bridget Baker, and Simona Surdu

Expanded Scopes Of Practice For Dental Hygienists Associated With Improved Oral Health Outcomes For Adults

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ABSTRACT Dental hygienists are important members of the oral health care team, providing preventive and prophylactic services and oral health education. However, scope-of-practice parameters in some states limit their ability to provide needed services effectively. In 2001 we developed the Dental Hygiene Professional Practice Index, a numerical tool to measure the state-level professional practice environment for dental hygienists. We used the index to score state-level scopes of practice in all fifty states and the District of Columbia in 2001 and 2014. The mean composite score on the index increased from 43.5 in 2001 to 57.6 in 2014, on a 100-point scale. We also analyzed the association of each state's composite score with an oral health outcome: tooth extractions among the adult population because of decay or disease. After we controlled for individual- and state-level factors, we found in multilevel modeling that more autonomous dental hygienist scope of practice had a positive and significant association with population oral health in both 2001 and 2014.

Margaret Langelier is project director of the Center for Health Workforce Studies, School of Public Health, University at Albany, State University of New York (SUNY).

Tracey Continelli is a research associate at the Center for Health Workforce Studies, University at Albany, SUNY, and an assistant professor of nursing at The Sage Colleges, in Albany.

Jean Moore (jean.moore@health.ny.gov) is director of the Center for Health Workforce Studies, University at Albany, SUNY.

Bridget Baker is a senior research associate at the Center for Health Workforce Studies, University at Albany, SUNY.

Simona Surdu is a senior research associate at the Center for Health Workforce Studies, University at Albany, SUNY.

Improving the oral health of Americans has been a national priority in the past decade. Increasing evidence of the relationship between physical and oral health and the identification of genetic components of oral pathology support the importance of early screening to identify and stratify risk for developing oral disease.[1] As a result, the importance of population oral health has taken on new significance.

Strategies for reducing oral disease burden in the population are multidimensional and include workforce policies that engage dentists, dental hygienists, primary care clinicians, and others in risk assessment, disease prevention, and disease management. This shift from an emphasis on the treatment of oral disease to a focus on the prevention of oral disease and the management of oral health requires the engagement of a comprehensive oral health care team, especially for underserved populations.[2]

Despite recent progress in improving access to oral health services, underserved populations continue to suffer from preventable dental conditions that have consequences across the lifespan.[3] In its recently published "Oral Health Strategic Framework 2014–2017," the Department of Health and Human Services outlined goals for improving oral health, including preventing disease and promoting oral health through the increased delivery of clinical and community preventive services.[4] Access to preventive oral health care at regular intervals and to treatment when needed is essential for the population to achieve optimal oral health.[3]

Health reform and interest in value-based health services have also spurred support for workforce innovations that increase access to high-quality, cost-effective services. Dental hygienists are well positioned to contribute to the transformation of delivery systems for oral health care and to improvements in oral health

outcomes. This is because dental hygienists, as preventive oral health specialists, are trained to provide oral health promotion, patient education, oral disease prevention, risk assessment, evidence-based disease management, and referral services that are within their professional competence.[5]

The term *scope of practice* describes the practice boundaries for a profession. Scopes of practice for dental hygienists are largely defined in state-specific statutes and regulations that specify the settings, services, and supervision required for dental hygienists' practice. We hypothesized that more expansive scopes of practice for dental hygienists would be associated with better population oral health.

One current strategy to improve access to basic oral health services is to allow dental hygienists to provide preventive care in community settings, such as schools and long-term care facilities, without the immediate supervision of a dentist—an enabling practice generally called *public health supervision status*.[6] However, regulations in some states require that a patient be seen by a dentist before being seen by a dental hygienist, even in public health settings. Because lack of access to dentists is a recognized problem for some people,[7] requiring a dental visit before being seen by a dental hygienist may be a barrier to receiving preventive care. And in some states a dentist must directly authorize the placement of a dental sealant on a permanent molar, although other states allow dental hygienists to independently determine the need for a dental sealant.

In recent years, scopes of practice for a variety of health professions have been expanded to allow for the higher levels of practice that are supported by advanced technology, new scientific knowledge about disease processes and treatments, and societal demands.[8–10] Policy makers and health care providers have questioned whether these expansions have positively affected population health and oral health.[11–13] Variations in states' scopes of practice make evaluating the impact of differences in required levels of supervision and allowable tasks on health or oral health outcomes challenging.[14]

In 2001 we received funding from the National Center for Health Workforce Analysis at the Health Resources and Services Administration (HRSA) to create a numerical index to quantify scopes of practice for dental hygienists across states.[15] The construction of this Dental Hygiene Professional Practice Index was based on the assumption that appropriate levels of required supervision for dental hygienists who were providing services within their core clinical competencies in public health settings would increase access to oral health services and support improvements in oral health outcomes over time.

The creation of the index was guided by a national advisory committee that included dentists, dental hygienists, a physician, and a state legislator. The selection of the variables to be used in the index was informed by an extensive process of stakeholder consultation. More than a hundred dental hygienists practicing in more than thirty states participated in focus groups as part of that process. Dental hygienists described optimal practice conditions for providing preventive care in settings outside dental offices, especially legal conditions that would expand underserved patients' access to dental hygiene services. Variables were selected based on the premises that dental hygienists' patient care must be provided within the parameters of their education, training, and competencies; that patient safety is of primary importance; and that the delivery of oral health services should be facilitated by regulation, not discouraged by it.[15]

Each variable in the index was assigned a weighted score to reflect that variable's relative impact on the ability of the dental hygienist to provide preventive services in a community setting (for the scoring instrument, see online Appendix Table 1).[16] To ensure consistency in source information across states, each variable was scored based on the state statute and regulation governing the practice of dentistry and dental hygiene.[15]

The variables were grouped into four categories (Exhibit 1). The ideal composite score was 100 points. In 2001 state scores ranged from a low of 10 in West Virginia to a high of 97 in Colorado (for a complete list of scores, see Appendix Table 2).[16]

Several researchers have used the 2001 scores on the Dental Hygiene Professional Practice Index to study the relationships between dental hygienist scope of practice, oral health outcomes, and cost of services. Paul Wing and coauthors used the scores along with oral health surveillance data from the 2002 Behavioral Risk Factor Surveillance System (BRFSS) survey from the Centers for Disease Control and Prevention (CDC) to show that the scope of practice had a positive and significant impact on the use of oral health services in a state: The more expanded the scope, the higher the utilization.[17] The 2001 index scores were positively and significantly correlated with the percentage of BRFSS respondents in 2002 who had had their teeth cleaned by a dentist or dental hygienist in the previous year and negatively correlated with the number of people who had had any teeth removed because of decay or disease.

Tanya Wanchek found that state entry require-

EXHIBIT 1

Categories, scores, and variables in the Dental Hygiene Professional Practice Index

Category	Max. score for category (points)	Range of scores for each variable in category (points)	Variables
Regulation	10	1–4	Governance of profession, composition of state regulatory board, licensure available by credential or endorsement, scope of practice clearly defined, practice not restricted to patients of record
Supervision by practice setting	47	1–4	Direct, general, collaborative, or unsupervised practice in dental offices and in public health settings (including long-term care facilities, schools, federally qualified health centers, community dental clinics, correctional facilities, mental health facilities, and homes).
Tasks permitted under varying levels of supervision	28	2–4	Several preventive services not requiring physical presence of dentist, administering local anesthesia or nitrous oxide, performing initial oral assessments, ability to supervise dental assistant, opportunity to qualify to perform additional functions, etc.
Reimbursement	15	5–10	Ability to directly bill Medicaid or commercial insurance payers for services

SOURCE Authors' analysis of data from the following sources: (1) Health Resources and Services Administration. The professional practice environment of dental hygienists in the fifty states and the District of Columbia, 2001 (see Note 15 in text). (2) Langelier M, et al. A Dental Hygiene Professional Practice Index by state, 2014 (see Note 21 in text).

ments and practice restrictions were negatively correlated with the number of dental hygienists employed per capita and with dental hygienists' wages.[18] Moreover, reduced dental hygienist employment and wages were associated with decreased access to oral health care, as measured by the prevalence of dental visits in the population.

Other studies described the impact of regulation of oral health and health care professionals on both labor markets and health outcomes. Morris Kleiner and Robert Kudrle found evidence that restrictive dental licensing requirements were associated with a lower supply of providers and higher prices for dental services, and did not improve oral health outcomes in the population.[19] Coady Wing and Allison Marier found that regulations that limited the authority of dental hygienists to provide services increased the prices of those services by approximately 12 percent in the period 2005–07.[20] They also found that when dental insurers were allowed to reimburse dental hygienists directly for their services, the proportion of people who used dental services increased 3–4 percent in the following year.

In 2014, again with support from HRSA, we updated state scores on the index to reflect changes in scopes of practice for dental hygienists and to provide comparative data to describe changes over the decade across states.[21] In this article we present the results of this update and discuss the implications for increasing dental care access for those most in need of it.

Study Data And Methods

The 2014 update to the scores on the Dental Hygiene Professional Practice Index was completed by two researchers, who independently scored index categories based on state-specific statutes and regulations. (One of the researchers in the 2001 study participated in the 2014 update.) Discrepancies between the two researchers were resolved through a review of other source material. We then used the 2001 and 2014 state scores in statistical testing to describe the impact of scopes of practice for dental hygienists on an oral health outcome in the population.[21]

Measures of population oral health for US adults are neither widely available nor systematically collected, except in the BRFSS.[22] The BRFSS is a telephone survey administered in each state and the District of Columbia to noninstitutionalized adults ages eighteen and older. The BRFSS uses sampling techniques designed by the CDC to be representative of individuals at the state level. Because of its large sample size, it provides an ideal source of individual-level demographic and oral health data.

Standard individual-level demographic control variables from the survey used in our statistical analyses were age, race/ethnicity, sex, marital status, income, education, employment status, and visits to a dentist in the previous year (for the variables in the analyses, see Appendix Table 4).[16] Data from the 2002 BRFSS were used for our 2001 analysis, and data from the 2012 BRFSS (the most recent year available) were used for our 2014 analysis.

State-level control variables came from a vari-

ety of sources. The variables were the rates of dentists and dental hygienists per 100,000 population, per capita income, the percentage of the population having public water systems that provided fluoridated water, and the percentage living in an urban area.

The outcome variable from the BRFSS was the number of permanent teeth removed because of decay or disease. The survey question asked, "How many of your permanent teeth have been removed because of tooth decay or gum disease?" The possible answers were "1 to 5," "6 or more but not all," "all," "none," and "don't know/not sure"; respondents could also refuse to answer.[23]

We created a binary outcome variable from the data: Respondents who had had no teeth removed because of decay or disease were coded as 1, and those who had had any teeth removed were coded as 0. We excluded from the analysis those who had had all of their teeth removed, because the likelihood that they would require the services of a dental hygienist was small. The outcome variable reflected a favorable oral health outcome: specifically, the logged likelihood that individuals had had no teeth removed because of decay or disease.

FACTOR ANALYSES Statistical testing was conducted in stages. First, we tested the validity of the index using both exploratory and confirmatory factor analysis on the scores assigned to each of the four categories for each year (2001 and 2014), using SPSS (version 22) and AMOS (version 22) (for the results of the factor analyses, see Appendix Tables 3A–B).[16] Exploratory factor analysis, as the name implies, does not impose a preexisting structure on the data. It is therefore not intended for hypothesis testing but is a useful technique for exploring an unknown or as-yet-unexamined structure.[24]

Confirmatory factor analysis provides a much more rigorous statistical test than does exploratory factor analysis and is considered the gold standard among factor analytic techniques for determining the validity of a construct.[25] Confirmatory factor analysis imposes a preexisting structure on data, which requires the researcher to first specify the hypothesized theoretical construct.[24] In this case, the construct was that the four categories in the index were all aspects of the overarching concept of scope of practice.

MULTILEVEL MODELING Once the validity of the index was established, we used multilevel logistic modeling to analyze the impact of scope of practice of dental hygienists, as measured by the index, on the oral health outcome in states' adult populations.

One of the key assumptions of traditional multivariate statistical techniques is that each case in the analysis is independent of every other. However, because the professional practice environment for dental hygienists is determined by state law, the impact on individuals in a given state will not be independent, since they share a common dental hygiene practice environment. This nested model violates the assumption of independence and can produce false positive results.

Demonstrating that broader scopes of practice, especially in public health settings, are correlated with better oral health outcomes is useful.

Multilevel modeling techniques allow researchers to account for the nested structure, which results in more accurate estimates. Multilevel modeling also permits testing for relationships across different units of analysis—in this case, the effect of state-level scope of practice on individual oral health outcomes for the years 2001 and 2014. For our multilevel modeling, we used the Hierarchical Linear Modeling (HLM) software.

LIMITATIONS Our study had several limitations. First, oral health outcome variables directly tied to dental hygienist interventions were not available. As a proxy for an oral health outcome, we used a BRFSS survey question that asked about tooth extractions among adults because of decay or disease. In 2002 the BRFSS survey also contained a question that asked how long it had been since the respondent had had his or her teeth cleaned by a dentist or dental hygienist.[26] However, that question was eliminated in subsequent survey iterations, which meant that we could not use it for this comparative analysis.

Second, although our findings suggest causation, we could establish only a strong association between dental hygiene scope of practice and no tooth loss in the population because of decay or disease. The results met eight of nine criteria for establishing a causal relationship.[27] However, it was not possible to establish temporality or time order (the ninth criterion), because the BRFSS data do not contain information on when tooth loss occurred.

Study Results

The mean composite score on the Dental Hygiene Professional Practice Index across states increased from 43.5 in 2001 to 57.6 in 2014 on the 100-point scale (Exhibit 2). Changes were most noticeable in the supervision category, in which mean scores improved from 19.1 to 27.3. This increase was attributable to regulatory changes in many states that reduced the direct supervision required for dental hygienists, most notably in public health settings. While the maximum score in a state increased only slightly (from 97 in Colorado in 2001 to 98 in Maine in 2014), the minimum score changed more noticeably (from 10 in West Virginia in 2001 to 18 in Mississippi in 2014) (Appendix Table 2).[16]

We categorized state composite scores on the index from 2014 by quintiles (Exhibit 3). These quintiles, used in both 2001 and 2014, allowed us to analyze changes in the states over time.

New or expanded dental hygiene practice models that build on dental hygienists' foundational competencies, skills, and functions, including dental hygiene therapy, are now recognized in some states, which caused those states to have a higher composite score in 2014 than in 2001. For example, Montana's score increased from 41 to 89 after the state enacted a limited access permit that allowed dental hygienists to provide preventive services without the previous authorization or presence of a dentist in certain public health settings.[28] West Virginia's score increased by 60 points with the state's passage of dental hygiene public health permit legislation, which allowed dental hygienists with that permit to provide specific services under direct, general, or no dental supervision.[29] (For changes in states' scores, see Appendix Table 2.)[16]

Scope of practice for dental hygienists, as represented by the states' composite index scores, had a positive and significant association with having no teeth removed because of decay or

EXHIBIT 2

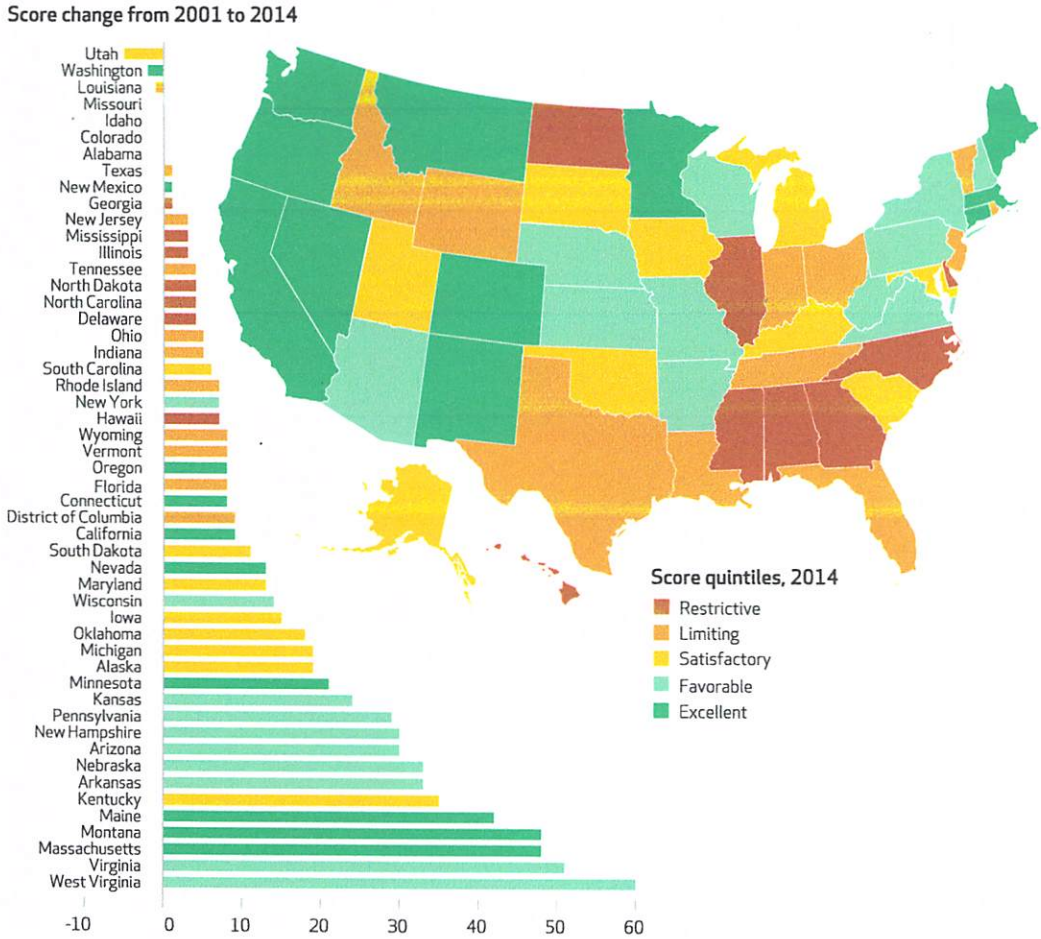
Dental Hygiene Professional Practice Index results for 2001 and 2014 and state-level control variables used in multilevel logistic modeling

	For all scores:			
Variables	**Minimum**	**Maximum**	**Mean**	**SD**
Composite score, 2001	10.0	97.0	43.5	20.4
Composite score, 2014	18.0	98.0	57.6	21.4
Regulation, 2001	4.0	10.0	7.4	1.4
Regulation, 2014	6.0	10.0	7.8	1.5
Supervision, 2001	2.0	47.0	19.1	10.4
Supervision, 2014	6.0	47.0	27.3	11.4
Tasks, 2001	0.0	26.0	14.8	6.4
Tasks, 2014	0.0	26.0	18.0	5.4
Reimbursement, 2001	0.0	15.0	2.2	5.2
Reimbursement, 2014	0.0	15.0	4.4	6.7
	For all states:			
Variables	**Minimum**	**Maximum**	**US rate**	**SD**
Dental hygienist rate,[a] 2000	12.6	77.0	39.4	13.7
Dental hygienist rate,[a] 2009–13	27.2	108.4	50.0	15.1
Dentist rate,[a] 2000	26.5	116.0	55.9	13.0
Dentist rate,[a] 2009–13	32.6	120.7	52.0	15.9
Population with fluoridated water,[b] 2000	2.0%	100.0%	65.8%	25.8%
Population with fluoridated water,[b] 2012	100.0%	99.9%	74.6%	24.4%
Per capita income, 2001	$22,815	$45,421	$30,319	$4,828
Per capita income, 2012	$33,073	$74,710[d]	$42,693	$7,605
Urban population, 2000	38.2%	100.0%	79.0%	15.3%
Urban population, 2010	38.7%	100.0%	80.8%	14.9%

SOURCE Authors' analysis of data from the following sources: (1) Health Resources and Services Administration. The professional practice environment of dental hygienists in the fifty states and the District of Columbia, 2001 (see Note 15 in text). (2) Langelier M, et al. A Dental Hygiene Professional Practice Index by state, 2014 (see Note 21 in text). (3) For rates of dentists and dental hygienists in 2001, the census of 2000; in 2012, the American Community Survey, 2009–13. (4) For population with fluoridated water, Centers for Disease Control and Prevention. (5) For urban population, censuses of 2000 and 2010. (6) For per capita income, US Department of Commerce, Bureau of Economic Analysis. **NOTES** "States" are the fifty states plus the District of Columbia. The four categories in the composite index score are explained in Exhibit 1. SD is standard deviation. [a]Numbers of professionals per 100,000 population. [b]People on public water systems receiving fluoridated water.

EXHIBIT 3

Quintiles of state scores on the Dental Hygiene Professional Practice Index in 2014



SOURCE Authors' analysis of data from the following sources: (1) Health Resources and Services Administration. The professional practice environment of dental hygienists in the fifty states and the District of Columbia, 2001 (see Note 15 in text). (2) Langelier M, et al. A Dental Hygiene Professional Practice Index by state, 2014 (see Note 21 in text). **NOTES** States' scores are based on categories selected by the authors to rank in the 2014 indexes. Quintile labels—restrictive (scores of 18–39), limiting (40–47), satisfactory (48–54), favorable (55–77), and excellent (78–98)—reflect the authors' appraisal of dental hygienists' ability to practice to the full extent of their competency in public health settings in a state. Four states' scores did not change from 2001 to 2014.

disease—a proxy for population oral health—although the association was stronger in 2001 than in 2014 (Exhibit 4). We found similar associations between the rates of dentists and dental hygienists per 100,000 population and our oral health outcome in 2001, but not in 2014. Marital status, education, employment, and income were uniformly significant in both years. Categories of race/ethnicity were largely not significant in 2001 but significant in 2014.

In addition to analyzing the associations of composite index scores on our oral health outcome, we also analyzed the impact of each of the four categories in the scope of practice. We found that regulation was significant in 2014 but not in 2001, while supervision by practice setting was significant in 2001 but not in 2014, when we held all relevant state- and individual-level factors constant (Appendix Table 5).[16] The tasks permitted category exhibited the strongest state-level association with the oral health outcome, but it was significant only in 2001. The reimbursement category was significant in both years.

To summarize, in 2001 four of the five multilevel logistic models (the composite score and scores in three of the four categories—supervision, task, and reimbursement) had positive significant associations with our oral health outcome. In 2014 three of the five (the composite score and scores in two categories—regulation

EXHIBIT 4

Effect of variables related to dental hygienists' scope of practice on the likelihood of having no teeth removed because of decay or disease, 2001 and 2014

Variable	Odds ratio	
	2001	2014
STATE LEVEL		
Intercept	0.921216**	0.921065**
Composite score on Dental Hygiene Professional Practice Index	1.005161****	1.002744**
Dental hygienist rate[a]	1.004925***	1.003614*
Dentist rate[a]	1.003856**	1.003154
Population with fluoridated water[b]	1.002542**	1.001726*
Per capita income	0.999978***	0.999988**
Urban population	1.004195*	1.004863**
INDIVIDUAL LEVEL		
Age	0.939298****	0.947811****
Female (ref: male)	1.074283****	0.938606****
Marital status (ref: unmarried)	0.951859***	0.931333***
Education (ref: less than a bachelor's degree)	2.167903****	2.122161****
Employed (ref: unemployed)	0.917515****	1.133762****
Annual income (ref: <$50,000)	1.804209****	1.669391****
Last dental visit (ref: none in past 12 months)	1.140513****	1.175174****
Race/ethnicity (ref: non-Hispanic white)		
Non-Hispanic black	1.017108	0.540519****
Non-Hispanic Asian or Pacific Islander	0.959888	0.711551****
Non-Hispanic American Indian or Alaskan native	1.195283**	0.642701****
Non-Hispanic other or 2 or more races	0.980379	0.797761****
Hispanic	0.923882*	0.804444****

SOURCE Authors' analyses of data for 2002 and 2012 from the Behavioral Risk Factor Surveillance System survey and data from the following sources: (1) Health Resources and Services Administration. The professional practice environment of dental hygienists in the fifty states and the District of Columbia, 2001 (see Note 15 in text). (2) Langelier M, et al. A Dental Hygiene Professional Practice Index by state, 2014 (see Note 21 in text). **NOTES** Each odds ratio for the categorical or discrete variables indicates the likelihood of having no teeth removed because of decay or disease, compared to the reference group. For example, for females, an odds ratio greater than 1 would indicate that females are more likely than males to have no teeth removed because of decay or disease, while an odds ratio less than 1 would indicate that females are less likely than males to have no teeth removed. Odds ratios for the continuous variables indicate that a change in the outcome variable is associated with a unit change in the predictor variable. For example, in 2001 and 2014 an increase of one year in age reduced the odds of having no teeth removed because of decay or disease. Additional information about the odds ratios is included in the Appendix (see Note 16 in text). For explanations of state-level variables, see the Notes to Exhibit 2. [a]Numbers of professionals per 100,000 population. [b]People on public water systems receiving fluoridated water. *$p < 0.10$ **$p < 0.05$ ***$p < 0.01$ ****$p < 0.001$

and reimbursement) had positive significant associations. It is possible that the overall increase in scores over time reduced variation among states and, therefore, reduced the likelihood of finding significant differences in 2014.

Discussion

As noted above, our study was limited by the lack of direct measurement data on oral health interventions by dental hygienists. Although earlier BRFSS survey data included answers to a question about the use of dental hygienists, the question was subsequently eliminated, which made later data less useful than earlier data. The paucity of national data related to the delivery and use of oral health services and the general lack of current good data about the oral health status of the population affects researchers' ability to understand the impact of particular workforce policies or interventions on oral health outcomes.

Strategically locating dental hygienists in community health centers that serve high-need populations, schools, group living facilities for elderly people, and social and health care programs that target underserved populations may increase access to and use of oral health services for those who now have limited access. Enabling hygienists to provide services within their professional competencies under reasonable supervision requirements may yield improvements over time in the oral health status of the populations served.

Dental hygienists' competencies and scopes of practice have evolved since 2001. Our 2014 analysis found that several states had progressed to the "ideal" practice environment envisioned when the scoring instrument was originally constructed. New workforce models for dental hygienists are available in some states, and new

technologies—including laser therapy for periodontal disease, glass ionomer cements, and silver diamine fluoride—offer improved interventions in the oral disease process. In some states, dental hygienists now provide interim therapeutic restorations and local anesthesia for gum therapy without direct supervision or the physical presence of a dentist. The evolution of dental hygienists' practice suggests a need to change the component variables in the original index to more accurately reflect current scopes of practice and to allow for more precise future evaluations of the impact of scopes of practice on outcomes.

Conclusion

The Dental Hygiene Professional Practice Index is an important tool for use in comparative analyses of dental hygienists' scopes of practice across states and over time, and for evaluating the impact of scopes of practice on population oral health outcomes. Demonstrating that broader scopes of practice, especially in public health settings, are correlated with better oral health outcomes is useful. It is important for policy makers to consider the impact of scope of practice when investigating strategies to increase the availability of preventive oral health services, especially for underserved populations.

Oral health is a broad concept that goes beyond healthy teeth. Improving oral health requires a multipronged strategy that includes the effective use of available resources. The challenge of achieving improved population oral health will require the full engagement of all oral health care professionals. ■

This article is based on part of the analysis from a comprehensive 2014 technical report to the National Center for Health Workforce Analysis at the Health Resources and Services Administration (HRSA) on dental hygienists' scope of practice (see Note 21 in text). The scope-of-practice research was supported by HRSA (Grant No. U81HP27843, a Cooperative Agreement for a Regional Center for Health Workforce Studies, between HRSA and the Center for Health Workforce Studies). The content and conclusions in this article are those of the authors and should not be construed as the official position or policy of, nor should any endorsements be inferred by, HRSA, the Department of Health and Human Services, or the US government.

NOTES

1 Slavkin HC. Revising the scope of practice for oral health professionals: enter genomics. J Am Dent Assoc. 2014;145(3):228–30.

2 Institute of Medicine. Advancing oral health in America. Washington (DC): National Academies Press; 2011.

3 Institute of Medicine. Improving access to oral health care for vulnerable and underserved populations. Washington (DC): National Academies Press; 2011.

4 Department of Health and Human Services. Oral health strategic framework 2014–2017 [Internet]. Washington (DC): HHS; [cited 2016 Oct 12]. Available from: http://www.hrsa.gov/publichealth/clinical/oralhealth/oralhealthframework.pdf

5 Hurlbutt M, Young DA. A best practices approach to caries management. J Evid Based Dent Pract. 2014;14(Suppl):77–86.

6 Mertz E, Mouradian WE. Addressing children's oral health in the new millennium: trends in the dental workforce. Acad Pediatr. 2009;9(6):433–9.

7 Lee HH, Lewis CW, Saltzman B, Starks H. Visiting the emergency department for dental problems: trends in utilization, 2001 to 2008. Am J Public Health. 2012;102(11):e77–83.

8 National Council of State Boards of Nursing. Changes in healthcare professions' scope of practice: legislative considerations [Internet]. Chicago (IL): NCSBN; [revised 2009 Oct; cited 2016 Oct 12]. Available from: https://www.ncsbn.org/ScopeofPractice_09.pdf

9 Institute of Medicine. The future of nursing: leading change, advancing health. Washington (DC): National Academies Press; 2011.

10 Dower C, Moore J, Langelier M. It is time to restructure health professions scope-of-practice regulations to remove barriers to care. Health Aff (Millwood). 2013;32(11):1971–6.

11 Levy D. Maryland Public Health Dental Hygiene Act: impact study [Internet]. Baltimore (MD): Maryland Department of Health and Mental Hygiene, Office of Oral Health; 2013 [cited 2016 Oct 12]. Available from: http://phpa.dhmh.maryland.gov/oralhealth/Documents/EvaluationReport.pdf

12 Westat. Impact of state scope of practice laws and other factors on the practice and supply of primary care nurse practitioners: final report [Internet]. Rockville (MD): Westat; 2015 Nov 16 [cited 2016 Oct 12]. (Prepared for Office of the Assistant Secretary for Planning and Evaluation, Department of Health and Human Services). Available from: https://aspe.hhs.gov/sites/default/files/pdf/167396/NP_SOP.pdf

13 Muench U, Coffman J, Spetz J. Does independent scope of practice affect prescribing outcomes, healthcare costs, and utilization? [Internet]. Washington (DC): Health Care Cost Institute; [cited 2016 Oct 12]. (Issue Brief). Available from: http://www.healthcostinstitute.org/files/HCCI-Issue-Brief-Independent-Prescribing-Outcomes.pdf

14 Martsolf GR, Auerbach DI, Arifkhanova A. The impact of full practice authority for nurse practitioners and other advanced practice registered nurses in Ohio [Internet]. Santa Monica (CA): RAND Corporation; 2015 [cited 2016 Oct 12]. Available from: http://www.rand.org/pubs/research_reports/RR848.html

15 Health Resources and Services Administration. The professional practice environment of dental hygienists in the fifty states and the District of Columbia, 2001 [Internet]. Rockville (MD): HRSA; 2004 Apr [cited 2016 Oct 12]. Available from: http://bhpr.hrsa.gov/healthworkforce/reports/dentalhygiene50statesdc.pdf

16 To access the Appendix, click on the Appendix link in the box to the right of the article online.

17 Wing P, Langelier MH, Continelli TA, Battrell A. A Dental Hygiene Professional Practice Index (DHPPI) and access to oral health status and service use in the United States. J Dent Hyg. 2005;79(2):1–10.

18 Wanchek T. Dental hygiene regulation and access to oral healthcare: