

Dental Hygiene Scope of Practice: Developing a Measurement Tool, Finding Associations With Oral Health Outcomes, and Informing Policy Change

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May 29, 2021

Scope of Practice and Medical Licensure Virtual Conference



The Oral Health Workforce Research Center (OHWRC) at CHWS

- The [Center for Health Workforce Studies \(CHWS\)](#) has more than 20 years' experience studying all aspects of the health workforce
 - Established in 1996, based at the University at Albany School of Public Health
 - Committed to collecting and analyzing data to understand workforce dynamics and trends
 - Goal to inform public policies, the health and education sectors, and the public
 - Broad array of funders in support of health workforce research
- [Oral Health Workforce Research Center \(OHWRC\)](#) is based at CHWS and is funded under a cooperative agreement with the US Health Resources and Services Administration (HRSA) in the US Department of Health and Human Services
 - Partnership with the [Healthforce Center at University of California San Francisco](#)
 - In the 7th year of 8-year agreement
 - Diverse topics for research including the education and training pipeline, workforce and system innovation, and patients and consumers
 - Reports and resources available at oralhealthworkforce.com

The Dental Hygiene Professional Practice Indices

- DH scope of practice (SOP) varies considerably
 - Permitted tasks and required supervision differ by state and these differences impact service delivery
- Dental Hygiene Professional Practice Index (DHPPI):
 - Funding provided by HRSA in 2001 to create a numerical index
 - Assembled an advisory board of national experts
 - Conducted focus groups and interviews with over 100 dental hygienists
 - Exhaustive examination of statute and regulation in each state
 - Intended to capture legal scope of practice not actual practice
- The scoring instrument contained 69 variables grouped under 1 of 4 categories:
 - Regulation, supervision, tasks, and reimbursement
- Numerical scoring based on potential impact on practice in public health settings
- Each variable was given a score based on its impact on practice in public health
 - Maximum possible score of 100, minimum score of 0
- This instrument was used to score SOP in 2001 and 2014

The 2001 and 2014 DHPPI

- **Descriptive analysis**

2001 scores: 10 in West Virginia, 97 in Colorado
2014 scores: 18 in Alabama, Mississippi, 98 in Maine
Mean score on the DHPPI 43.5 (2001) ↑ 57.6 (2014)

- **Statistical analysis**

In 2001, SOP was positively but not significantly associated with the percent of the population in a state having their teeth cleaned by a dentist or dental hygienist in the past year

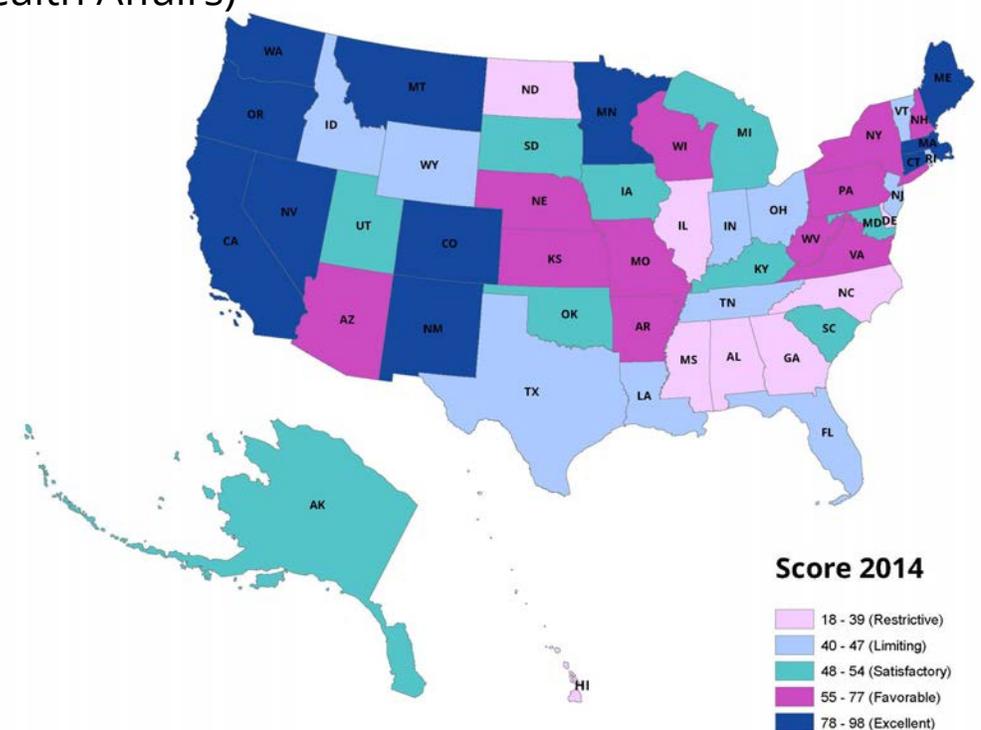
- **Factor Analysis**

In 2014, exploratory and confirmatory factor analysis confirmed that the component structures were all aspects of the overarching concept (in this case SOP)

- **Research question in 2014: Is SOP associated with population oral health outcomes?**

Used multilevel logistic modeling with the DHPPI an BRFSS data controlling for state and individual level factors including community water fluoridation, demographic and socioeconomic factors

- **Finding:** More expansive SOP for DHs in states was positively and significantly associated ($p < 0.05$) with having no teeth removed due to decay or disease among individuals in those states (published in December 2016, Health Affairs)

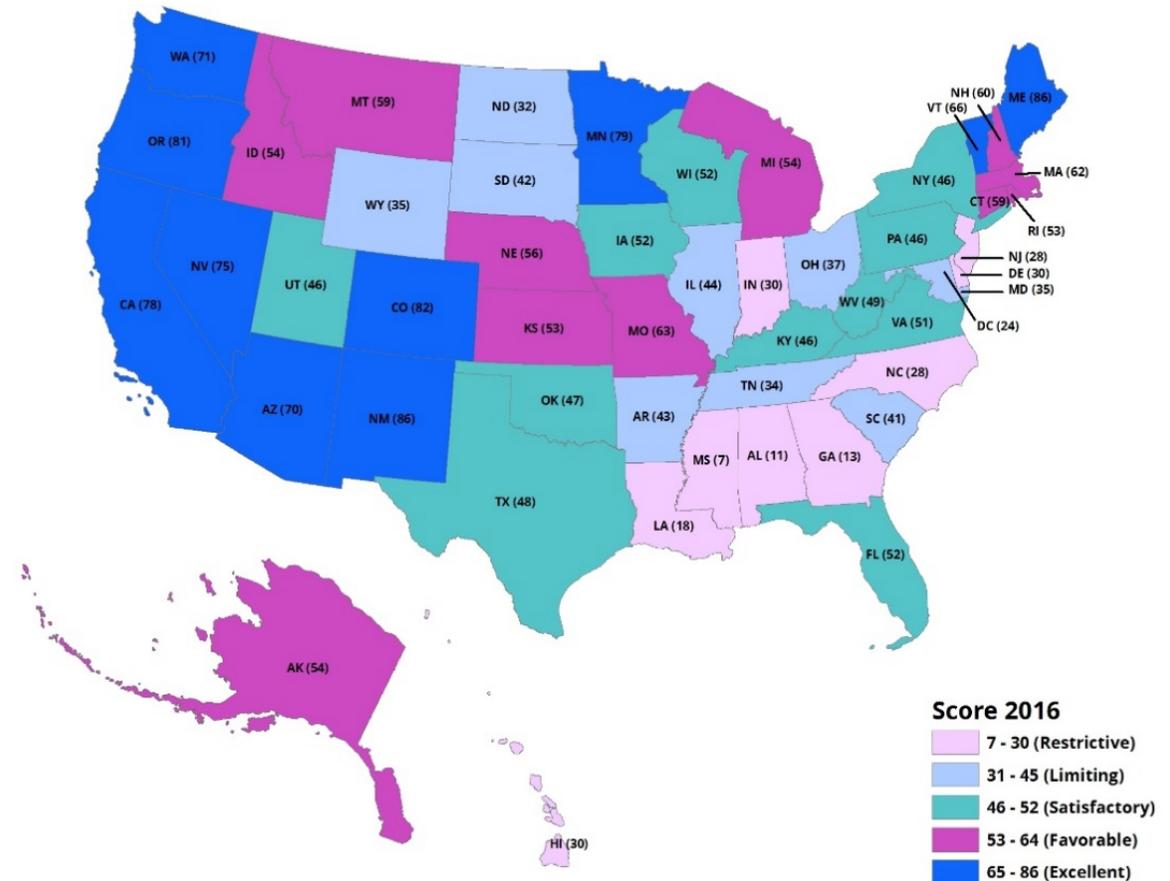


Process for Developing the New DHPPI Instrument

- Finding From 2014 Update: Variables in 2001 DHPPI no longer adequately represented SOP
 - Established avenues in many states to expanded permissions and reduced supervision in public health settings
- Dental hygienists increasingly seen as experts in prevention education and services
 - More autonomous roles
 - Team-based care
 - New technologies
 - New settings for care delivery
 - Point of entry - case finding
 - Roles as case managers/patient navigators
- The original instrument did not account for advances in materials and technology that occurred in dentistry (eg, lasers, glass ionomer sealants, etc.)
- Design process for the new DHPPI included focus groups with dental hygienists at the ADHA annual leadership symposium
 - 37 dental hygienists from 29 states

The 2016 DHPPI

- Examined statute and regulation in every state to build the new instrument
 - Some variables were retained or modified
 - New variables (dental hygiene therapy, basic restorative tasks)
 - Number of variables was reduced to 45
 - Scoring weights were redistributed
 - Variable scores from 0-4
 - Total possible score remained 100
- Factor analysis again confirmed the integrity of the construct
- As expected, scores were lower on the new index
 - Range of scores was 7 in Mississippi to 86 in Maine



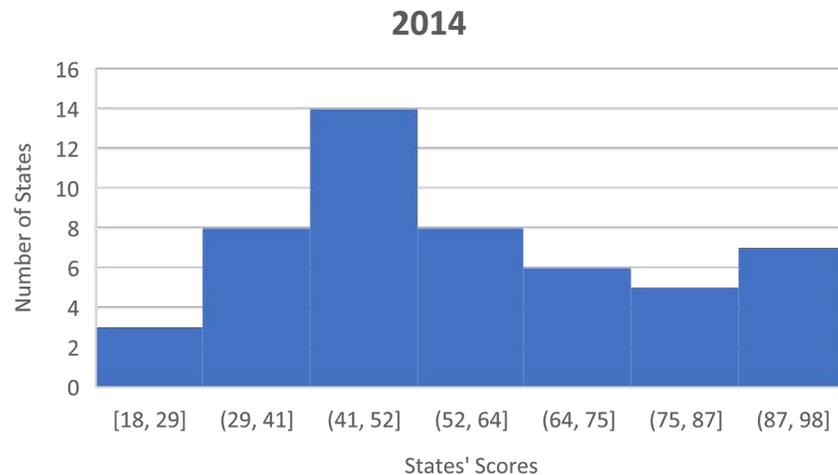
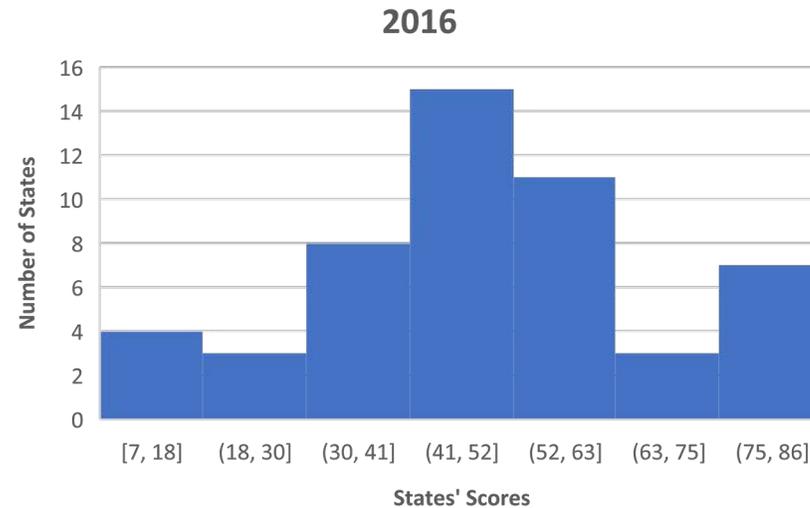
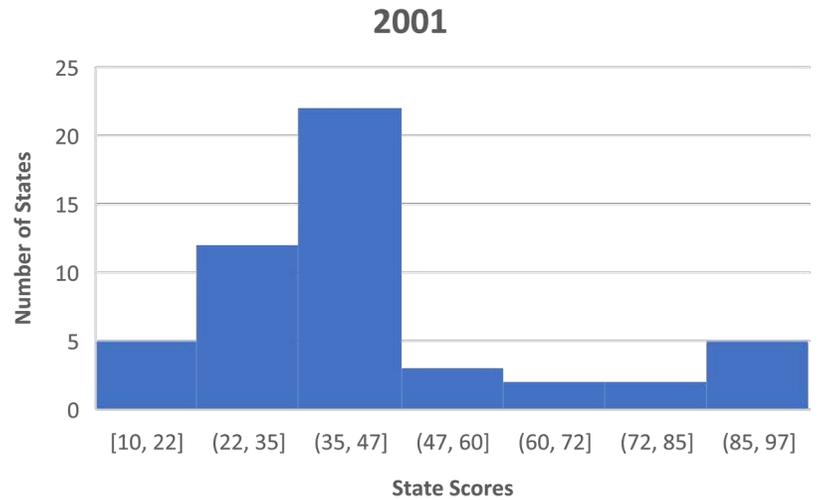
Mean Scores Varied by Year

Mean Scores 2001, 2014, 2016

Range of State Scores	2016	2014	2001
Highest Possible Score	100	100	100
Lowest Score	7	10	18
Highest Score	86	98	97
DHPPI Category	2016 Mean Scores	2014 Mean Scores	2001 Mean Scores
Regulation	5 (22 pts)	7.8 (10 pts)	7.4 (10 pts)
Supervision	23.9 (30 pts)	27.3 (47 pts)	19.1 (47 pts)
Tasks	16.5 (36 pts)	18 (28 pts)	14.8 (28 pts)
Reimbursement	3.6 (12 pts)	4.4 (15 pts)	2.2 (15 pts)
Composite State Score	48.9	57.6	43.5

- The mean score on regulation was lower comparatively in 2016 than in previous years due mainly to an expanded category and limited permissions in states for advanced or extended functions for DHs.
- The high mean score relative to the possible score for supervision in 2016 suggests that many states now allow for lower levels of supervision for DHs.
- The relatively low mean score on tasks in 2016 was probably related to the inclusion of permissible restorative tasks, prescriptive authority, and lasers that are not widely allowed in states. The index was built to assess practice going forward so inclusion of these variables was important.
- The variables in the reimbursement category were consistent across instruments but the value allocated to the category dropped in 2016 which likely affected the overall mean for all states.

Changing Scope of Practice for Dental Hygienists in 2001, 2014, and 2016



- High-scoring states in 2014 were also high-scoring on the new index (eg, ME, CO, CA, WA, NM were each classified as excellent environments at each scoring)
- Some states were innovators in expanding practice opportunities for dental hygienists (eg, MN with advanced dental therapy, VT recently enabled dental therapy; the model requires professionals to also be dental hygienists)
- Other states used a slower, more incremental approach to increasing scope of practice (eg, IA classified as satisfactory at each scoring)
- Some low-scoring states were consistently low-scoring (eg, GA, MS, NC classified as restrictive at each scoring)

An Analysis of the 2016 SOP on Oral Health Outcomes in the Population

- Research question: Does the state level scope of practice for dental hygienists impact the oral health of adults in those states, controlling for all other relevant factors?
- Methods:
 - Exploratory and Confirmatory Factor Analysis
 - Least Squares Regression using Hierarchical Linear Modeling
- Data
 - Dental Hygiene Professional Practice Index, 2016
 - Oral Health Surveillance Data - BRFSS
 - Individual level data on having no teeth removed due to decay or disease
 - Individual level data on last dental visit
 - State level data from a variety of sources

Exploratory Factor Analysis Results

- Exploratory factor analysis was first conducted to explore the patterns found within the 4 dimensions (regulatory and legal environment, supervision, tasks permitted, and reimbursement)
- Best EFA methods were used following Costello and Osborne (2005) of maximum likelihood and oblique rotation methods
- Results clearly indicated a statistically valid, one factor model with 4 distinct dimensions

Exploratory Factor Analysis	2016 Indices
Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy	0.769
Bartlett's Test of Sphericity	82.378
P-value for Bartlett's	0.000
Initial eigenvalue and associated percent of explained variance	2.707 / 68%
Number of factors found	1.000

Confirmatory Factor Analysis Results

- Factor analysis tests whether or not the separate dimensions measure an overarching concept; Do the regulatory environment, supervision, tasks, and reimbursement all measure scope of practice?
- The results of both exploratory and confirmatory factor analysis robustly confirm that the DHPPI is a single, overarching construct with 4 distinct dimensions
- Therefore, the null hypothesis is accepted and the proposed model is statistically validated. The 4 components summate to create a single professional practice index for each state in 2016

<i>Results From the Confirmatory Factor Analysis of the 2016 DHPPI</i>					
Variable	Standardized Estimate	Confirmatory Factor Analysis 2016			
		Unstandardized Estimate	Standard Error	C.R.	
Regulations	0.697	2.80	0.520	5.372	**
Supervision	0.748	5.184	0.882	5.877	**
Tasks	0.939	6.608	0.822	8.029	**
Reimbursement	0.63	3.208	0.676	4.735	**

<i>Confirmatory Factor Analysis Fit Indices 2016 DHPPI</i>	
Fit Indices	2016 Default Model
NFI	0.986
RFI	0.959
CFI	1.000
GFI	0.988
RMSEA	0.000
PCLOSE	0.598
CHI-SQUARE	1.164
P VALUE	0.559

Data: State Level

State-level variables

- Number of dentists per 100,000 population (5 year American Community Survey by state of employment)
- Number of dental hygienists per 100,000 population (5 year American Community Survey by state of employment)
- Percent of State population with access to fluoridated water (Centers for Disease Control)
- Per Capita Income (US Department of Commerce/Bureau of Economic Analysis)
- Percent of the population living in an urban area (US Census)
- Dental Hygiene Professional Practice Index 2016

Data: Individual Level

Individual-level variables (Source: BRFSS 2014):

- Race/Ethnicity (White NH & Asian NH vs All Others)
- Age (Age 45 and up vs Younger)
- Gender (Male vs Female)
- Income (\$50,000 or higher vs Less than \$50,000)
- Education (Bachelor's degree or higher vs Less than Bachelor's)
- Marital status (Married/co-habiting vs Not married/co-habiting)
- Last visit to a dentist or dental clinic (Last visit less than 12 months ago vs Further back in time)
- Number of permanent teeth removed due to decay or disease (No teeth removed due to decay or disease coded 1, vs Some teeth removed due to decay or disease coded 0) (binary dependent variable)
- First category in parentheses coded 1, second category in parenthesis coded 0

State and Individual Level Variables Included in the Equations

DESCRIPTIVE STATISTICS				
STATE LEVEL VARIABLES	Mean	Standard Deviation	Minimum	Maximum
Number of Dental Hygienists per 100,000 Population (Dental Hygienist Rate)	56	15	27	108
Number of Dentists per 100,000 Population (Dentist Rate)	53	16	33	121
Per Capita Income	\$42,492	\$7,605	\$33,073	\$74,710
Percent Urban	74	15	39	100
Percent on Fluoridated Public Water Supply	71	24	10	100
Scope of Practice Index 2016	49	19	7	86
INDIVIDUAL LEVEL VARIABLES (BRFSS)	Valid Percent			
No teeth removed due to decay or disease	58%			
Some (but not all) teeth removed due to decay or disease	42%			
Last dental visit to dentist or dental hygienist in the past year	66%			
Married or cohabitating	55%			
Not married or cohabitating	45%			
Bachelors degree or higher	26%			
Less than a Bachelor's degree	74%			
Income \$50,000 a year or higher	45%			
Income less than \$50,000 a year	55%			
Male	49%			
Female	51%			
White non-Hispanic or Asian/PI non-Hispanic	69%			
Black non-Hispanic, Native American non-Hispanic, Hispanic, Two or more Races, Other	31%			
Age 45 or higher	53%			
Age less than 45	47%			
Weighted Total	248,482,532			

The Results of the Multi Level Logistic Modeling

- SOP is the only state-level variable that exerts a positive and significant impact on adult oral health
- A 1-point increase on the SOP Index results in a .35% odds increase in adults with no teeth removed due to decay or disease, controlling for both state-level and individual-level factors
- Further preliminary analyses confirms as state level SOP increases, the positive and significant relationship between “last dental visit” and “no teeth removed” increases

MULTILEVEL MODELING			
State Level	Odds Ratio	T value	P. value
Intercept	1.115242	4.088	<0.001
Dental Hygienist Rate	1.000273	0.153	0.879
Dentist Rate	1.002494	0.873	0.388
Per Capita Income	0.999992	-1.367	0.178
Percent Urban	1.003469	1.202	0.236
Percent on Fluoridated Public Water Supply	1.001361	1.75	0.087
Scope of Practice Index 2016	1.003473	2.995	0.004
Individual Level (BRFSS)			
Last dental visit to dentist or dental hygienist (Within the past year=1)	1.131877	5.174	<0.001
Marital Status (Married or cohabiting=1)	0.881137	-6.47	<0.001
Education (Bachelors degree or higher=1)	1.84848	22.067	<0.001
Income (\$50,000 a year or higher=1)	1.913004	21.824	<0.001
Gender (Male=1)	0.939835	-5.979	<0.001
Race/Ethnicity (White NH or Asian/PI NH=1)	1.3402	9.247	<0.001
Age (Age 45 or higher=1)	0.236769	-108.074	<0.001

Rationale for Developing a Dental Hygiene SOP Infographic

- Research finds that broader SOPs for DHs are associated with better oral health outcomes in a state
- There is substantial variation in DH SOP across states, but no tools to help policy makers understand these differences
- Needed a succinct tool to convey variation to stakeholders and policymakers
- Researchers at the OHWRC decided to develop an infographic to highlight state-to-state variation in dental hygiene scope of practice

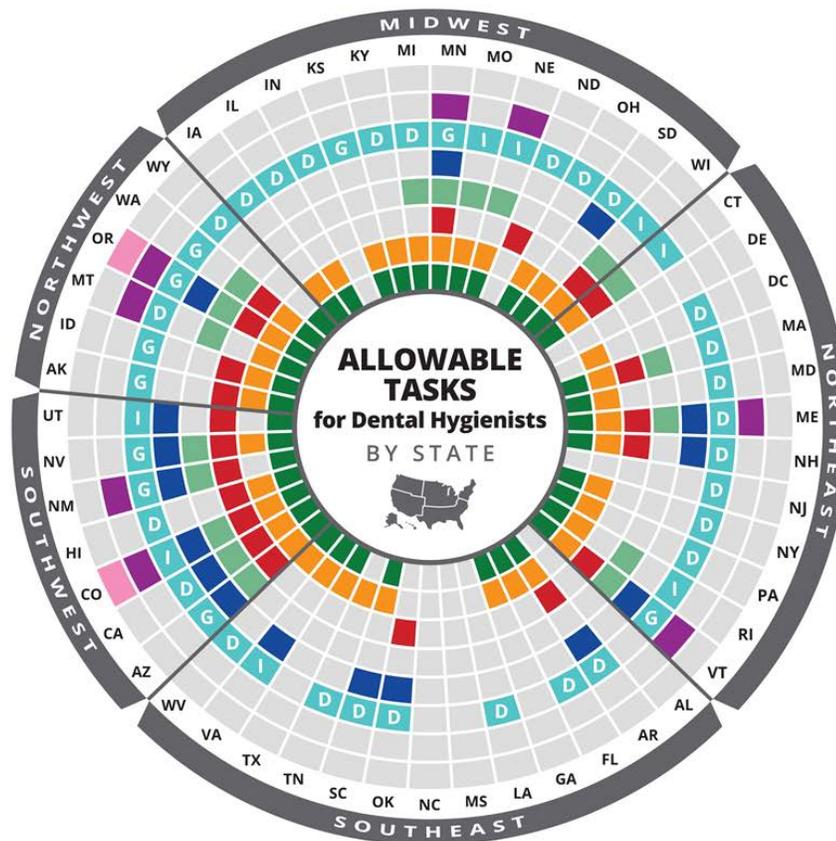
Process for Developing Infographic

- OHWRC in collaboration with ADHA conducted a series of **focus groups** with dental hygiene leaders from across the country to identify key DH functions and tasks to include in the infographic
- Determined a **limited number of key variables** to be displayed on the graphic
- Reviewed statutes and regulation in each state to accurately capture current legal conditions for practice
 - Infographic **updated in 2018 and 2019**
- Developed additional infographics on specific tasks and roles
 - Application of Silver Diamine Fluoride by DHs
 - Enabling Legislation for Dental Therapy

DH Tasks and Functions Included in the Infographic

- Dental hygiene diagnosis
- Prescriptive authority
- Level of supervision for administering local anesthesia
- Supervision of dental assistants
- Direct Medicaid reimbursement
- Dental hygiene treatment planning
- Provision of sealants without prior examination
- Direct access to prophylaxis from a dental hygienist

Variation in Dental Hygiene Scope of Practice by State



The purpose of this graphic is to help planners, policymakers, and others understand differences in legal scope of practice across states, particularly in public health settings.

Research has shown that a broader scope of practice for dental hygienists is positively and significantly associated with improved oral health outcomes in a state's population.^{1,2}

- Dental Hygiene Diagnosis
- Prescriptive Authority
- Local Anesthesia
 - D Direct
 - I Indirect
 - G General
- Supervision of Dental Assistants
- Direct Medicaid Reimbursement
- Dental Hygiene Treatment Planning
- Provision of Sealants
- Direct Access to Prophylaxis
- Not Allowed / No Law

Sources: 1. Langelier M, Baker B, Continelli T. *Development of a New Dental Hygiene Professional Practice Index by State*. 2016. Rensselaer, NY: Oral Health Workforce Research Center, Center for Health Workforce Studies, School of Public Health, SUNY Albany; November 2016. 2. Langelier M, Continelli T, Moore J, Baker B, Surdu S. Expanded Scopes of Practice for Dental Hygienists Associated With Improved Oral Health Outcomes for Adults. *Health Affairs*. 2016;35(12):2207-2215. http://www.oralhealthworkforce.org/wp-content/uploads/2017/03/OHWRC_Dental_Hygiene_Scope_of_Practice_2016.pdf

This work was supported by the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services (HHS), under the Health Workforce Research Center Cooperative Agreement Program (U81HP27843). The content and conclusions presented herein 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, HHS or the U.S. Government.

This graphic describes the highest level of practice available to a dental hygienist in a state, including dental hygiene therapy. The graphic is for informational purposes only and scope of practice is subject to change. Contact the applicable dental board or your attorney for specific legal advice.



Last Updated January 2019.

Closing Thoughts

- SOP is key to designing workforce strategies that increase access to preventive oral health services
- There may be a tipping point at which scope of practice expansion makes a significant difference relative to the oral health of the overall population
- Subjecting SOP indices to rigorous statistical tests such as factor analyses confer a much higher degree of validity to such constructs, resulting in a more accurate instrument with reduced error
- While sample size is necessarily limited in state level unit analyses (N=51), the use of multilevel modeling techniques allows for considerable expansion by overlaying them with much larger, individual level datasets that are representative of the population at both the state and national levels (eg, BRFSS, National Survey of Children's Health)
 - Multilevel modeling provides the ability to obtain the contextual impact of state level SOP on individual level oral health outcomes
 - Multilevel modeling incorporates interaction effects across some variables, which can allow the detection of specific_predictor/outcome relationships that are influenced by state level SOP
- Currently analyzing data to determine the impact of scope of practice on access to oral health services and on oral health outcomes for children, particularly economically disadvantaged children

Acknowledgements

- Other authors include Simona Surdu, Paul Wing, and Bridget Baker
- 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 \$449,943 with 0% financed with nongovernmental sources. The content of this presentation 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).

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