Leveraging Data to Monitor the Allied Health Workforce: State Supply Estimates

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KEY FINDINGS

This study compared state-level estimates of the supply of nine types of allied health care workers from two publicly available national data sources, the American Community Survey (ACS) and the Occupational Employment and Wage Statistics (OEWS) for 2014 and 2017, and state license records for five occupations from 12 states in 2016-2017. The nine occupations were occupational therapists, physical therapists, respiratory therapists, dental hygienists, social workers, speech-language pathologists, clinical laboratory technologists and technicians, diagnostic-related technologists and technicians, and medical assistants. License data were obtained for the first five occupations on this list from Arizona, Idaho, Iowa, Kentucky, Maine, Minnesota, Nevada, Ohio, Oregon, Texas, Vermont, and Virginia. Following are key study findings:

■ National workforce supply estimates from the ACS and OEWS for some occupations were generally comparable between 2014 and 2017. For example, the per 100,000 US population supply estimates of clinical laboratory technicians and technologists and respiratory therapists stayed within a comparable range between 2014 and 2017 using ACS and OEWS data.

■ The national supply estimates for some occupations, however, had inconsistent changes between 2014 and 2017, depending on the data source. Using ACS data, medical assistant supply stayed about the same, from 161 to 160 per 100,000 population, compared

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with an increase from 189 to 198 per 100,000 population using OEWS data. The estimated supply of social workers per 100,000 population was similar between 2014 and 2017 using OEWS data, while increasing from 256 to 271 per 100,000 population using ACS data.

- State-level supply estimates for occupations varied by occupation and across data sources within states. Estimates of the supply of clinical lab technicians and technologists were consistently higher from ACS compared to OEWS, for example, while occupational therapists supply estimates were higher using ACS compared to OEWS in some states but not in others.

- Supply estimates from licensure data were generally higher than estimates from ACS or OEWS with a few exceptions. In small states such as Vermont, we saw higher numbers of dental hygienists per 100,000 population from ACS data compared to licensure data. For social workers of all education levels, estimates from licensure data were generally lower than estimates from ACS and OEWS. Among social workers with a master's degree or higher, the supply estimates from licensure data were consistently higher than in ACS.

- When changes in supply estimates over time were examined, not only were the magnitude of change variable, but the direction of change also varied for several occupations, both at national and state levels, with no consistent pattern for any occupation, state, or data source.

- These differences in allied health workforce supply estimates from national surveys result from samples drawn from different populations, different sampling frames and sample sizes, and the times/frequency the data were conducted, which all affect their usefulness for estimating workforce supply at different geographic levels.

- Supply estimates from licensure data may overstate the available workforce in a state if they do not include information about work status and location.

Health workforce planners should understand the strengths and weaknesses of data used to estimate allied health workforce supply in order to assess how best to apply the estimates when assessing the adequacy of a state's workforce to meet the needs of its industry and population.

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INTRODUCTION

Health workforce planning requires data about health care occupations at the national, regional, state, and local levels. Data should inform estimation of the available supply of health care workers (including number and distribution), industry's demand for the workforce, and the population's need for health care services. Supply data are typically the most readily available workforce-related data and may be obtained from a variety of sources, including from state credentialing bodies, from professional membership organizations, from national surveys, and from business tracking data sources. While supply data on frequently-studied occupations such as physicians, registered nurses, and advanced practice nurses are commonly available at the national and state levels,[1-6] comparable data on other occupations in the workforce (which we collectively refer to as allied health occupations) are less often published or available due to the wide variation in the size and roles of this workforce.

Our previous report examined the availability of national-level supply data for allied health occupations that could be leveraged for health workforce planning.[7] The purpose of this report is to identify and compare sources at the state level, and how it varies compared to national estimates, over time for a select set of nine allied health occupations (or occupation groups) in order to 1) demonstrate the variety of available data sources to estimate the supply of these occupations, and 2) compare state-level estimates of supply and demographic characteristics obtained from different data sources. This information is intended to not only provide state-level supply findings, but also to illustrate how estimates of health workforce supply vary depending on the data source being used.

DATA AND METHODS

We obtained national- and state-level data on nine occupations or occupation groups (hereafter referred to as occupations): occupational therapists, physical therapists, respiratory therapists, speech-language pathologists, clinical laboratory technologists and technicians, dental hygienists, diagnostic-related technologists and technicians, medical assistants, and social workers from the American Community Survey and the Occupational Employment and Wage Statistics for 2014 and 2017. The occupations were selected to be illustrative of the range of allied health occupations, including five (occupational therapists, physical therapists, respiratory therapists, dental hygienists, and social workers) that were known to be licensed in each state. For the five licensed allied health occupations, we obtained data from license records directly from 12 states that reflect a range of geographies: Arizona, Idaho, Iowa, Kentucky, Maine, Minnesota, Nevada, Ohio, Oregon, Texas, Vermont, and Virginia. All state licensing data were received between September 2016 and May 2017.

Data Sources

We obtained health workforce supply data from two federal sources and state licensing records, as well as national population data, as described below.

American Community Survey (ACS): The ACS is a nationally representative annual survey conducted by the U.S. Census Bureau that contains data on jobs and employment, industry, educational attainment, race and ethnicity, and geographic data, among other topics.[8] ACS data are publicly available and can be downloaded from the Internet without cost.

We extracted ACS data from the Public Use Microdata Sample (PUMS) files provided by IPUMS.[9] ACS data are available as single year samples as well as in pooled five-year samples going back as far as 2005.[10] The multi-year pooled estimates of the ACS provide more geographic detail than the single-year estimates from the ACS. Although the single-year data sets are statistically less reliable due to smaller sample sizes compared to the five-year pooled samples, especially for smaller geographic areas, we used the single year data (for 2014 and 2017) to provide comparability of estimates across other data sources.

For this study, we restricted our extraction of the ACS sample data to the civilian population eighteen years and older, employed, non-institutionalized, and living in the 50 states and the District of Columbia. Pre-defined person-level replicate weights were applied to make the data representative at the national and state levels. In the ACS, each PUMS housing unit and person record contains 80 PUMS replicate weights.

Occupational Employment and Wage Statistics (OEWS): The Bureau of Labor Statistics' (BLS) OEWS program (formerly known as the Occupational Employment Statistics program) collects employment and earnings data from multiple, non-farm industries (employing 800 occupations) across the U.S.[11] The OEWS does not collect demographic data such as age, race, or education about employees. OEWS data on occupations are consistently available from 1997 forward on an annual basis. For this analysis, we used data from May 2014 and May 2017, which is publicly available and can be directly downloaded at no cost from the BLS website.

OEWS has a complex panel survey methodology that relies on six semi-annual panels of data, each with 200,000 non-farm businesses, resulting in a combined sample of 1.2 million businesses. Sampling weights are applied by BLS such that each panel represents the universe of establishments. OEWS uses three-year estimates to smooth employment and wage data and makes the assumption that employment and earning patterns change slowly; any sudden changes in labor market only show up gradually in the OEWS estimates.

For our analyses, we extracted employment information from the occupational profile Excel sheets provided at the national level as well as for each of the 12 states. Occupations are coded based on the Standard Occupational Classification (SOC) system.[12] No additional restrictions by demographics could be performed given that data are aggregated at the state and national levels. Although occupations are reported by the North American Industry Classification System (NAICS) at the national level, we did not restrict our data based on industry since data are not reported by industry at the state level.

State professional licensure data: When a professional license is required for health care workers, the licensing process is conducted at the state level. Many state licensing entities have mailing lists available, which are designed for marketers or researchers interested in surveying health care workers. These lists contain limited information about each licensee, such as license status, license expiration date and mailing address. Generally, state license records are updated as individuals renew their license and reflect the current state as of the date that the data are extracted. Archived, or longitudinal, data are less often available.

We obtained health professions licensure data for five occupations from license records directly from 12 states between September 2016 and May 2017. In a few cases, we were able to obtain some demographic information, such as sex and age, and other variables commonly used in health workforce research, such as practice location, work status and educational attainment.

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We found that about half of the time, the occupations and states studied had data available for download from a public-facing website. In many cases, the website was managed by the licensing board responsible for regulating an individual occupation in that state. In Vermont, Maine, and Virginia, a centralized website allowed us to download licensing data for multiple occupations. When a licensing board's website did not have a built-in function to download data, we extracted the data using a more time consuming "web-scraping" approach.

For the other half of the cases where data were not readily available on a public-facing website, we contacted the state licensing board and requested a file with the data. In some cases, we were required to complete a request form; in other cases, a request via email or phone was sufficient. In most cases, information about how to request the data was available on the board's web page. In a few cases, we had to call a representative from the board to get information about the request process. All requested files were delivered in an electronic format by email.

The cost of obtaining data varied and was not dependent on whether the data were obtained by download or by direct request. We were able to obtain the data without charge from about half of the licensing entities we contacted. Where there was a charge, the cost typically ranged from $20 to $500, though one quoted a price of as high as $3,000 for one file.

The tables in the **Appendix** detail the methods and costs of obtaining licensing data for the states we contacted.

Population data: We obtained population data for 2014 and 2017 from the annual estimates of population report published by the Census Bureau.[13] These population data were used to calculate the supply of each occupation per 100,000 population estimates at the national and state levels.

Defining Occupations

The nine occupations addressed in this report were identified using the 2010 Census occupation codes[14] used by the ACS and the 2010 SOC codes[15] used by the OEWS. A crosswalk exists between Census and SOC codes (**Appendix**) and evolves over time; under each coding structure, some occupations are collapsed due to concerns about sample size and assumptions about which occupations are of greatest interest to the public using the data. From state licensing records, we identified occupation names that best corresponded to the Census and SOC codes used to extract data from the ACS and OEWS.

Relative Standard Errors

Both ACS and OEWS estimates include some amount of error because they are based on a sample of the population. The relative standard error (RSE) is the quantitative measure of the variability of an estimate due to sampling and reflects the uncertainty associated with likely differences in estimates between samples as well as between a sample and the population. The RSE is calculated as the ratio of the standard error to the survey estimate, converted to a percentage. OEWS provides RSEs for most of the occupations in this report with exceptions for social workers, clinical laboratory technologists and technicians, and diagnostic-related technologists and technicians; RSEs for ACS data were calculated by our team.

The RSE generally gets smaller as the sample size increases, and we interpret estimates with small RSEs to be more precise. For example, a RSE of 0.1% implies that the amount of sampling error present in the estimate is only 0.1% of the estimate, or stated another way it is the percentage of the magnitude of the estimate that is subject to random sampling error. For our study, we recommend that estimates with a RSE of 25% to 50% (25%≤ RSE ≤ 49.9%) be interpreted with some caution, and the estimates with a RSE of 50% or greater be regarded as unreliable.[16,17] The state licensing records included in this report are not based on a sample of a population, but are a complete count of people licensed to work in each occupation. As a result, RSEs do not apply to estimates derived from these state licensing records.

COMPARISON OF SUPPLY SIZE ESTIMATES OF NINE ALLIED HEALTH OCCUPATIONS USING NATIONAL AND STATE DATA SOURCES

Following are national and state estimates (counts and per 100,000 population) of the supply of specific allied health occupations. As shown, the supply estimates vary depending on the data source being used, highlighting the need to understand how these sources derive the data and how best to use these estimates.

National Supply Estimates

Table 1 shows the national supply estimates for each of the nine selected occupations (where available), RSEs, and percent changes from 2014 to 2017. As can be seen from these analyses, ACS and OEWS can produce different estimates of the size of allied health occupation supply, and the direction of change over time is not always consistent. Estimates of the percent change in supply from 2014 to 2017 were notably large and variable for dental hygienist, diagnostic-related technologists and technicians, medical assistants and respiratory therapists depending on which dataset was used (ACS or OEWS). While for occupations such as clinical laboratory technologists and technicians, occupational therapists, physical therapists, social workers, and speech-language pathologists, the differences in the percentage change through the two time periods between the two datasets were comparable. At the national level, RSEs are relatively small for these estimates, which is expected due to the large sample size compared to state level estimates. Estimates from the OEWS survey, generally, had the smallest RSEs mainly because of the OEWS's large sample size and a statistically robust sampling process.

Table 1: National Estimates of Individuals in Select Allied Health Occupations, 2014 and 2017, by American Community Survey (ACS) and Occupational Employment and Wage Statistics (OEWS) Data Sources

Occupation	2014				2017				% Change 2014-2017	
	ACS # (RSE*)		OEWS # (RSE)		ACS # (RSE)		OEWS # (RSE)		ACS	OEWS
Clinical laboratory technologists and technicians**	314,202	(2.2%)	320,550	(2.4%)	324,811	(2.6%)	322,380	(1.2%)	3.4%	0.6%
Dental hygienists	162,553	(2.8%)	200,550	(2.4%)	193,330	(3.0%)	211,600	(1.2%)	18.9%	5.5%
Diagnostic related technologists and technicians**	337,032	(2.0%)	361,430	(1.4%)	384,286	(1.9%)	382,500	(0.7%)	14.0%	5.8%
Medical assistants	512,531	(1.7%)	601,240	(1.6%)	520,826	(1.9%)	646,320	(0.7%)	1.6%	7.5%
Occupational therapists	102,576	(3.6%)	114,660	(2.6%)	115,557	(3.3%)	126,050	(1.2%)	12.7%	9.9%
Physical therapists	228,876	(2.6%)	209,690	(2.0%)	256,214	(2.4%)	225,420	(1.1%)	11.9%	7.5%
Respiratory therapists	113,322	(3.9%)	120,330	(2.0%)	107,014	(3.8%)	128,250	(1.2%)	-5.6%	6.6%
Social workers – All education levels	814,744	(1.3%)	619,300	(1.4%)	882,267	(1.2%)	644,290	(0.8%)	8.3%	4.0%
Social workers – Master's degree or higher	300,422	(2.3%)	na***	na	331,026	(2.2%)	na	na	10.2%	na
Speech-language pathologists	145,750	(3.2%)	131,450	(2.4%)	160,134	(2.8%)	142,360	(1.2%)	9.9%	8.3%

*RSE=Relative standard error.
**Technologists and technicians are combined because the data sources combined the occupations into one category during most years reported.
***Individuals' education attainment is not available (na) from OEWS.

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Figure 1 shows the estimated national number of individuals in each occupation per 100,000 population for years 2014 and 2017. Estimates for several occupations are shown to have little change in size between 2014 and 2017, and are relatively consistent between data sources. For example, clinical laboratory technician and technologist supply is consistently estimated to be approximately 99 to 101 individuals per 100,000 U.S. population. Similarly, respiratory therapist supply was estimated to range from 38 to 39 individuals per 100,000 population between 2014 and 2017 using OEWS data, and 36 to 33 across the same years using ACS data.

The supply estimates for several other occupations, however, had inconsistent changes between 2014 and 2017 depending on the data source. Using ACS data, medical assistant supply stayed about the same, from 161 to 160 per 100,000 population, compared with an increase from 189 to 198 per 100,000 population using OEWS data. The supply of social workers per 100,000 population was similar between 2014 and 2017 using OEWS data, while increasing from 256 to 271 per 100,000 population using ACS data.

Figure 1. Estimated Number of Individuals in Select Allied Health Occupations in the U.S. per 100,000 Population in 2014 and 2017 by American Community Survey (ACS) and Occupational Employment and Wage Statistics (OEWS) Data Sources
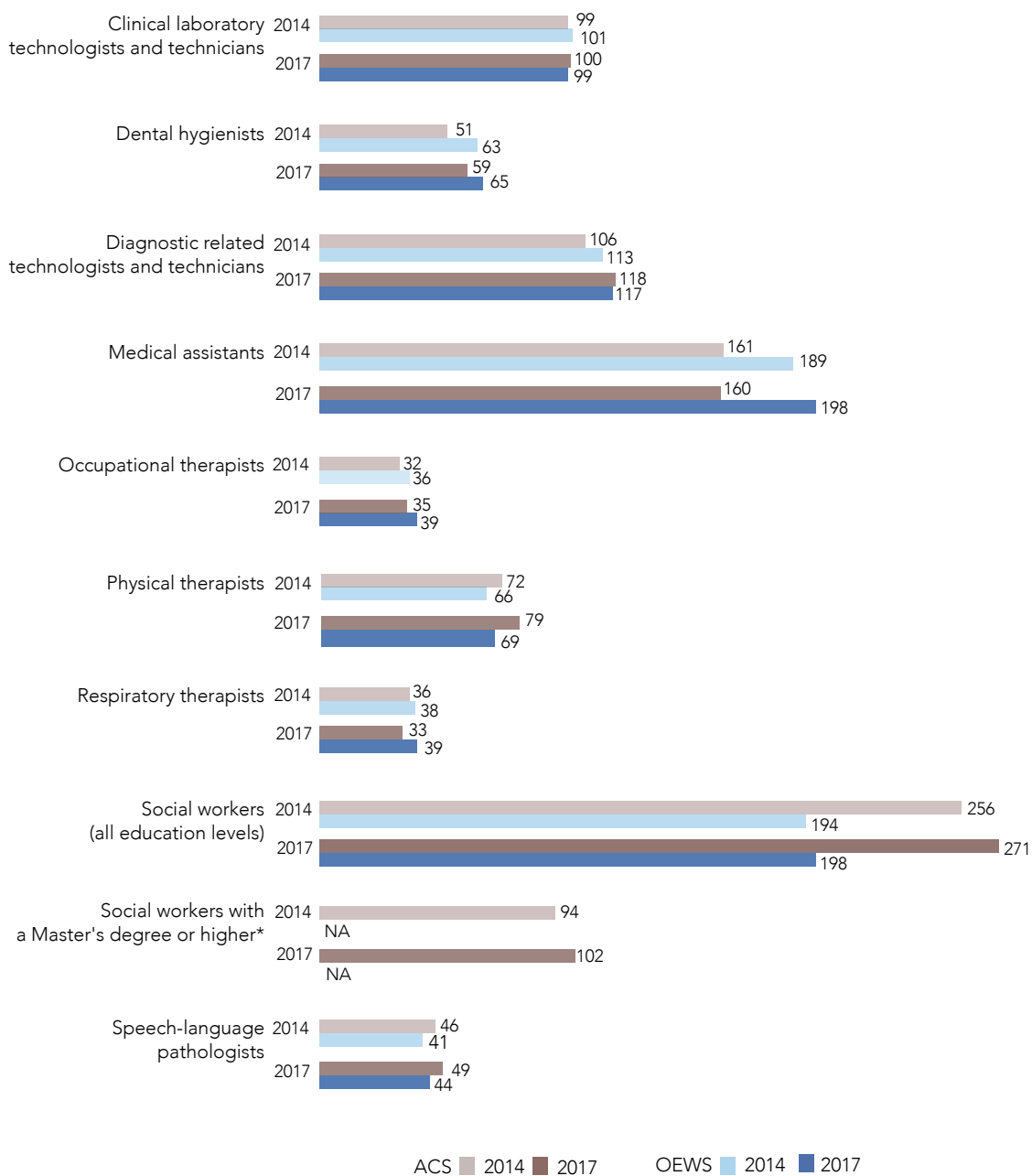
*Education status only available from ACS.

State-Level Supply Estimates

Figures 2 through **10** compare the state-level estimates of the number of health care workers per 100,000 population for each of the nine allied health occupations across the twelve selected states in 2014 and 2017, comparing data from ACS, OEWS, and state licensing records, where available. **Appendix Tables A2** through **A10** provide comparable supply estimates per 100,000 population for all 50 states and the District of Columbia. The **Appendix** also provides detail on how the state licensing data were obtained. Maps with state-level estimates for each of the nine occupations (including counts, estimates per 100,000 population and RSEs) for multiple years are available at https://familymedicine.uw.edu/chws/resources/

Figure 2. Estimates of <u>Clinical Laboratory Technologists and Technicians</u>* per 100,000 State Population in 2014 and 2017 Using OEWS and ACS in Selected States**
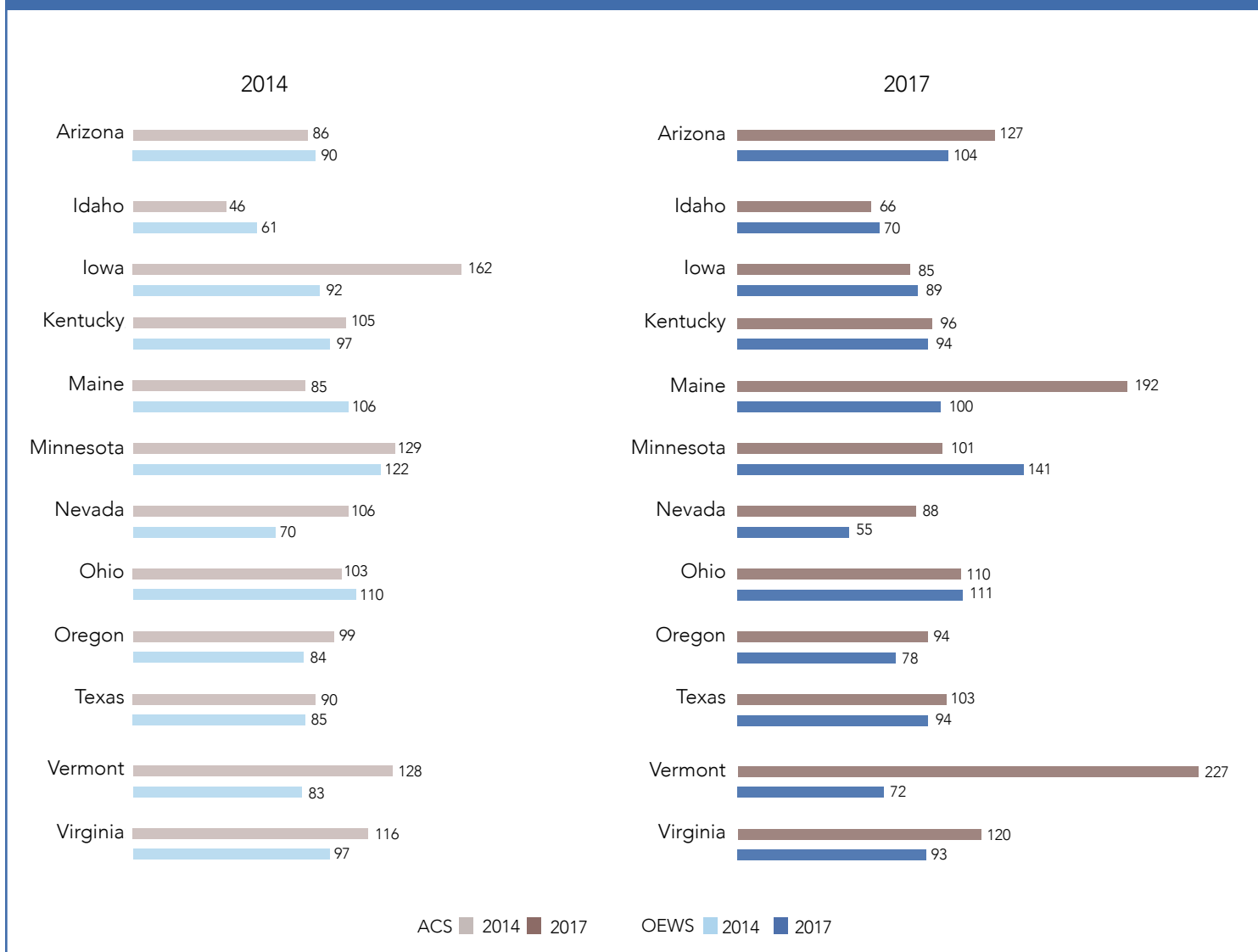
*Data source was not able to distinguish between technologists and technicians.
** State licensing data were not available for this occupation group given the wide range of occupations represented by this occupation title and because some of the occupations do not require licenses.

Figure 3. Estimates of <u>Dental Hygienists</u> per 100,000 State Population in 2014 and 2017 Using OEWS, ACS and State Licensing Data in Selected States*

2014

State	ACS 2014	OEWS 2014
Arizona	49	51
Idaho	60	77
Iowa	56	74
Kentucky	38	46
Maine	82	83
Minnesota	40	83
Nevada	26	47
Ohio	47	66
Oregon	48	99
Texas	42	50
Vermont	68	94
Virginia	56	52

2017

State	ACS 2017	OEWS 2017	Licensing 2016-2017
Arizona	40	41	57
Idaho	91	96	97
Iowa	42	74	78
Kentucky	37	55	60
Maine	56	84	98
Minnesota	93	91	90
Nevada	54	73	46
Ohio	55	74	66
Oregon	98	94	103
Texas	31	48	47
Vermont	188	115	112
Virginia	51	64	66

ACS ▓ 2014 ▓ 2017   OEWS ▓ 2014 ▓ 2017   ▓ Licensing 2016-2017
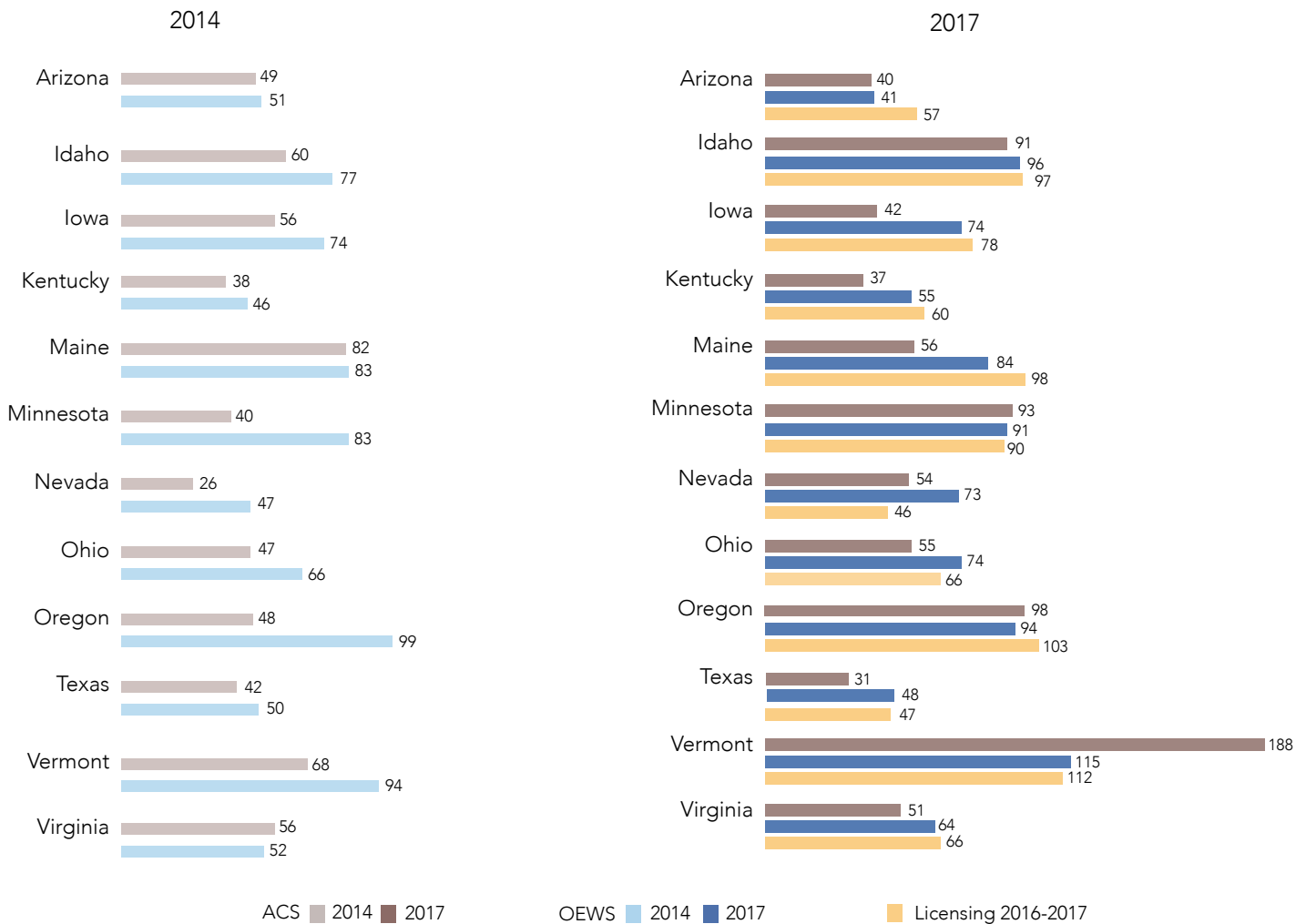
*Estimates from licensing data reflect all dental hygienists with an active license in each state, which may include those practicing in another state or those not actively employed as a dental hygienist.

Figure 4. Estimates of Diagnostic Related Technologists and Technicians per 100,000 State Population in 2014 and 2017 Using OEWS and ACS Data in Selected States

2014

State	ACS 2014	OEWS 2014
Arizona	115	96
Idaho	154	98
Iowa	108	116
Kentucky	153	146
Maine	186	125
Minnesota	125	130
Nevada	82	89
Ohio	124	136
Oregon	108	89
Texas	90	98
Vermont	49	85
Virginia	94	117

2017

State	ACS 2017	OEWS 2017
Arizona	98	105
Idaho	119	99
Iowa	119	125
Kentucky	115	142
Maine	114	126
Minnesota	154	147
Nevada	88	106
Ohio	125	127
Oregon	117	103
Texas	103	110
Vermont	176	93
Virginia	123	115

ACS ▢ 2014 ▢ 2017   OEWS ▢ 2014 ▢ 2017
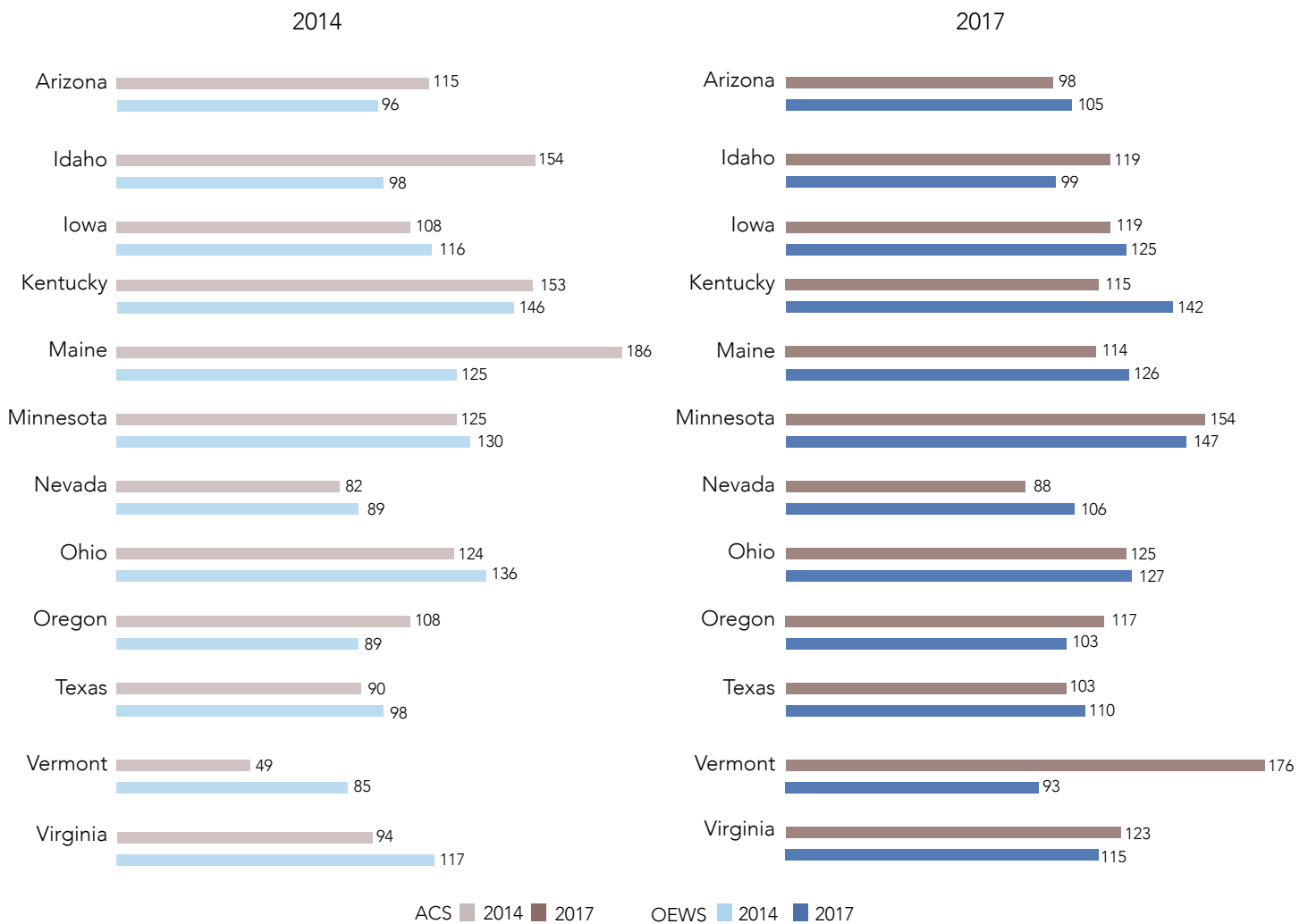
Figure 5. Estimates of <u>Medical Assistants</u> per 100,000 State Population in 2014 and 2017 Using OEWS and ACS Data in Selected States

2014

State	ACS 2014	OEWS 2014
Arizona	167	244
Idaho	165	163
Iowa	137	151
Kentucky	131	178
Maine	257	239
Minnesota	123	157
Nevada	92	195
Ohio	160	180
Oregon	173	236
Texas	179	206
Vermont	62	116
Virginia	126	128

2017

State	ACS 2017	OEWS 2017
Arizona	191	250
Idaho	108	193
Iowa	70	156
Kentucky	185	194
Maine	198	292
Minnesota	63	192
Nevada	205	212
Ohio	175	199
Oregon	176	276
Texas	154	205
Vermont	120	101
Virginia	123	161

ACS ▪ 2014 ▪ 2017   OEWS ▪ 2014 ▪ 2017

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Figure 6. Estimates of Occupational Therapists per 100,000 State Population in 2014 and 2017 Using OEWS, ACS and State Licensing Data in Selected States*

2014

State	ACS 2014	OEWS 2014
Arizona	16	18
Idaho	50	20
Iowa	19	32
Kentucky	66	40
Maine	61	65
Minnesota	40	39
Nevada	8	24
Ohio	29	37
Oregon	20	27
Texas	28	27
Vermont	40	33
Virginia	30	29

2017

State	ACS 2017	OEWS 2017	Licensing 2016-2017
Arizona	37	26	30
Idaho	24	25	39
Iowa	36	32	45
Kentucky	31	30	50
Maine	50	75	101
Minnesota	66	51	67
Nevada	18	24	30
Ohio	52	40	51
Oregon	44	30	45
Texas	31	36	35
Vermont	35	46	68
Virginia	38	35	46

ACS ☐ 2014 ■ 2017   OEWS ☐ 2014 ■ 2017   ☐ Licensing 2016-2017

*Estimates from licensing data reflect all occupational therapists with an active license in each state, which may include those practicing in another state or those not actively employed as an occupational therapist.

Figure 7. Estimates of Physical Therapists per 100,000 State Population in 2014 and 2017 Using OEWS, ACS and State Licensing Data in Selected States*

2014

State	ACS 2014	OEWS 2014
Arizona	47	57
Idaho	26	62
Iowa	29	58
Kentucky	55	59
Maine	134	92
Minnesota	78	69
Nevada	49	53
Ohio	55	58
Oregon	73	64
Texas	55	44
Vermont	165	105
Virginia	70	57

2017

State	ACS 2017	OEWS 2017	Licensing 2016-2017
Arizona	97	48	66
Idaho	50	70	118
Iowa	69	60	94
Kentucky	65	55	75
Maine	70	111	154
Minnesota	97	76	93
Nevada	65	52	71
Ohio	59	66	82
Oregon	74	66	100
Texas	56	56	62
Vermont	116	125	173
Virginia	63	76	90

ACS ▮ 2014 ▮ 2017   OEWS ▮ 2014 ▮ 2017   ▮ Licensing 2016-2017
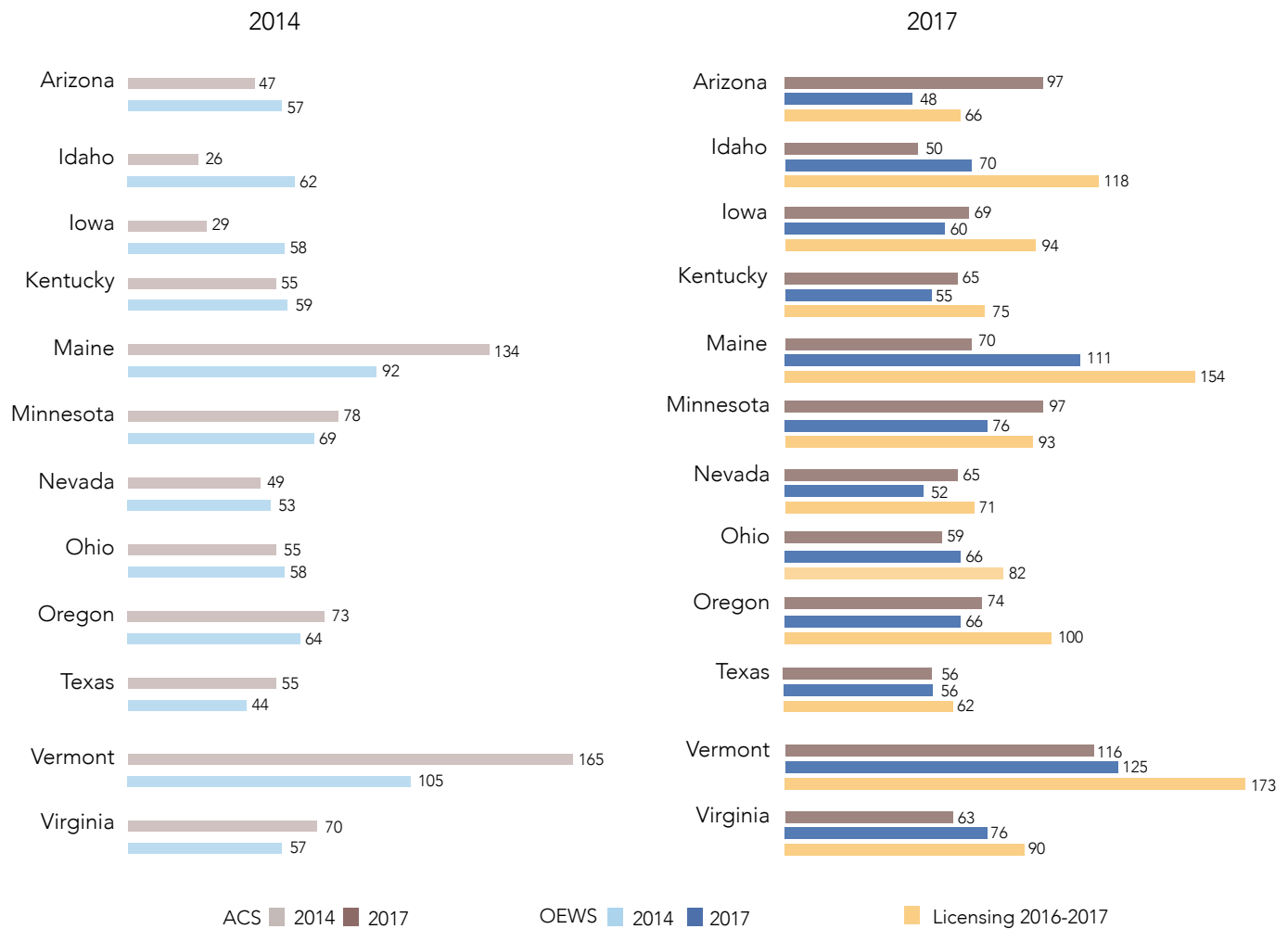
*Estimates from licensing data reflect all physical therapists with an active license in each state, which may include those practicing in another state or those not actively employed as a physical therapist.

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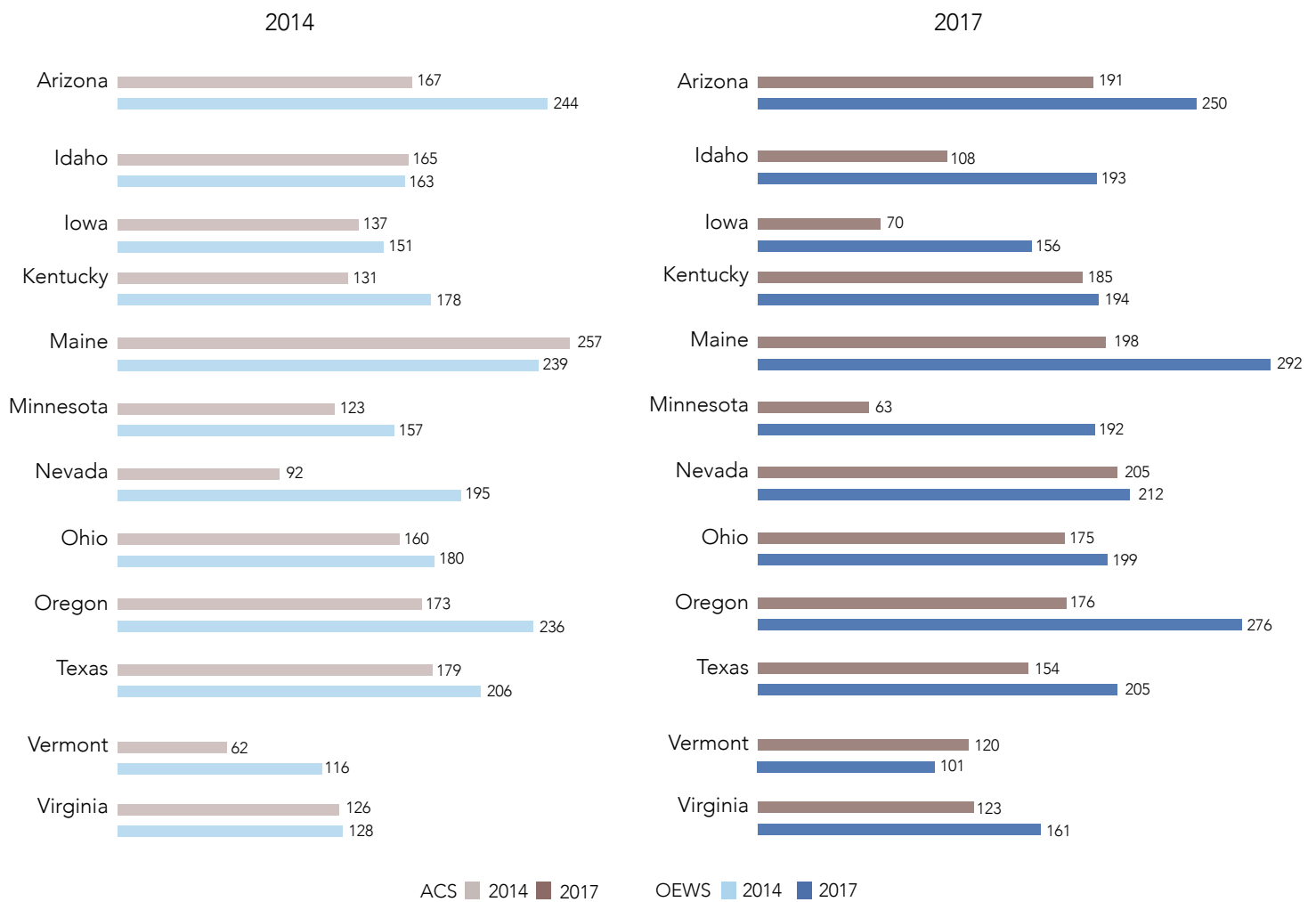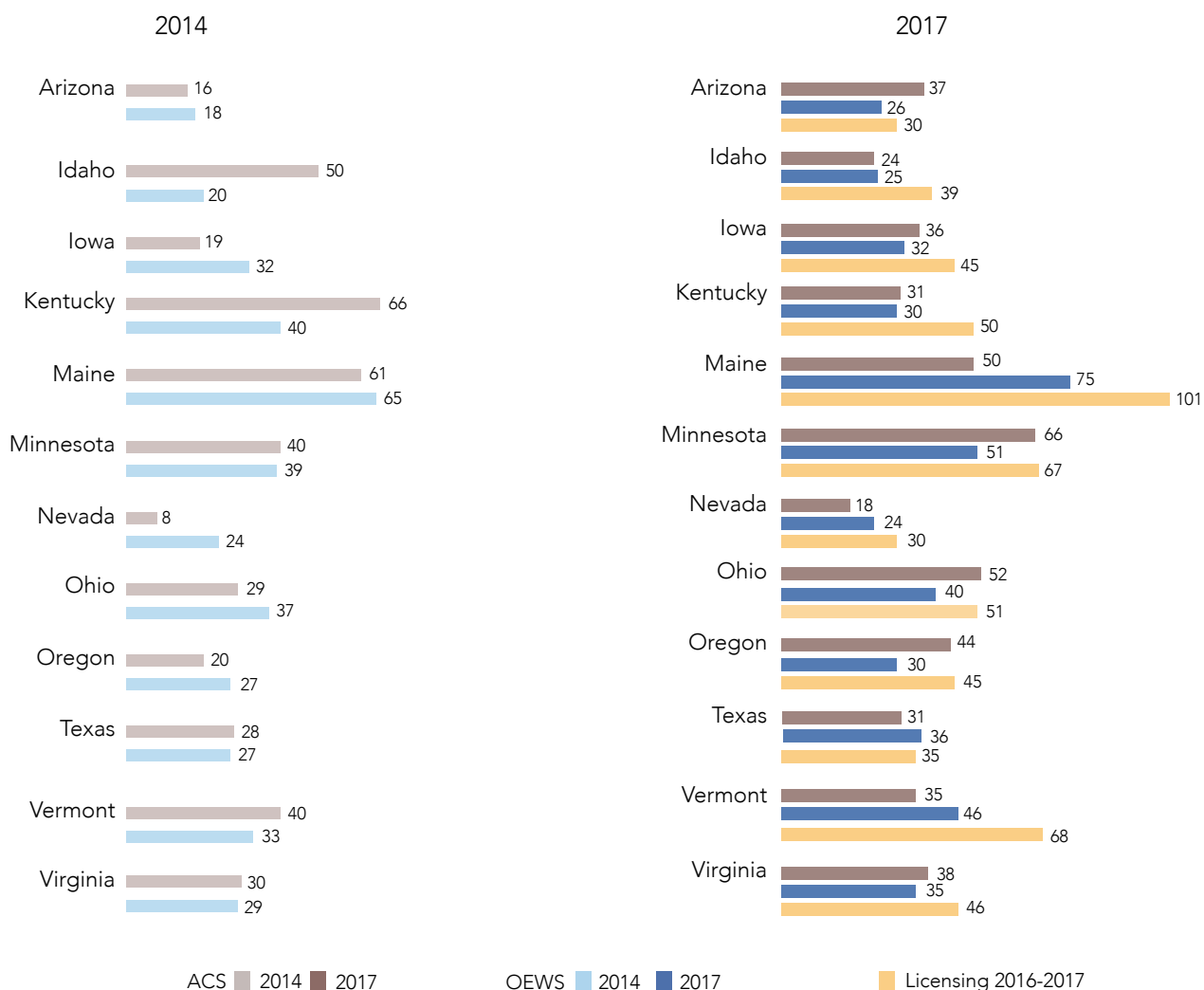**Figure 8. Estimates of <u>Respiratory Therapists</u> per 100,000 State Population in 2014 and 2017 Using OEWS, ACS and State Licensing Data in Selected States***

2014

State	ACS 2014	OEWS 2014
Arizona	24	36
Idaho	7	31
Iowa	37	33
Kentucky	47	56
Maine	17	32
Minnesota	31	28
Nevada	57	32
Ohio	56	51
Oregon	25	29
Texas	26	39
Vermont	50	35
Virginia	19	29

2017

State	ACS 2017	OEWS 2017	Licensing 2016-2017
Arizona	23	31	56
Idaho	12	34	53
Iowa	47	31	56
Kentucky	52	56	78
Maine	39	33	43
Minnesota	21	31	36
Nevada	43	36	57
Ohio	40	53	69
Oregon	15	31	45
Texas	31	40	50
Vermont	48	32	48
Virginia	32	30	46

ACS ■ 2014 ■ 2017   OEWS ■ 2014 ■ 2017   ■ Licensing 2016-2017

*Estimates from licensing data reflect all respiratory therapists with an active license in each state, which may include those practicing in another state or those not actively employed as a respiratory therapist.

Figure 9. Estimates of <u>Social Workers</u> (All Education Levels) per 100,000 State Population in 2014 and 2017 Using OEWS, ACS and State Licensing Data in Selected States*

2014

State	ACS 2014	OEWS 2014
Arizona	230	201
Idaho	204	175
Iowa	313	206
Kentucky	236	163
Maine	444	304
Minnesota	354	205
Nevada	146	147
Ohio	289	213
Oregon	297	207
Texas	162	99
Vermont	332	389
Virginia	212	173

2017

State	ACS 2017	OEWS 2017	Licensing 2016-2017
Arizona	226	194	61
Idaho	139	202	215
Iowa	233	194	127
Kentucky	246	243	117
Maine	398	302	446
Minnesota	274	269	247
Nevada	221	160	90
Ohio	316	234	197
Oregon	267	220	125
Texas	188	121	80
Vermont	293	476	189
Virginia	265	205	90

ACS ▮ 2014 ▮ 2017   OEWS ▮ 2014 ▮ 2017   ▮ Licensing 2016-2017

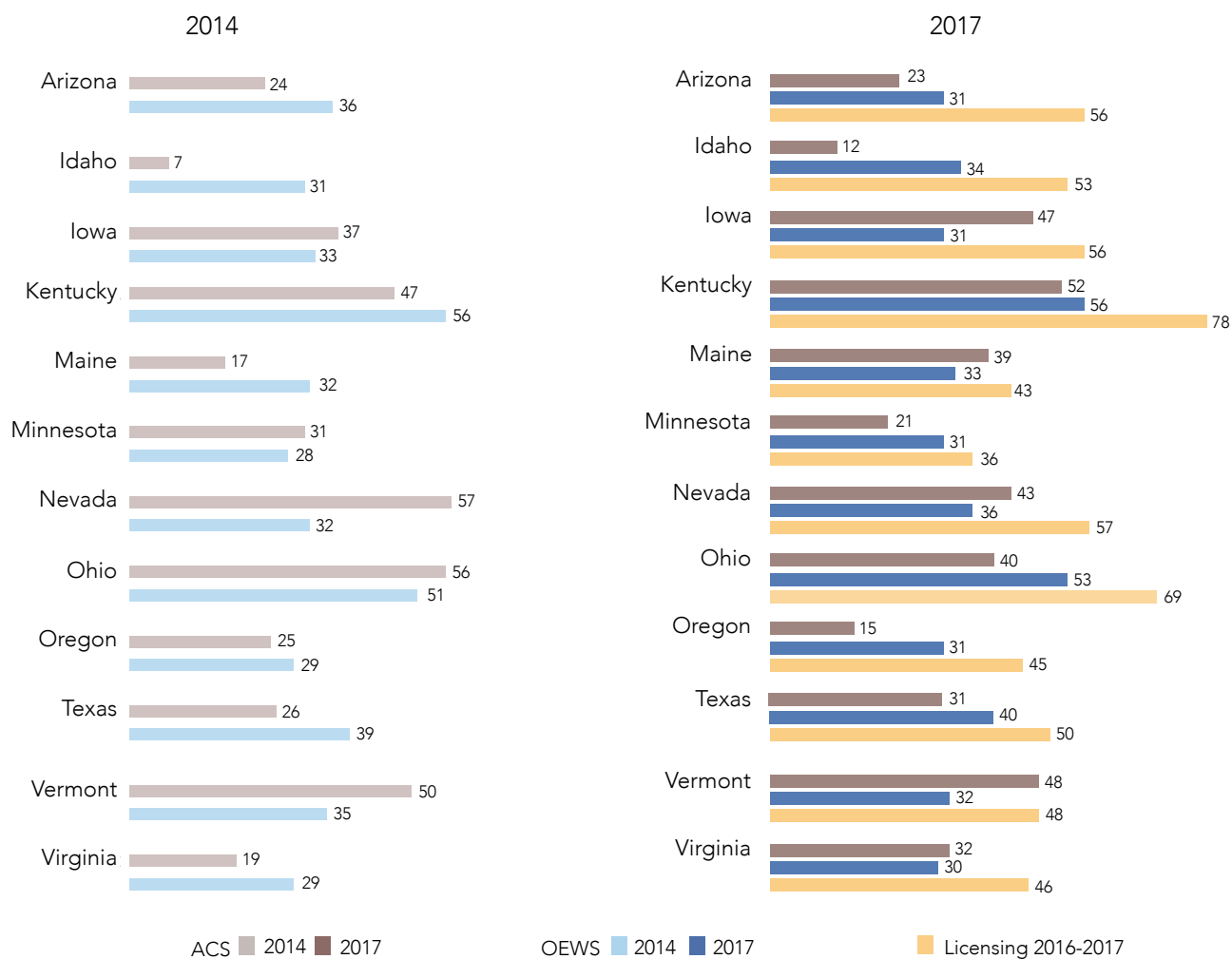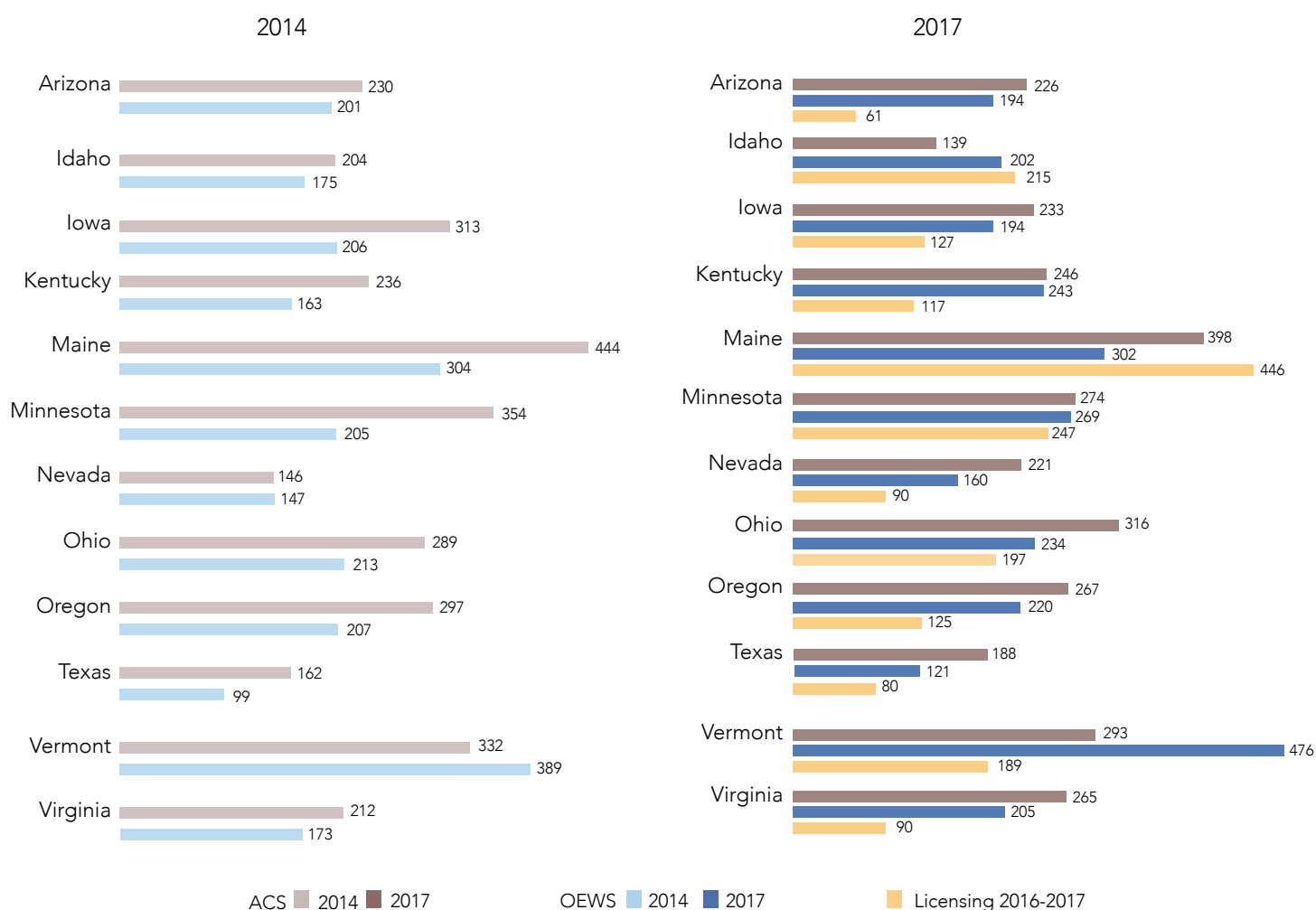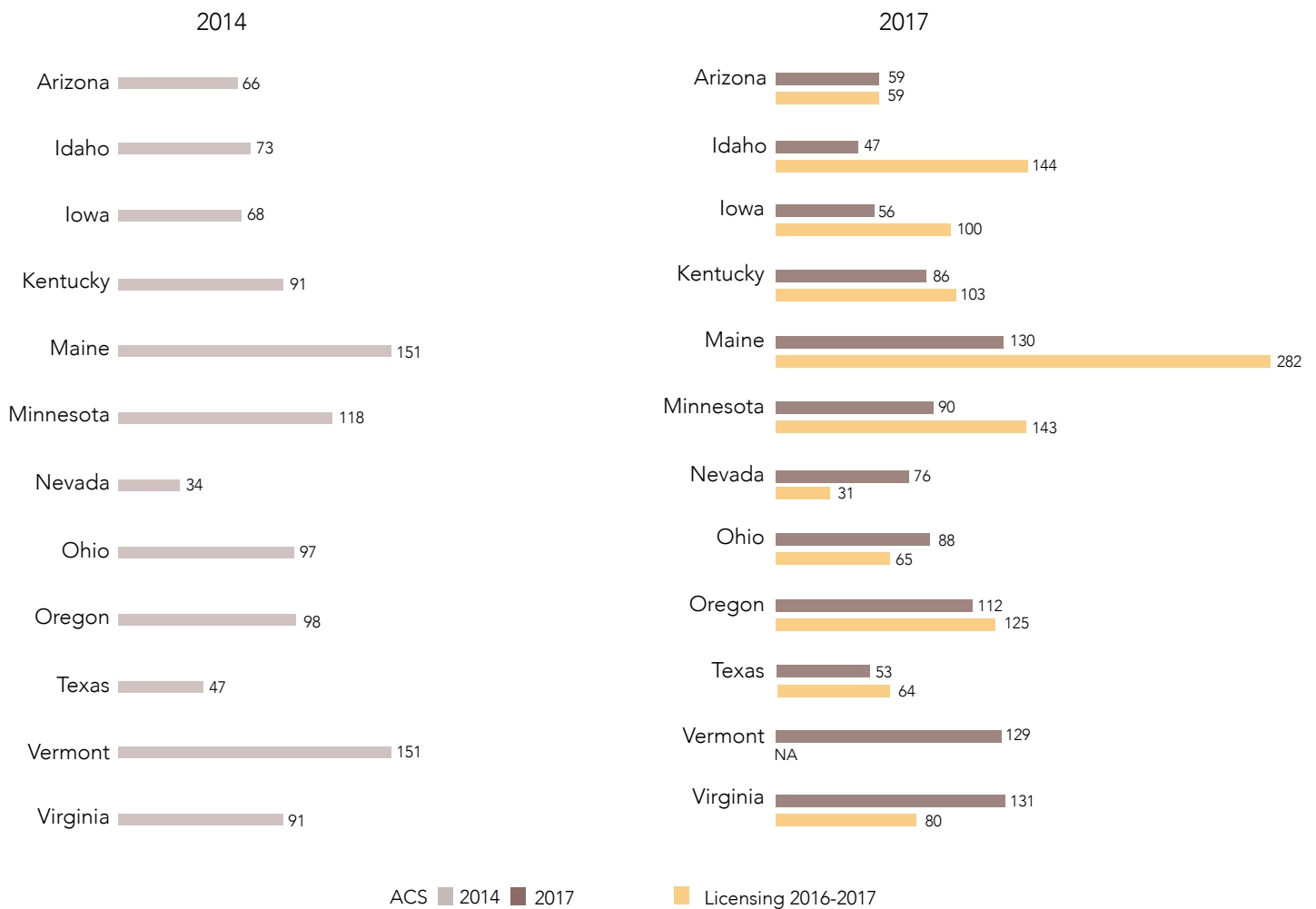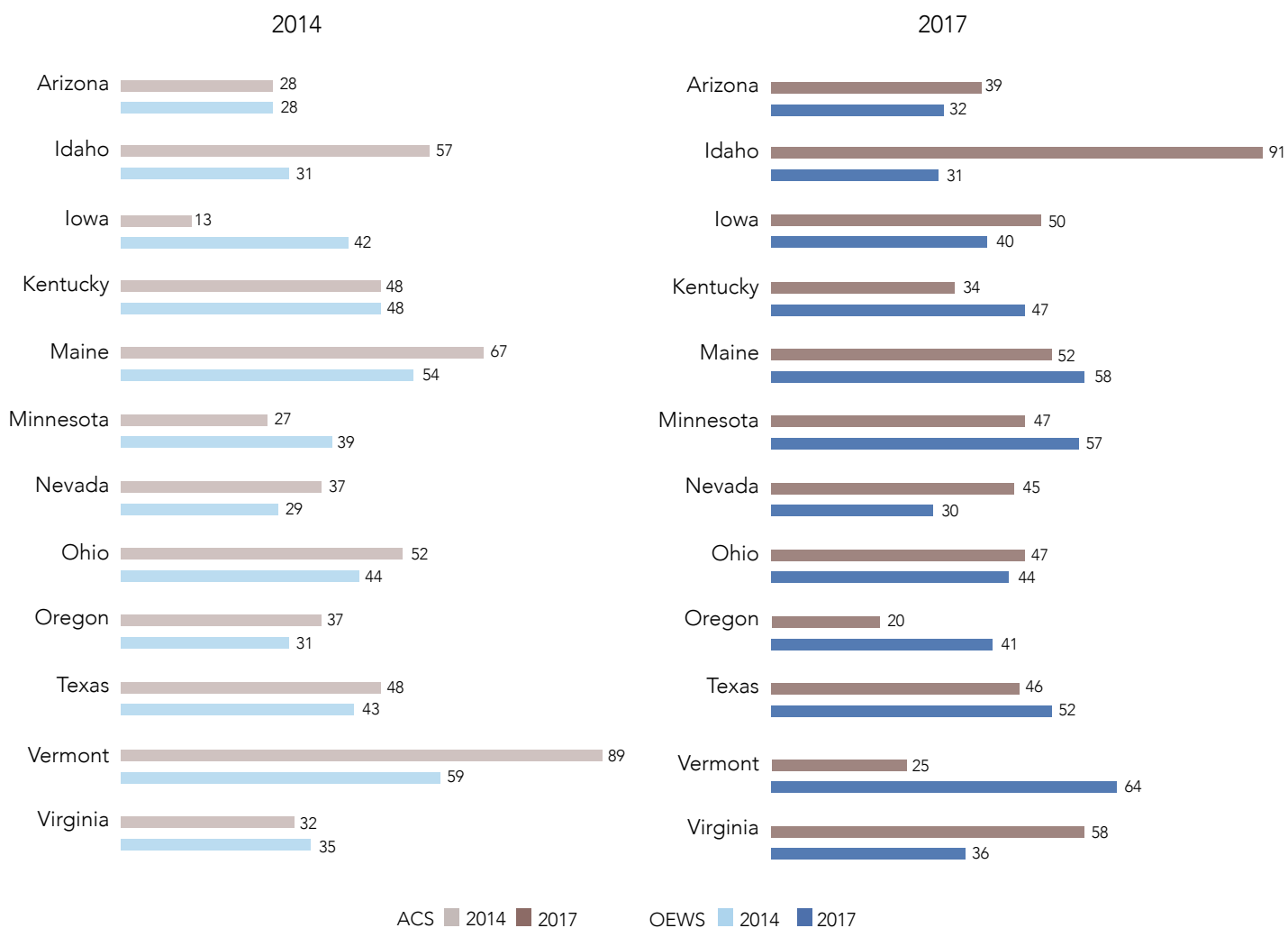*Estimates from licensing data reflect all education levels with an active license in each state, which may include those practicing in another state or those not actively employed as a social worker.

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Figure 10. Estimates of <u>Social Workers</u> (Master's Degree or Higher) per 100,000 State Population in 2014 and 2017 Using ACS and State Licensing Data in Selected States*

2014

State	Value
Arizona	66
Idaho	73
Iowa	68
Kentucky	91
Maine	151
Minnesota	118
Nevada	34
Ohio	97
Oregon	98
Texas	47
Vermont	151
Virginia	91

2017

State	ACS 2017	Licensing 2016-2017
Arizona	59	59
Idaho	47	144
Iowa	56	100
Kentucky	86	103
Maine	130	282
Minnesota	90	143
Nevada	76	31
Ohio	88	65
Oregon	112	125
Texas	53	64
Vermont	129	NA
Virginia	131	80

ACS ▇ 2014 ▇ 2017   ▇ Licensing 2016-2017

* Education level for social workers not available from OEWS data. Estimates from licensing data reflect all social workers with a masters level education or higher with an active license in each state, which may include those practicing in another state or those not actively employed as a social worker.

Figure 11. Estimates of <u>Speech-Language Pathologists</u> per 100,000 State Population in 2014 and 2017 Using OEWS and ACS Data in Selected States

2014

State	ACS 2014	OEWS 2014
Arizona	28	28
Idaho	57	31
Iowa	13	42
Kentucky	48	48
Maine	67	54
Minnesota	27	39
Nevada	37	29
Ohio	52	44
Oregon	37	31
Texas	48	43
Vermont	89	59
Virginia	32	35

2017

State	ACS 2017	OEWS 2017
Arizona	39	32
Idaho	91	31
Iowa	50	40
Kentucky	34	47
Maine	52	58
Minnesota	47	57
Nevada	45	30
Ohio	47	44
Oregon	20	41
Texas	46	52
Vermont	25	64
Virginia	58	36

ACS ▨ 2014 ▨ 2017   OEWS ▨ 2014 ▨ 2017

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Supply estimates for occupations varied considerably across states by occupation and across data sources within states. Comparing data sources among states, supply estimates from ACS for clinical lab technicians and technologists, for example, were consistently higher than supply estimates from OEWS in both years across the twelve selected states. On the other hand, supply estimates from OEWS for dental hygienists were generally lower than supply estimates from ACS. Furthermore, some occupations saw a mixed picture; occupational therapist supply estimates were higher using ACS compared to OEWS in some states but not in others.

RSEs are most useful when comparing estimates derived from a single data sources. For example, when comparing across states or for a single occupation, a larger RSE would indicate a less reliable estimate. Another use of the RSE is to compare the reliability of estimates over time for an occupation. However, RSEs may not be reliable to compare estimates derived from different data sources, as estimates from these datasets vary, likely because each data source uses different inclusion criteria, sample selection, survey frequency, and data collection processes.

Where state license records were available, supply estimates from licensure data were generally higher than estimates from ACS or OEWS with a few exceptions. In small states such as Vermont, we saw higher numbers of dental hygienists per 100,000 population from ACS data compared to licensure data. For social workers of all education levels, estimates from licensure data were generally lower than estimates from ACS and OEWS. When ACS was restricted to only social workers with a master's degree or higher, the supply estimates from licensure data were consistently higher than those found in ACS.

Examining changes over time, much like the national-level estimates, ACS and OEWS produce different magnitudes of change. At the state-level, not only are the magnitudes of change variable but the direction also varies based on data source, with no one consistent pattern for any particular occupation, state, or data source.

DISCUSSION

Similar to the conclusion of our prior report comparing national estimates of health care workers,[7] this report further demonstrates that no single source of data exists that provides all of the desired information for health workforce planning at the state level. Choosing which data source(s) to use to estimate workforce supply at the state or national levels involves weighing a number of considerations such as: having the most up-to-date data; the size of the sample; the dataset's statistical reliability and precision; and the availability of details about the workforce's demographic and socioeconomic characteristics.

The differences in allied health workforce supply estimates across datasets likely occur because each draw from different populations, rely on different sampling frames and sample sizes, and are conducted at different times/frequency. These characteristics of the data sources also affect their usefulness for estimating workforce supply at different geographic levels.

- Data source: The ACS is a household survey that collects self-reported data from individuals, while the OEWS, a survey of businesses, provides data about workers from the perspective of the employer. OEWS data are provided by a specific set of employers who report the number of individuals they employ at various times of the year. ACS generally captures more individuals in the workforce than OEWS because the ACS captures regularly employed, self-employed, and contract workers employed by a larger range of organizations than represented in the OEWS. License data are assumed to be a census of individuals in an occupation and do not require the use of survey weights to make the data representative, but the data do not provide information about whether an individual actively works in the occupation or not.

- Sampling frame and sample size: Both ACS and OEWS allow for analyses at the national and state levels. Licensure data are not generally aggregated at the national level and have to be obtained state-by-state, but include all of

a given licensed occupation and not a sample. ACS provides greater accuracy in workforce estimates at the state and national level when multiple years are pooled together, but this does not allow for comparability for single year estimates provided by OEWS. More granular geographic information is available by metropolitan area versus non-metropolitan area in OEWS and ACS, but further disaggregation is not possible with OEWS.

- Survey frequency and availability: The ACS, conducted annually, has about a two-year time lag between when the data are collected and when the data become publicly available. The OEWS is published semi-annually with about a 1.5 year time lag between when data are last collected and when the data become publicly available. Licensure data are updated as individuals obtain or renew their license.

The factors influencing the accuracy of ACS and OEWS workforce supply estimates can have a greater effect at the state-level given that a state's population may be small and/or the size of a particular health care occupation of interest may be small within a state. The smaller the sample size, the greater the standard error, and thus, the margin of error. The five-year files for ACS might provide more accurate estimates, but pooled estimates are more difficult to use when tracking changes over time and to make "current" estimates. Where we saw differences in the estimates of the number of individuals in an occupation between data sources, as described above, estimates from ACS could be greater than from OEWS because OEWS data are derived from select employers in the state of interest compared with samples of individuals from whom occupation information is obtained. Even though we tried to increase comparability by selecting individuals in the ACS dataset who were employed (versus unemployed or out of the labor force), ACS is not specifically designed to capture a representative sample of individuals by occupations so there is an element of randomness in which occupations are captured in any given year of the survey. The OEWS sample may also hold some bias to the extent that the occupations of interest are more or less included among workers employed by the organizations in the sample.

Data from state licensing/credentialing entities, when available, are presumed to provide the closest to accurate count of health care workforce supply because health professions licenses represent a census of an occupation able to practice in a state. Depending on whether or not licensure data include information about employment status and location, this source of workforce data, if not interpreted correctly, may overestimate the available supply of workers in a state. We included only active licenses in our analysis, but the number of licensed individuals in certain occupations may be larger than the number identified from ACS and OEWS because the license data may include individuals who were not currently practicing or are working out of state. This could explain the supply estimates we found for occupational therapists, respiratory therapists, physical therapists, and dental hygienists, for which supply estimates from license data were generally higher than estimates from ACS and OEWS. We did not observe a comparably clear pattern with social workers, perhaps due to variation in the roles of social workers that are required to be licensed by state licensing boards.

Our analysis has a few limitations that make comparability of estimates across data sources a challenge. Our estimates included self-employed workers in the ACS estimates, which are also likely to be included in the state license records, but not included in the OEWS estimates. The time frame for obtaining data from state licensing/credentialing entities were not perfectly aligned with OEWS or ACS. We also assumed that occupation titles used by state licensing boards matched the occupation codes used in the ACS and OEWS, but states may vary in how they define some occupations. In addition, we examined only headcounts of individuals in each of the nine occupations and not indications of the hours worked (e.g., full-time equivalents), or with some of the licensing data – whether or not they were currently employed in the field or practicing in the state that issued the license - which could result in an overestimate of available workforce supply.

CONCLUSION

Multiple data sources are needed to generate state-level estimates of the supply of allied health workers, including size and distribution of the workforce. Public data play a critical role in the ability of health workforce researchers and health workforce planners to not only make these estimates, but also to understand their sociodemographic characteristics including race/ethnic representation, wages, hours, and work setting. State license records are also important sources of information about the allied health workforce, providing a census of those licensed to work in the state (although many allied health occupations are not required to hold licenses and not all licensing boards provide information about current employment status) and frequently providing valuable data about the sociodemographic characteristics of specific occupations. Licensure data can be expensive and cumbersome to collect and requires coordinated efforts to be useful for state-level comparisons. A crucial step for health workforce planners is to understand the strengths and weaknesses of these data sources, as described by this report, and assess the overall usefulness of estimates derived from these data for identifying the adequacy of a state's supply of workers to meet the needs of its industry and population.

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APPENDIX

Supply Estimates of Nine Allied Health Occupations in 50 States

Table A-1 shows the occupation codes from the ACS and OEWS that were used by the analyses presented in this report, and illustrates the codes that are comparable between the two systems.

Table A-1: ACS and OEWS Occupation Codes Used in Analyses

Occupations and occupation groups (titles in parentheses specified in OEWS only)	ACS Census codes	OEWS SOC codes*
Occupational therapists	3150	29-1122
Physical therapists	3160	29-1123
Respiratory therapists	3220	29-1120
Speech-language pathologists	3230	29-1127
Clinical laboratory technologists and technicians **(Clinical laboratory technologists)** **(Clinical laboratory technicians)**	3300	29-2010 29-2011 29-2012
Dental hygienists	3310	29-2021
Diagnostic-related technologists and technicians **(Cardiovascular technologists and technicians)** **(Diagnostic medical sonographers)** **(Nuclear medicine technologists)** **(Radiologic technologists)** **(Magnetic resonance imaging technologists)**	3320	29-2030 29-2031 29-2032 29-2033 29-2034 29-2035
Medical assistants	3645	31-9092
Social workers** **(Child, family, and school social workers)** **(Healthcare social workers)** **(Mental health and substance abuse social workers)** **(Social workers, all other)**	2010	21-1020 21-1021 21-1022 21-1023 21-1029

ACS=American Community Survey. OEWS=Occupational Employment and Wage Statistics. SOC=Standard Occupational Classification system. https://www.bls.gov/soc/2010/home.htm

*This study used 2010 SOC codes.
**Licensed clinical social workers have the authority to diagnose and treat clients with mental illnesses and substance abuse problems and must hold at least a master's degree in social work. Social workers without graduate degrees may work health care settings, but cannot diagnose and treat. Because the OEWS does not capture individual provider demographic or socioeconomic information that would indicate whether or not an individual held a graduate degree, whereas the ACS does collect education information about survey respondents, in subsequent findings we distinguish social workers with different levels of education only when using ACS data.

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Tables A-2 to A-11. Estimates of occupation supply per 100,000 population state population in 2014 and 2017 using OEWS, ACS and state license data

For each of the nine allied health occupations or occupation groups included in the analyses covered by this report, following are tables displaying the estimates of supply per 100,000 state population in 2014 and 2017 using OEWS and ACS for all 50 states and, for select states and occupations where the data were readily available, 2017 state licensing data.

Table A-2: **Clinical laboratory technologists and technicians**

Table A-3: **Dental hygienists***

Table A-4: **Diagnostic related technologists and technicians**

Table A-5: **Medical assistants**

Table A-6: **Occupational therapists***

Table A-7: **Physical therapists***

Table A-8: **Respiratory therapists***

Table A-9: **Social workers – All education levels***

Table A-10: **Social workers – Master's degree or higher**

Table A-11: **Speech-language pathologists**

*Occupations for which state-level license data were obtained for select states.

Table A-2: State Level Estimates of <u>Clinical Laboratory Technologists and Technicians</u>*
per 100,000 Population Using Data from ACS and OEWS**

| State | Estimates of <u>Clinical Laboratory Technologists and Technicians</u>* per 100,000 Population | | | |
| | 2014 | | 2017 | |
	ACS	OEWS	ACS	OEWS
Alabama	103	90	84	95
Alaska	161	102	69	80
Arizona	86	90	127	104
Arkansas	62	92	75	76
California	82	70	72	75
Colorado	90	81	77	83
Connecticut	92	109	99	102
Delaware	177	64	71	55
District of Columbia	139	215	0	216
Florida	79	82	77	81
Georgia	71	104	118	96
Hawaii	96	90	117	97
Idaho	46	61	66	70
Illinois	109	94	78	88
Indiana	103	123	121	94
Iowa	162	92	85	89
Kansas	118	113	96	118
Kentucky	105	97	96	94
Louisiana	125	111	86	100
Maine	85	106	192	100
Maryland	116	159	132	121
Massachusetts	121	181	129	162
Michigan	112	132	133	137
Minnesota	129	122	101	141
Mississippi	87	115	122	103
Missouri	142	117	138	145
Montana	43	98	242	93
Nebraska	125	142	122	124
Nevada	106	70	88	55
New Hampshire	121	84	124	61
New Jersey	92	82	140	85
New Mexico	58	85	90	68

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Leveraging Data to Monitor the Allied Health Workforce:
State Supply Estimates

State	Estimates of Clinical Laboratory Technologists and Technicians* per 100,000 Population			
	2014		2017	
	ACS	OEWS	ACS	OEWS
New York	84	87	86	92
North Carolina	134	125	116	96
North Dakota	45	97	55	131
Ohio	103	110	110	111
Oklahoma	95	103	62	95
Oregon	99	84	94	78
Pennsylvania	113	142	97	123
Rhode Island	145	99	132	73
South Carolina	115	92	101	92
South Dakota	68	133	30	141
Tennessee	100	162	80	157
Texas	90	85	103	94
Utah	109	137	106	153
Vermont	128	83	227	72
Virginia	116	97	120	93
Washington	79	100	73	96
West Virginia	133	101	109	99
Wisconsin	107	110	155	105
Wyoming	31	84	219	85

*Data source was not able to distinguish between technologists and technicians.
**State license data were not obtained for this occupation group.

Table A-3: State Level Estimates of <u>Dental Hygienists</u> per 100,000 Population Using Data from ACS, OEWS, and Licensing Data from Selected States

| State | Estimated Number of <u>Dental Hygienists</u> per 100,000 State Population | | | | | | |
| | 2014 | | 2017 | | 2017 State License Records* | | |
	ACS	OEWS	ACS	OEWS	Per Capita Estimate	How License Data Obtained	Cost of License Data
Alabama	71	53	75	70			
Alaska	17	73	142	72			
Arizona	49	51	40	41	57	Request	Free
Arkansas	28	45	66	47			
California	41	54	47	58			
Colorado	65	76	63	87			
Connecticut	68	111	64	105			
Delaware	101	76	105	67			
District of Columbia	11	64	0	68			
Florida	36	54	54	49			
Georgia	50	51	59	63			
Hawaii	42	71	25	61			
Idaho	60	77	91	96	97	Request	$20
Illinois	63	59	58	74			
Indiana	66	75	53	72			
Iowa	56	74	42	74	78	Request	$47
Kansas	53	61	103	78			
Kentucky	38	46	37	55	60	Request	$100
Louisiana	29	42	59	41			
Maine	82	83	56	84	98	Download	Free
Maryland	52	50	45	53			
Massachusetts	70	91	74	83			
Michigan	67	95	86	101			
Minnesota	40	83	93	91	90	Request	$325
Mississippi	89	33	46	47			
Missouri	33	52	63	57			
Montana	13	69	32	69			
Nebraska	34	69	39	67			
Nevada	26	47	54	73	46	Request	$100
New Hampshire	103	87	111	92			
New Jersey	62	71	56	63			
New Mexico	40	52	37	48			

State	Estimated Number of Dental Hygienists per 100,000 State Population						
	2014		2017		2017 State License Records*		
	ACS	OEWS	ACS	OEWS	Per Capita Estimate	How License Data Obtained	Cost of License Data
New York	37	51	53	56			
North Carolina	48	56	50	61			
North Dakota	84	81	105	81			
Ohio	47	66	55	74	66	Request	Free
Oklahoma	46	45	52	60			
Oregon	48	99	98	94	103	Request	$100
Pennsylvania	52	72	67	74			
Rhode Island	131	98	77	122			
South Carolina	46	55	77	53			
South Dakota	82	68	161	78			
Tennessee	62	57	60	57			
Texas	42	50	51	48	47	Download	Free
Utah	97	82	104	88			
Vermont	68	94	188	115	112	Download	Free
Virginia	56	52	51	64	66	Download	$260
Washington	65	82	66	83			
West Virginia	63	58	42	56			
Wisconsin	97	86	81	85			
Wyoming	74	79	46	74			

*For states where license data were obtained. Estimates from license data reflect dental hygienists with an active license in each state, which may include those practicing in another state or those not actively employed as a dental hygienist. Download = data obtained from a licensing board website with a built-in ability to download the file, sometimes for free, sometimes for a fee. Request = data obtained by contacting the licensing board and requesting the relevant data, sometimes for free, sometimes for a fee.

Table A-4: State Level Estimates of Diagnostic Related Technologists and Technicians* per 100,000 Population Using ACS and OEWS Data**

State	Estimated Number of Diagnostic Related Technologists and Technicians per 100,000 State Population			
	2014		2017	
	ACS	OEWS	ACS	OEWS
Alabama	128	122	111	126
Alaska	91	91	106	NA
Arizona	115	96	98	105
Arkansas	103	106	166	137
California	75	72	88	86
Colorado	76	96	105	107
Connecticut	133	126	101	111
Delaware	44	157	217	135
District of Columbia	28	156	53	143
Florida	111	134	133	132
Georgia	108	97	138	100
Hawaii	93	84	52	77
Idaho	154	98	119	99
Illinois	96	100	151	111
Indiana	116	115	133	125
Iowa	108	116	119	125
Kansas	109	118	63	119
Kentucky	153	146	115	142
Louisiana	112	124	92	117
Maine	186	125	114	126
Maryland	117	127	105	134
Massachusetts	137	144	113	136
Michigan	99	132	136	137
Minnesota	125	130	154	147
Mississippi	97	115	181	133
Missouri	99	127	140	128
Montana	131	112	54	130
Nebraska	161	150	129	147
Nevada	82	89	88	106
New Hampshire	118	96	155	117
New Jersey	118	105	135	118
New Mexico	71	95	105	110

State	Estimated Number of Diagnostic Related Technologists and Technicians per 100,000 State Population			
	2014		2017	
	ACS	OEWS	ACS	OEWS
New York	100	119	114	119
North Carolina	130	116	103	115
North Dakota	55	112	82	130
Ohio	124	136	125	127
Oklahoma	93	106	124	118
Oregon	108	89	117	103
Pennsylvania	141	137	110	142
Rhode Island	86	139	164	174
South Carolina	122	116	113	120
South Dakota	135	203	162	192
Tennessee	128	147	149	136
Texas	90	98	103	110
Utah	61	86	145	81
Vermont	49	85	176	93
Virginia	94	117	123	115
Washington	87	110	129	102
West Virginia	165	146	141	167
Wisconsin	131	134	147	144
Wyoming	53	84	98	107

*Data source was not able to distinguish between technologists and technicians.
**State license data were not obtained for this occupation group.

Table A-5: State Level Estimates of <u>Medical Assistants</u> per 100,000 Population Using Data from ACS and OEWS*

| State | Estimated Number of <u>Medical Assistants</u> per 100,000 State Population | | | |
| | 2014 | | 2017 | |
	ACS	OEWS	ACS	OEWS
Alabama	105	140	125	176
Alaska	116	195	198	218
Arizona	167	244	191	250
Arkansas	49	92	57	110
California	197	210	189	227
Colorado	162	175	153	175
Connecticut	194	193	174	210
Delaware	153	203	134	257
District of Columbia	29	179	57	254
Florida	208	205	184	258
Georgia	154	211	152	204
Hawaii	160	204	138	235
Idaho	165	163	108	193
Illinois	142	146	159	155
Indiana	148	203	134	198
Iowa	137	151	70	156
Kansas	106	146	89	163
Kentucky	131	178	185	194
Louisiana	105	145	127	162
Maine	257	239	198	292
Maryland	140	174	166	195
Massachusetts	193	239	184	190
Michigan	201	229	211	229
Minnesota	123	157	63	192
Mississippi	102	72	127	98
Missouri	145	156	129	160
Montana	66	90	229	124
Nebraska	71	178	150	149
Nevada	92	195	205	212
New Hampshire	205	159	190	197
New Jersey	205	171	182	210
New Mexico	87	217	145	282

Table A-5 continued

| State | Estimated Number of Medical Assistants per 100,000 State Population | | | |
| | 2014 | | 2017 | |
	ACS	OEWS	ACS	OEWS
New York	141	121	144	127
North Carolina	144	144	152	167
North Dakota	90	107	34	82
Ohio	160	180	175	199
Oklahoma	159	199	180	215
Oregon	173	236	176	276
Pennsylvania	161	187	143	221
Rhode Island	259	248	208	227
South Carolina	107	174	148	190
South Dakota	73	126	41	116
Tennessee	162	221	150	203
Texas	179	206	154	205
Utah	160	252	293	231
Vermont	62	116	120	101
Virginia	126	128	123	161
Washington	175	182	170	182
West Virginia	134	184	115	181
Wisconsin	149	188	152	204
Wyoming	144	111	101	119

*State license data were not sought for medical assistants because licenses are not required in most states.

Table A-6: State Level Estimates of <u>Occupational Therapists</u> per 100,000 Population Using Data from ACS, OEWS, and Licensing Data from Selected States

State	Estimated Number of <u>Occupational Therapists</u> per 100,000 State Population						
	2014		2017		2017 State License Records*		
	ACS	OEWS	ACS	OEWS	Per Capita Estimate	How License Data Obtained	Cost of License Data
Alabama	27	23	23	25			
Alaska	25	29	7	36			
Arizona	16	18	37	26	30	Web scrape	Free
Arkansas	19	33	26	36			
California	21	25	24	27			
Colorado	21	50	46	49			
Connecticut	40	47	33	55			
Delaware	60	25	19	48			
District of Columbia	18	93	37	49			
Florida	25	29	20	31			
Georgia	19	26	16	27			
Hawaii	26	30	30	20			
Idaho	50	20	24	25	39	Request	Free
Illinois	40	34	45	41			
Indiana	47	39	30	43			
Iowa	19	32	36	32	45	Download	Free
Kansas	39	39	43	46			
Kentucky	66	40	31	30	50	Web scrape	Free
Louisiana	23	30	38	38			
Maine	61	65	50	75	101	Download	Free
Maryland	43	36	38	55			
Massachusetts	55	67	71	75			
Michigan	40	45	51	48			
Minnesota	40	39	66	51	67	Download	Free
Mississippi	18	25	16	32			
Missouri	38	48	40	39			
Montana	0	34	29	32			
Nebraska	68	41	30	46			
Nevada	8	24	18	24	30	Request	$50
New Hampshire	48	61	83	79			
New Jersey	39	40	32	58			
New Mexico	32	31	24	33			

| State | Estimated Number of <u>Occupational Therapists</u> per 100,000 State Population | | | | | | |
| | 2014 | | 2017 | | 2017 State License Records* | | |
	ACS	OEWS	ACS	OEWS	Per Capita Estimate	How License Data Obtained	Cost of License Data
New York	50	46	41	46			
North Carolina	33	32	33	32			
North Dakota	25	51	29	57			
Ohio	29	37	52	40	51	Request	Free
Oklahoma	39	21	29	23			
Oregon	20	27	44	30	45 (37)	Request	$100
Pennsylvania	48	49	66	57			
Rhode Island	31	42	34	36			
South Carolina	22	39	19	25			
South Dakota	53	35	120	47			
Tennessee	17	25	27	31			
Texas	28	27	31	36	35	Request	$240
Utah	33	25	15	28			
Vermont	40	33	35	46	68	Download	Free
Virginia	30	29	38	35	46	Download	$240
Washington	23	33	48	38			
West Virginia	7	28	13	34			
Wisconsin	38	52	28	56			
Wyoming	55	43	19	50			

*For states where license data were obtained. For Oregon, the number in parentheses represents licensees employed as an occupational therapist. All other estimates from license data reflect occupational therapists with an active license in each state, which may include those practicing in another state or those not actively employed as an occupational therapist. Web scrape = data extracted from a licensing board website that did not have a built-in capability to download the file. Download = data obtained from a licensing board website with a built-in ability to download the file, sometimes for free, sometimes for a fee. Request = data obtained by contacting the licensing board and requesting the relevant data, sometimes for free, sometimes for a fee.

Table A-7: State Level Estimates of <u>Physical Therapists</u> per 100,000 Population Using Data from ACS, OEWS, and Licensing Data from Selected States

| State | Estimated Number of <u>Physical Therapists</u> per 100,000 State Population | | | | | | |
| | 2014 | | 2017 | | 2017 State License Records* | | |
	ACS	OEWS	ACS	OEWS	Per Capita Estimate	How License Data Obtained	Cost of License Data
Alabama	38	46	69	52			
Alaska	56	68	106	68			
Arizona	47	57	97	48	66	Request	Free
Arkansas	80	59	61	64			
California	57	44	63	52			
Colorado	95	83	113	90			
Connecticut	131	101	128	110			
Delaware	118	67	82	97			
District of Columbia	0	115	55	95			
Florida	69	58	72	61			
Georgia	76	47	61	49			
Hawaii	80	58	78	67			
Idaho	26	62	50	70	118	Request	Free
Illinois	107	83	108	89			
Indiana	75	66	79	75			
Iowa	29	58	69	60	94	Download	Free
Kansas	71	56	71	68			
Kentucky	55	59	65	55	75	Request	$100
Louisiana	70	56	41	63			
Maine	134	92	70	111	154	Download	Free
Maryland	88	71	97	81			
Massachusetts	117	108	112	127			
Michigan	88	84	73	83			
Minnesota	78	69	97	76	93	Request	$363
Mississippi	35	51	96	58			
Missouri	75	64	91	74			
Montana	72	98	107	94			
Nebraska	65	71	103	78			
Nevada	49	53	65	52	71	Download	Free
New Hampshire	124	105	69	103			
New Jersey	101	78	114	83			
New Mexico	50	55	68	65			

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State	Estimated Number of <u>Physical Therapists</u> per 100,000 State Population						
	2014		2017		2017 State License Records*		
	ACS	OEWS	ACS	OEWS	Per Capita Estimate	How License Data Obtained	Cost of License Data
New York	90	78	93	79			
North Carolina	60	57	67	60			
North Dakota	0	69	66	90			
Ohio	55	58	59	66	82	Request	Free
Oklahoma	97	41	62	60			
Oregon	73	64	74	66	100 (91)	Request	$100
Pennsylvania	68	83	108	88			
Rhode Island	53	94	166	85			
South Carolina	62	58	75	58			
South Dakota	198	69	34	92			
Tennessee	70	61	74	69			
Texas	55	44	56	56	62	Request	$240
Utah	32	51	59	55			
Vermont	165	105	116	125	173	Download	Free
Virginia	70	57	63	76	90	Download	$360
Washington	78	67	95	68			
West Virginia	70	57	90	68			
Wisconsin	80	73	103	82			
Wyoming	53	60	29	81			

*For states where license data were obtained. For Oregon, the number in parentheses represents licensees employed as a physical therapist. All other estimates from license data reflect physical therapists with an active license in each state, which may include those practicing in another state or those not actively employed as a physical therapist. Download = data obtained from a licensing board website with a built-in ability to download the file, sometimes for free, sometimes for a fee. Request = data obtained by contacting the licensing board and requesting the relevant data, sometimes for free, sometimes for a fee.

Table A-8: State Level Estimates of <u>Respiratory Therapists</u> per 100,000 Population Using Data from ACS, OEWS, and Licensing Data from Selected States

State	Estimated Number of <u>Respiratory Therapists</u> per 100,000 State Population						
	2014		2017		2017 State License Records*		
	ACS	OEWS	ACS	OEWS	Per Capita Estimate	How License Data Obtained	Cost of License Data
Alabama	41	43	58	51			
Alaska	14	26	150	22			
Arizona	24	36	23	31	56	Web scrape	Free
Arkansas	45	37	30	32			
California	41	36	29	44			
Colorado	24	33	17	34			
Connecticut	32	33	12	35			
Delaware	50	37	30	42			
District of Columbia	0	67	29	50			
Florida	43	38	45	41			
Georgia	39	39	31	37			
Hawaii	74	17	30	27			
Idaho	7	31	12	34	53	Request	Free
Illinois	49	36	26	37			
Indiana	34	49	52	63			
Iowa	37	33	47	31	56	Download	Free
Kansas	45	38	55	38			
Kentucky	47	56	52	56	78	Request	Free
Louisiana	17	45	38	47			
Maine	17	32	39	33	43	Download	Free
Maryland	36	28	30	24			
Massachusetts	34	37	21	36			
Michigan	34	40	48	43			
Minnesota	31	28	21	31	36	Request	$130
Mississippi	102	53	54	50			
Missouri	48	41	37	46			
Montana	30	35	34	44			
Nebraska	25	49	43	52			
Nevada	57	32	43	36	57	Request	$50
New Hampshire	22	27	47	28			
New Jersey	35	35	23	33			
New Mexico	31	31	18	37			

State	Estimated Number of <u>Respiratory Therapists</u> per 100,000 State Population						
	2014		2017		2017 State License Records*		
	ACS	OEWS	ACS	OEWS	Per Capita Estimate	How License Data Obtained	Cost of License Data
New York	29	30	22	29			
North Carolina	28	38	30	39			
North Dakota	0	47	0	41			
Ohio	56	51	40	53	69	Request	Free
Oklahoma	40	28	30	32			
Oregon	25	29	15	31	45	Download	Free
Pennsylvania	37	41	31	43			
Rhode Island	18	37	27	30			
South Carolina	55	40	27	34			
South Dakota	40	38	11	40			
Tennessee	21	51	27	52			
Texas	26	39	31	40	50	Request	$57
Utah	27	29	35	30			
Vermont	50	35	48	32	48	Download	Free
Virginia	19	29	32	30	46	Download	$260
Washington	24	23	31	32			
West Virginia	31	50	141	51			
Wisconsin	19	35	29	33			
Wyoming	11	43	na	36			

*For states where license data were obtained. Estimates from license data reflect respiratory therapists with an active license in each state, which may include those practicing in another state or those not actively employed as a respiratory therapist. Web scrape = data extracted from a licensing board website that did not have a built-in capability to download the file. Download = data obtained from a licensing board website with a built-in ability to download the file, sometimes for free, sometimes for a fee. Request = data obtained by contacting the licensing board and requesting the relevant data, sometimes for free, sometimes for a fee.

Table A-9: State Level Estimates of <u>**Social Workers (All Levels of Education)**</u> per 100,000 Population Using Data from ACS, OEWS, and Licensing Data from Selected States

| State | Estimated Number of <u>Social Workers (All Levels of education)</u> per 100,000 State Population | | | | | | |
| | 2014 | | 2017 | | 2017 State License Records* | | |
	ACS	OEWS	ACS	OEWS	Per Capita Estimates	How License Data Obtained	Cost of License Data
Alabama	197	158	226	149			
Alaska	368	266	390	360			
Arizona	230	201	226	194	61	Web scrape	Free
Arkansas	215	125	165	142			
California	237	176	244	186			
Colorado	253	187	270	221			
Connecticut	435	268	374	289			
Delaware	202	221	354	227			
District of Columbia	271	466	359	497			
Florida	177	103	170	104			
Georgia	144	136	203	125			
Hawaii	187	226	233	234			
Idaho	204	175	139	134	215	Request	Free
Illinois	259	206	283	202			
Indiana	254	178	289	216			
Iowa	313	206	233	202	127	Download	Free
Kansas	248	163	281	162			
Kentucky	236	246	246	243	117	Request	$50
Louisiana	232	88	224	108			
Maine	444	304	398	302	446	Download	Free
Maryland	347	193	293	203			
Massachusetts	401	380	400	444			
Michigan	327	238	338	232			
Minnesota	354	205	274	269	247	Request	$500
Mississippi	233	198	188	163			
Missouri	276	257	247	281			
Montana	85	298	192	292			
Nebraska	388	222	358	211			
Nevada	146	147	221	160	90	Web scrape	Free
New Hampshire	287	117	342	NA			
New Jersey	323	146	343	118			
New Mexico	256	202	252	217			

State	Estimated Number of Social Workers (All Levels of Education) per 100,000 State Population						
	2014		2017		2017 State License Records*		
	ACS	OEWS	ACS	OEWS	Per Capita Estimate	How License Data Obtained	Cost of License Data
New York	404	276	439	284			
North Carolina	286	181	299	178			
North Dakota	149	187	249	236			
Ohio	289	213	316	234	197	Request	Free
Oklahoma	249	252	290	265			
Oregon	297	207	267	220	125	Request	$25
Pennsylvania	313	277	357	288			
Rhode Island	352	293	311	280			
South Carolina	170	137	211	162			
South Dakota	199	273	165	299			
Tennessee	195	156	259	173			
Texas	162	99	188	121	80	Download	Free
Utah	127	149	188	156			
Vermont	332	389	293	476	189	Download	Free
Virginia	212	173	265	205	90	Download	$320
Washington	208	178	249	183			
West Virginia	203	165	257	112			
Wisconsin	277	154	339	166			
Wyoming	130	171	199	223			

*For states where license data were obtained. Estimates from license data reflect social workers with an active license in each state, which may include those practicing in another state or those not actively employed as a social worker. Web scrape = data extracted from a licensing board website that did not have a built-in capability to download the file. Download = data obtained from a licensing board website with a built-in ability to download the file, sometimes for free, sometimes for a fee. Request = data obtained by contacting the licensing board and requesting the relevant data, sometimes for free, sometimes for a fee.

Table A-10: State Level Estimates of <u>Social Workers (Master's Degree or Higher)</u> per 100,000 Population Using Data from ACS and Licensing Data from Selected States*

| State | Estimated Number of <u>Social Workers (Master's Degree or Higher)</u> per 100,000 State Population | | | | | | |
| | 2014 | | 2017 | | 2017 State License Records** | | |
	ACS	OEWS*	ACS	OEWS*	Per Capita Estimates	How License Data Obtained	Cost of License Data
Alabama	52		79				
Alaska	126		119				
Arizona	66		59		59	Web scrape	Free
Arkansas	45		54				
California	90		93				
Colorado	81		109				
Connecticut	180		193				
Delaware	46		123				
District of Columbia	148		192				
Florida	57		57				
Georgia	41		68				
Hawaii	101		124				
Idaho	73		47		144	Request	Free
Illinois	121		145				
Indiana	102		71				
Iowa	68		56		100	Download	Free
Kansas	94		107				
Kentucky	91		86			Request	$50
Louisiana	119		95				
Maine	151		130		282	Download	Free
Maryland	183		159				
Massachusetts	196		183				
Michigan	153		142				
Minnesota	118		90		143	Request	$500
Mississippi	81		61				
Missouri	87		91				
Montana	26		25				
Nebraska	72		86				
Nevada	34		76		31	Web scrape	Free
New Hampshire	147		145				
New Jersey	123		131				
New Mexico	76		41				

State	Estimated Number of <u>Social Workers (Master's Degree or Higher)</u> per 100,000 State Population						
	2014		**2017**		**2017 State License Records***		
	ACS	OEWS*	ACS	OEWS*	Per Capita Estimate	How License Data Obtained	Cost of License Data
New York	167		204				
North Carolina	86		99				
North Dakota	54		22				
Ohio	97		88		65	Request	Free
Oklahoma	48		70				
Oregon	98		112		125	Request	$25
Pennsylvania	111		122				
Rhode Island	112		122				
South Carolina	80		66				
South Dakota	34		76				
Tennessee	69		95				
Texas	47		53		64	Download	Free
Utah	52		51				
Vermont	151		129		na	Download	Free
Virginia	91		131		80	Download	$320
Washington	74		102				
West Virginia	48		78				
Wisconsin	84		127				
Wyoming	28		36				

*Education level of social workers was not available from OEWS.
**For states where license data were obtained. Estimates from license data reflect social workers with an active license in each state, which may include those practicing in another state or those not actively employed as a social worker. Web scrape = data extracted from a licensing board website that did not have a built-in capability to download the file. Download = data obtained from a licensing board website with a built-in ability to download the file, sometimes for free, sometimes for a fee. Request = data obtained by contacting the licensing board and requesting the relevant data, sometimes for free, sometimes for a fee.

Table A-11: State Level Estimates of <u>Speech-Language Pathologists</u> per 100,000 Population Using ACS and OEWS Data*

| State | Estimated Number of <u>Speech Language Pathologists</u> per 100,000 State Population | | | |
| | 2014 | | 2017 | |
	ACS	OEWS	ACS	OEWS
Alabama	30	26	28	32
Alaska	114	41	77	36
Arizona	28	28	39	32
Arkansas	52	55	57	63
California	35	26	44	29
Colorado	38	54	57	61
Connecticut	72	48	74	48
Delaware	7	45	26	55
District of Columbia	66	55	26	39
Florida	44	34	38	35
Georgia	38	27	37	32
Hawaii	34	32	12	39
Idaho	57	31	91	31
Illinois	63	53	60	50
Indiana	28	39	39	38
Iowa	13	42	50	40
Kansas	26	44	72	51
Kentucky	48	48	34	47
Louisiana	51	44	67	49
Maine	67	54	52	58
Maryland	40	37	48	48
Massachusetts	74	54	76	62
Michigan	31	32	42	34
Minnesota	27	39	47	57
Mississippi	52	45	19	47
Missouri	58	59	54	55
Montana	81	37	64	32
Nebraska	28	49	51	55
Nevada	37	29	45	30
New Hampshire	61	43	70	49
New Jersey	56	54	68	65
New Mexico	14	48	31	44

| State | Estimated Number of Speech Language Pathologists per 100,000 State Population | | | |
| | 2014 | | 2017 | |
	ACS	OEWS	ACS	OEWS
New York	64	50	64	61
North Carolina	52	41	43	42
North Dakota	64	86	39	64
Ohio	52	44	47	44
Oklahoma	59	38	68	41
Oregon	37	31	20	41
Pennsylvania	47	37	70	43
Rhode Island	42	42	59	37
South Carolina	55	35	39	28
South Dakota	95	42	47	45
Tennessee	48	31	43	39
Texas	48	43	46	52
Utah	37	35	35	48
Vermont	89	59	25	64
Virginia	32	35	58	36
Washington	44	36	40	43
West Virginia	15	50	48	56
Wisconsin	48	43	55	41
Wyoming	142	51	69	50

*State license data were not obtained for this occupation group.