Envisioning an Ideal Health Workforce Data System for California

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The mission of Healthforce Center at UCSF is to equip health care organizations with the workforce knowledge and leadership skills to effect positive change.

ACKNOWLEDGMENTS

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Executive Summary

In early 2019, the California Future Health Workforce Commission released a report that contains 27 recommendations for improving the supply, distribution, diversity, knowledge, and skills of the state's health workforce. State legislators have introduced legislation that would implement some of these recommendations, and the governor's budget contains several items that would advance them.

Due to the limitations of data available to describe the health workforce in California, the commission had to base some of its recommendations on outdated and incomplete information. A robust health workforce data system is needed to assess the impact of implementing the commission's recommendations and to monitor trends in supply and demand for health care workers and health professions education.

At present, data describing California's health workforce and health workforce education must be pieced together from multiple sources. California's Healthcare Workforce Clearinghouse, which was established under Health and Safety Code §128052 (Senate Bill 139, Chapter 522, Statutes of 2007), was envisioned as a central repository of information about the supply and demand for health care workers and trends in health professions education. However, at present the clearinghouse disseminates only state- and county-level data for a limited number of measures of supply and demand for just eight licensed health professions. The only data available to describe other professions are (1) data collected by licensing boards, which can only be used to count the number of professionals by geographic location (and are relevant only to licensed professions), and (2) estimates of demand produced by the California Employment Development Department (EDD). For nearly all health professions aside from nursing, education-related data must be obtained from national sources.

The data that are currently available through the clearinghouse also do not include all of the variables that the US Health Resources and Services Administration (HRSA) and other national organizations recommend be contained in a "Minimum Data Set" for health workforce analysis. Specifically, they do not include data describing health care workers' gender, race/ethnicity, professional education, specialty, hours worked, or practice setting.

Several other states have health workforce data systems that are more robust than California's clearinghouse in one or more respects. Some states' data systems incorporate more detailed information about licensed health professionals than California's clearinghouse, or include additional health professions. Several states' data systems include data from sources other than licensing boards and state labor agencies. In addition, several states' web-based portals contain interactive tools that enable users to create customized visualizations of data or download datasets.

An ideal health workforce data system for California would encompass data on supply and demand for workers in all health occupations as well as data on health professions education. All licensing boards should collect the data elements contained in HRSA's Minimum Data Set. Existing data describing numbers of jobs and wages should be augmented with additional measures of demand for health care workers, such as vacancy and turnover rates. Surveys similar to those administered by the Board of Registered Nursing should be administered for all health professions education programs in California, so that the data system will contain timely and accurate information on the various education pipelines for health care workers.

An ideal health workforce data system should also encompass multiple products and services, including a web portal, fact sheets, reports, public-use datasets, and tools that can be used to query the data system and visualize data. Mechanisms should also be established that allow personnel operating the data system to respond to requests from the California State Legislature, state agencies, colleges and universities, media outlets, and other interested parties.

An ideal data system could be housed in the California Department of Consumer Affairs (DCA), the California Office of Statewide Health Planning and Development (OSHPD), or a university-based research center with expertise in the health care workforce. Based on the experience of other states, the most successful model is likely to be a partnership among all three of these entities and other entities that collect health workforce data, such as EDD.

Introduction

Five philanthropic foundations established the California Future Health Workforce Commission in 2017 to identify the state's greatest health workforce challenges and develop a comprehensive plan for addressing these challenges. In early 2019, the commission released a report that contains 27 recommendations for improving the supply, distribution, diversity, and competencies of the state's health workforce.[1] State legislators have introduced bills that would implement some of these recommendations (e.g., AB 890 – nurse practitioner independent practice, AB 1606 – UCSF San Joaquin Valley Medical Education Endowment Fund). The governor's budget also contains several items that would advance the commission's recommendations, such as allocation of funds to the Song-Brown program and Proposition 56 to support medical residency programs.

The commission's recommendations were grounded in the best available data on California's health workforce needs. However, in some cases these data were not current or were insufficiently detailed to characterize California's existing health workforce, the pipelines of trainees in health occupations, or the impact of the commission's recommendations. Some of the recommendations may have differed if current and more complete data were available. If any of the commission's recommendations are implemented, California will need a more robust health workforce data system to assess their impact and disseminate findings.

This white paper discusses existing sources of data that describe the health workforce and health professions education in California, provides examples of more robust health workforce data systems in other states, and describes options for building an ideal health workforce data system for California.

Existing Sources of Data on California's Health Workforce

California's Healthcare Workforce Clearinghouse

Established under Health and Safety Code §128052 (Senate Bill 139, Chapter 522, Statutes of 2007), California's Healthcare Workforce Clearinghouse was envisioned as a central repository of information describing supply and demand for health care workers and trends in health professions education.[2] The clearinghouse is administered by the Office of Statewide Health Planning and Development (OSHPD) and funded by the California Health Data and Planning Fund. The clearinghouse currently provides fact sheets, datasets, and an annual report to the California State Legislature.

As currently constituted, the clearinghouse has some important limitations. First and foremost, the clearinghouse is reliant on secondary data collected from other organizations, including other state agencies. The shortcomings of those data sources, which are described below, limit the data that clearinghouse staff can compile and display. As a result, the clearinghouse has thus far compiled and posted fact sheets on its website that present data for only eight health care occupations: licensed vocational nurses (LVNs), osteopathic physicians (DOs), physician assistants (PAs), physicians and surgeons (MDs), registered dental assistants, registered dental hygienists, registered nurses (RNs), and respiratory care practitioners. Datasets are available free of charge through the California Open Data Portal for only three professions: DOs, MDs, and PAs.[3] Apart from name, mailing address, and age, OSHPD does not have access to data collected by licensing boards for other health professions.[4]

Second, data are available on only a limited number of topics. For most of the eight occupations, the only data provided in the fact sheets concern age, job openings, wages, projected growth in employment, and the counties in California that have the largest numbers of licensees. The Medical Board of California and the Osteopathic Medical Board of California administer mandatory surveys that collect information about MDs and DOs, respectively, regarding specialty, race/ethnicity, languages spoken other than English, professional activities, and medical school attended, which allows the clearinghouse to present more information about these two occupations than others.

Third, most of the data the clearinghouse provides are not available in a format that allows users to answer their own questions about California's health workforce. As indicated previously, the publicly available datasets contain information for only DOs, MDs, and PAs, and the number of variables is limited. In addition, these datasets

contain only county-level data. This is an important limitation because many of California's counties cover such large geographic areas that a county-level estimate of the supply of available health care workers may mask important variation in their distribution within a county, which may in turn affect access to care. County-level data also do not permit users to conduct analyses that examine variation in the characteristics of individual physicians.

Finally, none of the datasets or fact sheets address trends in health workforce education. The absence of these data prevent the clearinghouse from addressing important topics such as the capacity of educational programs to train new entrants to the workforce, the demographic characteristics of graduates, and the geographic distribution of training programs across California.

Sources of Data about Health Workforce Supply and Demand

An ideal health workforce data system for California should include information from additional state sources and from national sources.

State sources of supply and demand data

Licensing boards are an important source of data on California's health workforce. The California Department of Consumer Affairs (DCA) posts information on its website describing trends in the number of active licenses, renewed licenses, and new licenses awarded per fiscal year for all licensed health professions.[5] DCA also provides downloadable datasets containing information that can be used to assess the geographic distribution of licensed health professionals.[6] However, these datasets do not provide information about whether license holders are actually practicing in their professions (or simply maintaining an active license), how many hours they work, or what populations they serve.

Some licensing boards collect additional data. The Medical Board of California requires that licensees complete a survey as part of the license renewal process, which collects information about practice location, hours worked per week, types of professional activities (e.g., patient care, administration), specialty, board certification, race/ethnicity, and languages spoken other than English. The Osteopathic Medical Board of California administers a similar survey to DOs. The legislation that established the Clearinghouse requires OSHPD to work with all health professions licensing boards to collect data on supply, geographic distribution, race/ethnicity, and languages spoken by health professionals. However, some licensing boards have interpreted the legislation as not requiring them to collect any data they were not previously collecting, which has substantially limited the data available regarding these professions.

The California Board of Registered Nursing contracts with UC San Francisco (UCSF) to produce periodic sample surveys of RNs and advanced practice nurses (APNs). Surveys of RNs are conducted every two years, and surveys of APNs were conducted in 2010 and 2017. These surveys address important workforce topics that the clearinghouse and licensing files do not address, such as whether licensees are working in nursing, whether they work full-time or part-time, the settings in which they practice, their satisfaction with attributes of their employment and profession, and the characteristics of the patients they serve. The Board of Registered Nursing also contracts with UCSF to produce forecasts of supply and demand for RNs every two years. Reports that summarize findings from the surveys and forecasts are available on the Board of Registered Nursing's website.[7]

Data that health care facilities are required to report to OSHPD, including the Hospital Annual Financial Disclosure Reports, contain information about the number of productive hours worked for a limited number of occupations (e.g., RNs) and occupational groups (e.g., technicians). These data can be used to estimate current employment of health professionals within the following types of entities that are required to provide data to OSHPD: hospitals, nursing homes, and community health centers.

The California Employment Development Department (EDD) collects and disseminates limited data describing the labor markets for health occupations. The agency partners with the US Bureau of Labor Statistics to conduct the Occupational Employment Statistics (OES) survey, which collects data on employment and wages from a sample of establishments on a semiannual basis.[8] EDD also produces 10-year forecasts of employment by occupation, which are based on projection models developed by the Bureau of Labor Statistics.[9] The major limitation of the

EDD data is that they are consistently available for health occupations only at the state level. Estimates are generated for some occupations at the metropolitan statistical area (MSA) level, but data on the same occupations are not reported consistently across all MSAs in the state. In addition, the EDD datasets use the occupational titles defined by the federal government's Standard Occupational Classification (SOC) system. These occupational titles do not always align with the occupational titles that California's licensing boards use. In addition, the OES enumerates the number of full-time equivalent jobs rather than the number of people in each occupation. A strength of EDD's data system is that the agency's website contains interfaces that can be used to visualize or download estimates for individual health occupations.

National sources of supply and demand data

The American Community Survey (ACS) is a product of the US Census Bureau and provides annual data describing the employment and demographic characteristics for a sample of people in the United States.[10] The sample design is based on housing units, and the sample is weighted to represent the noninstitutionalized population of the United States. For many health occupations, the sample size is often too small to produce estimates for anything but the number of persons employed in that occupation. For large occupations, such as RNs, the number of sample cases in the dataset is large enough to produce reliable estimates of key demographic and employment characteristics at the state level. However, among even the largest occupations, the sample sizes do not support analysis below the state level. Another important limitation of these data is that there is no way to identify individuals who were educated or licensed in a particular field but are retired or now working in a different field. The data identify only a person's current, self-reported occupation. For example, a social worker who still maintains his or her license but works as a probation officer will not be identified as a social worker. In addition, the ACS data frequently collapse occupations into much broader occupational groups, making it impossible to identify any information about those individual occupations. The occupational group "Diagnostic Related Technologists and Technicians," for example, encompasses six smaller occupational groups that would be considered distinct occupations (Cardiovascular Technologists and Technicians, Diagnostic Medical Sonographers, Nuclear Medicine Technologists, Radiologic Technologists and Technicians, Magnetic Resonance Imaging Technologists, and Medical Dosimetrists). A strength of the ACS is that estimates for California can be compared with estimates for other states.

Information about the number of clinicians authorized to bill Medicare and Medi-Cal can be obtained via the National Plan and Provider Enumeration System (NPPES) Downloadable File,[11] which includes all clinicians who have a National Provider Identifier. The data include the type of clinician, their 9-digit zip code, and their gender. Clinician types include physician specialties, behavioral health providers, APNs, and other occupations that are allowed to bill federal programs for their services.[12] These data can be used to approximate the number of practicing clinicians for specific specialties at the local level. The Drug Enforcement Administration Active Controlled Substances Act (CSA) Registrants Database, which includes the names, clinician types, and practice addresses of clinicians registered to prescribe controlled substances, can also be purchased.[13]

The Health Resources and Services Administration (HRSA) collects some data that can be used to analyze the health workforce. The National Sample Survey of Registered Nurses was conducted every four years from 1980 through 2008, and was repeated in 2018.[14] These data include approximately 3,000 California RNs per year and can be used to estimate employment rates and settings, education, and demographic characteristics. HRSA also collects data about employment at Federally Qualified Health Centers.[15] In addition, HRSA has produced state-level projections of supply and demand for behavioral health workers,[16] primary care practitioners,[17] nurses,[18] and dentists and dental hygienists.[19]

Some national organizations collect data about their members, which can be used to obtain information about health professionals working in California. For example, the National Council of State Boards of Nursing has collaborated with the National Forum of State Nursing Workforce Centers to conduct the National Nursing Workforce Survey of RNs and LVNs/LPNs every two years since 2013.[20] However, some of these organizations do not release public-use datasets or do not include indicators for the respondent's state of residence in their public-use datasets, which renders these potential sources of data unusable for California-focused analysis.

Sources of Data on Health Workforce Education in California

An ideal health workforce data system for California also should include information about the distribution of educational programs in health occupations across California, the capacity of educational programs, and the demographic characteristics of graduates.

Public college and university systems in California maintain databases that include information related to student enrollments and graduations and can be used specifically for analysis of health professions programs. However, to our knowledge, only the California Community Colleges Chancellor's Office (CCCCO) has previously permitted external researchers to access their data to complete a state-mandated study (requested by SB 664).[21] The CCCCO data include information about every course taken by a student, including grade received, demographic and economic background of the student, and financial aid received. CCCCO provides EDD with the data to link payroll tax information, so that CCCCO can report increases in earnings among graduates of community college certificate and degree programs. The California State University and University of California systems have similar data, but these data are not publicly available. Such data are also not available for private colleges and universities in California.

The California Board of Registered Nursing contracts with UCSF to conduct annual surveys of pre-licensure and post-licensure RN education programs (both public and private). Pre-licensure programs consist of associate and bachelor's degree programs that prepare people for licensure as an RN. Post-licensure programs encompass APN education programs and other programs that prepare RNs to take on leadership roles in clinical care, administration, or education. The Board of Registered Nursing posts reports that summarize findings from these surveys on its website and is in the process of creating a visual display tool for its website.[22]

For other health care occupations, education-related data must be obtained from the US Department of Education's Integrated Postsecondary Education Data System (IPEDS) or from associations of health professions schools. IPEDS is the largest source of data and includes information about all educational institutions that participate in federal financial aid programs.[23] While the IPEDS datasets are useful for identifying trends in numbers of graduates and numbers of educational programs, the data contain limited information about students' characteristics. For example, data are available for students' gender and race/ethnicity but not students' age. There is also no way to identify whether students are attending an on-campus or an online program, which limits researchers' ability to ascertain the geographic areas in which students are located. In addition, the terminology IPEDS uses to categorize educational programs in health professions is not identical to the terminology used by California licensing boards or EDD. For example, many schools that offer a master's degree program that provides training for licensure as a licensed marriage and family therapist, licensed professional clinical counselor, or licensed psychologist offer other graduate-level programs in psychology that do not prepare individuals to become licensed behavioral health professionals (e.g., programs in experimental or organizational psychology). In some cases, colleges and universities report IPEDS data in a way that makes it impossible to distinguish graduates who have trained to pursue licensure as a behavioral health professional from graduates who have not. Moreover, the IPEDS data do not distinguish individuals who have completed their initial degree and are entering the profession from those who are advancing their education after having been licensed and employed in that profession. Thus, for some professions, IPEDS data do not provide an accurate estimate of the supply of new entrants to the workforce. For example, the IPEDS data do not distinguish people who receive a bachelor's degree in nursing as their entry-level degree from people who previously completed an associate degree in nursing and are pursuing a bachelor's degree to advance their education and career opportunities.

Many associations of health professions schools (e.g., the Physician Assistant Education Association) collect data describing the number of enrollees and/or graduates, but the level of detail available varies substantially. Some associations report data only at the national or state level, whereas others provide data at the school level that can be used to assess trends in the supply and distribution of health professions education programs and graduates at sub-state levels. In addition, some associations disseminate data only in PDF-formatted reports, which makes it difficult for researchers and policy analysts to extract data to conduct their own analyses.

Health Resources and Services Administration Minimum Dataset Recommendations

HRSA has developed a "Minimum Data Set" that includes variables related to workforce supply and demand and health professions education. HRSA recommends that every state use standardized data collection instruments to obtain these data for every licensed/certified health care occupation.[24] Table 1 lists the recommended measures of demographic, educational, and practice characteristics. *Essential variables* are those that HRSA recommends be collected for all licensed health professions; *optional variables* are those that would provide additional useful information about a state's health workforce. The University of Michigan's Behavioral Health Workforce Research Center, which is funded by HRSA, has developed a Minimum Data Set for behavioral health professions[25] and has conducted surveys of social workers and marriage and family therapists that have collected information about variables included in the Minimum Data Set.

Table 1. Elements of a Health Workforce Minimum Data Set

Demographic Characteristics	Educational Characteristics	Practice Characteristics
Essential Variables		
Birth date	Professional education, entry level	Employment status
Gender	Professional education, highest level	Number of positions
Race/ethnicity	Licensure (initial year and state)	Hours by activity (e.g., patient care)
	Specialty (as applicable)	Practice setting
	Certifications (as applicable)	Practice location
		Title
Optional Variables		
State or country of birth	Name and location of educational institutions	Patients served
Languages spoken frequently		Practice capacity
		Retirement plans

Source: Armstrong, D, and Moore, J. *The Health Workforce Minimum Data Set (MDS): What You Need to Know.* Health Workforce Technical Assistance Center. January 2015. http://www.chwsny.org/wp-content/uploads/2016/06/MDS_Resource_Brief.pdf.

Health Workforce Data Systems in Other States

Several states have health workforce data systems that are more robust than California's Healthcare Workforce Clearinghouse. The oldest data system is North Carolina's Health Professions Data System, which was established in 1974. North Carolina's data system is administered by the Cecil G. Sheps Center for Health Services Research at the University of North Carolina at Chapel Hill in partnership with the North Carolina Area Health Education Center and the state's health professions licensing boards. Data are collected continuously as part of licensure renewal processes, which include a mandatory survey completed by all licensees in 19 health professions. Licensing boards extract data and transmit it to the Sheps center. Variables for which data are available include age, gender, race/ethnicity, health professions school attended, graduation year, practice address, practice setting, specialty, and hours worked per week. The Sheps center disseminates findings from the data system via multiple channels, including fact sheets, reports, journal articles, presentations, webinars, maps, and interactive data visualization tools housed on the data system's website. The data remain the property of the licensing boards, and Sheps center researchers seek their approval for every new use of the data.[26] Sheps center researchers have leveraged their ability to link individuals' records over time to study employment patterns over individuals' life cycles and to examine educational advancement and transitions from one profession to another (e.g., from licensed practical nurse to registered nurse).[27]

Several states' health workforce data systems incorporate data from sources other than licensing boards. New York's Health Workforce Data System, which is administered by the Center for Health Workforce Studies at the State University of New York at Albany, includes reports on the results of annual surveys of nursing schools regarding applications, admissions, graduations, barriers to expanding capacity, and the local job market for newly trained RNs.[28] Virginia's health workforce data system incorporates data from the US Bureau of Labor Statistics regarding employment and compensation in the health care sector. The state's Healthcare Workforce Data Center uses these data to produce a series of briefs regarding employment in health care at national, state, and regional levels, and compensation of health care workers.[29]

In addition, a few states have established novel means of obtaining data that cannot be collected through licensing boards. Washington has developed a Health Workforce Sentinel Network[30] to provide rapid, real-time information to identify emerging shortages in health care occupations. The Sentinel Network is a partnership between Washington's Workforce Board and the University of Washington's Center for Health Workforce Studies. Employers in the health sector can volunteer to participate in the network; participants are asked to respond to a series of questions about workforce demand in their facilities four times per year. The questions elicit information about occupations for which employers are experiencing difficulty recruiting sufficient staff as well as the reasons they believe they are having such difficulty (e.g., competition from other types of employers).

Finally, several states have developed interactive tools that allow users to visualize data available through their web-based portals. North Carolina's web-based portal contains a tool that enables users to generate maps of ratios of health professionals by county and to download the data used to create maps.[31] Users can also generate maps and download data for physicians and dentists by specialty. The web-based portal for Washington's Health Workforce Sentinel Network contains a tool that displays findings regarding demand for workers by facility type and region.[32] Virginia's portal includes a tool called "Student Choice: Healthcare" that people considering health careers can use to compare earnings, length of education, and median educational debt across health professions.[33] The Bowen Center for Health Workforce Research and Policy, established five years ago as a partnership between the Indiana state government and Indiana University,[34] has established the Bowen Health Workforce Information Portal, which offers interactive county-level maps, data query tools, and data downloads that describe supply and characteristics of workers in six health care occupations.[35] Users can overlay data points for the locations of hospitals and clinics to assess whether variation in supply is associated with proximity to hospitals and clinics.[36] Appendix A presents examples of data visualizations available through North Carolina, Washington, Virginia, and Indiana's web-based portals.

Envisioning an Ideal Health Workforce Data System in California

Creating an ideal health workforce data system for California will require investment of resources to increase the number of variables on which data are collected and the products and services available. It will also require consideration of which organizations should compile, analyze, and disseminate health workforce data and the costs associated with these activities.

Data Elements

An ideal health workforce data system for California would encompass data on supply and demand for health workers as well as data on health workforce education.

Supply

For the supply of health workers, the specific data elements would encompass those included in HRSA's Minimum Data Set. All boards that license health professionals and all organizations that certify health workers in California should incorporate questions about Minimum Data Set variables into surveys that are conducted in conjunction with licensing and license-renewal processes. Answering these questions should be mandatory to the extent permissible under the state constitution. Legislative action may be required to ensure that the surveys are mandatory, as prior legislation has not empowered licensing boards to require that surveys be completed. Licensing boards may also need additional resources to cover costs associated with administering these surveys.

Demand

EDD's estimates of employment levels and wages for health workers should be augmented with additional measures of demand for health workers, such as vacancy and turnover rates. Due to the challenges associated with obtaining adequate response rates to surveys about these topics, California may wish to consider a strategy similar to the Washington's Health Workforce Sentinel Network, which collects and disseminates rapid, real-time information to identify emerging shortages.

Education

Educational program data for all health occupations should be collected on an annual basis using survey methods similar to those that the Board of Registered Nursing uses to obtain data on nursing education programs. Using similar methods to collect data across educational programs for all health occupations would facilitate comparison of trends in education across occupations. An alternative approach could involve accessing databases from public universities and conducting a mandatory survey of private colleges and universities. This process would need to be carefully designed to ensure comparability of data across disparate sources.

Products and Services

An ideal health workforce data system for California would encompass multiple products and services that are updated annually, including the following:

- Standardized fact sheets and reports
- Tools for querying the data system and visualizing data
- Public-use and/or restricted-use datasets that can be analyzed by external researchers and stakeholders while meeting basic requirements of confidentiality
- A website through which people can query the data system and access datasets and publications
- A mechanism for responding to requests for data from the California State Legislature, state agencies, colleges and universities, media outlets, and other interested parties
- Dissemination of information about the data system and its products via webinars, social media, and other means

Compilation, Analysis, and Dissemination of Health Workforce Data

Compilation, analysis, and dissemination of workforce data can be accomplished through three mechanisms:

- Assign responsibility to licensing boards
- Expand the capabilities of California's Healthcare Workforce Clearinghouse
- Establish a collaboration between a university and state government agencies and licensing boards

While licensing boards can play important roles in data collection, few states have given them responsibility for health workforce data analysis because licensing boards may not have staff with the necessary expertise. Licensing boards are primarily responsible for oversight of the professionals they license, and thus their staff and resources are focused on this function. In addition, having each individual licensing board responsible for analysis of data regarding the profession it oversees could inhibit standardization of data elements and holistic analysis of data across professions.

The clearinghouse is already authorized in California law and now collects and disseminates data on select health professions. If additional resources were available, OSHPD could expand the clearinghouse's capabilities and the types of information it disseminates. These resources could include funds that OSHPD could use to hire additional staff with expertise in health workforce data analysis or contract with experts outside state government.

As noted in the discussion of health workforce data systems in other states, most states with robust data systems involve partnerships among universities, state government agencies, and licensing boards. Universities contribute

expertise in analysis of health workforce data and evaluation of health workforce initiatives, as well as a broad perspective on health organizations' current and future workforce needs. In these collaborative centers, university faculty have been able to secure additional funding from other state agencies, philanthropic foundations, and federal agencies to conduct in-depth analyses, such as a current project at the Bowen center in Indiana to conduct annual primary care needs assessments.

Estimated Cost

The costs associated with establishing an ideal health workforce data system in California include both startup costs and ongoing costs. Startup costs would include funding to upgrade or replace the clearinghouse's website to provide tools for querying and visualizing data, in addition to funding for licensing boards to modify their data systems to collect more workforce data. Employers and educational institutions would also incur some start-up costs to develop systems for collecting data and transmitting it to the clearinghouse. Ongoing funding would be needed to maintain these data collection systems and to cover costs associated with salaries and benefits for personnel, software to conduct data analyses and display data, and fees for website hosting, web conferencing, and social media accounts. Information about the costs of Indiana's and North Carolina's health workforce data systems (both of which are partnerships between state government agencies and universities) were obtained from their directors. If their estimates are adjusted for the higher cost of programmers and other personnel in California, we estimate that startup costs for the entity that would administer the ideal data system would be $1 million and that ongoing costs to maintain the system would be $250,000 to $500,000 per year. These costs would not include costs that licensing boards, employers, or educational institutions would incur to collect and transmit data on an ongoing basis.

Conclusion

California's Healthcare Workforce Clearinghouse is an important resource but is far from the one-stop shop for health workforce information envisioned in the legislation under which it was established. At present it contains no data about health workforce education programs and only limited data on the characteristics of people in select licensed health professions and demand for these professions. Other states' health workforce data systems include additional health care occupations, additional data elements, and additional sources of data. Some states have also created tools to help users visualize data. In addition, some states' data systems are partnerships among state agencies, licensing boards, and universities, an approach that leverages the strengths of each type of entity to improve the breadth and depth of data and analysis available to stakeholders. The California Board of Registered Nursing, other state agencies, and philanthropic organizations have contracted with university-based researchers to collect and analyze California health workforce data, but these contracts are often time limited and address only a limited range of health occupations.

Creating an ideal health workforce data system for California will require investment of additional resources to expand collection of data to more health occupations and increase the range of products and services available to the state legislature, state government agencies, employers, educational institutions, the media, and other key stakeholders. Legislation may be required to ensure that surveys of licensed and certified health workers are mandatory and that the data collected could be shared within accepted privacy standards. An ideal data system will also require sustained partnerships among licensing boards, state agencies, and universities to expand the amounts and types of health workforce data that are collected, analyzed and disseminated.

## Appendix A. Visualizations of Health Workforce Data from Other States

Supply and Demographic Characteristics of the Health Workforce

Indiana University's Bowen Health Workforce Information Portal includes a tool that enables users to create maps that display total full-time equivalent (FTE) health professionals and numbers of people per FTE health professional for five health professions by county, state legislative districts, Congressional districts, and several other geographic units. For physicians, separate maps can be generated for primary care and specialist physicians and for physicians in seven specialties (emergency medicine, family medicine, geriatrics internal medicine, obstetrics/gynecology, pediatrics, and psychiatry). Information about the location of six types of health care facilities can be layered on top of the data regarding provider supply, enabling users to examine the relationship between location of facilities and provider supply. Users can also overlay indicators for geographic areas that have been designated as Dental Health, Mental Health, or Primary Care Health Professional Shortage Areas. The map below displays the numbers of people per FTE primary care physician by county.
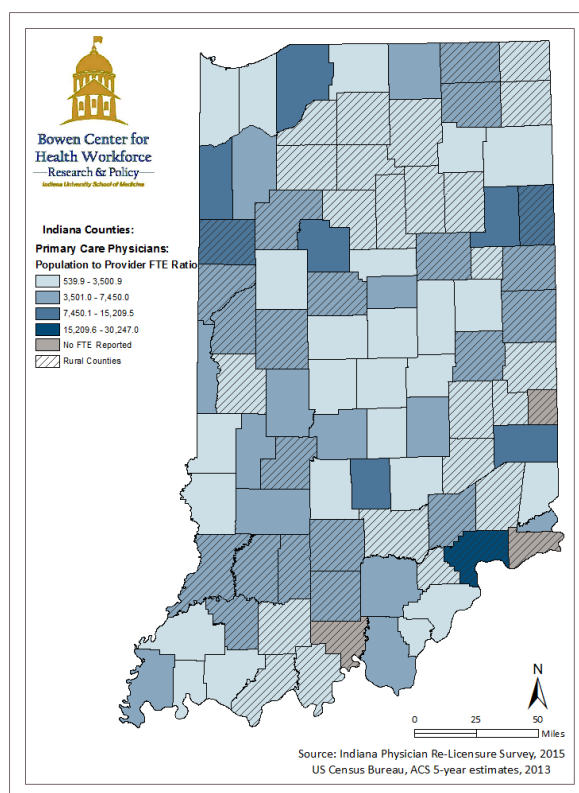
Source: Bowen Health Workforce Information Portal. Map Gallery https://bowenportal.org/index.php/data-resources/map-gallery/physician-map-gallery/

The online portal for North Carolina's Health Professions Data System contains a tool that generates graphs of trends in supply per 10,000 persons and demographic characteristics for each profession as well as maps of supplies of health professionals per 10,000 persons by county. The trend graphs provide users with important information about the extent to which numbers of health professionals and their demographic characteristics have changed over time. For physicians, data can be displayed for all physicians or by specialty. The figure below displays data for psychologists.
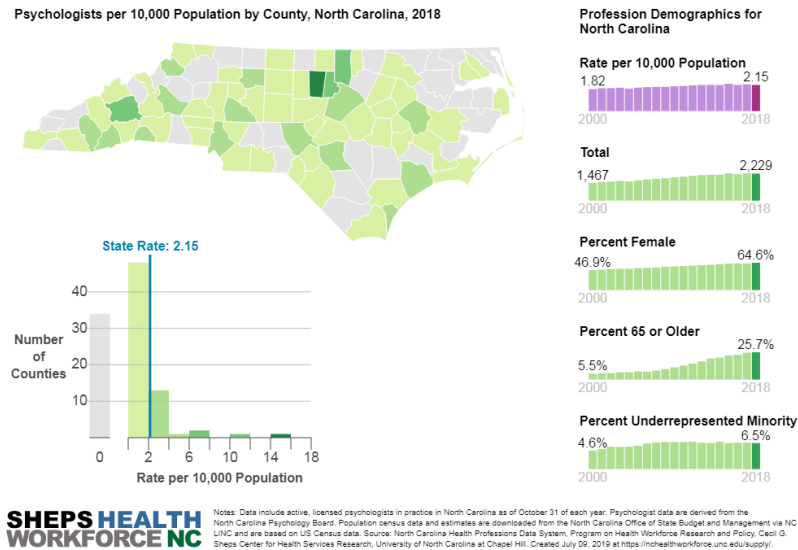
Psychologists per 10,000 Population by County, North Carolina, 2018

Source: Cecil G. Sheps Center for Health Services Research. North Carolina Health Professional Supply Data. https://nchealthworkforce.unc.edu/supply/
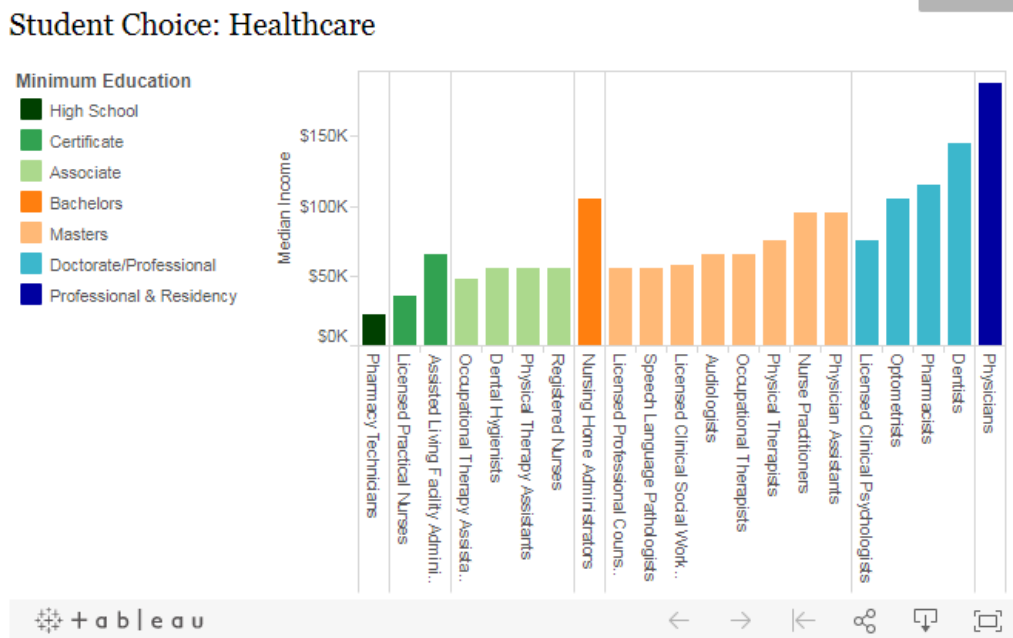
Demand for the Health Workforce

The Washington Health Workforce Sentinel Network's website includes an interface that allows users to visualize findings from the network's surveys of employers regarding emerging shortages in health occupations. Users can generate charts that display occupations for which employers report that having vacancies for exceptionally long periods of time. Findings can be displayed for separately for each of the 17 types of employers that participate in the network. Such data can help employers set expectations for the length of time required to fill vacancies and can also help educational institutions identify occupations in which expansion of training opportunities may be warranted. The table below displays findings regarding occupations for which home health agencies reported having exceptionally long vacancies in 2017 or 2018.
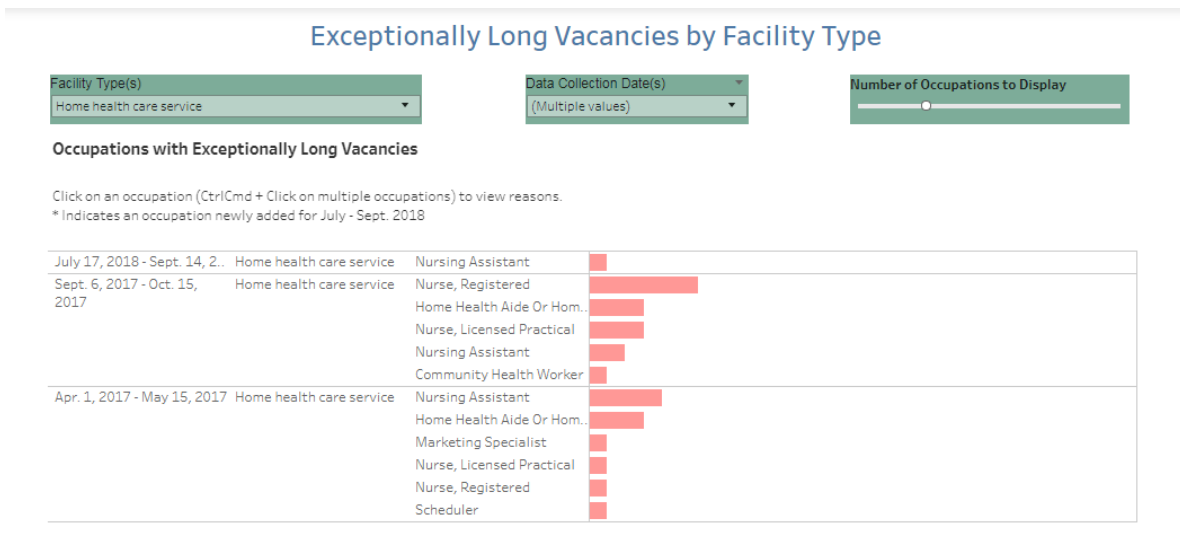
Source: Washington Health Workforce Sentinel Network. Findings by Facility Type. http://wa.sentinelnetwork.org/findings/facility/

Health Career Exploration

The web-based portal for Virginia's health workforce data system includes a tool called "Student Choice: Healthcare" that people considering health careers can use to compare earnings, length of education, and median educational debt across health professions. Data visualizations that can be generated include a chart that plots the minimum level of education required for 21 health occupations against median income in these occupations. These data enable users to compare earnings and educational requirements across occupations as well as differences in return on investment in education across occupations that require the same level of education.

Source: Virginia Healthcare Workforce Data Center. Student Choice: Healthcare.
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