Health Program

The Complexities of National Health Care Workforce Planning:

A review of current data and methodologies and recommendations for future studies

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DCHS
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Executive Summary

Health care systems around the globe are struggling to identify the adequate mix of health care professionals necessary to meet the needs of current and future patient populations. The U.S. is no exception.

Health care consumes 17 percent of the U.S. gross domestic product (GDP), and the U.S. consistently spends more on health care per capita than other developed countries.[1] Health care costs exceed $9,000 per capita and will increase at six percent annually for the next decade.[2]

Indeed, with reforms underway across the country to drive improvements in the quality, efficiency and effectiveness of the health care system, in addition to the present-day context of national deficit reduction strategies, it is imperative that we take a fresh look at the American health care workforce.

Due to the data currently available, however, it is difficult to offer both a complete forecast of the nation's health care workforce supply and assess its adequacy for meeting the demand for services in coming years. Traditional supply-demand analyses for the health care industry workforce fall short of our needs. Fragmented and inconsistent data collection, variance in methodological assumptions and rigor, mistrust between professional groups, and wide differences in regulatory and educational context contribute to an incomplete understanding of workforce supply and demand.

Our report emphasizes the importance of developing a new national approach to workforce planning. A national, consistent strategy for data collection and research, in addition to providing states with a common approach to workforce measurement and forecasting methodologies, will enable policymakers and educators to develop a stronger long-term strategy for planning the U.S. health care workforce. Although it does not currently exist, this type of methodology is necessary to capture an accurate picture of the health care workforce supply needed moving forward.

The following are key findings from our research on the American health professional workforce:

A national picture of the supply of health care professionals is difficult to establish

- The existing landscape of health care workforce supply lacks a consistent and comprehensive national overview of the full extent of professions and health workers active in the system. In particular, data on mid-level, allied health care and direct care workers such as home health aides is limited and poorly

represents the full range of employment settings.

- Comprehensive and comparable data sources for current health care workforce supply information across a broad range of professions are lacking; current sources are limited, inconsistent, profession-specific and non-comparable. The lack of timely, available information further complicates accurate supply trend projections.

External Factors Impact Workforce Supply, Composition and Forward Planning

- Workforce participation (entry, retention, exit and re-entry) is subject to unpredictable and variable supply-side influences including labor market factors such as access to professions, licensure requirements and skills portability, as well as structural workforce issues such as participation levels, workforce aging, lifestyle factors and gender.
- Demand-side variables include shifting utilization patterns of evolving consumer expectations of health care; demographic characteristics such as population aging, past activity or utilization trends in service delivery; policy changes that impact pricing and payment systems; and the uptake of insurance and evolving service delivery models. Workforce planning models must consider changes in practice patterns, provider skills required by new team-based service delivery models, funding and payment models, changes in health risk, staffing models, technology innovations, and provider activity and productivity. Other limitations of planning models include the comparability of data collected and the precision of data collection instruments.

A National Workforce Strategy is Critical

- The National Center on Workforce Analysis at the Bureau of Health Professions in the Health Resources and Services Administration (HRSA) is taking significant steps to improve workforce planning. Unfortunately, the National Health Care Workforce Commission, appointed by the Government Accountability Office (GAO), lacks appropriated funds to carry out activities to complement HRSA's work.

Based on our findings, we recommend a workforce planning strategy that:

A FRAMEWORK THAT PROVIDES A COMPLETE PICTURE OF THE HEALTH CARE WORKFORCE AND THE DRIVERS BEHIND SUPPLY AND DEMAND	• Advances a planning agenda that provides a complete picture of the health care workforce as well as the drivers behind supply and demand; • Champions a national supply-and-demand model covering both a macro (entire health workforce) and specialty-specific viewpoint to inform and assist states with locally-based planning and provision; • Recognizes the differing needs of geographic areas (local, state, regional and national); • Adopts an inter-professional approach to workforce research and planning; • Links research and planning to health and higher education sectors; • Supports workforce planning infrastructure capabilities at the state level while ensuring that states become collaborators in the health care framework; • Incorporates strategies to address gaps in workforce distribution and practices such as primary care and specialty areas (i.e., aged care); • Enables new channels of health care delivery through retail health, group visits, direct access by consumers to diagnostic exams and bio-monitoring devices, and payment methods encouraging consumer self-care; • Considers the changing role of insurance and employers as influencers and/or gatekeepers in accessing health providers; • Factors the impact of information technologies that equip consumers and clinicians to better understand treatment options, and relate decisions to outcomes and costs; • Considers the evolution of health service research that correlates optimal outcomes with core competencies and performance measurement for caregivers; • Incorporates changes in educational, licensing and disciplinary infrastructures, programs and institutions to yield a more productive, prepared workforce; and • Evaluates and incorporates key findings from landmark industry studies such as the *IOM Future of Nursing* report.
IMPROVED DATA COLLECTION AND RESEARCH	• Establishes consistent collection and processing arrangements as well as a common definition set and minimum data set; • Recognizes that data collection requirements will differ by geographic location; • Incorporates workforce projections with different data resources (e.g., productivity, impact of behavioral factors, impact of innovation on productivity, and longitudinal career entry and trajectory studies); and • Includes a wide range of relevant demand, supply and productivity scenarios, evidence-based care models that identify the balance of professionals and necessary skill-mix.
EVIDENCE-BASED SCENARIO TESTING TO IDENTIFY OPTIMAL MIX OF STAFFING AND SKILLS	• Models should test supply of workforce by population-based health outcomes using a combination of supply variables in a range of demand, supply and productivity scenarios in four to six communities, including those experiencing supply problems such as rural/remote areas and/or underserved populations. • Compares scenarios to identify which approaches are likely to be most cost-effective in improving the accessibility, quality and sustainability of health workforce services.

Foreword

Health care systems around the globe are struggling to identify the adequate mix of health care professionals necessary to meet the needs of current and future patient populations. The U.S. is no exception. Due to the data currently available, it is difficult to offer both a complete forecast of the nation's health care workforce supply and assess its adequacy for meeting the demand for services in coming years. Indeed, with reforms underway across the country to drive improvements in the quality, efficiency and effectiveness of the health care system, in addition to the present-day context of national deficit reduction strategies, it is imperative that we examine the landscape of the American health care workforce. The following analysis explores the current and future supply of 12 different health care professions – all of which are integral to health care delivery. This report will begin to give federal, state and local leaders the tools they need to assess workforce supply in a meaningful and consistent way.

This Study

The Bipartisan Policy Center's (BPC) Health Professional Workforce Initiative is investigating workforce transformation by examining the current workforce landscape, incentives and innovations in care coordination as well as the future of the health care workforce. This study, conducted by the Deloitte Center for Health Solutions in collaboration with the BPC's Health Professional Workforce Initiative Expert Advisory Panel, is the first step in capturing and analyzing key supply-side workforce issues.[3] With the guidance of BPC's Health Professional Workforce Initiative Expert Advisory Panel, the Deloitte Center for Health Solutions examined industry and occupation-specific primary databases, published data from occupational groups, national employment estimates and future projections, and U.S. and international peer reviewed literature. The study adopts a broad definition of *health care professional workforce* ranging from the vocationally trained to post-tertiary clinical specialists. Examining 12 health care service delivery professions, this study offers an initial starting point – not a definitive landscape – from which to build an inter-professional "whole of workforce" perspective.

Health care professions in this study include:

- Chiropractors
- Dentists
- Home Health Aides
- Personal and Home Care Aides
- Licensed Practical/Licensed Vocational Nurses
- Nursing Aides, Orderlies, and Attendants
- Pharmacists
- Physical Therapists
- Physician Assistants
- Physicians (includes Surgical Specialists, Medical Specialists, Primary Care)
- Psychologists
- Registered Nurses (including Advanced Practice Registered Nurses)[4]

Background

Establishing future workforce requirements is an inherently imprecise activity. Health care is a complex environment, and many uncertainties affect workforce supply and demand. Characterized by multiple stakeholders at the national, state and local levels and within professional, educational and other jurisdictions, the interdependencies between the groups that make up the health care sector are complicated. Moreover, efficient and effective workforce planning and deployment is inextricably linked to changes in demand for services, clinical technologies that facilitate diagnosis and treatment, payments that influence provider behaviors, workforce policies that frame licensing and scope of practice, as well as the overall structure of the system especially as it is impacted by the recently-passed Patient Protection and Affordable Care Act (PPACA) of 2010. Indeed, Section Five of the PPACA emphasizes the need for strategies to increase workforce supply and capabilities, develop workforce diversity, and strengthen professional areas where supply is weak (refer to Appendix A for an outline of the provisions of the PPACA).[5] These strategies are necessary to plan for a supply of professionals that is able to meet the changing demands of the health care system.

Key drivers of estimates of increased demand for health care are based upon assumptions about the health needs of the aging population,[6] the growing prevalence of chronic disease,[7] the cost burden of chronic disease and co-morbidities,[8] population risk profiles,[9] and anticipated increased utilization due to provisions in the PPACA intended to expand access to care.[10,11]

Clearly, the health care industry offers consistent and continuous job growth in the U.S. Employment in the health care industry rose from 8.7 percent in 2000 to 11.5 percent of the total U.S. civilian workforce in 2010 and is projected to increase to 13.5 percent by 2020. Total employment in health care is projected to increase from 16.4 million in 2010 to 22.0 million in 2020.[12] While these numbers reflect substantial job growth, there is a pressing need to identify workforce priorities and policies that ensure an effective, properly trained workforce that leverages technologies and efficient operating models. Additionally, as these priorities and policies are identified, they need to be complemented by sustainable advances in educational curricula, continuing education, ongoing competency assessments and licensure requirements.

Traditionally, health care workforce studies focus on one or two key professions that comprise only a portion of the industry's workforce. Historically, health professional groups – physicians, nurses, allied health professionals – have developed supply-demand analyses based on assumptions unique to their respective disciplines. These analyses discount the possibility of care provided by other professionals or reduced utilization as a result of payment changes or clinical technologies that support self-

diagnoses and treatment by consumers.[13,14,15,16,17] As a result, estimates of demand are based on historic utilization patterns void of possible "future state" changes in demand and the size of needed workforce.

A substantial component of the workforce – personal care and home care aides – includes semi- or non-skilled workers. Studies of workforce supply-demand in these categories tend to be less sophisticated and based solely on population demand. The health care workforce, however, is no less dependent on the availability of these work groups than for those more frequently studied. Therefore, this study includes major categories in the U.S. health care workforce as a necessary means of establishing its size and assessing future demand.

Workforce Requirements: Supply and Demand

Supply and demand variables determine current and future workforce needs. Both supply and demand are characterized by uncertainties and difficulties in the identification and collection of suitable data. Developing a universally accepted group of variables for national and state-based health care workforce modeling is highly complicated. It is likewise difficult to ensure that uniform, valid and reliable data could be applied to these models.

Supply, for example, is influenced by labor market factors that vary by profession including income relativities, work hours, licensure requirements, access to professions and skills portability. Furthermore, structural workforce issues such as workforce aging, lifestyle factors and gender also impact supply. All of these may impact participation in the health care workforce (entry as well as exit). Other factors include technological advances that may influence productivity through changes in workforce practices, but may also introduce new fields of medical endeavor.

Additional factors that influence the workforce supply, composition and forward planning include:

- Educational cycles, training time, training capacity limitations, clinical education shortages, availability and location of undergraduate, baccalaureate and graduate medical and nursing education (GME and GNE) positions, and faculty shortages;[18]
- Uncertainty of future supply in some professions due to lengthy training periods and likely entrance of intake cohorts into the workforce;
- Variations in capabilities, active participation, retention and re-entry due to interstate and intrastate variations in training programs;
- State licensure laws and scope of practice regulations;
- Leveraging competencies and expansion of clinical roles (where appropriate);
- Workforce participation patterns and preferences (i.e., age and gender), opportunity costs or trade-offs associated with willingness to work at different remuneration levels, work hours or locations;
- Issues specific to some vocations such as high turnover rates, worker satisfaction, low remuneration levels and lack of career growth;
- Immigration policy; and
- Economic conditions.

Demand is influenced by shifting utilization patterns as a result of evolving consumer expectations, demographic characteristics (i.e., aging), utilization trends in service delivery, policy changes that affect pricing and payment systems, the uptake of insurance, and the optimal mix of service provider skills.

Other factors will also contribute to health care workforce demand and should be considered, including changes in:

- The incidence and prevalence of disease in the U.S. population due to demographic, environmental and lifestyle trends;
- The clinical delivery of care reflecting personalized medicine, advanced diagnostics, consumer access to self-help tests and bio-monitoring data;
- The increasing demand for primary and non-acute care services and focus on prevention- and population-based strategies;
- The structure and organization of local delivery systems reflecting alignment of physicians and hospitals in clinically integrated systems to participate in bundled payments, accountable care organizations and other programs;
- Payments and incentives that encourage utilization of certain health services over others, framing compensation expectations and linking them to priorities such as health outcomes;
- Health care reform and expansion of insurance coverage to the previously uninsured;
- Consumer expectations about services provided by health professionals, especially their use of electronic health records in tandem with personal health records;
- Expanded diversity profile of the health care workforce to be more responsive to projected population demographic changes;
- Improvements to care quality and efficiency that may require novel categories of professionals (i.e., health informatics), different combinations of professionals and employment settings, or different education based on new research and best practice findings;
- The education, licensing and regulatory oversight of health professionals, especially as liability, error reporting, outcomes and cost information become publicly transparent; and
- Changes in costs and the financing mechanisms that facilitate or limit access to health professionals and the health care workforce overall.

A comprehensive workforce planning strategy will need to incorporate the factors above as well as capture the dynamic nature of the variables of health care workforce supply and demand. Although it does not currently exist, this type of analysis will be critical to the future of workforce planning.

Healthcare Workforce Models and Data

Workforce Planning Methodologies

Health care workforce models provide a mechanism for making projections about future workforce needs, informing clinical, education and labor market policies and priorities. Workforce models can range from simple to complex and can produce highly varied results. They tend to employ population-based forecasting methods; in particular, the "stock and flow"[19] approach captures estimates of existing workforce numbers and utilization data and translates them into estimates of required full-time equivalent workers. Other less commonly used approaches to workforce modeling include econometric and simulation modeling. Some studies or projections adopt a heterogeneous approach, combining a number of elements within a single study to account for a broader range of key factors that need to be considered. Appendix B summarizes several approaches to projecting workforce requirements, including the workforce-to-population, needs-based, service-demands and service-delivery approaches.

Limitations with current workforce planning models include accounting or making provision for uncertainties such as changing practice patterns, new service delivery models, changes in funding or payment models, changes in health risk, any relationship of staffing models to quality of care provided, and the impact of technology innovations on patterns of care and provider activity and productivity. Other limitations include cost, comparability of data collected and the precision of data collection instruments.

A number of factors may impact future supply deliberations, including:

- Correlations between quality of care in acute and sub-acute settings and required levels of staffing by nurses, technicians and other caregivers;[20,21,22]
- New technology for distance medicine, home-based care, bio-monitoring and e-visits that alter demand for in-person visits to physicians, allied health clinics and other ambulatory facilities;[23,24,25]
- Health promotion and wellness as well as the addition or substitution of alternative forms of care such as natural medicine, naturopathy and Traditional Chinese Medicine;[26]
- Re-casting of traditional work roles and responsibilities ranging from utilizing trained workers to the full extent of their training to employing support workers

who can alleviate certain administrative duties;[27]

- The use of non-traditional care providers such as unpaid or informal caregivers;[28]
- Practice variations which suggest that provider behavior such as responsiveness and propensity to intervene have implications for both the cost of care as well as the systemic capacity to provide care;[29,30,31,32,33]
- Consumer engagement, patient self-management and patient activation strategies designed to facilitate assumption of personal responsibility for managing health;
- Active consolidation of providers in particular markets through mergers and acquisitions by large health systems, impacting network availability and access to certain specialties; and
- Research on, access to, and financing of appropriate health care professional education.

A sound database is critical for an advanced workforce planning model that incorporates the factors listed above. Unfortunately, comprehensive and comparable data for health care workforce supply across a broad range of professions are lacking, and existing sources of information are limited, inconsistent, profession-specific and non-comparable. Currently there is a depth of workforce research around the supply and demand for physicians and nurses, but less so for other professions which are integral to the overall health care workforce. State oversight of licensing and training contributes to data variability, creating a complex set of projections at the aggregate or national level.

Data and Research Issues

Data on workforce employment and supply can be obtained from a number of sources, ranging from national and state databases to professional organizations and societies.

National databases that collect employment information consistently across all professions include those from the U.S. Bureau of Labor Statistics (BLS) and the Census Bureau (Table 1).

Table 1: National databases collecting employment information

STUDY/INSTITUTION	DESCRIPTION
Occupational Employment Statistics Bureau of Labor Statistics.[34]	• A semi-annual, cross-sectional national mail survey to employers that collects data on wage and salary workers in non-farm establishments for around 800 occupations. Objective is to collect data to produce estimates of employment and wages for specific occupations. Does not include persons who are self-employed.
National Employment Matrix Occupational Employment Projections Bureau of Labor Statistics.[35]	• Presents current and projected employment over a 10-year period between 2010-2020 for 300 industries and 750 occupations. Projections are released every two years with the most recent release being 2012. • Combines data from different sources including the Occupational Employment Statistics Survey and the Current Population Survey.
American Community Survey Census Bureau.[36]	• Representative survey of the U.S. and Puerto Rican population that captures social, economic and housing data. Economic data collected includes industry, occupation categories and place of work.

The BLS publishes the Occupational Employment Statistics (OES) employment and wage estimates for about 800 occupations. Based upon a semi-annual survey of non-farm establishments, the OES estimates the number of jobs in certain occupations, and the wages paid. Unfortunately, while the BLS is comprehensive, it highlights broad trends and lacks the specificity to identify the various health professionals within a category. For example, it identifies "registered nurses" without noting various levels of education and practice competencies.

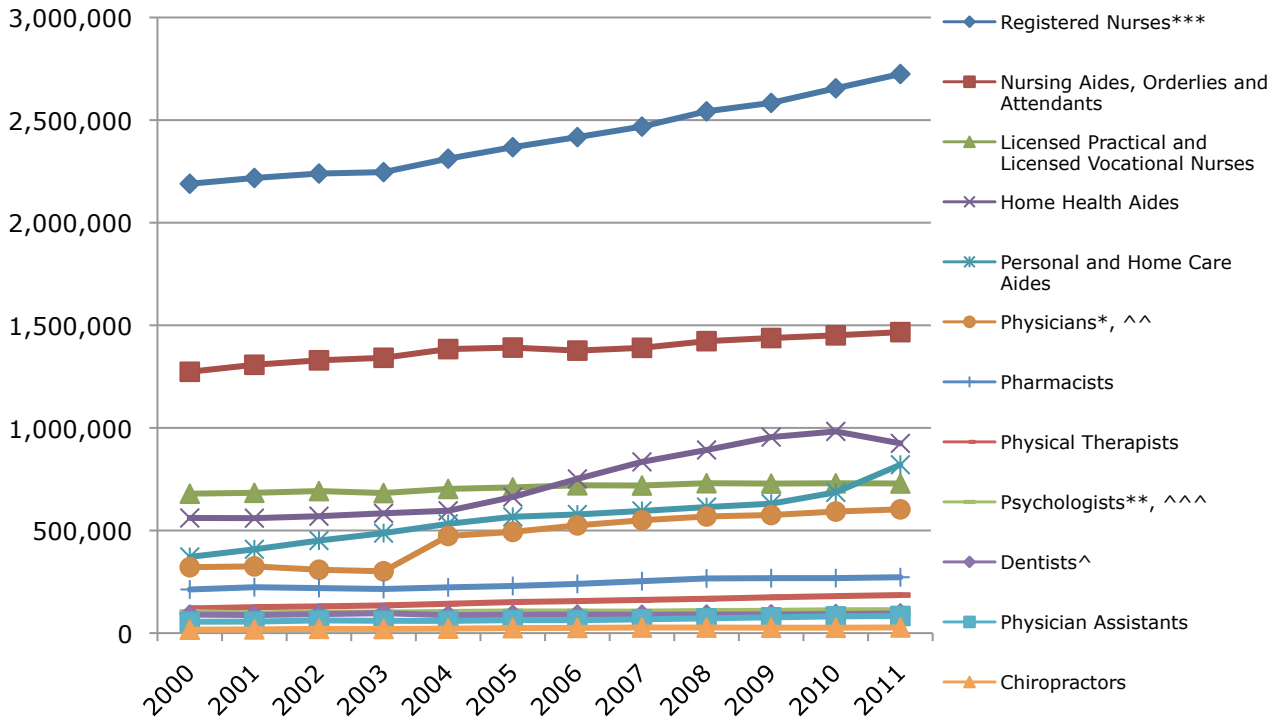
Occupational employment data are used to develop information regarding current and projected employment needs and job opportunities. BLS figures indicate that all professions of interest in this study experienced growth over the past 10 years. The most notable increases occurred in the physician and nursing categories, and in support worker categories such as home health aides and personal and home care aides. Table 2 presents OES employment estimates for the professions of interest in this study by selected years.

Table 2: National occupational employment estimates, by selected years 2000-2011

PROFESSIONAL GROUP	NATIONAL OCCUPATIONAL EMPLOYMENT ESTIMATES, BY SELECTED YEARS† *(SOURCE: OCCUPATIONAL EMPLOYMENT STATISTICS, BUREAU OF LABOR STATISTICS)††*						
	2000	**2002**	**2004**	**2006**	**2008**	**2010**	**2011**
Chiropractors	16,740	20,630	21,830	25,470	27,050	26,250	27,510
Dentists^	90,090	92,460	86,950	90,670	90,680	92,710	95,800
Home Health Aides	561,120	569,670	596,330	751,480	892,410	982,840	924,650
Licensed Practical and Licensed Vocational Nurses	679,470	692,290	702,740	720,380	730,500	730,290	729,140
Nursing Aides, Orderlies, and Attendants	1,273,460	1,329,310	1,384,120	1,376,660	1,422,720	1,451,090	1,466,700
Personal and Home Care Aides	371,280	451,040	555,780	578,290	614,190	686,030	820,600
Pharmacists	212,660	219,390	222,960	239,920	266,410	268,030	272,320
Physical Therapists	120,410	130,290	142,940	156,100	167,300	180,280	180,440
Physician Assistants	55,490	61,910	59,470	62,960	71,950	81,420	83,540
Physicians*	321,290	308,800	473,394	525,030	568,400	592,410	603,100
Psychologists**	103,120	100,560	103,020	105,290	107,750	111,390	111,430
Registered Nurses***	2,189,670	2,239,530	2,311,970	2,417,150	2,542,760	2,655,020	2,724,570

† Full data for 2000-2011 are shown in Appendix C and in Figure 1.
†† Due to methodological changes over time including changes in occupational, industry and geographic classification and changes in the way data are collected, the BLS cautions against making conclusive comparisons of OES data over time. http://www.bls.gov/oes/oes_ques.htm#Ques11
^ Dental categories changed in 2004 to incorporate two categories, "dentist, general" and "dentist, all other specialties."
*Physicians work in one or more of several specialties including but not limited to anesthesiology, family and general medicine, general internal medicine, obstetrics and gynecology, pediatrics, psychiatry and surgery. In 2004, category "Physicians and surgeons, all other" was added.
** Psychologists include clinical, counseling and school psychologists. In 2004, category "Psychologists, all others" was added.
*** Registered Nurses include Advanced Practice Registered Nurses.

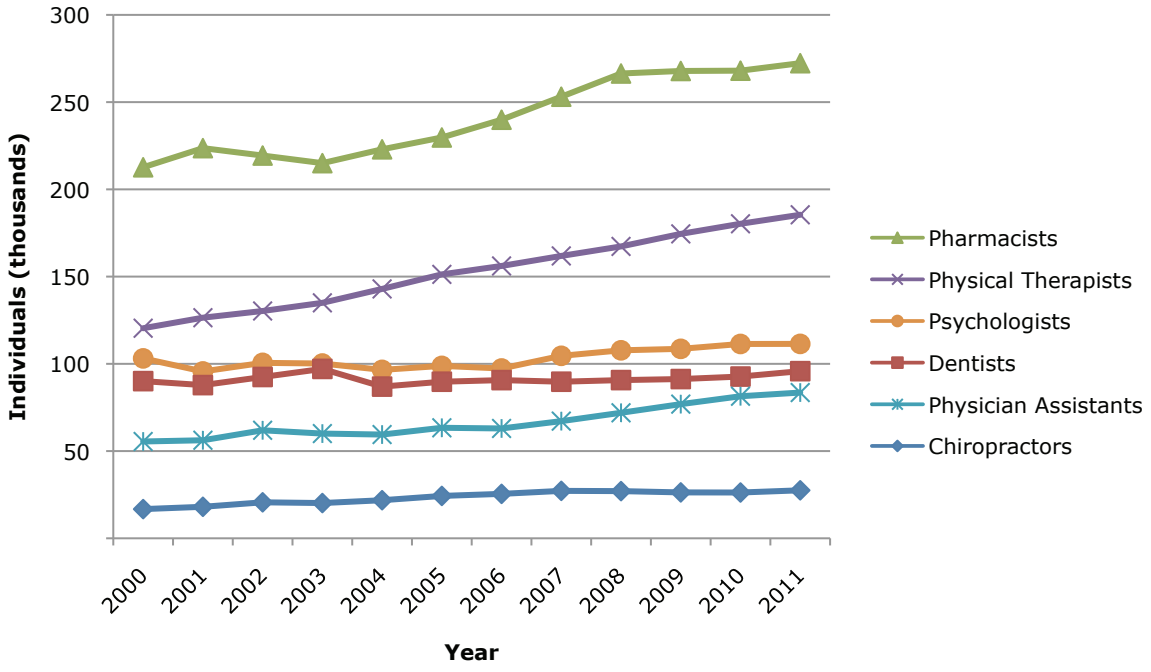
Figure 1: National occupational employment estimates for selected professions, 2000-2011



Source: Occupational Employment Statistics, Bureau of Labor Statistics; in thousands

Figure 1a shows in finer detail the smaller professions from Figure 1.

Figure 1a. Detail. National occupational employment estimates, 2000-2011



- *Dental categories changed in 2004 to incorporate two categories, "dentist, general" and "dentist, all other specialties."*
- *Physicians work in one or more of several specialties including, but not limited to, anesthesiology, family and general medicine, general internal medicine, general pediatrics, obstetrics and gynecology, psychiatry and surgery. In 2004, category "Physicians and surgeons, all other" was added.*
- *Psychologists include clinical, counseling and school psychologists. In 2004, category "Psychologists, all others" was added.*
- *Registered Nurses include Advanced Practice Registered Nurses.*

State licensure re-certification cycles are also important sources of active supply information but occur at the state level and do not provide a national picture due to differences in data collection and definitions. However, licensure information may be somewhat misleading as individuals may hold licenses for several jurisdictions.[37] Other sources include data collections and studies undertaken by particular professional organizations and societies such as those covering the physician population (AMA, AOA and AAMC), dentists (ADA), nurses (AACN and AANP), and pharmacists (AACP and ASHP). These profession-based sources of data vary widely in terms of data collection methodologies, often between different avenues of the same profession. Some of the professions do not appear to routinely collect profession-level data.

Approaches adopted by these groups tend to:

- Combine various sources of data such as national employment statistics and proprietary surveys to create a more comprehensive database of supply inputs;
- Survey a sample of the profession to make national projections; and
- Collect a variety of different supply estimates, not necessarily consistently, and mostly non-comparable to estimates collected for other health care workers.

A range of studies and reports produced by professional groups were examined and are listed in Appendix D.

One long-established way of explaining supply is by defining the ratio of the total number of a particular professional group available to the population. This may be expressed as a number per 1,000 or 10,000 or 100,000 depending upon the profession under examination. Table 3 shows ratios per population located in the secondary literature for some of the professions of interest to this study.

Table 3: Ratio per population, selected professions

PROFESSIONAL GROUP	RATIO PER POPULATION (YEAR OF ESTIMATE)
Chiropractors	29.1/100,000 (2004)[38]
Dentists	59.0/100,000 (2005)[39]
Home Health Aides	212.6/100,000 (2004)[40]
Licensed Practical & Licensed Vocational Nurses	i) 239.0/100,000 (2004)[41] ii) 211.3/100,000 (2000)[42]
Nursing Aides, Orderlies & Attendants	475.0/100,000 (2004)[43]
Personal & Home Care Aides	Source not identified
Pharmacists	77.0/100,000 (2004)[44]
Physical Therapists	49.5 per 100,000 (2004)[45]
Physician Assistants	16.9 per 100,000 (2004)[46]
Physicians	277.0/100,000 (2010)[47] 317/100,000 population (2009)[48] ~259/100,000 (2005-2020)[49] 228/100,000 (2006)[50] 256/100,000 (2009) active physicians consisting of MD 238/100,000 and DO 17/100,000[51] 219/100,000 (2009) active patient care physicians consisting of MD 204/100,000 and DO 15/100,000[52]
Psychologists	33.5/100,000 (2004)[53]
Registered Nurses	802/100,000 (2004)[54]

Table 3 illustrates the heterogeneity of workforce supply estimates, further underscoring the need for a consistent framework for data collection and reporting at both the national, state and professional level.

Moreover, workforce participation – and the supply of providers at any given time – is influenced by factors such as gender, particularly the work/life preferences of female participants.[55,56] Varied data from secondary sources on age and gender of selected professions is shown in Table 4. Often, especially for semi-skilled or non-skilled health workers (nursing aides, orderlies and attendants, for example), there are little or no data sources on age and gender yet these professions are in increasing demand.

Other factors that influence the workforce supply and composition include job satisfaction,[57] turnover, and limitations to scope of practice for some professional groups.[58] Some studies note that in the context of workforce replacement, such things as high job turnover, worker satisfaction, low remuneration levels, lack of career pathways, and high levels of accidents and injuries sustained as being issues, particularly for licensed practical nurses/licensed vocational nurses, nursing aides, home health aides and personal care workers.[59,60]

Table 4: Age and gender profile of selected professions

PROFESSIONAL GROUP	AGE	GENDER
Chiropractors	Source not found	78% Male/22% Female (2009)[61]
Dentists	Mean age: 50 years (2006)	80% Male/20% Female of professionally active dentists (2006)[62]
Home Health Aides	Mean age: 42 years (2000)	5% Male/95% Female (2007)[63]
Licensed Practical & Licensed Vocational Nurses	Mean age: 43 years (2001)	5% Male/95% Female (2001)[64]
Nursing Aides, Orderlies & Attendants	Source not found	Source not found
Personal & Home Care Aides	Source not found	Source not found
Pharmacists	Median age category: 51-55 years (2009)	55% Male/45% Female (2009)[65]
Physical Therapists	Source not found	Source not found
Physician Assistants	Median age: 38 years (2010)	38% Male/61% Female (2010)[66]
Physicians	Mean age: 51.7 years (2009)	70% Male/30% Female (2009)[67]
Psychologists	Mean age: 54 years (2010)	43% Male/57% Female (2010)[68]
Registered Nurses	i) Average Nurse Practitioner is 48 years (2010-2011) ii) Median age of Registered Nurse: 48 years (2008)	i) Average Nurse Practitioner is female (96%) (2010-2011)[69] ii) Registered Nurse: 7% Male/93% Female (2008)[70]

Current data collection systems are disconnected and suffer from a lack of reliable and consistent data on our health professional workforce. Experts consulted as part of this study[71] suggested that regularly collected supply data, at a minimum, should include:

- Demographics (age, race/ethnicity, gender);
- Services and activities performed by different health care professionals;[72]
- Education (training, licensure, specialty); and
- Practice pattern or current capacity information (i.e., productivity, employment setting, geographic location, services provided, work hours, direct care vs. non-direct care such as administration).

In the absence of such data elements, it is difficult to assess our current workforce capacity and to make true projections of future workforce planning needs. Supply is not just a function of the number of providers, but also of the characteristics of those providers as well as how much those providers are willing to work at various remuneration levels.

Employment Projections: BLS and Beyond

The BLS publishes an extensive estimate of future employment. Long-term occupational employment projections are framed over a 10-year period and published every two years, the most recent covering 2010-2020 and released in February of 2012. The BLS projections are national and do not project by state or region. Applying an input-output model, the employment projections reflect factors that influence occupational employment over time including population growth, industry output, technological change, occupational employment and openings, and demand for goods and services.[73]

Drawing upon demographic assumptions of an aging workforce and health care utilization patterns of an aging population, BLS projections covering 2010-2020 suggest a strong growth in health care and related occupations. Over this time, the health care sector is projected to grow by nearly 33 percent, compared to about fourteen percent for all other employment sectors, with over 5.7 million jobs between 2010-2020.[74] Health care occupations in this study fall into both the professional and service categories of the national employment matrix occupational classification scheme. The BLS projects that employment will grow most rapidly in occupational groups of health care support (34.5 percent), personal care and services occupations (26.8 percent) and health care practitioner and technical occupational groups (25.9 percent) within the 2010-2020 projection period.

BLS projections are based upon expectations of health care demand and utilization patterns including an aging population, new service innovations and technologies, growth in employment outside of traditional health care inpatient facilities, a preference for home-based care as an alternative to institutional care, and a growth in use of personal support services to assist people living at home with activities of daily living. Growth settings are expected to be in non-traditional locations (such as home-based care), offices of health practitioners, and in nursing and residential care facilities. BLS also estimates the numbers required to fill new positions and replace vacancies created by reduced supply through retirements of the aging health workforce and attrition. A more detailed description of the methodology can be found in the footnote.[75]

The BLS projects that between 2010-2020 the biggest increases in job growth will occur in the following professions (see Figure 2 and Table 5):

- Registered nurses – 711,900 new jobs with projected growth rate of 26.0 percent;

- Licensed practical and licensed vocational nurses – 168,500 new jobs with projected growth rate of 22.0 percent;
- Home health aides – 706,300 new jobs with projected growth rate of 69.0 percent;
- Nursing aides, orderlies and attendants – 302,000 new jobs with projected growth rate of 20.0 percent;
- Personal and home care aides – 607,000 new jobs with projected growth rate of 70.0 percent; and
- Physicians and surgeons – 168,300 new jobs with a projected growth rate of 24.0 percent.

Unfortunately, while the BLS is comprehensive, it lacks the specificity to identify the various health professionals within a category. This lack of detail has implications for future employment projections. For example, while the BLS projects that there will be 168,300 new jobs for physicians over the 2010-2020 timeframe, it is not clear what types of physicians are needed at which points in that time period.

Figure 2. Number of estimated employed (2010) and projected employment (2020): National Employment Matrix (in thousands)

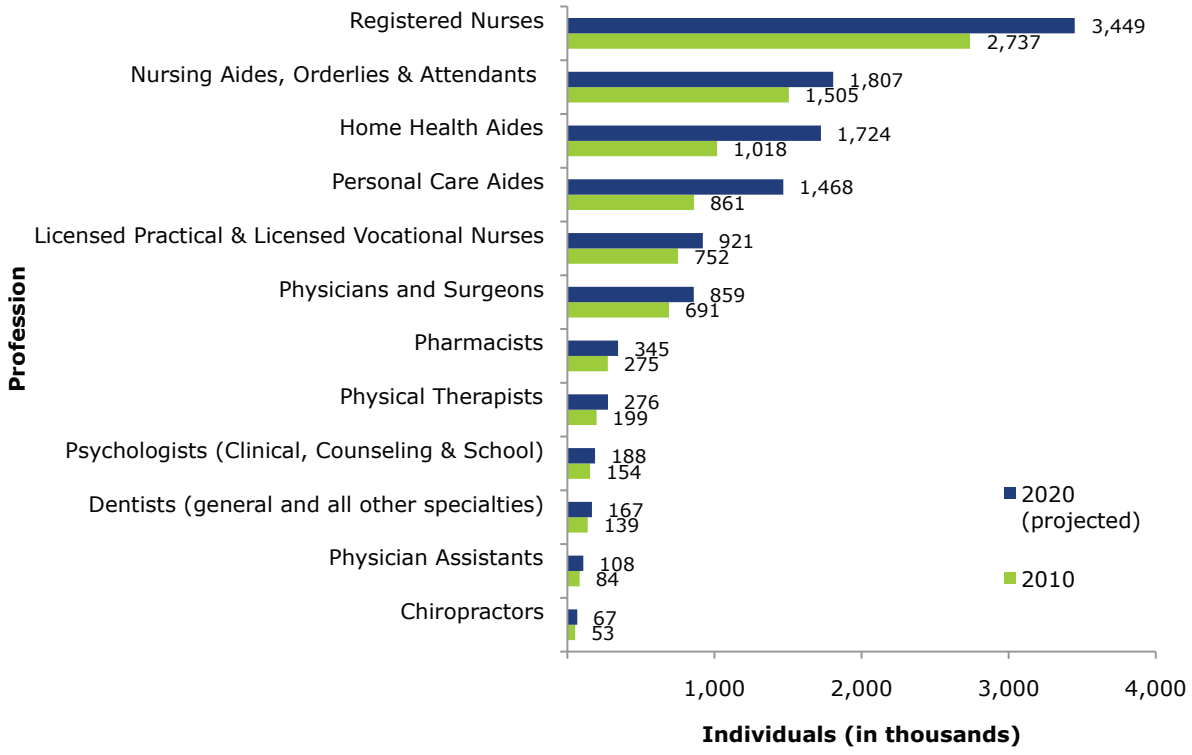


Table 5 shows employment and projected employment for the professions in this study for 2010-2020, including the numeric and percentage increases over that period.

Table 5: Employment and projected employment by selected occupation: 2010 and projected to 2020[76]

2008 NATIONAL EMPLOYMENT MATRIX TITLE	EMPLOYMENT NUMBER		NUMERIC CHANGE	PERCENTAGE CHANGE
	2010	2020 (projected)	2010-2020	2010-2020
Chiropractors	52,600	67,400	14,900	28%
Dentists (general and all other specialties)	138,500	167,000	28,500	21%
Home Health Aides	1,017,700	1,723,900	706,300	69%
Licensed Practical & Licensed Vocational Nurses	752,300	920,800	168,500	22%
Nursing Aides, Orderlies & Attendants	1,505,300	1,807,200	302,000	20%
Personal Care Aides	861,000	1,468,000	607,000	70%
Pharmacists	274,900	344,600	69,700	25%
Physical Therapists	198,600	276,000	77,400	39%
Physician Assistants	83,600	108,300	24,700	30%
Physicians and Surgeons	691,000	859,300	168,300	24%
Psychologists (Clinical, Counseling & School)	154,300	188,000	33,700	22%
Registered Nurses	2,737,400	3,449,300	711,900	26%

A range of studies and reports produced by professional groups that include projected estimates were examined and are summarized below in Table 6, with full results presented in Appendix D.

Table 6: Projected supply from profession-specific organizations

PROFESSIONAL GROUP	ESTIMATED NUMBERS
Dentists	184,578 projected for 2010; 195,267 projected for 2020[77]
Nurses (RN)[78]	2,069,369 projected FTE for 2010; 2,001,998 projected FTE for 2020[79]
Pharmacists	304,986 projected for 2020[80]
Physician Assistants	83,466 projected for 2010[81]
Physicians	872,900 projected for 2010; 951,700 projected for2020[82]

The differences in profession-specific estimate methodologies highlight the need for more consistency across data collection and projection analyses.

Looking Ahead: Workforce Innovations in the U.S.

A number of key steps are planned or in place at the federal level to address issues related to the health care workforce landscape. These are detailed in Appendix E and include:

NATIONAL HEALTH CARE WORKFORCE COMMISSION	A 15-member committee (as yet unfunded) appointed by the GAO, the National Health Care Workforce Commission is required to review health care workforce supply and demand, and make recommendations regarding national priorities and policy. Other areas of focus will involve review of the implementation of state health workforce development grants program and workforce development actions including career pathways, policies and practices regarding recruitment, retention and training of the health care workforce.
NATIONAL CENTER FOR HEALTH WORKFORCE ANALYSIS HTTP://BHPR.HRSA.GOV/HEALTHWORKFORCE	A key initiative of the National Center for Health Workforce Analysis (NCHWA) is the development of guidelines for a uniform minimum health data set across health professions in order to improve data collection and allow for comparisons over time and across states, jurisdictions and professions.[83]
STATE HEALTH CARE WORKFORCE DEVELOPMENT GRANTS HTTP://WWW.HRSA.GOV/GRANTS/HEALTHPROFESSIONS/SHCWDGFAQS.PDF	Provides competitive grants to enable state partnerships to conduct comprehensive planning and carry out health care workforce development strategies at state and local levels.
OTHER	In addition, professional organizations are increasingly sharing knowledge across their respective disciplines to better understand and meet the demands and requirements of the evolving health care workforce. Organizations such as the AAMC, AOA, AACN, AACP and others continue to generate analyses and policy recommendations in these important areas.

Findings

The U.S. health care industry is capital intense, highly regulated and labor intensive. These three factors complicate efforts to radically and/or quickly change its workforce composition. There can be lags of 10 years or more in the supply of some health professionals after their first entry into education and training. This introduces considerable uncertainty into the projection process, as does making allowance for likely future workforce participation trends.

Health care consumes 17 percent of the U.S. gross domestic product (GDP), and the U.S. consistently spends more on health care per capita than other developed countries.[84] As widely noted, health care costs exceed $9,000 per capita and will increase at six percent annually for the next decade.[85] Innovative approaches to recruiting, educating and deploying the health care workforce are imperative to effectively manage increased demand for services while reducing costs and improving quality.

Traditional supply-demand analyses for the health care industry workforce fall short in addressing these objectives. Fragmented and inconsistent data collection, variance in methodological assumptions and rigor, mistrust among professional groups, and wide differences in regulatory and educational context contribute to an incomplete understanding of workforce supply and demand. Interstate and intrastate variations in training programs, licensure laws and scope of practice restrictions result in variations in workforce capabilities. These factors also contribute to workforce mobility as workers seek optimal practice conditions, as well as in the extent to which professional groups can actively participate and provide services to the full extent of their training.[86]

To ensure an adequate, effective workforce in the U.S. health care system, a fresh approach is critical. There is a need for more research related to the matching of skills and capabilities to innovations in care delivery and population health, and to the "interchangeability" of professionals. The National Health Care Workforce Commission and the National Center for Health Workforce Analysis are both integral to the transformation of the U.S. health care system. These groups must lead in the creation of a solid methodological foundation upon which workforce shortages, demand and regulatory oversight can be constructed.

A national workforce planning strategy for policymakers to consider might include:

1. A coordinated workforce planning framework and infrastructure that:

- Advances a planning agenda that provides a complete picture of the health care workforce as well as the drivers behind supply and demand;
- Champions a national supply-and-demand model covering both a macro (entire health workforce) and specialty-specific viewpoint to inform and assist states with locally-based planning and provision;
- Recognizes the differing needs of geographic areas (local, state, regional and national);
- Adopts an inter-professional approach to workforce research and planning;
- Links research and planning to health and higher education sectors;
- Supports workforce planning infrastructure capabilities at the state level while ensuring that states become collaborators in the health care framework;
- Incorporates strategies to address gaps in workforce distribution and practices such as primary care and specialty areas (i.e., aged care);
- Enables new channels of health care delivery through retail health, group visits, direct access by consumers to diagnostic exams and bio-monitoring devices, and payment methods encouraging consumer self-care;
- Considers the changing role of insurance and employers as influencers and/or gatekeepers in accessing health providers;
- Factors the impact of information technologies that equip consumers and clinicians to better understand treatment options, and relate decisions to outcomes and costs;
- Considers the evolution of health service research that correlates optimal outcomes with core competencies and performance measurement for caregivers;
- Incorporates changes in educational, licensing and disciplinary infrastructures, programs and institutions to yield a more productive, prepared workforce; and
- Evaluates and incorporates key findings from landmark industry studies such as the *IOM Future of Nursing* report.

2. Data and research

Improved coordination between federal and state entities is needed to resolve issues related to data collection and research, in addition to directed guidance for states with respect to developing a common approach to workforce measurement and forecasting methodologies, which may include some of the following key components outlined below:

DATA AND RESEARCH

Organizing principles of data collection and forward-planning consisting of:

- Consistent collection and processing arrangements;
- Institutional structures to support data collection, analysis, interpretation and publication; identification of a data "custodian";
- Consistent concepts through a common definition set and a minimum data set(s);
- Measures that can be scaled up or down at the state level according to need; and
- Recognition that data collection requirements will differ by geographic location (local, state, regional or national).

Baseline information features, or minimum data sets for workforce planning could include:

- Demographic characteristics including age, gender, location or diversity;
- Qualifications, training or certification achievements including type, source and date of qualification or certification acquired;
- Workforce characteristics such as labor force status, job tenure, specialty area, classification level, hours worked, hours spent in patient-care, industry and sector of employment, earnings, or geographic location/distribution;
- Current and projected workforce entrants;
- Inward and outward migration data of health workers;
- Current and projected workforce exits; and
- Time spent outside of the workforce as well as re-entries.

ADDITIONAL DATA

Workforce projections may require different data resources, such as:

- Productivity of health providers over time;
- Impact of behavioral factors such as motivation and compensation;
- Impact of innovation on productivity;
- Short- and long-term impact of prevailing economic conditions on supply;
- Longitudinal career entry and trajectory studies;
- Impact of technology on workload and work tasks;
- Impact of technology on patient activation;
- Re-allocation of administrative duties from professionals; and
- Changing workplace roles between highly trained professions and those with shorter training times and faster entry pathways into the workforce.

PROJECTION METHODOLOGIES

Design principles may include:

- A wide range of relevant demand, supply and productivity scenarios;
- A "toolbox" approach toward meeting differing requirements;
- Concentration on the major health workforce groups, recognizing that projections for smaller or diverse groups may be needed on a less regular basis;
- Regular updates aligned with education and training planning cycles;
- Timely, dynamic style of modeling;
- Evidence-based care models that identify the balance of professions and necessary skill-mix and productivity measures or factors that influence productivity; and
- Key baseline measures that capture demand drivers including demographics, population health information and service delivery characteristics.

3. Scenario testing

Evidence-based scenarios are required for identifying the optimal mix of health care team staffing and skills necessary for meeting patient needs in new team-based service delivery models such as clinical care organizations.

- Models should test supply of workforce by population-based health outcomes using a combination of supply variables in a range of demand, supply and productivity scenarios in four to six communities, including those experiencing supply problems such as rural/remote areas and/or underserved populations.
- Scenario comparisons are needed to identify which approaches are likely to be most cost effective in improving the accessibility, quality and sustainability of health workforce services.

Appendix A: Provisions in the PPACA Related to Health Care Workforce Planning

PPACA SECTION[87]	PROVISION	IMPACT ON WORKFORCE PLANNING
Innovations in workforce		
5101	National Health Care Workforce Commission	• Provides recommendations to Congress and the administration on national health workforce priorities, goals and policies • Submits annual report to Congress and the administration on several workforce issues (e.g., current supply/demand data and projections)
5102	State health care workforce development grants	• Provides competitive grants to enable state partnerships to complete comprehensive planning and carry out activities leading to comprehensive health care workforce development strategies
5103	Health care workforce assessment	• Codifies the existing National Center for Health Workforce Analysis in HHS • Establishes several regional centers for health workforce analysis to collect, analyze and report data related to primary care workforce programs
Increasing workforce supply		
5201	Federally supported student loan funds	• Eases current criteria for schools and students to qualify for loans, shorten payback periods, and decrease the non-compliance provision for the primary care student loan program
5202	Nursing student loan program	• Increases loan amounts and updates the years for nursing schools to establish and maintain student loan funds
5203	Health care workforce loan repayment programs	• Establishes a loan repayment program for pediatric subspecialists and providers of mental and behavioral health services to children and adolescents who are or will be working in a Health Professional Shortage Area, Medically Underserved Area, or with a Medically Underserved Population

PPACA SECTION[87]	PROVISION	IMPACT ON WORKFORCE PLANNING
5204	Public health workforce recruitment and retention program	• Offers loan repayment to public health students and workers in exchange for working at least three years at a federal, state, local or tribal public health agency
5205	Allied health workforce recruitment and retention program	• Offers loan repayment to allied health professionals employed at public health agencies or in settings providing health care to patients
5206	Grants for states and local programs	• Awards scholarships to mid-career public and allied health professionals employed at the federal, state, tribal or local level to receive additional training
5207	Funding for National Health Service Corps	• Increases and extends appropriations for the National Health Service Corps scholarship and loan repayment program for FY 2010-2015
5208	Nurse-managed health clinics	• Creates $50 million grant program administered by HRSA to support nurse-managed health clinics
5209	Elimination of cap on the Commissioned Corps	• Eliminates cap on the number of U.S. Public Health Service Commissioned Corps members
5210	Establishing a Ready Reserve Corps	• Establishes a Ready Reserve Corps within the Commissioned Corps for service in times of national emergency
Enhancing education and training		
5301	Training in family medicine, general internal medicine, general pediatrics, and physician assistantship	• Provides grants to develop and operate training programs, provides financial assistance to trainees and faculty, and enhances faculty development in primary care and physician assistant programs
5302	Training opportunities for direct care workers	• Authorizes funding over three years to establish new training opportunities for direct care workers providing long-term care services and support
5303	Training in general, pediatric and public health dentistry	• Reinstates a separate line of dental funding in Title VII of the Public Health Service Act • Allows dental schools and education programs to use grants for pre-doctoral training, faculty development, dental faculty loan repayment and academic administrative units
5304	Alternative dental health care provider demonstration project	• Provides grants to establish training programs to increase access to dental health care services in rural, tribal and underserved communities

PPACA SECTION[87]	PROVISION	IMPACT ON WORKFORCE PLANNING
5305	Geriatric education and training; career awards; comprehensive geriatric education	• Authorizes funding to geriatric education centers to develop curricula and best practices, and support training in geriatrics, chronic care management and long-term care for faculty in health professions schools and family caregivers
5306	Mental and behavioral health education and training grants	• Awards grants to schools for the development, expansion or enhancement of training programs in social work, graduate psychology, professional training in child and adolescent mental health, and pre-service or in-service training to paraprofessionals in child and adolescent mental health
5307	Cultural competency, prevention and public health and individuals with disabilities training	• Reauthorizes and expands programs to support the development, evaluation and dissemination of model curricula for cultural competency, prevention and public health proficiency and aptitude for working with individuals with disabilities
5308	Advanced nursing education grants	• Strengthens language for accredited Nurse Midwifery programs to receive advanced nurse education grants
5309	Nurse education, practice and retention grants	• Awards grants to nursing schools to strengthen nurse education and training programs and improve nurse retention
5310	Loan repayment and scholarship program	• Adds faculty at nursing schools as eligible individuals for loan repayment and scholarship programs
5311	Nurse faculty loan program	• Establishes a federally funded student loan repayment program for nurses with outstanding debt who pursue careers in nurse education. Nurses agree to teach at an accredited school of nursing for at least four years within a six-year period
5313	Grants to promote the community health workforce	• Awards grants to states, public health departments, clinics, hospitals, federally qualified health centers and other non-profits to promote positive health behaviors and outcomes in medically underserved areas
5314	Fellowship training in public health	• Authorizes the secretary to address workforce shortages in state and local health departments in applied public health epidemiology and public health laboratory science and informatics
5315	United States Public Health Sciences Track	• Directs the surgeon general to establish a U.S. Public Health Sciences Track to train physicians, dentists, nurses, physician assistants, mental and behavior health specialists, and public health professionals emphasizing team-based service, public health, epidemiology, and emergency preparedness and response in affiliated institutions

PPACA SECTION[87]	PROVISION	IMPACT ON WORKFORCE PLANNING
5316	Rural physician training grants	• Establishes a grant program for medical schools to recruit and train medical students to practice medicine in underserved rural communities
5317	Demonstration grants for family nurse practitioner training programs	• Establishes a training demonstration program that supports recent family nurse practitioner graduates in primary care for a 12-month period in Federally Qualified Health Centers (FQHCs) and nurse-managed health clinics
Supporting the existing health care workforce		
5401	Centers of Excellence	• Establishes The Centers of Excellence program to develop a minority applicant pool to enhance recruitment, training, academic performance and other supports for minorities interested in careers in health
5402	Health professions training for diversity	• Provides scholarships for disadvantaged students who commit to work in medically underserved areas as primary care providers • Expands loan repayments for individuals who will serve as faculty in eligible institutions
5403	Interdisciplinary, community-based linkages	• Authorizes funding to establish community-based training and education grants for Area Health Education Centers (AHECs) and programs
5404	Workforce diversity grants	• Expands the allowable uses of nursing diversity grants to include completion of associate degrees, bridge or degree completion program, or advanced degrees in nursing, as well as pre-entry preparation, advanced education preparation, and retention activities
5405	Primary care extension program	• Creates a primary care extension program to educate and provide technical assistance to primary care providers about evidence-based therapies, preventive medicine, health promotion, chronic disease management and mental health
Strengthening primary care and other workforce improvements		
5501	Expanding access to primary care services and general surgery services	• Provides primary care practitioners, as well as general surgeons practicing in health professional shortage areas, with a 10 percent Medicare payment bonus for five years
5503	Distribution of additional residency positions	• Redistributes residency positions that have been unfilled for the prior three cost reports and directs those slots for training of primary care physicians. Special preference given to programs in states with a low physician resident to general population ratio

PPACA SECTION[87]	PROVISION	IMPACT ON WORKFORCE PLANNING
5504	Counting resident time in outpatient settings and allowing flexibility for jointly operated residency training programs	• Allows any time spent by the resident in a non-provider setting to be counted toward direct graduate medical education (DGME) and indirect medical education (IME) if the hospital incurs the costs of the stipends and fringe benefits
5505	Rules for counting resident time for didactic and scholarly activities and other activities	• Modifies current law to allow hospitals to count resident time spent in didactic conferences toward IME costs in the provider (i.e., hospital) setting and toward DGME in the non-provider (i.e., non-hospital) setting
5506	Preservation of resident cap positions from closed hospitals	• Redistributes medical residency slots from a hospital that closes on or after the date that is two years before enactment of the legislation based on certain criteria
5507	Demonstration project to address health professions workforce needs; extension of family-to-family health information centers	• Establishes a demonstration grant program to support low-income individuals with the opportunity to train for occupations in the health care field that pay well and are expected to experience labor shortages or be in high demand • Establishes a demonstration program to competitively award grants for up to six states for three years to develop core training competencies and certification programs for personal and home care aides
5508	Increasing teaching capacity	• Establishes a grant program to support new or expanded primary care residency programs at teaching health centers
5509	Graduate nurse education demonstration program	• Establishes a demonstration program to increase graduate nurse education training under Medicare

Appendix B: Approaches and Analysis Methods to Project Workforce

Health workforce models provide the mechanism for making projections about the future health workforce and testing possible solutions. Models range from simplistic to complex and can produce highly varied recommendations. A good projection model should be based on a clear formulation, in a quantifiable manner, of objectives and problems to be solved.

"An essential task is to take into account those resources and activities that collectively define the major characteristics of the health system and its labor market;"[88] numerous approaches have been used to accomplish this task (see Table 1). Researchers are not restricted to a single approach and commonly combine several approaches within a single study in order to account for a broader range of key variables that need to be considered.

Table 1. Commonly used approaches to project workforce

APPROACH	DESCRIPTION	VARIABLES	ADVANTAGES	LIMITATIONS	EXAMPLES OF STUDIES
Single approach					
Workforce-to-population ratio	• Projects the number of health care workers required to match the current level of services given the likely changes in workforce • Assumes a degree of population growth	• Workforce characteristics — Work force participation in starting/base year — Distribution by age and sex — Unemployment — Work pattern (full- or part-time) — Entry rates — Exit/attrition rates — Salary — Costs of education • Population demographics — Total in	Quick, easy to apply and understand	• Replicates any inadequacies in current workforce-to-population ratios • Does not consider workforce changes (e.g., interchangeability of health professionals), practice organization, practice style, service demands, service delivery, or health needs	• Physician Supply Model (PSM) – Health Resources and Services Administration (HRSA). • Nursing Supply Model (NSM) – HRSA.

		starting/base year — Distribution by age and sex — Growth rate — Urban/rural distribution			
Service demands	• Projects the number of health care workers required to match the current level of services given the likely changes in demand — Current utilization rates are applied to future population profile (e.g., aging population, GDP growth) to determine expected demand for services • Assumes that population changes are predictable	• Health service utilization rate • Access to services • Preferences of health consumers • Economic and financial variables that influence health service utilization and labor participation — Insurance coverage — Financing mechanisms and payment methods — GDP • Population demographics — Total in starting/base year — Distribution by age and sex — Growth rate — Urban/rural distribution	Anticipates changes in health practices (such as new surgical techniques or drugs) and in the health system (such as PPACA)	• Replicates any inadequacies in current level, mix and distribution of services • Difficult to determine the baseline of true service demand • Data heavy with difficulties in identifying appropriate data	• Physician Aggregate Requirements Model (PARM) – HRSA. • Nursing Demand Model (NDM) – HRSA.
Service delivery	• Projects the number of health care workers required to match the current level of services given the likely changes in service production and delivery • Assumes standards for each service covered are practicable and can be achieved within timescale and projection	• Productivity standards • Service volume and complexity • Impact of technology • Impact of public policy changes • Impact of treatment guideline changes (e.g., on pricing and payment systems, workload, etc.) • Impact of scope of practice changes	• Relatively easy and understandable	• Productivity norms and standards difficult to articulate and measure • Potentially unrealistic assumptions relating to service delivery	Dreesch N, Dolea C, Dal Poz MR, et al. "An Approach to Estimating Human Resource Requirements to Achieve the Millennium Development Goals." *Health Policy Plan*. 2005;20(5):267-76.

Health needs	• Projects the number of health care workers required to provide appropriate services to the future population — Appropriate services are based on estimated health deficits (disease patterns, disability) • Assumes that all health needs can and should be met and resources are used according to need	• Epidemiological/ burden of illness — Current major causes of morbidity and mortality — Expected changes in patterns of sickness and disease	• Easy to understand • Potential of addressing population health needs • Independent of utilization • Can include unmet needs in estimation process	• Replicates any inefficiencies in resource allocation and services delivery • Does not account for changes in technology and clinical practice • Requires extensive data	O'Brien-Pallas L, Baumann A, Donner G, et al. "Forecasting Models for Human Resources in Health Care." *Journal of Advanced Nursing*. 2001;33:120–9.
Mixed approach					
Adjusted service delivery	• Projects the number of health care workers required to match the current level of services based on estimated health deficits and demographics — Identifies tasks and skills required for evidence-based intervention based on functional job analysis • Assumes effective evidence-based interventions can be delivered in all settings and conditions	• Epidemiological/ burden of illness — Current major causes of morbidity and mortality — Expected changes in patterns of sickness and disease • Population demographics — Total in starting/base year — Distribution by age and sex — Growth rate — Urban/rural distribution • Productivity standards	Useful for specific programs and to identify training needs	Detailed workflow studies or expert opinion are needed to estimate time requirements per intervention (translates into number of time employees)	Birch S, Kephart G, Murphy GT, O'Brien-Pallas L, Alder R, MacKenzie A. "Health Human Resources Planning and the Production of Health: Development of an Extended Analytical Framework for Needs-Based Health Human Resources Planning." *Journal of Public Health Management Practice*. 2009;S56–61.

Service demands and service delivery	• Projects the number of health care workers required to accommodate the expected change in utilization due to PPACA increasing health insurance coverage among those currently uninsured	• Health service utilization rate • Insurance coverage • Impact of public policy changes	• Anticipates changes in the health system due to PPACA • Relatively easy and understandable	• Replicates any inadequacies in current level, mix and distribution of services • Potentially unrealistic assumptions relating to service delivery	Hofer AN, Abraham JM, Moscovicee I. "Expansion of Coverage under the Patient Protection and Affordable Care Act and Primary Care Utilization." *The Milbank Quarterly*. 2011;89(1):69–89.

The level of detail and complexity of a model reflects the availability and quality of data, as well as the underlying assumptions. The most sophisticated models are not able to account for all of the many complexities of a real health system. There is a trade-off between simplicity and accuracy of the model; many compromises and simplifications must be made. Commonly used analysis methods allow for variables to behave differently with respect to defined circumstances or attributes (see Table 2). The projection horizon of a model must be sufficient – often 10 years – in order to take action and solve identified problems. Creation of multiple scenarios within a model can allow for the evaluation of variables that drive results and can provide a range for the future health workforce. Lastly, "responsible parties must check regularly on projections that have been used" and ensure they are updated as required.[89]

Table 2. Commonly used analysis methods to project workforce

ANALYSIS METHOD	DESCRIPTION	ADVANTAGES	LIMITATIONS
Deterministic	• Most commonly used for health workforce projections • Assumes that an outcome is certain	• Easy to apply • Can be developed using commonly available computer software • Generally does not require advanced information technology programming skills (other than what would normally be expected of someone working in data processing and analysis) • Clear and easy to understand	• Always delivers the same result for the same input values
Stochastic (non-deterministic)	• Allows for the introduction of random changes and provides some means of introducing uncertainty	• More flexible • Allows for how the system would behave under different parameters	• Programming and analysis are more complex • Detailed data required

	during the planning process • Example: Markov chains		• Costly to implement
Microsimulation	• Evaluates individual people with their own attributes and simulates events and transitions • Individuals are allowed to vary depending on rules which represent individual preferences and tendencies	• More flexible • Simulates changes in individuals' health states and behaviors under different rules/parameters	• Programming and analysis are more complex • Detailed data required • Costly to implement

Appendix C: Bureau of Labor Statistics: Data from the Occupational Employment Statistics Survey

National occupational employment estimates, years 2000-2011†

^Dental categories changed in 2004 to incorporate two categories, "Dentist, general" and "Dentist, all other specialties."

*Physicians work in one or more of several specialties including, but not limited to, anesthesiology, family and general medicine, general internal medicine, general pediatrics, obstetrics and gynecology, psychiatry, and surgery. In 2004, category "Physicians and surgeons, all other" was added.

**Psychologist includes clinical, counseling and school psychologists. In 2004, category "Psychologists, all others" was added.

***Registered Nurses includes Advanced Practice Registered Nurses.

† Due to methodological changes over time including changes in occupational, industry and geographic classification, as well as changes in the way data are collected, the BLS cautions against making conclusive comparisons of OES data over time. http://www.bls.gov/oes/oes_ques.htm#Ques11

		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
1	**Chiropractors**	16,740	18,060	20,630	20,210	21,830	24,290	25,470	27,190	27,050	26,310	26,250	27,510
2	**Dentists^**	90,090	87,810	92,460	97,090	86,950	89,750	90,670	89,750	90,680	91,280	92,710	95,800
3	**Home Health Aides**	561,120	560,190	569,670	583,880	596,330	663,280	751,480	834,580	892,410	955,220	982,840	924,650
4	**Licensed Practical and Licensed Vocational Nurses**	679,470	683,790	692,290	682,590	702,740	710,020	720,380	719,240	730,500	728,670	730,290	729,140
5	**Nursing Aides, Orderlies and Attendants**	1,273,460	1,307,600	1,329,310	1,341,650	1,384,120	1,391,430	1,376,660	1,390,260	1,422,720	1,438,010	1,451,090	1,466,700
6	**Personal and Home Care Aides**	371,280	408,360	451,040	487,200	532,490	566,860	578,290	595,350	614,190	630,740	686,030	820,600
7	**Pharmacists**	212,660	223,630	219,390	215,030	222,960	229,740	239,920	253,110	266,410	267,860	268,030	272,320
8	**Physical Therapists**	120,410	126,450	130,290	134,970	142,940	151,280	156,100	161,850	167,300	174,490	180,280	185,440
9	**Physician Assistants**	55,490	56,200	61,910	60,030	59,470	63,350	62,960	67,160	71,950	76,900	81,420	83,540
10	**Physicians*, ^^**	321,290	325,220	308,800	301,270	473,394	493,230	525,030	550,020	568,400	575,490	592,410	603,100
11	**Psychologists**, ^^^**	103,120	95,640	100,560	100,180	103,020	105,570	105,290	104,590	107,750	108,590	111,390	111,430
12	**Registered Nurses*****	2,189,670	2,217,990	2,239,530	2,246,430	2,311,970	2,368,070	2,417,150	2,468,340	2,542,760	2,583,770	2,655,020	2,724,570

Appendix D: Profession-Specific Databases and Studies

PROFESSION	ORGANIZATION/ PRIMARY DATA COLLECTED	DESCRIPTION
Chiropractors	National Board of Chiropractic Examiners (NBCE)[90]	• Approximately every five years, the NBCE conducts a survey of the chiropractic profession (last survey completed in 2009). • Reports created based on results from survey that summarize the practice of chiropractic in the United States based on the responses of chiropractors from all 50 states and the District of Columbia.
Dentists	American Dental Association (ADA)[91]	• Provides numbers and demographics of dentists. • Actual and projected figures, completed annually. • Reports created annually with age, gender and work status (full- or part-time) of licensed and active dentists.
	American Dental Education Association and Institute of Medicine. *Current Demographics and Future Trends of the Dentist Workforce*.[92]	• Provides numbers and demographics of dentists. • Actual and projected figures in a one-time report.
Licensed Practical Nurses (LPN) Licensed Vocation Nurses (LVN)	Seago, JA. et al. *Supply, Demand, and Use of Licensed Practical Nurses*. November 2004.[93]	• Provides demographic characteristics on LPNs utilizing data from the BLS. • One-time report that has data for 1984-2001.
Nursing Aides, Orderlies & Attendants	*Nursing Aides, Home Health Aides and Related Health Care Occupations: National*	• Demographic statistics on nursing aides and home health aides from various sources. • A comprehensive review of eight federal datasets, certified nursing aide registries in 45 states, and fieldwork in four states

Home Health Aides	*and Local Workforce Shortages and Associated Data Needs*. National Center for Health Workforce Analyses.[94]	(California, Illinois, New York and Wyoming).
Nursing (RN and APRN)	HRSA: National Sample Survey of Registered Nurses.[95]	• Data on active Registered Nurse (RN) population in the U.S. • Random sample and sample was de-duplicated – even if had multiple licenses in different states. • Repeated every four years and reports on sample including: number of nurses by gender, age, geography and work status.
	Pearson: Nurse Practitioners.[96]	• Number of practicing NPs by state and the number of schools per state (Note: not number of students or graduates). • Survey completed and reported annually.
	American Academy of Nurse Practitioners (AANP): National Nurse Practitioner Survey and Database.[97]	• Private database completed annually with active nurse practitioners. • Fact sheets completed annually with statistics on age and gender of practicing NPs.
	National League for Nursing[98]	• Number of enrollees in nursing school per year.
	American Association of Colleges of Nursing[99]	• Annual enrollment and graduation numbers from U.S. nursing schools with baccalaureate and graduate programs.
	National Council of State Boards of Nursing[100]	• Planned project to develop a system to house, track and disseminate nursing workforce data. Goal of becoming the national repository for data on the supply of nurses in the U.S. • Objective is to create a standardized national public use database for federal, state and local nursing workforce planning efforts.
Pharmacists	Pharmacist Workforce Study.[101]	• Data on licensed and active pharmacists. Data available for 2000, 2004 and 2009. • Comprehensive report published every four years providing statistics on age, gender and work status for licensed and active pharmacists from a geographically representative sample.
	American Association of Colleges of Pharmacy (AACP)[102,103]	• Number of graduates from each U.S. college and school of pharmacy • Annual report, *Profile of a Pharmacy Student*, available for each year from 1990-2009 provides number of graduates.

	Survey of Pharmacy Law.[104]	• Annual survey that counts licensed pharmacists in each state.
	National Association of Chain Drug Stores (NACDS) Foundation: Chain Pharmacy Employment Survey.[105]	• Counts FTE, gender distribution, work status for pharmacists and vacant positions at chain pharmacy companies. • Reports annually on gender and work status for sample of chain community pharmacies.
Physical Therapists	American Physical Therapy Association[106]	• Licensed physical therapists by state and demographics of APTA members. • Non-representative sample, reports annually.
Physician Assistants	American Academy of Physician Assistants (AAPA): Physician Assistant Masterfile.[107]	• Numbers of new students and graduates from PA programs, number passing NCCPA certification, number of PA licensees by states. • Sample survey done of PA members completed annually with statistics on age, gender and work status (full- or part-time).
Physicians	American Medical Association (AMA). *Physician Characteristics and Distribution in the U.S.* 2011.[108]	• Extensive statistics based on AMA Masterfile for all physicians in the U.S. and U.S. territories through Dec. 31, 2009; includes physician characteristics and distribution, analysis of professional activity by specialty and geographic region, primary care specialties, osteopathic physicians, and physician trends. • Targets all physicians, including members and non-members of the AMA, graduates of foreign medical schools residing in the U.S. who meet U.S. standards for entry into accredited graduate medical training programs, or who have been granted a state license to practice medicine, and physicians licensed to practice in the U.S. but temporarily located abroad. • Compiled annually. • Information includes major professional activity (i.e., practice location), primary specialty, specialty board certification status, age and sex, race/ethnicity, work status (active/inactive), hours worked, country, school, and year of graduation as well as physician-to-population ratios.
	HRSA. *The Physician Workforce: Projections and Research into Current Issues Affecting Supply and Demand*.[109]	• Actual and projected numbers for physician workforce using data from AMA and the American Osteopathic Association (AOA). • Targets medical students and physicians (including residents and fellows). • Tracks physicians by age, sex, graduates, specialty, productivity, retirement rates, physician wealth and earnings, market trends away from physician practice consolidation, changes in managed care, medical malpractice, physician burnout, health, societal expectations, and governmental policies.
	American Association of	• Baseline projections of physician supply (and demand) in the U.S.

	Medical Colleges (AAMC). *The Complexities of Physician Supply and Demand: Projections Through 2025*.[110]	assuming no changes in current trends to demonstrate what will happen to physician workforce supply if no changes occur, as well as a variety of scenarios that are likely to impact supply and demand projections. • Targets active physicians (excluding residents and fellows). • Depicts projected shortage of FTE physicians under scenarios where: demand increases, aging U.S. population, population growth between 2006-2025, universal health coverage, increased physician productivity, greater role of PAs and NPs in patient care, expansion of graduate medical education capacity, and combined scenarios of worst case, best case, and most plausible.
	AAMC. *The Impact of Health Care Reform on the Future Supply and Demand for Physicians Updated Projections Through 2025*.[111]	• Update to AAMC Model published in 2008, reflecting actual PPACA provisions and new projections using baseline data from 2008 factored into "most plausible scenario" from original model: increased physician utilization for persons over 45, decreased working hours by age and generation; moderate growth in GME, moderate increase in productivity.
	Sargen, M. et al. *Gaps in the Supply of Physicians, Advance Practice Nurses and Physician Assistants*.[112]	• Projections for year 2025 for supply of "advanced clinicians" workforce (physicians, APNs and PAs) compared to expected demand for advanced clinical services. • Targets patient care MDs and DOs (excluding residents and physicians in non-clinical roles), APNs employed in clinical nursing (NPs, clinical nurse specialists, nurse midwives, and certified registered nurse anesthetists), and PAs.
	American Osteopathic Association (AOA). Annual Osteopathic Medical Profession Report.	• Offers annual demographic information on osteopathic medicine, including diversity of membership, geographic distribution of practicing DOs, and osteopathic medical students and distribution among medical specialties.[113]
Psychologists	Annual survey of American Psychologist Association (APA) membership.[114]	• Numbers and demographics of member psychologists. • Non-representative sample, compiled annually. • Reports via tables with age, gender and work status (full- or part-time) on members of the APA.

Appendix E: Federal and Regional Centers for Health Workforce Research

Many initiatives are currently underway in health workforce research area including the following:

FEDERAL GOVERNMENT ENTITIES	
Entity	**Research Focus**
National Health Care Workforce Commission	Created by the PPACA to provide recommendations to Congress and federal agencies on federal, state and local workforce issues and policies.
National Center for Health Workforce Analysis	Created by the PPACA to support state and regional workforce data collection and analysis.
U.S. Department of Labor Bureau of Labor Statistics (BLS)	Produces the BLS Occupational Outlook Handbook, which contains data related to U.S. workforce. Data includes annual employment, workforce challenges and projections.
Institute of Medicine (IOM) of the National Academy	Conducts research on the health care workforce that examines such issues as the preparedness of certain sectors to meet patient demand and the protection of health care workers against threats such as pandemics.

RESEARCH INSTITUTIONS AFFILIATED WITH ACADEMIC RESEARCH INSTITUTIONS	
Center for Interdisciplinary Health Workforce Studies Vanderbilt University Institute for Medicine and Public Health	Conducts studies focused on building integrated and efficient health care workforce to improve access and quality and to control the cost of care.

Leonard Davis Institute of Health Economics University of Pennsylvania/HHS	Focuses on health care policy issues mainly related to projecting the demand for physicians and other health care professionals and understanding the future dimensions of the U.S. health care system.
Health Workforce Information Center University of North Dakota School of Medicine and Health Sciences Center for Rural Health	Provides funding for workforce programs and access to the health care workforce resources to health providers, educators, researchers and policymakers nationwide to meet future workforce demands.
National Health Policy Forum (NHPF) George Washington University	Provides analysis and policy-relevant information to inform congressional and federal agency staff. The Forum's workforce programming addresses health professions education, the adequacy of the current and future health workforce, and the potential impact of delivery system changes on workforce needs.
NON-PROFIT ORGANIZATIONS AND FOUNDATIONS FOCUSING ON NATIONAL WORKFORCE ISSUES	
Alliance for Health Reform	Focuses on PPACA and other health reform issues (e.g., ARRA, health information technology). Provides briefs, forums, webinars, etc. to help inform lawmakers and their staffs, journalists, policy analysts and advocates. Produces workforce briefs that focus on future supply and demand.
Center for Studying Health System Change (HSC)	Research focuses on health system reforms.
Robert Wood Johnson Foundation	Funds and conducts research focused on ways to improve health outcomes and the health care delivery system.
The SCAN Foundation	Funds research to address the long-term care system and health care for seniors. Workforce studies include those related to the nursing home and direct care workforce.
TRADE ASSOCIATION AFFILIATED ORGANIZATIONS	
The Robert Graham Center (American Academy of Family Physicians [AAFP])	Focuses on primary care workforce.
American Academy of Physician Assistants (AAPA)	Focuses on PA workforce; conducts annual PA Census Report.
American Association of Colleges of Nursing (AACN)	Conducts survey on nursing graduates.
American Dental Association (ADA)	Focuses on dentist workforce, research and surveys provide demographic information and future projections.

American Medical Association (AMA)	Focuses on physician workforce and has adopted several policies related to physician workforce planning.
American Nursing Association (ANA)	Provides surveys and factsheets on the nursing workforce. Surveys include employment and earnings of registered nurses.
American Osteopathic Association (AOA)	Focuses on the osteopathic medical profession workforce and provides relevant data on demographics, and specialty and geographic distribution.
American Physical Therapy Association (APTA)	Provides physician therapy workforce data that includes data on demographic characteristics, licensure, practice profiles and salaries.
American Psychological Association (APA) Center for Workforce Studies	Focuses on psychology's labor force and educational system. Conducts several surveys workforce surveys.
Association of American Medical Colleges (AAMC) Center for Workforce Studies	Conducts and disseminates research and data that focuses on physician supply, training and education.
American Hospital Association (AHA)	Conducts research and provides workforce data related to hospitals. AHA also has a Commission on Workforce to provide expertise on workforce issues.
Future of Nursing Campaign for Action	Research focuses on the nursing and primary care population. Also provides nursing workforce minimum data sets.
National Conference of State Legislators (NCSL)	Focuses on workforce issues impacting states. Also tracks federal workforce legislation.
OECD	Monitors events in member countries as well as outside OECD area, and includes regular projections of short- and medium-term economic developments.
Paraprofessional Healthcare Institute (PHI)	Conducts research and provides workforce data related to the direct care workforce.
The Pharmacy Manpower Project, Inc.	Develops data and conducts research regarding the size and demography of the pharmacy workforce.

Regional workforce centers[115]

Six regional workforce centers were funded by HRSA in 1996 until funding ceased in 2006. Currently, four centers remain and conduct local and state/interstate studies on health workforce matters.[116]

HRSA REGIONAL WORKFORCE CENTER	OBJECTIVE/RESEARCH FOCUS
Southeast Regional Center for Health Workforce Studies The Cecil G. Sheps Center for Health Services Research	Conducts research and analysis, works to improve access to a health workforce in the Southeast and North Carolina. Draws on the resources of the Chapel Hill campus with its five health professions schools: medicine, pharmacy, dentistry, public health and nursing. Collects and maintains data describing the need for and supply of health professionals. One of six regional workforce centers that were affiliated with the National Center for Health Workforce Analysis through a HRSA Bureau of Health Professions program that ended in 2006.
Center for the Health Professions (formerly California Center for Health Workforce Studies)	Helps health care professionals, schools, organizations and policymakers educate and manage the health care workforce. Includes resources on supply and distribution, research, skills and training, cultural competency and diversity, and leadership. Delivers health workforce research programs. Includes the Integrated Nurse Leadership Program. Part of the University of California, San Francisco.
Center for Health Workforce Studies, State University of New York (SUNY) at Albany	Conducts studies of the supply, demand, use and education of the health workforce; collects and analyzes data to understand workforce dynamics and trends; and informs public policies, the health and education sectors, and the public. One of six regional workforce centers that were affiliated with the National Center for Health Workforce Analysis through a HRSA Bureau of Health Professions program that ended in 2006.
The Washington, Wyoming, Alaska, Montana, Idaho (WWAMI) Center for Health Workforce Studies*	One of six Rural Health Research Centers funded by the Office of Rural Health Policy. Focuses on training and supply of rural health care providers, availability and quality of care for rural women and children, and access to high-quality care for vulnerable and minority rural populations. Based in the Department of Family Medicine at the University of Washington School of Medicine.

*Not available

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