Health Workforce Analysis Guide
2016 Edition

HWTAC
Health Workforce Technical Assistance Center

Center for Health Workforce Studies
School of Public Health
University at Albany, State University of New York

Health Workforce Analysis Guide, 2016 Edition

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PREFACE

The *Health Workforce Analysis Guide, 2016 Edition* was developed to provide an updated framework for health workforce planners, policymakers, and researchers interested in developing a better understanding of available health workforce data and how to use these data to conduct health workforce research. The guide covers a wide array of topics, including basic health workforce research terminology and methods and special challenges associated with conducting health workforce research. The guide also provides examples of research that aim to clarify key workforce-related concepts, methods, data interpretations, and policy challenges.

This report was prepared by the Health Workforce Technical Assistance Center (HWTAC) staff, including Paul Wing, David Armstrong, Gaetano Forte, and Jean Moore. The Health Resources and Services Administration (HRSA) of the US Department of Health and Human Services (HHS) supports HWTAC under grant number U81HP26492.

Established to support the efforts of HRSA's National Center for Health Workforce Analysis (NCHWA), HWTAC provides technical assistance to states and organizations that engage in health workforce planning. HWTAC conducts a number of initiatives each year designed to provide assistance with health workforce data collection, analysis, and dissemination. HWTAC is based at the Center for Health Workforce Studies (CHWS) at the School of Public Health, University at Albany, State University of New York (SUNY), and was formed as a partnership between CHWS and the Cecil G. Sheps Center for Health Services Research at the University of North Carolina.

The views expressed in this report are those of HWTAC and do not necessarily represent positions or policies of the School of Public Health, University at Albany, SUNY, HRSA, NCHWA, or the University of North Carolina.

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Why a Health Workforce Analysis Guide?

In 2000, HRSA released a State Health Workforce Data Resource Guide designed to help researchers develop the capacity to conduct effective health workforce research that would inform workforce programs and policies. This guide updates the original, reflecting substantive changes in both availability of data and methods for health workforce research. For example, improved data sources are now available at the national level, and at the same time, an increasing number of states are actively engaged in health workforce data collection and analysis. Analytic approaches are also evolving, in part because of the availability of better data.

The United States relies primarily on labor markets to determine how many health workers of different types to educate, train, and deploy. While the health workforce labor market works, it suffers at times from incomplete information and delays in responding to unmet demand. This sometimes results in workforce imbalances, which may take the form of specialty imbalances, geographic imbalances, and skill mismatches that ultimately limit access to care for many high-need populations.[1]

Additionally, the health workforce labor market is influenced by a wide array of stakeholders. They include: providers, insurers, health care consumers, health professions education programs, students in those programs, prospective students who are considering entering a health profession or occupation, and those already working in health care but considering a career change.

This guide is intended to assist health services researchers and others who wish to collect and analyze health workforce data, as well as to develop supply or demand projection models that can more accurately estimate the current and future supply of and demand for health workers.

With the rapid pace of change in health care, it has become both more important and more challenging to assess current and future health workforce needs. A number of emerging developments contribute to this challenge and make it difficult to estimate the numbers and types of workers that will be needed in the future, including:

- The shifting focus of the health care delivery system from acute care to primary and preventive care

- Increasing emphasis on population health

- Growing numbers of integrated service delivery systems, including accountable care organizations (ACOs)

- Payment reform, moving from fee-for-service to bundled payments and value-based payment models

- Increasing use of team-based service delivery models

Better data and analytics can help to support a greater understanding of current and future health workforce supply and demand as well as evidence-based policy development and resource allocation.

The Basic Policy Question

Health policymakers are often required to answer policy questions related to health care and the health workforce. Perhaps the single most important health workforce question to consider is the following:

Is the supply of health care workers adequate to meet the health care needs of the population?

This question can be raised in a range of situations and contexts—for example:

- By profession (eg, physicians, nurse practitioners, physician assistants)

- By setting (eg, acute care, long-term care, ambulatory care)

- By geography (eg, rural, urban)

- By health care delivery model (eg, accountable care organizations)

- For specific underserved populations (eg, the elderly, children, the poor)

- For specific health problems (eg, behavioral health, diabetes, asthma)

- For specific policy initiatives (eg, improving access, containing costs, improving quality)

These variations on the basic policy question suggest a need to develop more effective methods of data collection, analysis, and interpretation, especially to address diverse population needs and current and future health workforce demands.

Health policymakers need the best answer to the basic policy question to guide their decision making related to such issues as funding health professional education programs, assuring adequate Medicaid reimbursement rates for needed services, supporting expanded capacity for education programs, offering loan repayment in return for service in high-need areas, and expanding scope of practice for a specific occupation. The answer to this basic policy question also helps educational institutions to better

determine appropriate class sizes and develop new and innovative programs for health professionals. Health care providers want to know whether they should revise their staffing plans, increase salaries, or reduce services. Prospective health professionals want to know whether there will be career opportunities after graduation.

The Health Workforce Labor Market

Health workforce labor markets are associated with a number of imperfections that contribute to supply and demand imbalances, manifested as surpluses, shortages, and maldistributions. These imbalances contribute to the need for interventions—often in the form of public policies and programs—to try to achieve better balance. Characteristics of health workforce labor markets that limit the effectiveness of interventions include the following:

- Health professions education typically occurs in urban areas. Programs tend to locate in urban areas and often provide clinical experiences for students in urban areas as well, with limited exposure to rural practice. This may influence the decisions by health professionals to practice either in the area in which they trained or in a comparable area, which can contribute to geographic maldistribution.[2]

- Uncertainties around the demand for workers in new roles as a result of changes in the delivery of health care services, which may range from the growing use of team-based care models to technological advances used in the diagnosis and treatment of diseases.

- The lengthy educational pipeline for many health professions, which can render short-term responses to health workforce shortages or maldistributions problematic.

- Constraints on legal scopes of practice—that is, restrictions on what licensed health professionals are allowed to do versus what they are trained and competent to do—which can limit access to services.[3]

- The changing skill mix of health professionals such as advanced practice nurses, which can create opportunities for reconfiguring staffing models to improve cost-effectiveness and efficiency. However, such reconfigurations can make health workforce data analysis more challenging.[4]

- Factors such as geographic and social preferences of individual health professionals and their families, which can exacerbate workforce maldistribution. For example, some health professionals may reject practice opportunities in rural communities for personal reasons.[5]

Workforce imbalances can have significant impacts on health care cost, quality, and access. The impact of imbalances on access to care has received much public policy attention over the past several decades. Imbalances thought to have the greatest impact on access to care include:

- Chronic geographic imbalances that prevail in rural and inner-city areas[5]

- Shortages of practitioners with particular training and skill sets (eg, primary care providers)

- Shortages of a specific category of worker (eg, home health aides)

Geographic imbalances that impact the entire health care delivery system are likely to be most severe for "unattractive" geographic locations. In addition, these imbalances are likely to be greater within populations and communities already struggling with access to limited services: low-income populations living in inner-city areas or remote rural areas.[5]

Imbalances such as an inadequate supply of primary care providers also may impact the quality of care—not only because of the lack of necessary services, but also due to increased demands and stress on existing providers. Insufficient primary care capacity may force providers to work longer hours and may increase the number of people seeking services in emergency rooms for care that was not accessible in ambulatory settings. This may also contribute to higher costs by raising compensation levels to reflect the scarcity of workers.

Similarly, an oversupply of health workers may result in chronic underemployment of health personnel and/or overuse of services, thereby impacting both the quality and cost-effectiveness of care.

Wide variations in the per-capita ratios of some health professionals across states—especially in small geographic areas—suggest that the current health workforce labor markets are not particularly effective in avoiding localized maldistribution problems.

State Roles and Responsibilities Related to Health Workforce Planning

The importance of health care to the public, in conjunction with the shortcomings of the health workforce marketplace, has resulted in several significant roles for states related to the health workforce. Although the situation in each state is different, these roles usually include at least some of the following:

- *Support for health professions education at state universities and colleges.*
  In most states, public colleges and universities produce a high percentage of the health professionals in the state's health workforce. Some states also subsidize health professions education in independent or private institutions.

- *Special programs, projects, and grants.*
  Many states fund initiatives to address specific health-related concerns, such as access to care in underserved areas, using loan repayment and scholarships to encourage practitioners to locate in high-need areas. Such programs can have a major impact on the delivery of health care in those areas.

- *Regulation of the professions.*
  States are responsible for determining the requirements for licensure, legal scope of practice, and professional misconduct for licensed health professions in their states.

- *Reimbursement policies for Medicaid and other payers.*
  States often decide which health professionals are eligible for reimbursement under its Medicaid program. In addition, states may mandate private insurance coverage for particular health professions or services.

Important Assumptions

Several assumptions were made in developing this guide and have helped to shape its content and format:

- Different stakeholders have different interests and capabilities related to health workforce data and analysis that can inform policies. Some are very sophisticated, while others have limited experience and resources.

- Despite these differences, there are many commonalities that would benefit from consistent efforts to define issues, identify policy options, and share information and resources.

- Better information and data about the supply of and demand for different health professions and occupations will generally result in better workforce planning and ultimately better health care.

- Many workforce research questions may be addressed at different levels of detail and sophistication. When timelines are short and data are scarce, straightforward approaches using available data will need to suffice.

Structure of this Guide

This guide focuses on the 2 key elements of any health workforce analysis: data and methods. It also provides examples of health workforce analyses to better illustrate effective analytic approaches. The overall structure is shown schematically in Figure 1.

Figure 1. Components of the Health Workforce Analysis Guide
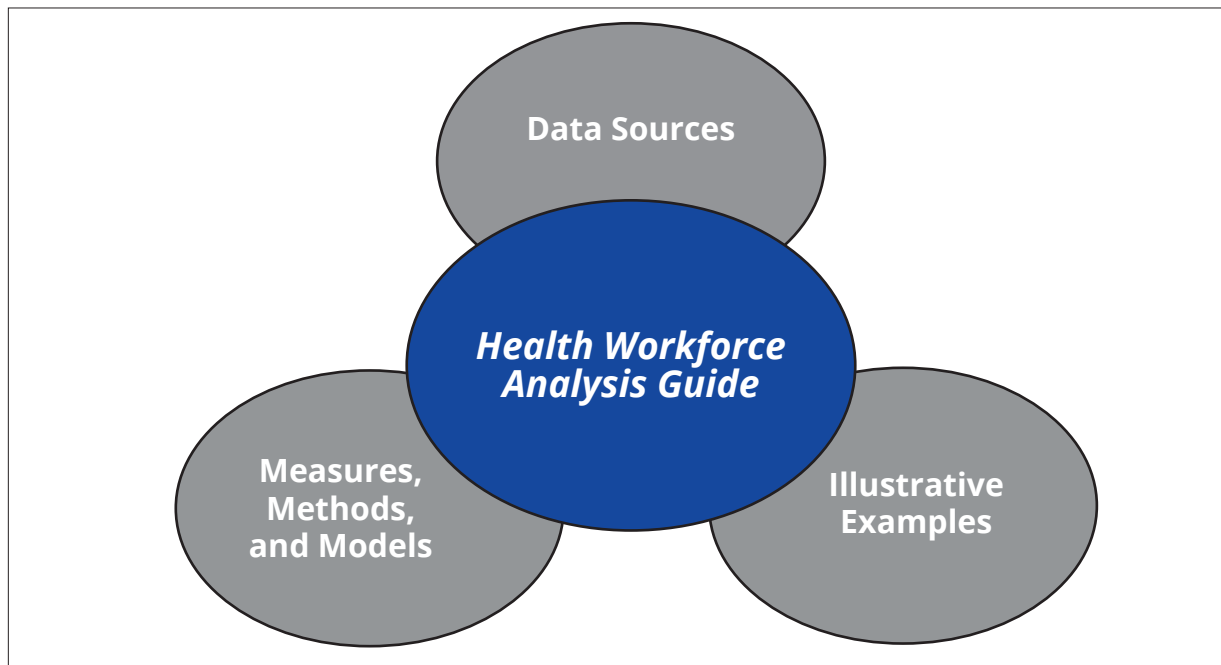
Topics Covered

The guide includes the chapters and appendices described below.

Chapter 2 discusses health workforce data sources and acquisition and provides a brief description of important federal and non-federal sources of health workforce data. It also provides a primer on how to acquire health workforce data.

Chapter 3 offers a framework for health workforce analysis. This chapter defines important terms and describes an array of methods and models that may be used to analyze important aspects of the health workforce.

Chapter 4 provides examples of health workforce studies that have been conducted. The examples address a variety of questions and issues on different aspects of the health workforce, with brief synopses, citations, and illustrations of tables, maps, and charts.

Chapter 5 discusses several challenges that may complicate health workforce analyses. The topics include new professions and occupations, scope of practice variation, coordination with education programs, new technologies, data limitations, and looking beyond data.

The *Appendix* defines acronyms relevant to the study of the health workforce.

Topics Not Covered

The focus of this guide is on tools and techniques that may be used to analyze and better understand issues relevant to the supply of health workers as well as demand, and need for them. Several issues and topics related to health workforce research are not dealt with directly in this guide, including:

- *The educational preparation of health professionals.*
  While the specific skills and competencies of different types of health workers is an important topic, efforts to study this are beyond the scope of this guide.

- *The quality of services provided by health care workers.*
  Quality of service is also relevant to any assessment of the supply and demand or need for health professionals, but is also beyond the scope of this guide.

- *The regulation of health care professionals.*
  All states have responsibility for licensing and/or certifying health professionals, but the variation in regulatory frameworks is too varied and complex to document in this guide.

- *Nonclinical workers.*
  The health care system includes administrative staff and other workers not involved in direct patient care but nevertheless essential to the delivery of services to patients. Methods to conduct research on these workers are not discussed in this guide.

- *Primary data collection.*
  Effective tools, strategies, and techniques to collect data related to the health workforce clearly are critical to the success of any health workforce research initiative. However, the details of sampling frames, survey design, questionnaire layout and wording, response coding, data entry, response incentives, etc., are beyond the scope of this guide.

- *Advanced statistical analysis.*
  Various methods and models are discussed in this guide, including counts and ratios as well as basic supply, need, and demand models, but no advanced statistical techniques are

addressed. While advanced statistical techniques such as multivariate linear and nonlinear regression models are important tools for health workforce research, they are beyond the scope of this guide.

CHAPTER 2:
Sources of Health Workforce Data

CHAPTER 2: SOURCES OF HEALTH WORKFORCE DATA

One of the prerequisites for effective health workforce planning and policymaking is access to timely, accurate data. Comprehensive health workforce planning requires data that describe:

- Health workers (eg, physicians, nurse practitioners, physician assistants, dentists, home health aides)

- Health care organizations (eg, hospitals, clinics, nursing homes)

- Health professions education programs (eg, medical schools, nursing schools)

- Population demand for health services (eg, hospital discharges, procedure counts)

- Population need for health services (eg, population demographics and characteristics, prevalence of illness)

This chapter identifies some of the most commonly used data sources relevant to health workforce planning and policymaking and discusses strategies for acquiring data.

Federal Data Sources

The federal government collects data in many of the areas listed above. Most of these data sets are available to researchers and others for analysis and are suitable for studying the health workforce in the US. The most important of these data sets are described below and include the responsible agencies.

Compendium of Federal Data Sources Relevant to Health Workforce Analysis[6]

This compendium, published in 2013 by HRSA's National Center for Health Workforce Analysis, profiles 19 federal data sources that may be used to support health workforce research and analysis. For each data source, the compendium provides the lead federal agency, website, description of the data source, sample size, relevance for health workforce analysis, geographical detail, and availability.

The following are included in the Compendium and are briefly described as they represent important sources of information for health workforce research.

- *HRSA's Area Health Resources File (AHRF)[7]*
  The AHRF is a family of health data resources updated annually. It includes an extensive county-level database compiled from more than 50 sources and includes county and state

data files, Microsoft® Access® databases, an AHRF Mapping Tool, and AHRF HealthResourcesComparisonTools (HRCT).

- *The American Community Survey (ACS)[8]*
  The ACS of the US Census Bureau is an ongoing statistical survey that annually samples 3.5 million households in the United States and Puerto Rico. It was officially launched on an annual basis in 2005. To guarantee accuracy for estimates, the sampling rate varies from 15% for small, rural areas to less than 1% for large urban areas.

  The ACS contains data on persons living in the sampled housing units and group quarters. The ACS includes information on age, sex, race and ethnicity, language, disability, health insurance status, state of residency and employment, employment status, hours worked, occupation, education, income, household size and characteristics, and family characteristics and relationships, among other items.

- *The Current Population Survey (CPS)[9]*
  Sponsored jointly by the Census Bureau and the Bureau of Labor Statistics (BLS), CPS is another survey administered by the Census Bureau. The CPS is the primary data source used by BLS to compute the national unemployment rate.

- *Behavioral Risk Factor Surveillance System (BRFSS)[10]*
  BRFSS was initiated by the Centers for Disease Control and Prevention (CDC) in 15 states in 1984. The CDC collects data annually and makes available to researchers a set of sample survey data sets that describe the demographics, health status, health-related behaviors, mental health conditions, and access to health care of the US population with state-level estimates. The number of states participating in the survey increased until 2001, at which time all 50 states, the District of Columbia, Puerto Rico, Guam, and the US Virgin Islands were participating.

  The objective of BRFSS is to collect uniform, state-specific data on preventive health practices and risk behaviors that are linked to chronic diseases, injuries, and preventable infectious diseases affecting the adult population. Since 2011, BRFSS has conducted both landline and cellular telephone–based surveys. The health characteristics estimated from BRFSS pertain to the adult population (aged 18 years and older) residing in households.

  The BRFSS questionnaire includes 3 components: the core component, in which a standard set of questions are asked in all participating states; the optional CDC modules, with sets of questions on specific topics of current interest (e.g., excess sun exposure, cancer

survivorship, and mental illness) that states may elect to add to their questionnaires; and the state-added questions, which are developed or acquired by participating states and added only to their questionnaires.

- *The Centers for Medicare and Medicaid Services (CMS)*
CMS administers the federal Medicare and Medicaid programs, which provide health insurance for the elderly (including some people with disabilities) and the poor, respectively. CMS makes available many reports and data files concerning the Medicare and Medicaid programs.[11] The files generally focus on beneficiaries and the services provided to them, not the providers and practitioners providing the services.

  The *National Plan and Provider Enumeration System (NPPES)* is administered by the CMS. The most important product of NPPES is the *National Provider Identifier Registry (NPI Registry)*, an administrative system that assigns unique ID numbers to all health care providers and organizations in the US that bill electronically for health care services.[12] The resulting data set is increasingly being used to examine the supply of health professionals. However, it does not permit estimation of full-time equivalents (FTEs) .

- *Occupational Employment Statistics (OES)*
The OES program, maintained by the *Bureau of Labor Statistics (BLS)* within the *US Department of Labor (USDOL)*, produces annual employment and wage estimates for more than 800 occupations. These estimates are available for the nation as a whole, for individual states, and for metropolitan and nonmetropolitan areas. National occupational estimates for specific industries are also available.[13]

- *Current Employment Statistics (CES)*
The CES program within the BLS surveys approximately 143,000 businesses and government agencies, representing approximately 588,000 individual worksites, to provide detailed industry data on employment, hours, and earnings of workers on nonfarm payrolls.[14]

- *Employment Projections (EP)*
The EP program within the BLS develops and publishes information about the US labor market projected 10 years into the future.[15]

- *The Medical Expenditure Panel Survey (MEPS)*
MEPS is a national data source administered by the Agency for Healthcare Research and Quality (AHRQ) that measures how Americans use and pay for medical care, health insurance, and out-of-pocket spending. Conducted annually since 1996, MEPS is a set of

large-scale surveys of families and individuals, their medical providers, and their employers that provide data on health status, the use of medical services, charges, insurance coverage, and satisfaction with care.[16]

The data, which are available for download, include the MEPS Household Component (MEPS-HC), the MEPS Medical Provider Component (MEPS-MPC), and the MEPS Insurance Component (MEPS-IC). The MEPS-HC contains information about the health status of Americans, health insurance coverage, and access, use, and cost of health services. The MEPS-MPC survey collects information from providers of medical care that supplements the information collected from persons in the MEPS-HC sample to provide the most accurate cost data possible. The MEPS-IC survey collects information from employers in the private sector and state and local governments on the health insurance coverage offered to employees.

- *The Healthcare Cost and Utilization Project (HCUP)*
  HCUP is a comprehensive source of hospital data, including in-patient and ambulatory care, along with emergency department visits.[17]

  HCUP databases are derived from administrative data and contain encounter-level clinical and nonclinical information, including all-listed diagnoses and procedures, discharge status, patient demographics, and charges for all patients regardless of payer (eg, Medicare, Medicaid, private insurance, uninsured). Since 1988, these databases have enabled research on a broad range of health policy issues, including quality and cost of health services, medical practice patterns, access to health care programs, and treatment outcomes at the national, state, and local market levels.

- *The Integrated Postsecondary Education Data System (IPEDS)*
  IPEDS is operated by the *National Center for Education Statistics (NCES),* US Department of Education, and is a system of interrelated annual surveys that gather information from the more than 7,500 colleges, universities, and technical and vocational institutions that participate in federal student financial aid programs. These institutions are required to report data on enrollments, program completions, graduation rates, faculty and staff, finances, institutional prices, and student financial aid. Data are collected for 197 health professions and occupations in 35 different health professional categories as part of IPEDS.[18]

  These data are made available to students and parents through the College Navigator college search website[19] and to researchers and others through the IPEDS Data Center.[20]

Other federal data sources

The following are additional federal resources that are not included in the compendium.

- *HRSA's Nurse Sample Survey*
  The latest of these surveys was conducted in 2012 and focused on nurse practitioners.[21] Earlier surveys, which covered only registered nurses (RNs), provide the most comprehensive national data available on the professional nursing workforce. Public use data files are available on HRSA's website.

- *HRSA's Web-Based Nursing Model*
  This web-based nursing model allows users to project state-specific supply of and demand for RNs and licensed practical nurses (LPNs) into the future, providing policymakers with long-term guidance on potential future imbalances in the nursing workforce in their state. This model also allows users to upload their own state-level supply data and modify some of the supply model parameters (eg, changes in retirement age and number of new RNs and LPNs). The model is accessible via the HRSA website.[22]

- *The Decennial Census*
  The Decennial Census is the best-known product of the US Census Bureau.[23] Conducted every 10 years, the results of this survey create a statistical picture of the US population that documents the ebbs and flows of the population in geographic areas across the country.

- *2012 Economic Census Geographic Area Series*
  In 2015, the Census Bureau released a new 2012 Economic Census Geographic Area Series with data relevant to health care and social assistance.[24] The files provide state-level statistics on the number of establishments, revenues, payrolls, employees, and other variables on health care and social assistance organizations. The files contain statistics for offices of physicians, outpatient care centers, home health care services, continuing care retirement communities and assisted living facilities for the elderly, hospitals, and child day care services.

Non-federal Sources of Health Workforce Data

Many other data sources are available to help fill gaps and add important details to the statistical picture of the health workforce. Some of these are listed below.

State-level Health Workforce Data

A number of states have developed systems for health workforce data collection, often linked closely with their responsibilities for licensing health professionals. These data sets support a wide range of health workforce planning activities, from descriptions of basic supply and distribution of providers to analysis of shortage areas. Also, state Departments of Labor operating in conjunction with the USDOL collect data on employment, including health care, which often proves helpful in understanding health workforce issues.

The state data files are typically limited to a single state. Other states may be able to jump-start the development of their own systems by acquiring copies of survey instruments and report templates already in use by other states. They may also find useful statistical comparisons and benchmarks in neighboring states or in states with similar demographic characteristics.

The *Health Workforce Technical Assistance Center (HWTAC)* developed a S*tate Health Workforce Data Collection Inventory* to learn more about states engaged in health workforce data collection. The inventory describes state data collection efforts focusing on health workforce supply, demand, and educational pipelines. The inventory is posted to the HWTAC website.[25]

Data and information from professional and provider associations

Professional and provider associations may be important data sources for health workforce research. These include the American Hospital Association (AHA), the Association of American Medical Colleges (AAMC), the American Medical Association (AMA), and the American Dental Association (ADA). A number of these organizations publish aggregated data books, some of which contain a variety of tables and charts based on analyses by in-house researchers. Prime examples of such data books include:

- *JAMA Medical Education issues*
  Collectively, these volumes provide valuable insight into trends in the production of new physicians in the US. One can track changes in the production of new physicians, trends in choice of specialties by medical residents, and other relevant topics.

- *AAMC Data Books*
  These volumes present a wide range of statistics on medical schools in the US, including accredited schools; applicants, enrollments, and graduates; faculty; revenues; graduate medical education (GME); tuition, financial aid, and student debt; teaching hospitals; health care financing; research; faculty compensation; and price indices.

- *The AHA Guide®*

  Published annually, this guide serves as a comprehensive directory of US hospitals, health systems, networks, alliances, and other organizations. The AHA also publishes its annual AHA Hospital Statistics™, which includes 5-year trends in utilization, personnel, revenues, and expenses across local, regional, and national markets.

- *State-specific health workforce data books*

  A number of states—including North Carolina, South Carolina, and New York, among others—produce periodic health workforce data books that provide population demographic data, health status indicators, and basic data on the health workforce within their state. Excerpts from these are provided in Chapter 4 of this guide.

- *Physician Characteristics and Distribution in the US*

  This AMA annual report describes various physician characteristics by state and specialty, including demographics, professional activities, and education.

These and other resources provide valuable contextual information for different health workforce issues. This is especially true for annually released data books that support trend analysis.

Marketing/mailing list companies

Companies that collect and sell mailing lists are another source of health workforce data. Their primary clients are often pharmaceutical companies or other groups that sell products and services to individual health professionals. The companies typically sell lists of physicians or other health professionals with guaranteed-accurate mailing addresses, phone numbers, and other contact information. Examples of companies that sell health workforce data are SK&A[26] and Medical Marketing Service, Inc.[27]

A key advantage of this data source is that it tends to be updated routinely and thus is fairly accurate. Disadvantages include the lack of relevant workforce-related descriptors (age, hours worked, etc) as well as the relatively high cost of these data, although it may be possible to negotiate a more favorable price if the data are used for workforce research rather than marketing.

Online job posting data

A relatively new source of health workforce data is online job postings. These proprietary databases can be used to track the job market demand for specific health professions by aggregating the number of online job postings. These databases often require a substantial amount of work before they can be used for health workforce analysis, however. For a discussion of the applicability of these databases to health

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workforce studies see Morgan et al. (2016).[28]

Health care utilization data

There is growing interest in understanding the impact of the health workforce on health outcomes. Consequently, data on health care utilization is often used in health workforce research. Access to Medicare and Medicaid data via CMS and MEPS was discussed previously.

Many states are developing or considering all-payer claims databases (APCDs) that compile health care utilization claims from both public and private payers in order to better understand access, quality, and cost issues.[29] The national APCD Council is a resource for learning more about state efforts to develop APCDs.[30] The aggregated claims data may provide insights on the impact of the workforce on health outcomes and service delivery.

Data Acquisition

Some of the data sets described in this chapter may be easily located and downloaded, while others may be less accessible. The section that follows suggests the steps that a researcher might follow to gain access to a particular data set and describe some of the issues that he or she may encounter when trying to obtain some of these data files.

Steps for acquiring data

The basic steps involved in acquiring data are generally straightforward:

- Locate a data set with the desired data elements for the desired subjects and time frames, with an acceptable format and delivery mechanism.

- Contact the organization that owns the data to determine whether the data are available and any restrictions that may be placed on access or use of the data.

- If the file and any restrictions are acceptable, determine the cost of acquiring the desired data set and documentation.

- Purchase the data set and arrange for delivery. Online delivery is the most straightforward option.

The major difficulties usually associated with data acquisition are cost and data use restrictions. Data from companies whose primary business is selling data can be expensive, particularly for large files.

Data use and restrictions

Typically, researchers who want access to data may be asked to sign a data use agreement with the owner of the data or an authorized agent that specifies the conditions under which the data can be used, restrictions on how the data may be reported, and the conditions (if any) under which the data would be shared with third parties.

Research involving human subjects—including research based on surveys or questionnaires as well as research conducted by academic institutions—is often subject to review and approval by local Institutional Review Boards (IRBs) to protect the safety and privacy of study subjects. For survey research, this generally means that any survey responses, tabulations, and reports generated from the survey must not reveal personally identifiable data.

Factors that might permit someone to identify a specific individual include small sample size and variables that reveal personal information such as age, gender, and address. The most common mechanism for de-identifying responses to a survey is to collect a large number of responses, so that at least some minimum number of respondents (often 5) will have the same combination of personal characteristics. For practical purposes, this often results in redacting data for any geographic area with fewer than 5 respondents with the same set of characteristics.

Costs

Health workforce researchers should not be surprised to hear that high-quality data (ie, data that are accurate and timely) may be quite expensive.

Below are suggested ways to reduce your data costs:

- Use public data sources wherever possible. This will almost always be the lower-cost option.

- Negotiate with vendors of nonpublic data sets. It is often possible to obtain a lower price by agreeing to some restrictions on the use of the data set.

- Sample a selection of records that meet your research criteria.

- Request aggregate data. Some vendors may consider selling "preprocessed" data (eg, counts, totals, and averages for ZIP codes in lieu of record level data) at a reduced cost.

CHAPTER 3:
Health Workforce Analysis

CHAPTER 3: HEALTH WORKFORCE ANALYSIS

At first glance, measuring health workforce supply may appear to be a straightforward task. For example, one might think that to obtain a count of oral health professionals in a state, one need only consult the state licensing board. Unfortunately, as we shall see, this task is not so simple. This chapter provides a basic introduction to health workforce analysis and describes some of the important issues related to the definitions, measurement, quality, analysis, and interpretation of health workforce data.

Basic Terminology

Before describing the components of an analysis, it is important to introduce and define some important terms that are central to the study of the health workforce.

Supply/Demand/Need

These 3 terms are fundamental concepts associated with many health workforce studies.

Supply represents the numbers of personnel working or available to work in health care settings. The economic interpretation of supply incorporates the notion of willingness to work at a particular compensation level. Depending on the situation, some supply estimates also incorporate specific adjustments that reflect capacity for work and productivity. For example, FTE estimates are based on the number of hours that health workers devote to the provision of clinical services.

Demand is an economic concept based on the willingness of employers to purchase the services of health care personnel at a particular compensation level. Demand is usually a primary reference point in workforce studies because it takes into account economic realities, and because current levels of employment reflect economic demand.

Need represents a normative judgment about the ideal number of workers that should be available to provide health services in a particular area or to a particular population to keep them healthy, regardless of their ability to pay. Need tends to be greater than demand. This is often the case in rural areas and poor urban neighborhoods because of a variety of financial and nonfinancial factors related to employment, income, and personal preferences. However, in some instances, demand may exceed need, as is the case with supplier-induced demand.[31]

Shortage/Surplus/Imbalance/Maldistribution

These 4 terms describe different situations when supply and demand or need are not in balance.

Shortage represents a situation in which demand or need exceeds supply. There is no standard definition for shortage, and it can be computed for geographic regions, types of employers, individual firms, or specific medical procedures. Shortages may even represent unfilled positions in an organization or unit. Shortages can be rated by magnitude, but there are no standards for such ratings. A shortage is generally not rated as severe until patients have difficulty scheduling needed care or services in a timely manner.

Surplus refers to situations in which supply exceeds demand or need, but again, there is no standard definition. Although there are some situations in which a surplus of practitioners might negatively affect patient care (eg, loss of skills due to lack of regular practice), the individuals most affected by surplus are generally recent graduates and licensees who have difficulty finding suitable employment in a highly competitive workforce market.

Imbalance is a general term used to represent situations in which the supply and demand or need are not in equilibrium.

Maldistribution is a term describing situations in which the total supply of practitioners in a particular geography equals or exceeds the total demand or need for them, but there are shortages and surpluses at a more local level. Thus, the supply is not distributed so as to match the demand or need at the local level.

Indicators of Shortage

The bottom line for many health workforce studies is a determination of whether a shortage of practitioners of a particular health profession currently exists or will exist in the future. Generally, this determination is based on a comparison of supply and demand. If demand estimates exceed supply estimates, then the conclusion is that a shortage exists. This section explores a number of approaches to assessing whether a workforce shortage exists.

Direct measures of shortage

Perhaps the simplest way of determining whether a shortage of health workers exists is to ask those who employ the workers. If hospitals and other health care providers have vacant positions that they cannot fill, then a shortage may exist. Such direct assessments often may be obtained using relatively simple

surveys or phone calls. If the contact person is knowledgeable and trustworthy, then the results may be all that are needed.

Another direct measure is patient wait times. If patients are required to wait for a protracted amount of time before seeing a provider, a shortage exists. Like vacancies, patient wait times may be obtained from surveys or phone calls. Although both of these approaches may be used for one-time assessments, routine periodic monitoring will significantly enhance insights.

Indirect measures of shortage

It may be possible to gain important insights about shortages or surpluses of health personnel by observing indirect indicators or measures. Indirect indicators are statistics that, although not directly measuring supply or demand, are related to supply or demand in some systematic way. Indirect indicators include advertising measures, average time required to fill a position, turnover rates, and income measures. Each of these is briefly described below. While compiling data for any of them is not particularly challenging, accurate interpretation requires practice and experience.

- *Advertising measures*
  The amount of advertising done by employers to recruit health personnel is clearly related to shortages and surpluses that may exist. Generally, more advertising indicates a greater shortage or greater urgency to fill vacant positions. Compiling the relevant statistics is not difficult; one must simply sum the column inches of advertising, perhaps making separate counts for display ads and other ads, in an appropriate set of publications. One might choose local newspapers, a regional newspaper, and 1 or 2 professional journals. For national or regional publications not targeted at a specific state or locality, one should be careful to count only ads placed by organizations within the target region. Online ads and bulletin boards also should be included. Alternatively, if you do not want to compile your own data, there is an increasing number of online job posting databases available for purchase. These databases require a considerable amount of work before they can be used for health workforce analysis, however.[28]

  It is important to remember that a variety of factors may influence advertising patterns. One way to account for such patterns is to collect the statistics on a regular basis, using the same criteria and definitions. This permits researchers to include any special knowledge and experience they have about a situation when they analyze and interpret the advertising statistics. One may then approach a human resources director with a question like: "We've observed that you're recruiting more RNs these days. What specific problems are you addressing?"

- *Average time to fill a position*

  The average time to fill a position is an indirect measure that must be collected directly from employers. These statistics, if compiled separately for different job titles and positions, may provide useful indications of the relative difficulty encountered in filling different types of positions.

- *Turnover rates*

  Turnover rates, which must be compiled by employers, indicate the relative difficulty that employers have in retaining personnel. As with other indirect measures, turnover rates reflect a range of factors including wages, working conditions, job satisfaction, and the general economy. Nevertheless, because these are elements that contribute to the interplay between supply and demand, these data are most certainly of value as long as researchers understand the general patterns and trends that define normal operations.

- *Income measures*

  Income measures also can reveal shortages of workers. By tracking salaries and wages for a representative set of health care organizations, one may observe unusual changes in salaries that might indicate a significant change in the supply/demand balance. For example, an unexpectedly large increase in salaries might be an adjustment in response to a shortage of workers. As with all indirect measures, interpreting the significance of such trends requires experience as an observer.

A Framework for Health Workforce Analysis

Considering that this guide is designed to help inform health workforce researchers, policymakers, planners, and other interested stakeholders, it is important to have a conceptual framework that supports researchers across a variety of levels of ability and experience. The framework presented schematically in Table 1 presents a list of dimensions and characteristics that outline key aspects of health workforce studies.

Study Purpose

The framework begins with the study purpose, which first and foremost requires researchers and analysts to clearly understand the proposed goals and objectives identified by the individual or agency requesting the study. This is critical for identifying the most appropriate data sets to address the research questions or hypotheses, determining the most appropriate methods and models for data collection and analysis, and presenting the results and findings in a manner that addresses the study research questions or hypotheses.

Table 1. Framework for Health Workforce Analysis

Study purpose	
Goal(s) for health	Overarching goal(s)/purpose(s)
Objective(s)	Specific objective(s)
Profession(s)	Specific profession(s)/specialty(ies)/occupation(s)
Study characteristics	
Theme	Supply, demand/need, adequacy of supply
Sophistication	Basic, intermediate, advanced
Methods	Counts, ratios, comparisons and benchmarks, modeling
Study data	
Geography	Units, addresses/locations of practices, migration patterns
Type of data source	Existing datasets, administrative records, surveys, interviews, reconciling differences
Data elements	<u>Supply characteristics:</u> demographics, education, credentialing, practice <u>Demand characteristics</u>: population demographics, health status indicators, health service utilization
Sampling	Universe, probability sample, nonprobability sample

The study purpose is a vital aspect of the framework that keeps a study from missing the point or falling short. It should reflect the overarching study goal(s) (eg, assessing the adequacy of the behavioral health workforce) as well as the specific study objective(s) (eg, determining the number of behavioral health professionals required to serve a particular population). Understanding the study purpose does not guarantee a successful study, nor does a failure to understand the study purpose guarantee a failure. However, a clear understanding of the study purpose helps direct attention toward essential aspects of the identified problem and minimizes wasted effort and resources.

Many health workforce studies focus on a particular health profession (or set of professions), often specified or implied in the original study request. This is clearly a critical factor that defines which data sets to focus on and what kinds of benchmarks and targets to use.

Study Characteristics

The study characteristics identified in Table 1 are another important aspect of the framework.

The 3 study characteristics that are central to any health workforce analysis are the theme, the level of sophistication, and the specific methods used. The first 2 characteristics are especially relevant to this guide. They define a 3 X 3 matrix of 9 categories into which health workforce studies can be classified. This matrix is used in Chapter 4 to classify and organize examples of studies and reports presented in this guide.

Theme

The 3 themes included in this guide, introduced and defined at the beginning of this chapter, are the supply of health professions and occupations, the demand/need for health professions for a given population, and the adequacy of the supply of professionals/workers relative to demand. These categories help to define the types of data and analytical tools that are most relevant to the study at hand.

Sophistication

The level of sophistication required of the researcher or team conducting the study is the second defining dimension of the study characteristics. Three levels are included in this guide: basic, intermediate, and advanced. This typology should not be considered hard and fast, but rather as a guide to distinguish the different levels of sophistication employed in health workforce studies. It can be used to help direct researchers to cases and methods likely to be especially appropriate for their capabilities and resources.

- *Basic studies and analyses* generally focus on counts of health professionals and occupations and relatively simple indicators of demand or need for professionals or workers. Charts, tabulations, and maps tend to be based on simple counts and comparisons of averages and population ratios.

- *Intermediate studies and analyses* generally include more detailed or elaborate statistics, comparisons covering multiple years, or more detailed breakouts of supply and demand statistics for different geographic regions and population subgroups. Tables, graphs, and maps tend to be based on multiple variables.

- *Advanced studies and analyses* generally involve advanced statistical techniques designed to reveal underlying patterns and relationships among multiple variables obtained from different data sets. The results of these analyses often include computed indicators and projections requiring more sophisticated computation and data manipulations.

Figure 2 provides an additional perspective on these 2 study characteristics and reflects the fact that comparisons of "themes" are generally matched with respect to sophistication. Thus, a basic supply analysis is generally matched with a basic demand analysis. Also implied in this figure is that researchers new to health workforce planning and analysis should initially focus their attention and resources on basic analyses on the supply, demand, and adequacy of health professionals and occupations. As their experience and expertise grows and as sufficient resources are acquired, they may shift their efforts to intermediate and advanced analyses.

Figure 2. Health Workforce Analysis Hierarchy

WORKFORCE DEMAND/NEED			WORKFORCE SUPPLY		
Advanced analyses and data	**Intermediate analyses and data**	**Basic analyses and data**	**Basic analyses and data**	**Intermediate analyses and data**	**Advanced analyses and data**
Multivariate analyses of factors related to demand and need	Comparisons with other states and US averages	Population counts and characteristics for state and counties	Licensees and employment	Comparisons with other states and US averages	Projections of supply
Multidimensional indicators of need for substate areas and population groups	Estimates for population subgroups and practice settings	Health status of population	Ratios and baselines	Historical trends	Multivariate analyses of aspects of supply
Projections of future demand and need	Historical trends of demand and need	Direct measures of demand (eg, vacancies)	State and substate counts	Distributions by practice types and settings	
		Indirect measures of demand	New entrants and exits	Distributions by populations served	
			Tables and maps		

Basic adequacy analyses

Intermediate adequacy analyses

Advanced adequacy models and analyses

Methods

The third study characteristic involves the actual methods of analysis used to address the question(s) posed. Study methods are not generally specified in a request for a health workforce study. Rather, the researcher is expected to decide which tools and data should be used to address the issue or answer the question. Methods available to researchers run the gamut of basic counts and ratios, to intermediate comparisons with benchmarks and simple correlations, to multivariate linear and logistic regressions, to complex supply and demand projection models.

It is not always possible to specify in advance which analytic methods would be most suitable for a particular situation, but careful consideration may help one choose options that will give the desired results with available staff and resources. Ultimately, the researcher must choose the analytical tools most appropriate for the issue or question at hand.

Counts

The problem of estimating the supply of the health workforce may seem deceptively simple. For example, it may appear that all an analyst must do is find out how many professionals are licensed to practice in a state. Unfortunately, the problem is seldom as simple as that, as Figure 3 reflects. Factors like migration, labor force participation, and the use of workforce substitutes must be considered in any thorough data analysis, particularly if one is developing future projections of the supply of personnel.

Figure 3. Health Workforce Supply Model

Total Population ↔ **Immigration Migration**

Types of data needed:
High school graduation rates
College graduation rates
Career interests
Demographic trends

Primary, secondary, & college education

Dropouts & Other Careers ↔ **High School and College Graduates** ↔ **Immigration Migration**

Types of data needed:
Career preferences
Program openings
Tuition and scholarships
Salary trends

Application for health professions education

Dropouts ↔ **Students in Health Professions Education Programs** ↔ **Immigration Migration**

Types of data needed:
Trends in graduates
Choices of specialties
Work preferences
Duration of programs

Graduations, licensure, and certification

Deaths ← **Licensed and Certified Professionals** ↔ **Immigration Migration Occupation Shifts**

Types of data needed:
Numbers licensed
Numbers employed
Recruiting statistics
Geographic preferences

Labor force participation

Deaths & Retirements ← **Active Health Care Professionals** ↔ **Immigration Migration Occupation Shifts**

One does not generally begin with a full-scale supply model like the one illustrated in Figure 3. A common place to start is with the estimation of the current supply of licensed workers. Licensing agencies can provide accurate counts of the numbers of practitioners licensed to practice in a state. Usually, it is also possible to obtain counts by county, ZIP code, and/or other geographic units to provide additional detail for analysis. These data should not be used in an analysis or model unless the counts are adjusted for factors such as age and labor force participation.

Generally, raw counts of licensed professionals will significantly overestimate workforce supplies. In 2010, the Center for Health Workforce Studies, School of Public Health, University at Albany, State University of New York, estimated that there were 53,760 FTE patient care physicians practicing in New York State. Figure 4 shows the steps involved in estimating this number. At the time of this analysis, 86,022 physicians were licensed by the New York State Education Department. However, when participation in the labor force (retirement, inactive, and training status) and address (physicians practicing within the borders of New York State) were considered, and adjustments made for productivity (based on hours worked in patient care), these licensees translated to 53,760 FTE patient care physicians. Certainly, using the gross head count of physicians licensed in New York State as the supply estimate would significantly overestimate the supply available to care for patients.

Figure 4. Estimated Numbers of Physicians in New York State, 2010
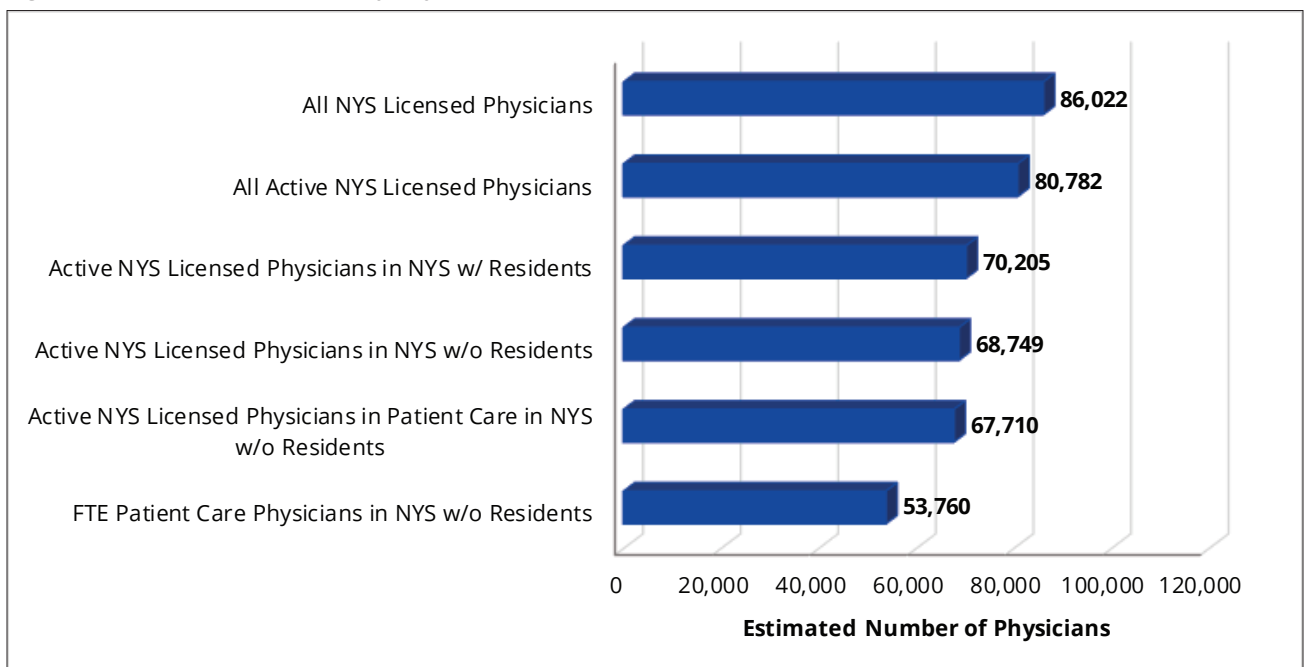
Source: Center for Health Workforce Studies.

The next step in the estimation process adjusts the raw supply figures to account for those not providing direct patient care. Each of the adjustments must be based on data about one or more characteristics of the workers. Among the adjustments that may be made to the supply estimates are age, gender, and non–patient care activities. Periodic surveys of personnel may be very helpful in understanding the labor force participation of different categories of workers.

The task of estimating the supply of unlicensed workers is often more difficult than that for licensed personnel, since there are often no master lists of individuals from which to estimate the supply. There is also less standardization of job titles and legal scope of practice across states.

Ratios

The simplest approach to understanding the supply of workers involves computing ratios of workers to other relevant factors. Physician-to-population ratios are often used as indicators of the relative supply of physicians in the US, in individual states, and in other jurisdictions. Other possible reference parameters include numbers of other professionals, hospital beds, patients, X-ray machines, and health care services. Such ratios provide the context for understanding the supply and making it possible to compare ratios for specific geographies with other geographies/benchmarks.

Comparisons and benchmarks

As indicated above, understanding the supply, demand, and/or adequacy of the health workforce in one geographic region relative to another or to a specific benchmark is a common approach used by health workforce researchers. In order to understand the distribution of registered nurses in a state, one might array on a map the RN-to-population ratio or the RN–to–hospital bed ratio at the county level. These comparisons would allow one to evaluate counties that have a greater or lesser supply based on these ratios.

Experienced health workforce researchers sometimes use these comparisons as a first step to identify areas of potential imbalance between supply and demand prior to conducting a more complex analysis. In some instances, benchmarks have been developed to help guide researchers and planners to quickly assess the adequacy of the workforce supply in an area. One commonly used benchmark is the population–to–primary care physician ratio. Areas that have ratios above the benchmark set by the Division of Shortage Designation are considered areas of shortage and may be officially designated as such through application to the federal government.[32]

Comparisons may be facilitated by the use of carefully designed tables or maps that highlight the ratio(s) of interest (eg, primary care practitioners per capita) for all counties in a state or for all states in a region. More complex comparisons might incorporate data for 2 or more years to highlight whether the supply of practitioners has kept pace with population increases.

Need and demand models

Estimates of the supply of health workers by themselves have little value for planning and policymaking. Even ratios of professionals to population provide only limited insights about the relative supply of practitioners. The real need for planners and policymakers is explicit comparisons of supply estimates to demand/need estimates for the professionals being studied.

Need models

Need models can be used to estimate the numbers of health workers needed to achieve a desired level of health care for a given population. Critical elements in these techniques are standards or norms for the levels of care required by well-served population groups. Generally, these standards of care are developed by panels of experts or government regulators and based on general consensus of practitioners. Most such standards specify desired levels of services, feasible levels of workload, or both, including:

- The average numbers and kinds of services that can be provided by each category of health care worker

- Estimates of the number of people in a population who should receive a particular set of services from health care workers, with attention to the impact of age, gender, and other demographic factors

- Average numbers and kinds of services that should be provided to each patient with each disease or health condition that affects the population

Using this approach, it is possible to estimate the number of health workers needed, now or in the future, to address a given disease prevalence profile. The calculation is done by multiplying the number of individuals in the population by the total number of diseases or conditions and the service required per disease or condition for each category of worker, then dividing this product by the average or desirable workload of the respective categories of workers. The health problems expected to occur in the population thus can serve as the basis for estimating the number of workers needed to serve the population.

This approach is logically appealing because it starts with the disease and disability profiles and burdens of the population and translates those profiles first into needed services and finally into need for health care workers. It is an easily understood and defensible method that permits care for healthy people, preventive services, and new disease entities to be included in the need estimates. Although need models have these advantages, they also present challenges:

- Since many of the numerical estimates required to perform the calculations are often not readily available, experts must render judgments about the values of different parameters used in the models.

- Standards for services required for various medical conditions frequently fail to explicitly consider the general level of health implied by the judgments of medical need. For example, it is one thing to develop workforce needs based on a target infant mortality rate of 10 deaths

- Clinical determinations of medical needs and service intensity are usually based on group averages rather than subpopulations. The more detailed the needs assessment, the more apt the results are to be inapplicable to all possible subpopulations.

- Needs models seldom address practical questions of how the services needed by a population will actually be delivered by health care practitioners and facilities. Unless the delivery system is properly designed or modified, there may be no way to use additional personnel to provide the needed services.

Demand models

An advanced strategy for estimating the demand for health care workers is illustrated schematically in Figure 5. This model relates characteristics of the population to characteristics of patients and the health care delivery system (especially income levels, insurance coverage, expenditures, and wage data) to estimate the demand for health workers. Conceptually, this is effective because it provides opportunities to study alternative responses to health workforce problems. However, it requires significant effort to identify the appropriate relationships and compile the requisite data.

Figure 5. Health Workforce Demand Model

```
                    ┌─────────────────────────┐
              ┌────>│    Total Population      │<──── Recovery
              │     └─────────────────────────┘         │
   Recovery   │                 │                        │
   with no    │          Prevention programs             │
   care       │                 ▼                        │
              │     ┌─────────────────────────┐          │
              └─────│  Ill or Injured          │<──── Chronic illness
                    │  Individuals             │          │
                    └─────────────────────────┘          │
                                 │                        │
                         Awareness of problems            │
                         and symptoms                     │
                                 ▼                        │
                    ┌─────────────────────────┐          │
                    │  Individuals Seeking Care │          │
                    └─────────────────────────┘          │
                                 │                        │
                         Entry into the health            │
                         care system                      │
                                 ▼                        │
                    ┌─────────────────────────┐          │
         Referrals ─│  Patients at Care Sites  │          │
                    └─────────────────────────┘          │
                                 │▲                       │
                         Demand for health care           │
                         services                         │
                                 ▼                        │
                    ┌─────────────────────────┐          │
   Deaths and ◄─────│  Treatment and Care at a │──────────┘
   complications    │  Price                   │
                    └─────────────────────────┘
```
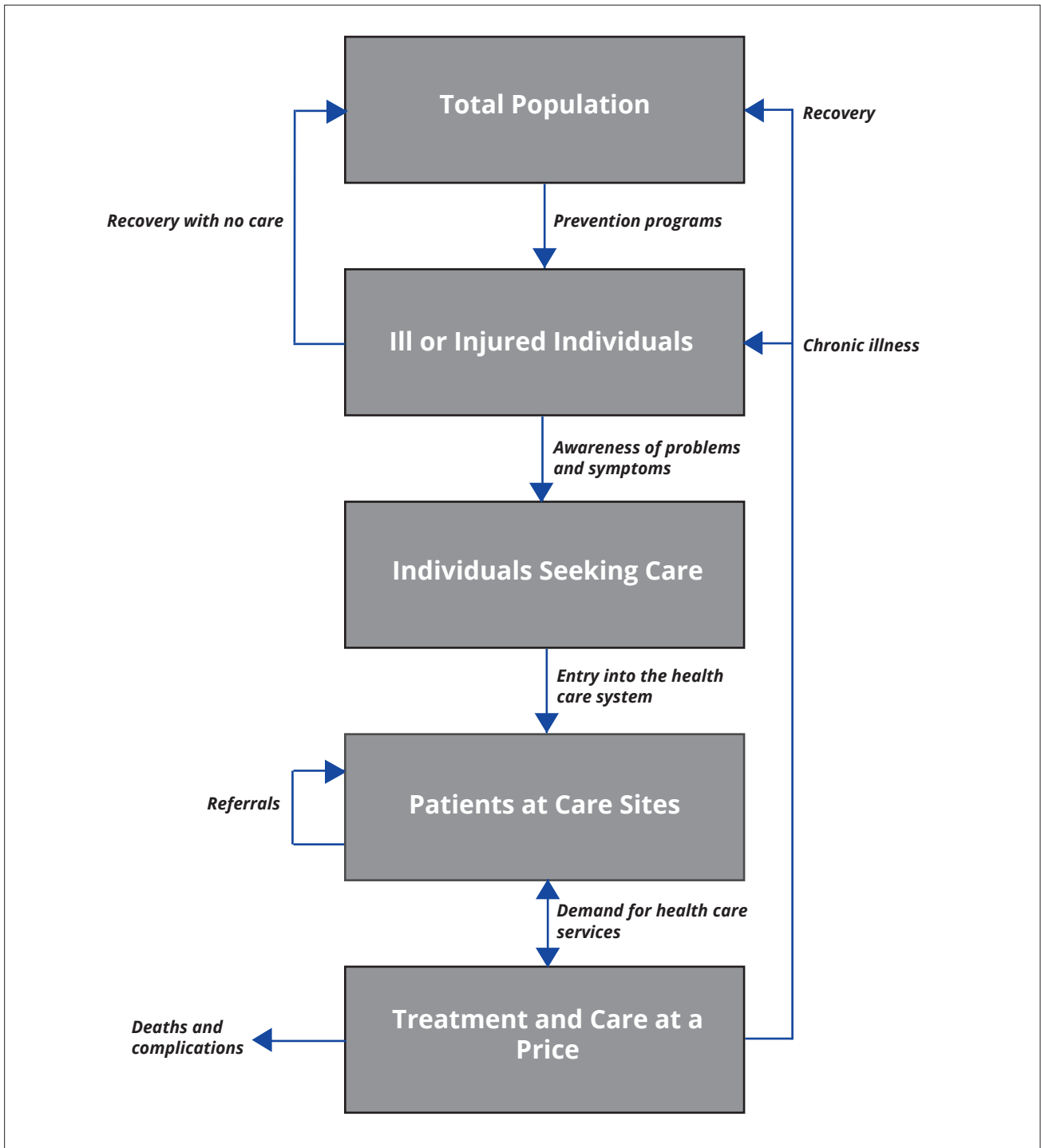
Demand models like this also allow for the consideration of special populations and health problems. The assumption made implicitly by many planners and policymakers that any health professional can and will serve any patient is often incorrect. Certain population groups may encounter access problems even when the total supply of professionals appears adequate. For example, some professionals are unwilling to serve Medicaid patients, the medically uninsured, or patients with diseases like AIDS. Special health

problems like AIDS or Ebola can also place additional demands on the health care system, and it may be difficult to quantify the resulting impact on the workforce. In these cases, the usual methods for measuring supply and demand may prove to be inadequate, and historical data may also be an inadequate basis for policymaking.

Study Data

One of the recurring themes of this guide is that without high-quality (ie, timely, accurate, and sufficiently detailed) data, high-quality health workforce analysis and research is not possible. Before we present illustrative examples of studies addressing actual health workforce policy questions, it is important to discuss briefly some of the major dimensions of health workforce data.

Type of data source

It is useful make a distinction between primary data sources and secondary data sources. Data collected by the researcher through observation, a questionnaire, or an interview for the specific purpose of his or her study is referred to as *primary data*. Data collected by some other party, typically not for the specific purpose of the researcher's study, is referred to as *secondary data*.

There are 4 types of data sources that are especially relevant to health workforce analysis: existing data sets (secondary data), administrative records (secondary data), surveys (primary or secondary data), and interviews (primary data).

- *Existing data sets*
  Much of the data that health workforce researchers analyze are from existing data sets. The AHRF system and virtually all federal and state data sets fall into the secondary data category. Man data files traditionally used for monitoring the broader labor market to understand job opportunities for the public and reduce unemployment in the population also provide valuable insights to health workforce planners and policymakers. Chapter 2 provided a sampling of the relevant health workforce–related data sets in this category.

- *Administrative records*
  Administrative records are compiled by public and private organizations as part of their day-to-day operations. Thus, claims and expenditure files compiled by Medicare and Medicaid, business surveys conducted by the Census Bureau, hospital administrative files, and files from licensing agencies, among others, fall in this category.

The resulting files can contain many kinds of data, including data on the workforce, clinical practice settings, special equipment, other inputs and costs, and perhaps most important, clinical services, outcomes, and impacts. Because administrative records are not designed with research purposes in mind, it can be a challenge to manipulate them in such a way as to facilitate analysis.

- *Surveys*

    Surveys of practitioners and providers are an important source of data used in health workforce research. A survey provides a researcher with the opportunity to systematically gather data directly from health care practitioners on their demographic characteristics, training and education experiences, practice characteristics, and even opinions and beliefs. In some cases, researchers conduct surveys of the general population to understand the need/ demand for services. Surveys are often designed specifically to capture data needed to answer a particular research question or inform a particular research topic. Government agencies (federal and state) sometimes use recurring surveys of practitioners or the population to collect data that are made available to researchers for their own analyses or self-directed research.

    Conducting a survey is relatively resource intensive. Sampling frames and mailing lists are generally costly, and mailed surveys entail material, postage, and data entry costs that can become prohibitive when surveying more than a few hundred individuals. The increased availability of online surveys has alleviated some of the cost pressures, but these come with their own challenges, such as very low response rates.

    Interested readers are encouraged to consult Dillman et al (2009)[33] for additional information on surveys and survey methodologies.

- *Interviews*

    Interviews provide an important opportunity to gain insights into health workforce issues. In some instances, they may focus on topics that have not been studied systematically (eg, interdisciplinary team configurations that can improve cost-effectiveness and outcomes). In other instances, stakeholder interviews can help to identify the most widely accepted workforce policies and programs designed to improve access to services.

    The downside to interviews, of course, is that the information gleaned from them is not easily generalizable to larger populations or contexts. This can pose a challenge for researchers.

- *Reconciling sources*

  Sometimes data from 2 or more sources that purport to present the same data element have conflicting values. One might naturally ask which of the data sets is "correct" and whether the data are measuring the same thing. Answering these questions can be challenging and requires careful consideration of sources, definitions, collection procedures, and intended uses of the different data sets. It may be useful to review the methods associated with data collection to better understand how to evaluate them.

Geography

Geography is an important factor in virtually all health workforce studies. All studies have some sort of geographic component, as all health care services are provided and utilized in a particular place. A few considerations and caveats are offered below.

- *Units*

  A variety of different geographic units have been used to compute different health care and health workforce statistics, including Census regions and divisions, states, counties, Metropolitan Statistical Areas (MSAs), congressional districts, cities, towns, ZIP codes, and census tracts. Unfortunately, not all of these units have contiguous boundaries. For example, one cannot simply aggregate data on ZIP codes into totals for counties. Perhaps even more problematic, some of the boundaries bear little resemblance to the patterns of health care service utilization by the population.

  In practice, counties are commonly used to aggregate counts of practitioners and population, partly because many data sets provide county-level detail. Researchers looking for more detailed analysis often use ZIP codes. For some analyses, the geography of interest is a particular point defined by longitude and latitude. This level of geography is often required in local or small-area analyses (eg, Health Professional Shortage Area designation feasibility studies).

- *Address*

  It is sometimes difficult to determine practice addresses of health care providers. Many of the available data sets fail to distinguish whether an address represents a mailing address, a billing address, or a practice address. While this may be less of an issue for statewide analyses, it can be a major problem for substate analyses. For example, lists of licensed physicians in Westchester County in New York State include many physicians who practice in adjacent Bronx County in New York City, which has many medically underserved neighborhoods. Using licensure data based on mailing or billing addresses without adjustment or further information

about practice addresses can result in inaccurate estimates of the supply of physicians in both counties.

- *Migration*

  Migration of professionals, especially within-state migration, presents another challenge for researchers. If a licensed professional moves his or her practice or changes employers, the change may not be detected by the licensing organization until the next official registration process. This, too, can contribute to inaccurate supply estimates.

  Patient travel across county or state boundaries creates similar problems for researchers. In this case, practitioner-per-capita ratios can be distorted because population counts in the denominator of the ratios are either too high or too low, reflecting the migration of patients from or to another county or state.

Data elements

Understanding the characteristics used to describe health workforce supply and demand is also essential for researchers. A number of data elements are important for health workforce analysis.

- S*upply characteristics*

  NCHWA proposed the Minimum Data Set (MDS) to improve the quality and consistency of health workforce data collection. The MDS recommends a small set of key questions to include in health professions surveys on demographic, education/credentialing, and practice characteristics of health professionals. Table 2 provides a summary of recommended elements for health professions data collection.

Table 2. Recommended MDS Health Workforce Data Elements

Demographic	Practice
Date of birth	Employment status
Sex	Practice specialty
Race	Principal and secondary practice activities (eg, direct patient care and research)
Ethnicity	Location of principal and secondary practice
Birthplace (country)	Average direct care hours per week by location
Education/credentialing	Type of setting (eg, hospital or health center)
Highest degree earned in profession	Number of weeks worked during the past year
School graduated from in profession	National Provider Identifier (NPI) number
School graduation year	
Specialty certifications	

Each MDS element provides insight into the specific profession. For example:

○ Data on practice location and direct care hours of health professionals are needed to determine the service delivery capacity in a community. These data are essential for identifying medically underserved and health professional shortage areas, which are used to target state and federal resources.

○ Data on the age and current employment status of practitioners can support analysis of retirement patterns and projections of future practitioner supply.

○ Data on the professional school(s) attended provide an understanding of migration patterns within a profession and can assess the contribution of individual schools and programs in meeting the health needs of a community.

● *Demand/need characteristics*

○ *Population demographics*
Just as demographic characteristics are important in supply estimation, they are also important for demand/need estimation. The age and gender profile of the population are important correlates of the kinds of diseases, illnesses, and other morbidities that the health care system can expect in the future.

Other population characteristics also can help those managing the health care system, among them racial/ethnic characteristics related to the prevalence of certain diseases and education and income levels that may be linked to the demand for selected medical procedures and services.

○ *Health status indicators*
A wide array of health status indicators can help inform the need for services and interventions to improve population health. These include disease and illness prevalence statistics (eg, the percentage of the population that is obese or has diabetes, cancer, or heart disease).

○ *Health services utilization*
Data on the utilization of health services is essential for estimating the demand for services. The number of office visits, procedures ordered, hospital bed days, and practitioner encounters, as well as the characteristics of the foregoing, define the health services utilization of a particular population or in a particular geography. This information is frequently used by researchers to determine the number, type, and mix of health care providers required.

Sampling

Many data sets are the result of collection efforts based around a sample of potential observations. Most surveys are fielded to a sample of potential respondents. However, even administrative data can be released as samples rather than as universe data sets due to the unwieldy size of some of these data sets (eg, Medicare claims data). To help readers understand sampling, we describe briefly below the major types of sampling available to researchers, along with a few important statistical concepts related to sampling.

- *Universe sample*

  A universe or census sample occurs only when a survey questionnaire is administered to every member of the population of interest. With a 100% response rate, there is no chance of sampling error. Researchers are able to compute standard deviations reflecting the variation in the values of different parameters reported by respondents. These variations also exist for averages and other estimates derived from most of the data sets used in health workforce studies. In practical terms, a universe sample is a theoretical ideal. Information on all members of a population of interest rarely exists.

- *Probability sample*

  Probability sampling is a more cost-effective approach to survey research. Rather than sending a questionnaire to every person or organization in the universe of interest, one sends questionnaires to only a fraction of the universe, selected at random with a known probability of selection. Depending on the sample size, the results can be nearly as accurate as would be estimates based on responses from the entire universe, and the cost savings can be substantial.

- *Nonprobability sample*

  A nonprobability sample is typically used in situations in which a list of the population is not available (eg, the health care utilization by the homeless—there are no lists of people who are homeless). In such situations, researchersdo not select a sample at random from a population. They may choose individuals at hand (convenience sampling), select informants who can speak for a group (key informants) and perhaps ask those informants for the names of others who might be able to also provide information (snowball sampling), or construct a sample in such a way that the distribution of a particular characteristic (eg, gender) matches that in the population (quota sampling).

  Provided that the research is done well, a study based on a nonprobability sample can yield informative results about the subjects observed/studied. The downside to using a

nonprobability sample is that the findings from the research are not generalizable to a population or other context.

For more information about sampling theory and methods, readers are encouraged to review Chapter 7, "The Logic of Sampling," in Earl Babbie's *The Practice of Social Research*, 14th edition.[34]

CHAPTER 4:
Examples of Health Workforce Analysis

CHAPTER 4: EXAMPLES OF HEALTH WORKFORCE ANALYSIS

This chapter presents excerpts from health workforce reports and publications, including tables, charts, and maps that depict study outcomes and conclusions. The examples provided in this chapter have been selected from the health workforce research literature as especially effective for presenting information that may be easily interpreted and understood by health workforce planners and policymakers.

A brief description is provided with each study. For each description, an effort was made to highlight data sources and methods described in previous chapters of this guide. Interested readers should be able to determine whether the approaches used in the examples are applicable to their own studies.

Before presenting the illustrations, it is important to review the framework presented in the previous chapter in order to organize excerpts from a variety of studies into categories that reflect current health workforce research taking place across the country (see Table 3). Supply, demand, and adequacy are covered in separate sections in this chapter, each of which provides examples for different levels of sophistication. The level of sophistication (basic, intermediate, or advanced) is intended to reflect the complexity of the analytical techniques used in the analyses. Only basic and intermediate-level examples are presented below, as advanced examples often involve statistical techniques that are beyond the scope of this guide. Readers also should recognize that the assignment of reports to the different sophistication categories is often challenging.

Basic studies and analyses generally focus on counts of health professionals and relatively simple indicators of demand or need for workers. Charts, tabulations, and maps tend to be based on counts and population ratios.

Intermediate studies and analyses generally include more detailed or elaborate statistical analyses or comparisons covering multiple years. Tables, graphs, and maps tend to be based on multiple variables, complex comparisons, and trends.

Advanced studies and analyses generally involve advanced statistical techniques designed to reveal underlying patterns and relationships among multiple variables. These studies often include complex indicators, multivariate analyses, and health workforce supply and demand projection models.

Table 3. Types of State Workforce Data, Analyses, and Models by Theme and Sophistication

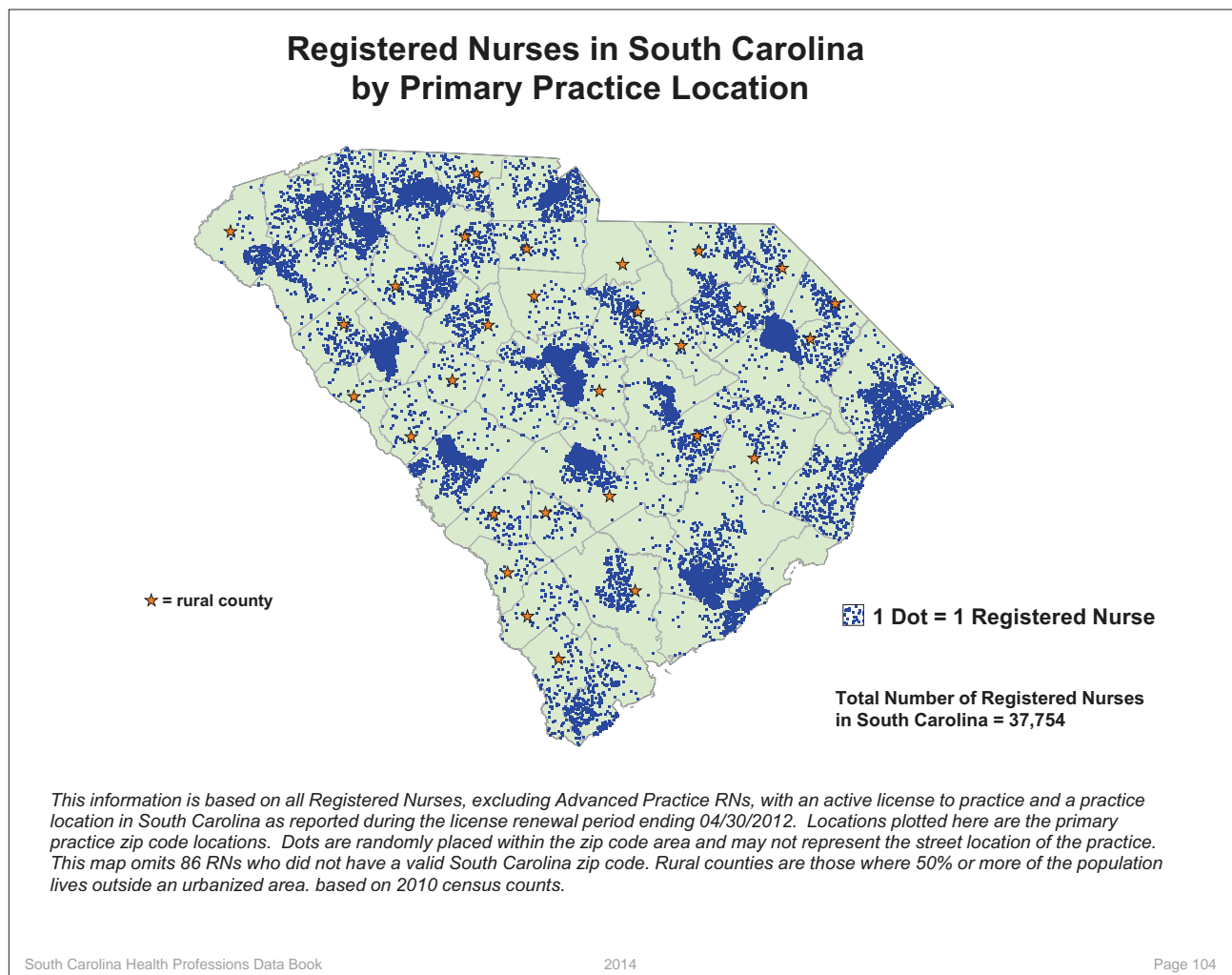| Basic	Intermediate	Advanced
Practitioner Supply		
Counts of Practitioners of Interest for the State, Counties, etc.	Comparisons of State Counts and Rations to Those for Other States and US Averages	Projections of Practitioner Supply
Practitioner per Capita Ratios for Counties and Other Geographies	Historical Trends of Practitioner Supply for the State, Counties, etc.	Multivariate Analyses of Aspects of Supply (eg, Specialty Choice, Job Change, Retirement)
Counts of New Entrants to or Exits from a Profession	Distribution of Practitioners by Practice Characteristics (eg, By Specialty or Settings)	
Practitioner Demand or Need		
Population of the State, Counties, etc. (eg, Size, Characteristics)	Comparisons of Demand and Need w/ US Averages, Other States, and Benchmarks	Projections of Demand and Need for Practitioners
Health Status of the Population for the State, Counties, etc.	Historical Trends of Demand and Need for the State, Counties, etc.	Analyses of Reasons for Differences Between Need and Demand
Direct Measures of Demand (eg, Job Vacancies)	Practitioner Demand/Need for Different Geographies, Settings, and Populations	Multivariate Analyses of Factors Related to Demand and/or Need
Indirect Measures of Demand (eg, Recruiting Costs, Patient Visits, Procedure Counts)		Multidimensional Indicator(s) of Need in Regions, Settings, and Population Groups
Adequacy of Practitioner Supply Relative to Demand or Need		
	Comparisons of Supply and Demand to Identify Areas and Populations with Unmet Needs	Comparisons of Practitioner Supply and Demand Projections
	Assessment of Adequacy of Supply for Settings and Regions	Analyses to Identify Contiguous Regions w/ Shortages and "Rational Service Areas"
	Indicators of Unmet Need and Problems (eg, Ambulatory Care Sensitive Conditions)	Multivariate Analyses of Factors Related to Adequacy of Supply (eg, Insurance)

Supply (Basic)

South Carolina

The maps and table in this example are drawn from a data book that provides extensive information about population demographics, 19 different health professions, vital statistics, and health status indicators for the 46 counties and substate regions in South Carolina. The report describes variation in the supply of health professionals that may warrant attention by state policymakers. Multiple sources of data were used to create the maps and tables in the report, including census and BRFSS data as well as health professions data that were collected during the license renewal process.

The maps show 2 different ways of presenting workforce data graphically. Note the difference in the geographic units used in the 2 maps—the dot density map is based on ZIP codes, while the other map uses counties.

South Carolina Example A

Registered Nurses in South Carolina by Primary Practice Location

★ = rural county

1 Dot = 1 Registered Nurse

Total Number of Registered Nurses in South Carolina = 37,754

This information is based on all Registered Nurses, excluding Advanced Practice RNs, with an active license to practice and a practice location in South Carolina as reported during the license renewal period ending 04/30/2012. Locations plotted here are the primary practice zip code locations. Dots are randomly placed within the zip code area and may not represent the street location of the practice. This map omits 86 RNs who did not have a valid South Carolina zip code. Rural counties are those where 50% or more of the population lives outside an urbanized area. based on 2010 census counts.

Concentration of Registered Nurses
Per 10,000 Population

**Counties in SC range from a low
of 10.7 to a high of 173.9 Registered
Nurses per 10,000 county residents**

- 112.0 to 173.9 (5)
- 80.0 to 111.9 (2)
- 50.0 to 79.9 (14)
- 17.0 to 49.9 (23)
- 10.7 to 16.9 (2)

**Note: The ( ) shows the total number
of counties with this range**
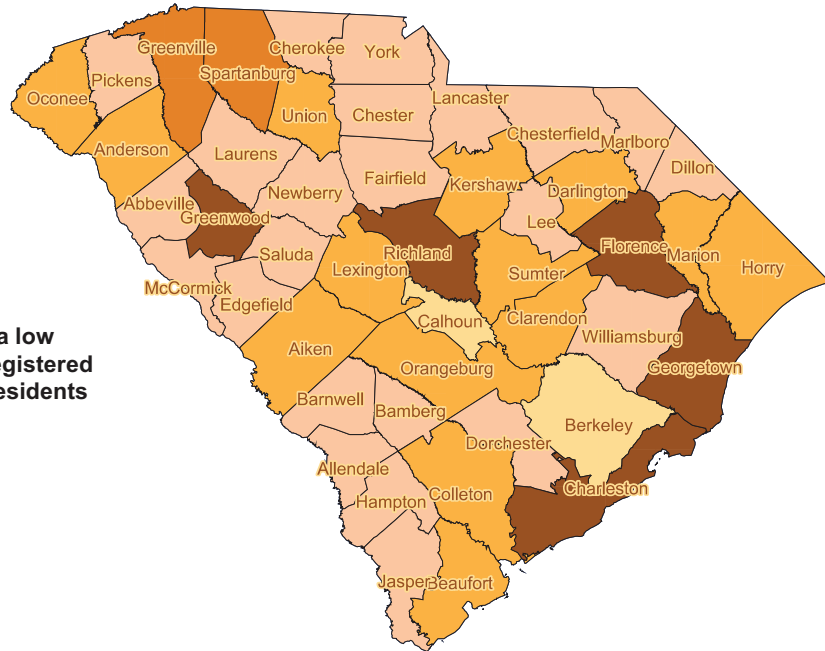
*This information is based on all Registered Nurses, (excluding Advanced Practice Nurses) with an active license to practice and a
practice location in South Carolina as reported during the license renewal period ending 04/30/2012. The county practice locations
are those reported as the primary practice site.*

South Carolina Health Professions Data Book   2014   Page 105

South Carolina Example C

Charleston

Health Profession Shortage Area Designations:

Primary Care: Partial   Mental Health: Partial   Dental Care: Partial

MSA Status:	Metropolitan
AHEC Region:	Lowcountry
DHEC Region:	Low Country
Perinatal Region:	Low Country

Physicians

Total Physicians Whose Primary Practice is in This Area	2,832
Family Practice	199
Internal Medicine	332
Obstetrics / Gynecology	115
Pediatrics	189
General Surgery	111
All Other Physicians (Specialists)	1,803
Physicians Per 10,000 Population	77.6
Primary Care Physicians Per 10,000 Population	22.9
Federal Physicians	83

Nurses

Registered Nurses	6,347
Certified Nurse Midwives	27
Nurse Practitioners	270
Certified Nurse Anesthetists	153
Clinical Nurse Specialists	20
Licensed Practical Nurses	827

Dentists and Hygienists

Dentists	342
Dental Hygienists	309
Dental Technicians	20

Other Health Professions

Pharmacists	716
Pharmacy Technicians	568
Physical Therapists	400
Physical Therapy Assistants	143
Occupational Therapists	221
Occupational Therapy Assistants	74
Physician Assistants	234
Respiratory Care Practitioners	300
Optometrists	61

Demographics

Estimated Population in 2012

Age:	0 - 19	20 - 64	65 +	Total	% by Race
White	50,284	158,446	36,348	245,078	67.1%
Black	30,630	63,922	12,693	107,245	29.4%
Other	4,258	7,760	821	12,839	3.5%
Total	85,172	230,128	49,862	365,162	100%
% by Age	23.3%	63.0%	13.7%	100%	

Vital Statistics and Health Status Indicators

Resident Births / Deaths	4,685	2,880
Total Pregnancies: # / Rate	5,767	73.6
% of Births < 2500 grams		8.6
Teen Pregnancies: # / Rate	359	17.8
Infant Mortality Rate: White / Black	4.1	10.5
Cancer Deaths		663
% of Adults Diagnosed With Heart Disease		2.7
% of Adults Diagnosed With Hypertension		34.9
% of Adults Diagnosed With Diabetes		11.0
% of Adults Who Currently Smoke		21.2
% of Adults Reporting a Sedentary Lifestyle		22.1
% of Adults Overweight or Obese (BMI ≥ 25)		58.3

Facility Data

General Hospital Beds	1,754
Hospital Discharges within Home County	99%
Skilled Nursing Facility Beds	1,308

Socio-Economic Data

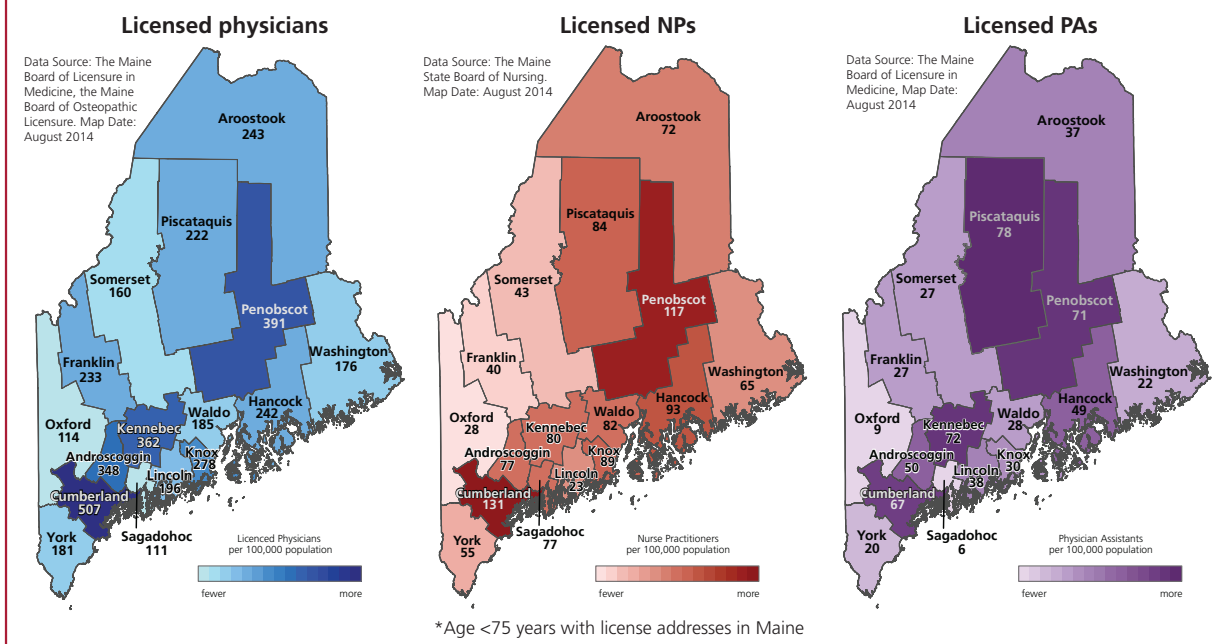|	
% of Adults Without Health Insurance	23.6
% Unemployed	7.3
% of Households With Income < $25,000	28.4
% With High School Education Or Less	37.2
# Medicaid Eligible	76,802
Per Capita Income	$43,642

Supply (Intermediate)

Maine

The following map and table are from a research brief that presents a variety of statistics about licensed physicians, nurse practitioners (NPs), and physician assistants (PAs) in Maine. Most of the brief is focused on physicians, although counts are provided for NPs and PAs. Basic counts came from the Maine licensing boards; additional data on physicians came from the AMA Physician Masterfile. One focus of the brief is the rural–urban distribution of practitioners, using Rural Urban Commuting Areas (RUCAs) by ZIP code. Another focus is practitioner age and tabulations of physicians, NPs, and PAs aged 55 years and older, with the goal of providing insights into potential future retirements.

Figure 4. Number of licensed physicians, NPs and PAs* per 100,000 population in Maine in 2014

Licensed physicians

Data Source: The Maine Board of Licensure in Medicine, the Maine Board of Osteopathic Licensure. Map Date: August 2014

Aroostook 243
Piscataquis 222
Somerset 160
Penobscot 391
Washington 176
Franklin 233
Oxford 114
Kennebec 362
Waldo 185
Hancock 242
Androscoggin 348
Knox 278
Lincoln 196
Cumberland 507
York 181
Sagadahoc 111

Licenced Physicians per 100,000 population
fewer — more

Licensed NPs

Data Source: The Maine State Board of Nursing. Map Date: August 2014

Aroostook 72
Piscataquis 84
Somerset 43
Penobscot 117
Franklin 40
Washington 65
Oxford 28
Kennebec 80
Waldo 82
Hancock 93
Androscoggin 77
Knox 89
Lincoln 23
Cumberland 131
York 55
Sagadahoc 77

Nurse Practitioners per 100,000 population
fewer — more

Licensed PAs

Data Source: The Maine Board of Licensure in Medicine, Map Date: August 2014

Aroostook 37
Piscataquis 78
Somerset 27
Penobscot 71
Franklin 27
Washington 22
Oxford 9
Kennebec 72
Waldo 28
Hancock 49
Androscoggin 50
Knox 30
Lincoln 38
Cumberland 67
York 20
Sagadahoc 6

Physician Assistants per 100,000 population
fewer — more

*Age <75 years with license addresses in Maine

Age by county

The age at which health care providers retire is influenced by many factors, making predictions difficult. Nonetheless, understanding the locations where large proportions of the workforce are nearing retirement age can help inform workforce planning. In half of Maine's 16 counties, 50% or more of physicians were 55 or older; in four, 50% or more of NPs were 55 or older; and in two, 50% or more of PAs were age 55 or older (Table 5). By contrast, Androscoggin, Penobscot, and Somerset had some of the lowest percentages of health care practitioners age 55 or older.

> In half of Maine's counties, 50% or more of physicians were age 55 or older.

Table 5. Percent of licensed physicians, NPs and PAs age 55 or older by county in Maine in 2014

County	Percent of licensed providers age 55 or older*		
	Physicians**	NPs	PAs
Androscoggin	35.8%	31.3%	11.1%
Aroostook	47.3%	44.0%	34.6%
Cumberland	40.5%	37.5%	17.8%
Franklin	47.1%	50.0%	37.5%
Hancock	62.5%	42.9%	50.0%
Kennebec	46.4%	50.5%	32.2%
Knox	53.6%	45.7%	16.7%
Lincoln	50.7%	43.5%	46.2%
Oxford	50.8%	37.5%	80.0%
Penobscot	35.6%	40.4%	24.3%
Piscataquis	51.4%	50.0%	38.5%
Sagadahoc	53.8%	44.4%	0.0%
Somerset	37.3%	40.9%	14.3%
Waldo	59.7%	56.3%	36.4%
Washington	66.7%	42.9%	14.3%
York	45.6%	44.0%	15.4%

*Among providers age <75 years with license addresses in Maine
**Includes allopathic and osteopathic physicians.

Source: Skillman SM, Stover B. *Maine's Physician, Nurse Practitioner and Physician Assistant Workforce in 2014*. Seattle, WA: WWAMI Center for Health Workforce Studies, University of Washington; 2014. http://depts.washington.edu/uwrhrc/uploads/Maine%20Workforce%20090514.pdf. Accessed May 2, 2016.

This poster provides data and analyses on LPNs in the United States and summarizes a number of relevant variables, including demographic and practice characteristics. The poster also compares the data for 2 different points in time, allowing policymakers to better understand changes in the LPN workforce over time. Data for this poster came from the ACS, which was discussed in Chapter 2.

National Example

Source: Coffman JM, Bates T, Chan K, Spetz J. Trends in the licensed practical nurse workforce from 2008 to 2013. San Francisco, CA: Health Workforce Research Center on Long-Term Care, University of California, San Francisco; 2014. http://healthworkforce.ucsf.edu/sites/healthworkforce.ucsf.edu/files/Presentation-Trends_in_the_Licensed_Practical_Nurse_Workforce_from_2008-2013.pdf. Accessed May 2, 2016.

Demand/Need (Basic)

New York

The following tables are excerpted from a data guide that contains extensive data on population demographics, health professionals, and population health status in New York State as a whole and across 62 counties and 11 regions within the state. The data guide is designed to inform regional stakeholders about the most pressing population health needs. The tables suggest the wide range of health status measures and indicators that may be found within most states.

New York Example

NEW YORK CITY — Total Population: 8,128,980 — Percent of Population Below FPL: 19% — Median Household Income: $80,528

Demographics	Percentage Distribution by Age Group				Race/Ethnicity	
	0 to 4	5 to 17	18 to 64	65 Plus	Number	% of Total
White, non-Hispanic	5.4%	10.7%	66.6%	17.3%	2,724,300	33.5%
Black, non-Hispanic	6.2%	18.0%	64.6%	11.3%	1,873,853	23.1%
Hispanic/Latino	7.9%	19.3%	64.6%	8.3%	2,310,163	28.4%
Asian/Pacific Islander	5.5%	13.6%	71.4%	9.4%	1,027,392	12.6%
American Indian/Alaska Native	7.0%	19.1%	65.4%	8.6%	15,133	0.2%
Multiple Races/Other	10.8%	19.6%	62.7%	6.9%	178,139	2.2%
Total	521,478	1,253,845	5,369,016	984,641	8,128,980	100%
Percent Female	48.9%	49.1%	52.2%	60.3%		

Education Level	Number	% of Total
Less than High School	1,142,283	20.7%
High School/GED	2,174,158	39.5%
Associate	334,602	6.1%
Bachelor's	1,096,625	19.9%
Master's or Above	758,212	13.8%

Other	Number	% of Total
Unemployment	393,224	9.5%
Medicaid Eligible	3,074,232	15.9%

Natality	Number	Rate/Percent
Births per 1,000 Females, 15-44	121,168	63.9
Teen Births per 1,000 Females, 15-17	2,335	15.2
% Low Birth Weight (<2500 grams)	10,573	8.7%
% Premature Births (<37 Weeks)	15,087	12.7%
% With Early Prenatal Care	80,561	70.4%
Infant Mortality (per 1000 Live Births)	584	4.8

Health Status/Health Behaviors	Number	Percent
% Adults without Health Insurance	244,686	18.0%
% Adults with Usual Source of Care	1,045,351	76.9%
% Adults with Hypertension	324,888	23.9%
% Adults with Diabetes	130,499	9.6%
% Adults with Asthma	126,421	9.3%
% Adults Smoking	197,108	14.5%
% Adults Obese	289,545	21.3%
% Adults with Poor Physical Health	135,936	10.0%
% Adults with Poor Mental Health	125,061	9.2%

Mortality/Cases per 100,000 Population	Number	Rate
Overall Age Adjusted Mortality	51,767	602.5
Childhood Mortality, Ages 1-4	78	17.6
Childhood Mortality, Ages 5-14	112	11.3
Chronic Lower Respiratory Disease Mortality	1,627	19.6
Diseases of the Heart Mortality	19,482	234.4
Diabetes Mortality	1,644	19.8
Unintentional - Motor Vehicle Mortality	294	3.5
Unintentional - Non Motor Vehicle Mortality	1,164	14.0

Hospitalizations/ED Visits per 10,000 Populatioin	Number	Rate
Total Hospitalizations	1,147,507	1,380.8
Total Patient Days	5,919,463	7,123.1
Total Preventable Hospitalizations	113,733	176.2
Total ED Visits	3,480,700	4,188.4
Chronic Lower Respiratory Disease Hospitalizations	37,142	44.7
Heart Disease Hospitalizations	101,451	122.1
Diabetes Hospitalizations	228,671	275.2
Asthma Hospitalizations, All Ages	25,777	31.0
Asthma Hospitalizations, Ages 0-4	4,719	84.6
Asthma Hospitalizations, Ages 65 Plus	5,195	54.0
Asthma ED Visits, Ages 0-17	42,997	231.5
Fall Related Hospitalizations, Ages Under 10	1,257	11.8
Fall Related Hospitalizations, Ages 65 Plus	18,354	180.6
Fall ED Visits, Ages 1-4	20,168	437.0

Cancer Mortality/Cases per 100,000 Population	Number	Rate
Cancer Deaths	12,321	147.6
All Cancer Cases	37,721	451.8
Lung and Bronchus Cancer Cases	4,257	51.0
Female Breast Cancer Cases	5,403	123.8
Prostate Cancer Cases	5,811	145.8

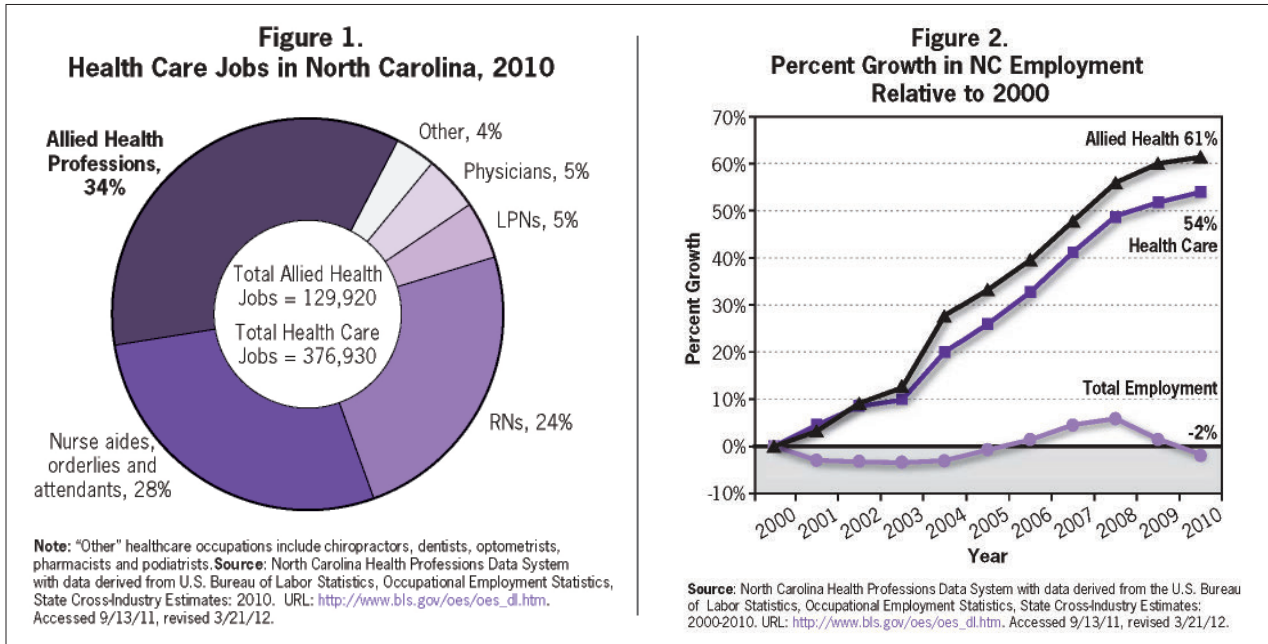124 — Health Workforce Planning Data Guide

Demand/Need (Intermediate)

North Carolina

The figures below, excerpted from a 2012 report, provide a summary of demand for allied health workers in the 9 Area Health Education Center (AHEC) regions of North Carolina.
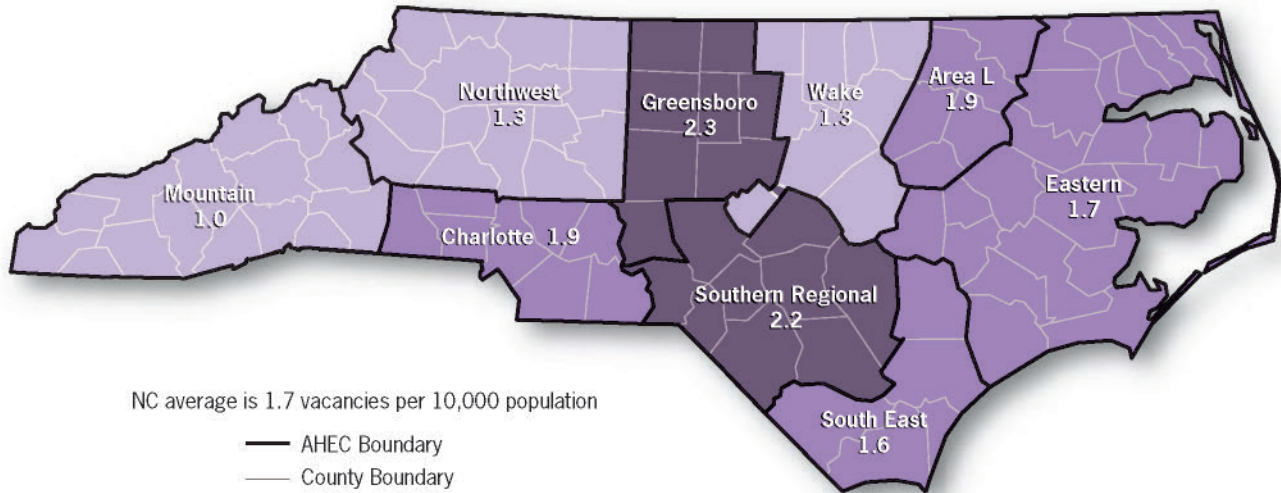
These data were based on information secured from online and regional newspaper job advertisements over a 10-week period in 2011. Data were de-duplicated by counting as a single vacancy any ad appearing more than once for the same job title, employer, location, and full- or part-time status. The vacancy count also was adjusted by allocating only 0.5 of a vacancy to positions listed as part-time.

North Carolina Example A and B

Figure 1.
Health Care Jobs in North Carolina, 2010

Allied Health Professions, 34%
Other, 4%
Physicians, 5%
LPNs, 5%
Total Allied Health Jobs = 129,920
Total Health Care Jobs = 376,930
RNs, 24%
Nurse aides, orderlies and attendants, 28%

Note: "Other" healthcare occupations include chiropractors, dentists, optometrists, pharmacists and podiatrists. **Source**: North Carolina Health Professions Data System with data derived from U.S. Bureau of Labor Statistics, Occupational Employment Statistics, State Cross-Industry Estimates: 2010. URL: http://www.bls.gov/oes/oes_dl.htm. Accessed 9/13/11, revised 3/21/12.

Figure 2.
Percent Growth in NC Employment Relative to 2000

Allied Health 61%
54% Health Care
Total Employment
-2%

Source: North Carolina Health Professions Data System with data derived from the U.S. Bureau of Labor Statistics, Occupational Employment Statistics, State Cross-Industry Estimates: 2000-2010. URL: http://www.bls.gov/oes/oes_dl.htm. Accessed 9/13/11, revised 3/21/12.

North Carolina Example C

Figure 3.
Allied Health Job Vacancy Advertisements per 10,000 Population
by AHEC Region, North Carolina, Fall 2011

Northwest 1.3
Greensboro 2.3
Wake 1.3
Area L 1.9
Mountain 1.0
Charlotte 1.9
Eastern 1.7
Southern Regional 2.2
South East 1.6

NC average is 1.7 vacancies per 10,000 population

— AHEC Boundary
— County Boundary

Notes: North Carolina newpapers and online listings for select allied health professions tracked from September 18, 2011 to November 26, 2011 (N=1,599).
Source: North Carolina Health Professions Data System, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill, 2012.
Population source: North Carolina Office of State Budget and Management, Socioeconomic Data, 2010. URL: http://www.osbm.state.nc.us/ncosbm/facts_and_figures/. Accessed 01/12/12.

North Carolina Example D

Table 4. Percent of Profession's Total Vacancies by AHEC

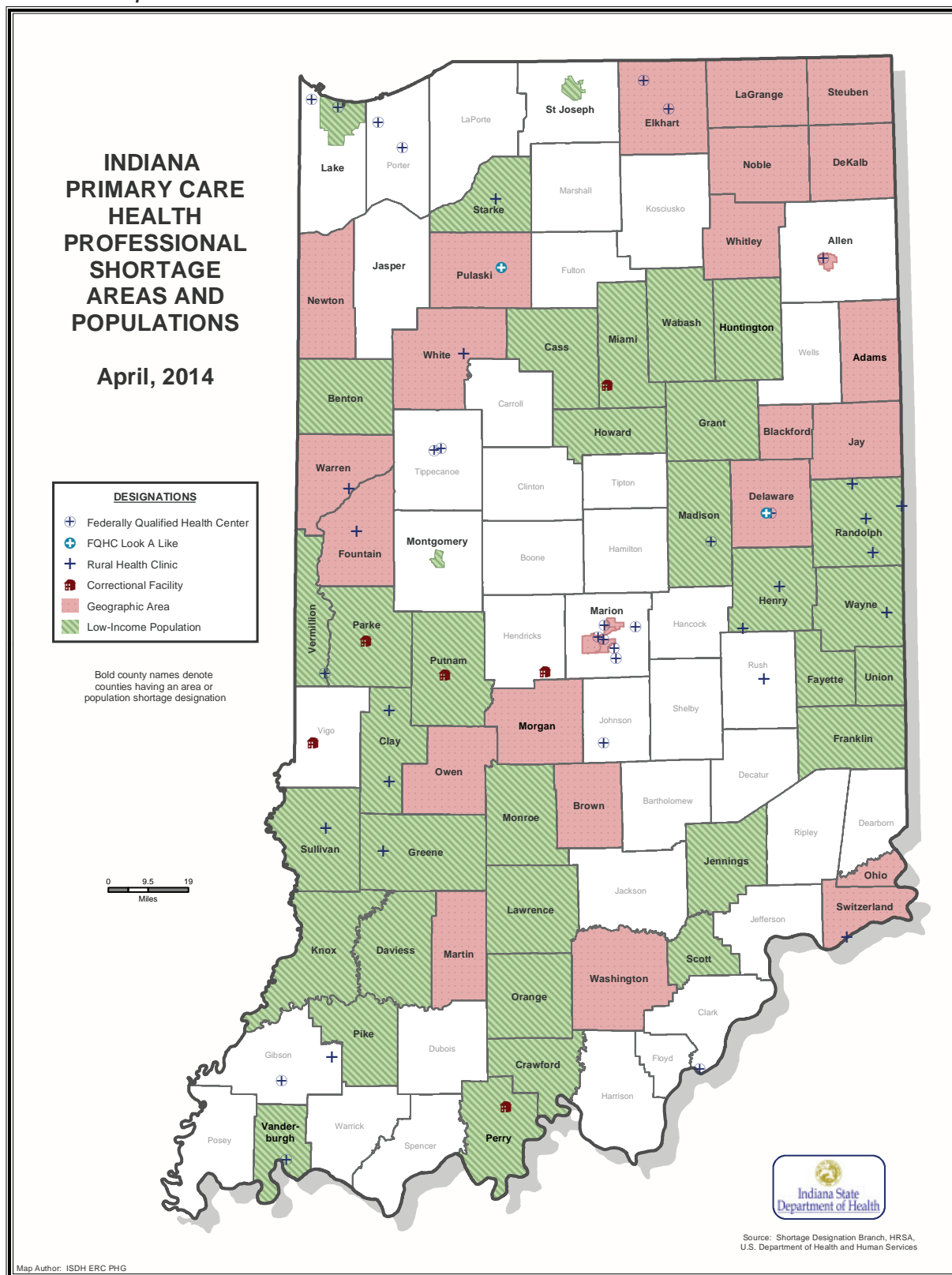| AHEC	Vacancies	Clincial Laboratory Sciences	Emergency Medical Services	Health Information Management	Imaging	Medical Assistant	Occupational Therapist	Occupational Therapy Assistant	Physical Therapist	Physical Therapist Assistant	Speech-Language Pathologist	All Professions
		n=139	n=46	n=202	n=68	n=164	n=232	n=102	n=274	n=170	n=202	n=1,599
Area L	n=60	2	2	1	6	1	5	2	4	8	5	4
Charlotte	n=345	26	15	32	22	28	19	21	20	14	15	22
Eastern	n=179	9	13	9	3	4	14	11	11	9	21	11
Greensboro	n=261	24	20	14	18	21	11	19	17	16	12	16
Mountain	n=76	3	2	2	1	4	7	14	4	5	7	5
Northwest	n=199	7	2	16	9	8	13	11	9	28	11	12
South East	n=77	4	9	3	9	4	4	2	7	4	7	5
Southern Regional	n=198	8	30	8	10	16	13	11	15	8	14	12
Wake	n=204	17	7	15	22	14	14	9	13	8	8	13
NC	n=1,599	100	100	100	100	100	100	100	100	100	100	100

Data are based on de-duplicated count of 1,599.

Source: Alcorn E, Gaul K, Fraher E. *Allied Health Job Vacancy Tracking Report*. Chapel Hill, NC: Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill; 2012. http://www.shepscenter.unc.edu/hp/publications/AHvacancy_fall2011.pdf. Accessed May 2, 2016.

Adequacy (Intermediate)

Indiana

The following maps were presented by the Indiana Center for Health Workforce Studies to the Indiana Medicaid Advisory Committee and depict Federal Health Professions Shortage Area designations to highlight workforce shortages in primary care, oral health, and mental health.

INDIANA PRIMARY CARE HEALTH PROFESSIONAL SHORTAGE AREAS AND POPULATIONS

April, 2014

DESIGNATIONS
- ⊕ Federally Qualified Health Center
- ⊕ FQHC Look A Like
- + Rural Health Clinic
- 🏠 Correctional Facility
- ▨ Geographic Area
- ▨ Low-Income Population

Bold county names denote counties having an area or population shortage designation

0   9.5   19
Miles

Source: Shortage Designation Branch, HRSA, U.S. Department of Health and Human Services

Map Author: ISDH ERC PHG

Source: Barclay J, Sheff Z. *Indiana's Health Care Workforce: An Overview.* Indianapolis, IN: Health Workforce Studies Program, Indiana University School of Medicine; 2014. http://ahec.medicine.iu.edu/files/9214/0855/3801/Medicaid_Adv_Comm_Aug_2014_2.pdf. Accessed May 2, 2016.

Note: The maps were originally developed by the Indiana State Department of Health (ISDH) Epidemiology Resource Center (https://secure.in.gov/isdh/25692.htm) using data from the Indiana Office of Primary Care (https://secure.in.gov/isdh/20544.htm) which is also located within the ISDH.
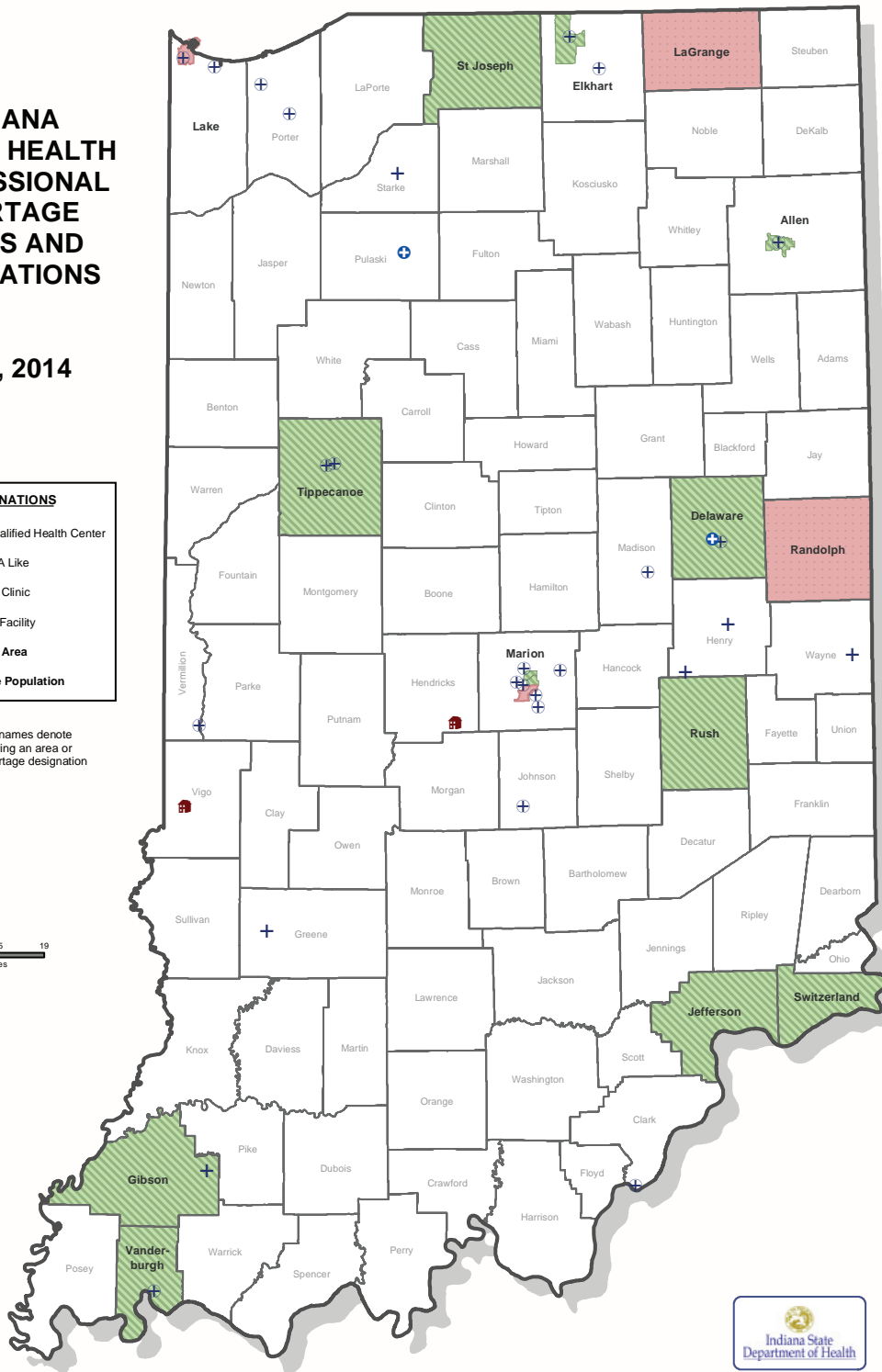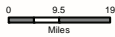
Indiana Example B

INDIANA
DENTAL HEALTH
PROFESSIONAL
SHORTAGE
AREAS AND
POPULATIONS

April, 2014

DESIGNATIONS

Federally Qualified Health Center
FQHC Look A Like
Rural Health Clinic
Correctional Facility
Geographic Area
Low-Income Population

Bold county names denote
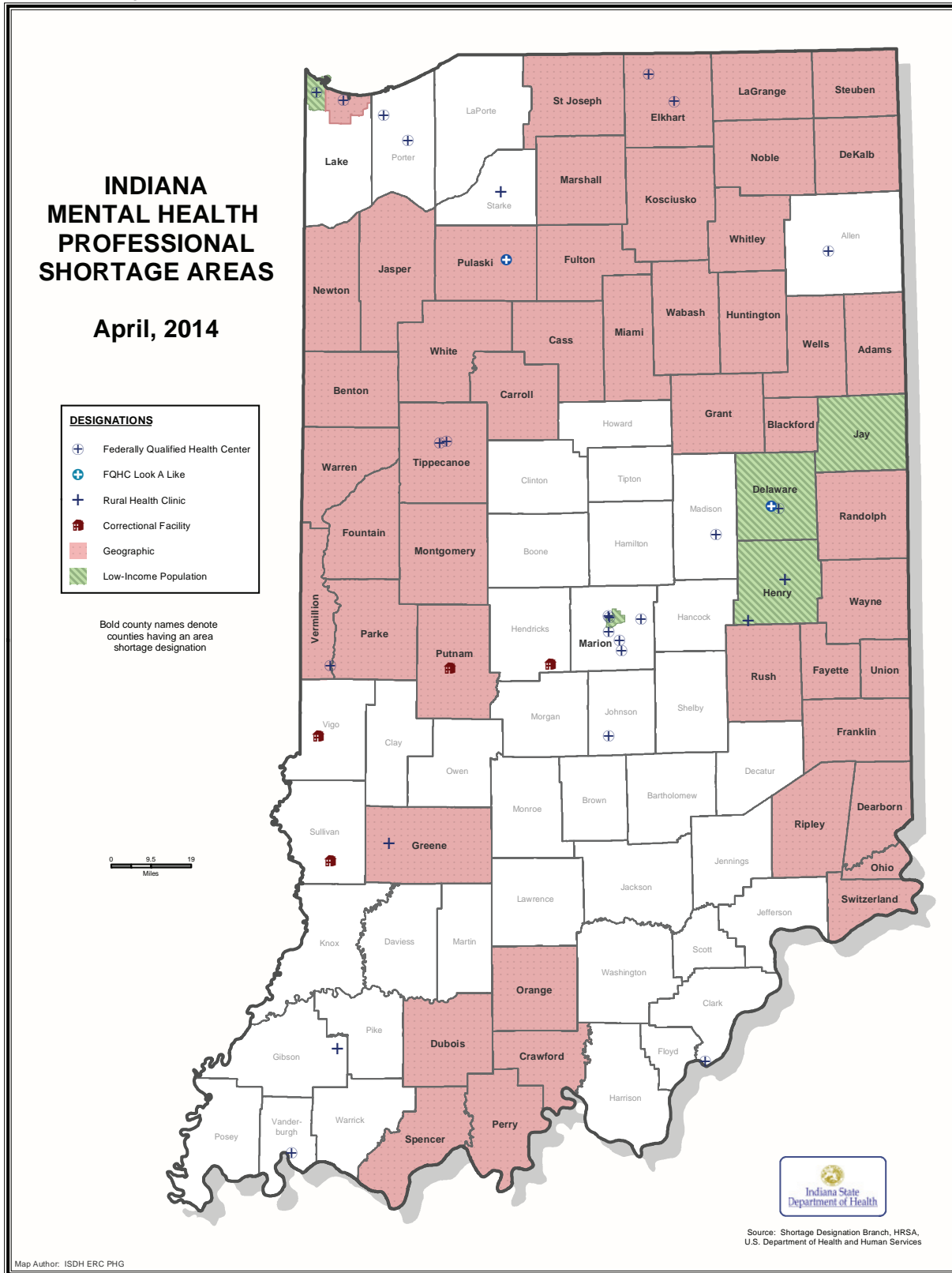counties having an area or
population shortage designation

0   9.5   19
Miles

Source: Shortage Designation Branch, HRSA,
U.S. Department of Health and Human Services

Indiana State
Department of Health

Map Author: ISDH ERC PHG

Source: Barclay J, Sheff Z. *Indiana's Health Care Workforce: An Overview.* Indianapolis, IN: Health Workforce Studies Program, Indiana University School of Medicine; 2014. http://ahec.medicine.iu.edu/files/9214/0855/3801/Medicaid_Adv_Comm_Aug_2014_2.pdf. Accessed May 2, 2016.

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CHAPTER 5:
Special Challenges for Health Workforce Analysis

CHAPTER 5: SPECIAL CHALLENGES FOR HEALTH WORKFORCE ANALYSIS

This chapter introduces 6 aspects of health workforce data and analysis that may influence the accuracy and interpretation of health workforce research:

- New professions and occupations
- Scope-of-practice variations
- Coordination with education programs
- New technologies
- Data limitations
- Looking beyond data

The examples discussed below reveal that, even though the methods used to study the workforce are generally the same for most health professions, there are aspects of some health professions (and of some health workforce issues) that warrant special attention. They represent situations that can disrupt analysis, make comparisons more difficult, require special insights and expertise, and necessitate special qualifiers and caveats in tabulations and reports. Most of the examples presented below reflect some type of inconsistency across different components of the health workforce, over time, or both.

New Professions and Occupations

New health care professions, occupations, and specialties are created in response to a number of situations, notably:

- Significant unmet need for health care
- Demands for more effective diagnostic and treatment protocols
- Need for cost reductions to promote access to needed services

A useful example of the first situation may be found within the field of oral health. Dental therapists and advanced dental hygienists are now being legally recognized in a handful of states to address problems of access to basic dental services among low-income populations. If these early innovations become standards for all states, unmet needs for dental services could be reduced. Although there are some differences, there are also some parallels here to the introduction of nurse practitioners and physician assistants into medical practices that began more than 4 decades ago.

The second situation arises when medical science improves our understanding of the causes, mechanisms, and treatment of disease and new professions, specialties, and occupations emerge to translate these scientific findings into practice. A prime example is interventional radiology, which makes possible less invasive treatment of many conditions that previously warranted surgery. Especially in the early stages of such transitions, the job titles, educational requirements, and other specifications for emerging professions have not been standardized across states, making reliable cross-state comparisons difficult.

Perhaps the most challenging situations for health workforce planners are those related to new unlicensed professions and occupations, including care coordinators and case managers. These workers play increasingly important roles in advising current and prospective patients as to which facilities, treatments, and practitioners to consider, along with documenting services, cost patterns, and resulting health outcomes. Because many of these individuals are not regulated or monitored by governmental agencies as licensed professionals, it is difficult to compare counts of these workers, let alone assess the quality and adequacy of their supply in relation to demand or need.

Scope of Practice Variations

Variations in health professionals' legal scope of practice across states is a related theme. As professions grow and mature, they often expand or adjust their scope of practice to reflect public needs, clinical realities, professional priorities, and/or fiscal necessities.

Because health professions are regulated and monitored primarily at the state level, there are often times when the legal scope of practice for a profession in a state is "out of sync" with evolving changes in professional competencies. Adjustments to the legal scope of practice in a state may also complicate interstate migration for a profession and the resulting services. For example, a regulation requiring that only individuals with specific training may perform a certain medical test may create a temporary delay in providing the test, even as it increases demand for practitioners with that training. Similarly, increasing (or decreasing) the educational prerequisites for entering a profession or renewing a license also may dramatically impact the supply of certain professionals.

The state-level variations in scope of practice create opportunities to systematically study the impact of broader scope-of-practice on clinical practice and outcomes. A prime example is the number of multistate analyses demonstrating that NPs who practice closer to their full scope of practice produce better, more cost-effective outcomes.[35,36]

Coordination With Education Programs

The education and training of health professionals is an important policy lever for adjusting the supply of many health professions. The supply of practitioners may be increased (or decreased) by adjusting the number of graduates from respective education programs.

It is important to remember, however, that the goals and objectives of educational institutions may not be fully compatible with the goals of policymakers. Educational institutions and programs are first and foremost aiming to ensure that their graduates are well prepared to effectively serve their future employers and provide opportunities for qualified applicants to work in their chosen field. Anticipating workforce surpluses or shortages is a secondary concern at best.

Special problems arise when the education pipeline is long. For example, if one wished to increase the number of physicians by 50% in a specialty that requires 5 years of residency training, it would take 10 or more years before the first of the new specialists entered the workforce. The first 5 years (or thereabouts) would be used to expand existing education/training programs or to add new ones, while the next 5 years would be required for the first graduates to complete their residency training. If the expanded number of new specialists entering a practice represented 10% of the total supply, then at least 5 additional years would be required to increase the number of specialists by 50%. Unfortunately, after the first 5 years of increased production, the system would start to create a surplus of specialists, which after an additional 5 years could require some measure of scaling back in order to avoid underemployment.

New Technologies

Another related topic is new technologies. Virtually every health profession, specialty, and facility has been affected by some new device, drug, or treatment protocol in recent years. The result has been a dramatic transformation of certain types of medical care over the past several decades. Surgeries that often took hours and required weeks of recuperation may now take considerably less time and have shortened recovery periods. Predispositions for certain diseases may be identified genetically in a matter of days. Telecommunication has revolutionized radiology by transmitting images captured at one location to remote areas—even on the other side of the world—for review and interpretation. In addition, the ever-increasing resolution of diagnostic images now reveals critical diagnostic details that drive clinical practice and decision making. Similar technologies could reinvigorate interest in telehealth and telemedicine, which could dramatically alter the diagnosis and treatment of a wide range of common illnesses and injuries.

The impacts of these technological innovations generally fall into one or more broad categories:

- Making treatment of some illnesses or injuries possible—eg, several previously untreatable types of cancer can now be successfully treated with new drugs and other therapies.[37]

- Reducing the costs of some medical procedures—eg, the demand for many surgical procedures now performed less invasively, such as laparoscopic surgery, has increased dramatically because of reduced costs and improved outcomes.

- Improving the diagnosis of some illnesses—eg, new images possible with magnetic resonance imaging (MRI) and advanced sonographic technologies result in less invasive procedures and more detailed and accurate diagnoses.[38,39]

- Developing totally new diagnostic and treatment protocols—eg, in the mental and behavioral health arena. Chemists, physicists, and computer scientists are now identifying new ways of diagnosing (and, to a lesser extent, treating) psychiatric and behavioral disorders.

- Simplifying some surgical procedures enough to make it possible for other specialties to perform them—eg, a number of extremely complex cardiothoracic surgical procedures have been sufficiently simplified as to enable cardiologists and even some general surgeons to perform them. This has been accompanied by a decline in cardiothoracic surgery specialty training, thereby creating concern about the future supply of these specialists.[40]

Although some of these innovations are directly related to health workforce demand and need, there may also be significant delays—perhaps many years—between the introduction and testing of a new technology and its incorporation into everyday practice. In that interim period, there may be uncertainty around the impact of technology on demand for services and workers. It is difficult—perhaps impossible, at least initially—to predict the impact that a new technological advance will have on health workforce supply, demand, or need.

Data Limitations

One of the mantras of this guide is that timely, accurate, relevant data are essential for effective health workforce analysis and research. Without good data, good analysis is not possible. Data limitations may fall into one or more categories, including inconsistent variable definitions over time, too small a survey sample, too many missing survey responses, too many incomplete records, inaccurate data entry, and errors in preparing the data for analysis. Researchers should understand the implications of these kinds of limitations and document them in their reports.

Generally speaking, these kinds of data limitations do not by themselves preclude analyzing the data and preparing summary tables, charts, and maps. It is important to note, however, that each limitation may introduce bias into the results and findings. At the very least, small samples yield wide confidence

intervals or statistical uncertainty in the final results. In addition, inconsistently defined variables or inaccurate data entry may yield in comparable data over time.

It is incumbent on the researcher to address explicitly any concerns about data limitations before his or her results are published or acted upon. This should be an essential element of the professional ethic that guides those who conduct health workforce research.

Looking Beyond Data

A host of special considerations and circumstances may affect the supply of, demand and need for, and adequacy of the health workforce. A few that are difficult to incorporate into an analysis or research protocol are briefly discussed below.

It is widely recognized that many socioeconomically disadvantaged individuals are either medically uninsured or underinsured, which often results in fewer preventive and primary care visits and additional costly visits to local emergency departments. Health insurance is one factor that should be considered in any study of demand for health care. It clearly affects both the demand for and the settings of specific health services. A person with insurance and a regular primary care practitioner is more likely to seek routine preventive care that may reduce the demand for emergency department and hospital visits. Studies have been conducted to quantify the effects of different types and levels of insurance on patient choice and outcomes.[41]

Cultural competence is another "invisible barrier" to effective health care. It is especially difficult to deal with analytically, because it is deeply rooted in personal beliefs and biases about people from different cultures and circumstances. Some practitioners are simply not culturally well matched to the people they serve.

Unfortunately, it can take years for practitioners to gain sufficient experience and trust in the community to be able to communicate effectively with their patients. Language and educational differences only magnify these challenges. Compounding the problem, measures related to cultural competence (for either practitioners or patient populations) are seldom coded in health workforce datasets.

Having a culturally diverse health workforce is perhaps the most effective way to address these issues, but matching practitioners racially and ethnically with populations in all counties and neighborhoods across a state is not always possible. Thus, health care organizations must actively promote and reward adoption of cultural competency among the health professionals they employ.

APPENDIX:
Acronyms and Abbreviations
Relevant to Health Workforce Analysis

APPENDIX: ACRONYMS AND ABBREVIATIONS RELEVANT TO HEALTH WORKFORCE ANALYSIS

This appendix contains a glossary of acronyms and abbreviations related to health personnel planning and policymaking, including organizations that are sources of data.

AACN	American Association of Colleges of Nursing
AACOM	American Association of Colleges of Osteopathic Medicine
AACP	American Association of Colleges of Pharmacy
AAHSA	American Association of Homes and Services for the Aging
AAMA	American Association of Medical Assistants
AAMC	Association of American Medical Colleges
AANA	American Association of Nurse Anesthetists
AAPA	American Academy of Physician Assistants
ABMS	American Board of Medical Specialties
ACGME	American Council on Graduate Medical Education
ACS	American Community Survey
ADA	American Dental Association
ADHA	American Dental Hygienists' Association
ADN	Associate Degree Nurse
AHA	American Hospital Association
AHCA	American Health Care Association
AHCPR	Agency for Health Care Policy and Research
AHRF	Area Health Resources Files
AHRQ	Agency for Healthcare Research and Quality
AHEC	Area Health Education Center
AMA	American Medical Association
ANA	American Nurses Association
AOA	American Optometric Association
AOTA	American Occupational Therapy Association
APA	American Psychological Association
APHA	American Public Health Association
APTA	American Physical Therapy Association
ASHA	American Speech-Language-Hearing Association

BPHC	Bureau of Primary Health Care
BC	Bureau of Census
BHW	Bureau of Health Workforce
BLS	Bureau of Labor Statistics
BSN	Bachelor of Science in Nursing
CAHEA	Committee on Allied Health and Accreditation
CDC	Centers for Disease Control and Prevention
CES	Current Employment Statistics
CIP	Classification of Instructional Programs
CMA	Certified Medical Assistant
CME	Continuing Medical Education
CMS	Centers for Medicare and Medicaid Services
CNA	Certified Nurse Assistant
CNM	Certified Nurse Midwife
CODA	Commission on Dental Accreditation
COTA	Certified Occupational Therapy Assistant
COGME	Council on Graduate Medical Education
CPI	Consumer Price Index
CPS	Current Population Survey
CRNA	Certified Registered Nurse Anesthetist
DC	Decennial Census
DDS/DMD	Doctor of Dental Surgery/Doctor of Dental Medicine
DO	Doctor of Osteopathic Medicine
Dx	Diagnosis
EP	Employment Projections
HCUP	Healthcare Cost and Utilization Project
HHA	Home Health Aide
HPSA	Health Professional Shortage Area
HRSA	Health Resources and Services Administration
IPEDS	Integrated Postsecondary Education Data System
IRB	Institutional Review Board
JAMA	Journal of the American Medical Association
LPN/LVN	Licensed Practical Nurse/Licensed Vocational Nurse
MEPS	Medical Expenditure Panel Survey

MD	Medical Doctor
MDS	Minimum Data Set
MSN	Master of Science in Nursing
MUA	Medically Underserved Area
MUP	Medically Underserved Population
NBME	National Board of Medical Examiners
NCES	National Center for Education Statistics
NCHWA	National Center for Health Workforce Analysis
NIH	National Institutes of Health
NIHCM	National Institute for Health Care Management
NIMH	National Institute of Mental Health
NLN	National League for Nursing
NMCES	National Medical Care Expenditure Survey
NP	Nurse Practitioner
NPI	National Provider Identifier
NPPES	National Plan and Provider Enumeration System
NTIS	National Technical Information Service
OES	Occupational Employment Statistics
OT	Occupational Therapist
PA	Physician Assistant
PCA	Patient Care Assistant
PECOS	Provider Enrollment, Chain, and Ownership System
PMSA	Primary Metropolitan Statistical Area
PPS	Prospective Payment System
PT	Physical Therapist
RN	Registered Nurse
Rx	Prescription
SIC	Standard Industrial Classification
SOC	Standard Occupational Classification
SNF	Skilled Nursing Facility
SSA	Social Security Administration
USDOE	United States Department of Education
USDOL	United States Department of Labor
USGPO	United States Government Publishing Office

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About the Authors

Paul Wing, EGD

Research Consultant, **Health Workforce Technical Assistance Center**

Paul Wing began working at the Center for Health Workforce Studies at the University at Albany as a senior researcher in 1996. He retired in 2008 as the deputy director, and returned in 2014 to take a 1-year appointment as a consultant. Areas of focus throughout his extensive career have included health workforce research, quantitative performance tool design, higher education management, resource allocation, and creating policy oriented presentations.

David Armstrong, PhD

Director, **Health Workforce Technical Assistance Center**

As director of HWTAC, Dr. Armstrong manages the day-to-day operations, disseminates information about the Center, and regularly provides technical assistance to individuals, hospitals, and various states and organizations.

Gaetano J. Forte

Technology Officer, **Health Workforce Technical Assistance Center**

As technology officer of HWTAC, Mr. Forte implements advances in technology for a broad range of the Center's activities, including the provision of technical assistance and the dissemination of its work. Mr. Forte is also a veteran health services researcher having spent nearly 2 decades studying the health workforce.

Jean Moore, DrPH

Project Advisor, **Health Workforce Technical Assistance Center**

Jean Moore serves as a project advisor for HWTAC, bringing over 16 years of experience as a health workforce researcher. For the past 12 years, Dr. Moore has also been the director of the Center for Health Workforce Studies at the University at Albany.

HWTAC

Health Workforce Technical Assistance Center

Center for Health Workforce Studies
School of Public Health | University at Albany, SUNY
1 University Place, Suite 220 | Rensselaer, NY 12144-3445

www.healthworkforceta.org