Strategies for Enumerating the U.S. Governmental Public Health Workforce

**A Joint Report of the Center of Excellence
in Public Health Workforce Studies,
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CONTENTS

LIST OF ABBREVIATIONS USED IN THIS REPORT

ABPM	American Board of Preventive Medicine
ACPM	American College of Preventive Medicine
ACS	American Community Survey
APHL	Association of Public Health Laboratories
ASPH	Association of Schools of Public Health
ASTHO	Association of State and Territorial Health Officials
ASTPHND	Association of State and Territorial Public Health Nutrition Directors
BLS	Bureau of Labor Statistics
CDC	Centers for Disease Control and Prevention
CEPH	Council on Education for Public Health
CHP	Center for Health Policy (Columbia University)
CHWs	Community Health Workers
COEs	Centers of Excellence
CPDF	Central Personnel Data File
CPS	Current Population Survey
CSTE	Council of State and Territorial Epidemiologists
DHHS	U.S. Department of Health and Human Services
DHS	U.S. Department of Homeland Security
DoD	U.S. Department of Defense
ECAs	Epidemiology Capacity Assessments
EMS	emergency medical services
EPA	U.S. Environmental Protection Agency
FTEs	full-time equivalents
HRSA	Health Resources and Services Administration
IHS	Indian Health Service
IOM	Institute of Medicine
NACCHO	National Association of County and City Health Officials
NAICS	North American Industry Classification System
NEHA	National Environmental Health Association
NHTSA	National Highway Traffic Safety Administration
NIHB	National Indian Health Board
NSF	National Science Foundation
NSSRN	National Sample Survey of Registered Nurses
OES	Occupational Employment Statistics
OPM	Office of Personnel Management
RNs	registered nurses
RWJF	Robert Wood Johnson Foundation
SLS	surveillance-like system
SOCs	Standard Occupational Classifications
TRAIN	TrainingFinder Real-Time Affiliate Integrated Network
USDA	U.S. Department of Agriculture
VA	U.S. Department of Veterans Affairs
WIC	Women, Infants, and Children

SUMMARY

Introduction: Developing and maintaining a competent and effective public health workforce is an important goal for the U.S. Department of Health and Human Services (DHHS), as outlined in its Healthy People initiative (Available at: http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=35). Enumeration and surveillance are key strategies for analyzing data regarding the size and composition of the public health workforce, and the continual monitoring of these data is essential to determining how to improve and maintain workforce competency and effectiveness. The Centers for Disease Control and Prevention and the Health Resources and Services Administration jointly funded a 1-year project through a cooperative agreement with the Public Health Foundation to have two Centers of Excellence, one at the University of Michigan and the other at the University of Kentucky, to address the following objectives: (1) outline options for developing a sustainable, systematic, and replicable plan for enumerating and characterizing the nation's public health workforce on an ongoing basis; (2) determine desired data elements required to provide useful information about the nation's public health workforce; (3) review available data sources regarding the public health workforce; assess usability of data for national enumeration purposes; and determine information or elements that are missing or unavailable; (4) develop formal recommendations for a proposed surveillance-like system for ongoing enumeration of the public health workforce; and (5) work with stakeholders to build consensus for developing an enumeration plan. This activity will be an ongoing, long-term element aimed at achieving a desired, useful system that can assist with evidence-based policy development regarding public health workforce concerns.
Methods: To meet these objectives, a case definition of the public health workforce was developed that focuses on a subset of workers employed in nontribal local, state, and federal government agencies. A comprehensive review of available public health workforce data sources was completed to determine whether existing data sources can be used to implement an enumeration study and to establish a surveillance-like system for long-term monitoring of the public health workforce. Finally, recommendations for public health workforce enumeration and surveillance were developed.
Results: Fifteen distinct data sources were reviewed and evaluated on the basis of specific criteria, including reliability, validity, frequency of data collection, and accessibility. No one data source has the breadth and specificity to provide adequate information regarding the size and composition of the entire public health workforce as outlined in the case definition for this project. Data from multiple sources have the potential to be used collectively to provide the information necessary for public health workforce enumeration and surveillance; however, all data sources have limitations, and some might require greater modification than others to be rendered more useful for these purposes. The required minimum data elements identified for use in public health workforce surveillance focus on demographic characteristics of the workforce (e.g., age, sex, race/ethnicity, and income); education and training characteristics (e.g., academic degrees, licensure/certification, and years of experience in current position); and job characteristics (e.g., full-time equivalent level, agency type [public health department or other], employment type [regular versus contract employee], job classification, job function, and service area zip code). These elements assume organizational-level data collection; additional elements can be added if primary data collection is undertaken at the individual worker level, although this is correspondingly more complex and resource-intensive than data collected at the organizational level.

Recommended Actions: The next steps for implementing a public health workforce enumeration study and surveillance-like system should include (1) identifying a working group of workforce researchers and stakeholders; (2) developing, through the working group, a consensus regarding key concerns, chief among them being development of a common public health workforce taxonomy, identification of methods for implementing additional or modified data collection with the help of national public health professional organizations, and defining strategies for modifying national data sources (e.g., data generated from the Bureau of Labor Statistics); (3) working with federal partners to refine federal public health workforce estimates further; (4) assisting public health organizations with data collection and analysis as necessary; (5) producing an enumeration estimate; and (6) developing a test model of a public health workforce surveillance-like system in a subset of states.

Strategies for Enumerating the U.S. Governmental Public Health Workforce

INTRODUCTION

Developing and maintaining a competent and effective public health workforce is a crucial goal for the U.S. Department of Health and Human Services (DHHS), as outlined in its Healthy People initiative.[1] Although progress has been made toward achieving this goal, much remains to be done as a result of inconsistencies in defining the persons the public health workforce comprises and the lack of consensus regarding workers' training. No standards or benchmarks exist that specify the ideal mix of education, experience, and diversity needed to produce an effective workforce.

Public Health Workforce Research Summary

Although research is being conducted on staffing patterns of health departments, cultural competence, and other workforce competencies, these efforts have been hampered by a considerable lack of data about the public health workforce.[2–4] Knowledge is limited regarding the workers the workforce comprises — how many workers populate it, what disciplines are represented, where workers deliver essential services, or how effective they are at doing so. Perhaps even less is known about the demographic composition of the workforce — their sex, race/ethnicity, educational backgrounds, reasons for entering public health, reasons for staying, or how they adapt to new demands as disease and population trends change and unstable funding affects their job security and future career prospects.

More attention has been focused recently on answering these critical questions regarding the public health workforce. In 2007, recognizing renewed interest in workforce research, Carol Gotway Crawford, PhD, then the Associate Director of Science in the Office of Workforce and Career Development at the Centers for Disease Control and Prevention (CDC), convened a stakeholders' meeting. An outgrowth of that workshop was a seminal workforce research article published by Crawford et al.[5]

To advance the public health workforce research agenda, Crawford et al. recommended eight broad research themes, as follows:

1. workforce size and composition;
2. workforce diversity;
3. workforce effectiveness and health impact;
4. recruitment, retention, separation, and retirement;
5. worker pay, promotion, performance, and job satisfaction;
6. demand for the public health workforce;
7. education, training, and credentialing the public health workforce; and
8. public health workforce policy.

These themes were used to guide systematic reviews of the public health workforce literature commissioned by the Robert Wood Johnson Foundation (RWJF) to be published in a special supplement of the *American Journal of Preventive Medicine* with the intent of providing a framework for considering future public health workforce research projects as a part of a larger public health services and systems research agenda.

In 1998, the Public Health Functions Working Group emphasized that a primary responsibility for public health is Essential Public Health Service 8 — Assure a competent public and personal health care workforce.[6] Fulfilling that function requires realistic policies and a sustained commitment to developing the public health workforce. Such policies are dependent on high-quality data for decision making; this will be of particular importance given the profound shifts in our health care system engendered by major reform efforts. Projecting future needs and trends in the workforce is dependent on first knowing the existing state of the workforce, specifically, the number and characteristics of the nation's public health workers. These data are necessary to developing relevant, constructive workforce policy. Simply put, knowing who is practicing public health, what they are trained to do, and in which settings they practice is essential.

The most credible recent attempt to enumerate the public health workforce was performed by Gebbie et al. In their landmark study, *The Public Health Workforce: Enumeration 2000*, commissioned by the Health Resources and Services Administration's (HRSA) Bureau of Health Professions, they used secondary data sources to estimate the nation's public health workforce to be approximately 450,000 persons.[7] The authors also noted a decline in the estimated ratio of workers to population, from 220/100,000 persons in 1980 to 158/100,000 in 2000. The authors described their work as "only the first step toward a comprehensive, accessible and current data source on the public health workforce." Yet, in the decade since that report was published, research has been modest, underfunded, and mostly sporadic, and it has lacked any type of coordinated approach.

The importance of workforce research was highlighted dramatically and reinforced by the 2003 report, *The Future of the Public's Health in the 21st Century*,[8] in which the Institute of Medicine (IOM) recommended that CDC and HRSA "periodically assess the preparedness of the public health workforce, to document the training necessary to meet basic competency expectations, and to advise on the funding necessary to provide such training." A necessary prerequisite for this undertaking is the enumeration of the U.S. public health workforce as part of a larger effort to assess the U.S. health workforce overall.

As noted, good policy development requires more than a simple headcount of those providing public health services. Knowing the characteristics of the professionals providing these services and where they are working, both in terms of agency type and geographic locale, is crucial. Demographic data of workers, including age and race/ethnicity, facilitate a more useful estimation of employment trends while permitting an examination of workforce diversity and the impact of that diversity on health outcomes. Information about worker education levels can serve as a limited proxy for competence and can help guide program development and offerings from schools and programs training the public health workforce. Additionally, data regarding worker

time allocation for provision of services (e.g., time devoted to clinical care, health education, or administrative reporting) can provide information on which projections for future worker need can be based.

A conclusion can be drawn quickly after examining the methodology used by Gebbie and colleagues in *Enumeration 2000*, reviewing literature summaries about previous efforts, and reviewing the RWJF-commissioned systematic reviews of the public health workforce research literature that no one system will provide either a full count or a breakdown of characteristics of the public health workforce. Major sources of data regarding the public health workforce include the Bureau of Labor Statistics (BLS) publicly available data, the data elements and published reporting of the federal Office of Personnel Management (OPM), and the questions and data elements included in the workforce sections of major profile surveys conducted by such groups as the Association of State and Territorial Health Officials (ASTHO), the National Association of County and City Health Officials (NACCHO), the Council of State and Territorial Epidemiologists (CSTE), and the Association of Public Health Laboratories (APHL). Additionally, the elements and characteristics of the Public Health Foundation's TrainingFinder Real-Time Affiliate Integrated Network (TRAIN) learning management system might offer valuable data regarding the public health workforce. Although these data sets provide information about different aspects of the public health workforce, none is adequate in both scope and depth to provide the detail necessary to enumerate the workforce accurately.

The difficulties inherent in the lack of a single data source and the lack of any standardized system for regularly and systematically collecting data on this segment of the health care workforce are compounded by the nature of public health. Public health practice is broad in scope, often employs multidisciplinary teams, and employs personnel in diverse settings with varied training and educational backgrounds. Activities might be performed by personnel employed by other public health system members outside of governmental public health agencies. These factors combine to impede efforts to collect workforce data, especially in developing a case definition acceptable to the specialty groups involved. Consequently, creating a common taxonomy for defining a public health worker is a key aspect of enumeration efforts.

Centers of Excellence Objectives

To stimulate public health workforce research activities, CDC, through its cooperative agreement with the Public Health Foundation, funded two Centers of Excellence (COEs): the Center of Excellence in Public Health Workforce Research and Policy at the University of Kentucky College of Public Health in 2008, and the Center of Excellence in Public Health Workforce Studies at the University of Michigan School of Public Health in 2009. The COEs' mission includes initiating and coordinating strategic efforts to improve the public health workforce through research. Through project years 2009 and 2010, the COEs' primary activities were focused on identifying, cataloging, and posting information about accessible data sets and resources, providing technical assistance to researchers, participating in scholarly activities and meetings, providing a venue and support for presentation and discussion of research activities and results, and identifying and assessing research measures, methods, and models.

To facilitate and guide COE activities, a national advisory committee of prominent leaders in public health policy, administration, and workforce research was established. The charge to the committee was three-fold —

• Think strategically about public health workforce research and policy efforts.
• Advise stakeholders about relevant public health policy, the research agenda for public health workforce topics, and the translation of new research findings into public policy.
• Help to ensure that the concerns of public health workforce research and policy receive attention from policymakers and funders.

Enumeration of the public health workforce was among the critical areas of research identified by the committee. As a result, CDC and HRSA implemented a joint strategy to develop a workforce enumeration system by having the COEs focus their 2010–2011 work plans on public health enumeration. The COEs were charged with addressing the following five objectives:

1. **Outline options for developing a sustainable, systematic, and replicable plan for enumerating and characterizing the nation's public health workforce on an ongoing basis.** The public health workforce can be enumerated and characterized through different mechanisms, some more feasible than others. Although a federally supported national survey that systematically collects data periodically from a range of public health organizations and agencies might provide the most comprehensive and reliable data regarding the workforce as a whole, the financial investment would be substantial. Use of existing data sources made available by multiple organizations and agencies creates challenges related to data compatibility and might not capture the whole workforce, but this might be the most feasible option, despite its limitations. The COEs were charged with exploring a range of enumeration options in detail and providing recommendations for a long-term national enumeration strategy.

2. **Determine desired data elements required to provide useful information about the nation's public health workforce.** To develop a plan for characterizing the workforce, the COEs first should determine which characteristics of the workforce are most important to capture. These characteristics might include demographics, education and training background, job classifications, and job functions, among others. A recommended set of minimum data elements required to provide useful information about the public health workforce was drafted, along with a supplemental list of data elements that would be ideal to capture and monitor through a national surveillance-like system (SLS). Feasibility of data collection was considered when developing the list of desired data elements.

3. **Review available data sources regarding the public health workforce; assess usability of data for national enumeration purposes; determine information/elements that are missing or unavailable.** Workforce data sources that are either publicly available or obtainable through data use agreements were identified through this project. The number of public health workers enumerated by each data source was recorded, and the data collection methodology of each source was described. Additionally, a qualitative assessment of

strengths, weaknesses, and overall use was documented. The report also discusses emerging data streams that have the potential to provide enhanced information about the workforce.

4. **Develop formal recommendations for a proposed SLS for ongoing enumeration of the public health workforce.** Surveillance was proposed as a strategy for routine monitoring of public health workforce characteristics. CDC and HRSA expressed interest in developing an SLS by using existing workforce data that capture the recommended minimum elements. To develop recommendations for implementing an SLS, a feasibility study contracted by the U.S. Department of Transportation's National Highway Traffic Safety Administration (NHTSA) of workforce injury surveillance was reviewed to determine components critical to developing an SLS, as were other national registry and surveillance systems. In addition, data sources most likely to be of immediate use for an SLS were identified.

5. **Work with stakeholders (e.g., BLS, ASTHO, NACCHO, OPM, data harmonization working group, and state personnel directors) to build consensus for developing an enumeration plan.** This activity will be an ongoing, long-term element directed toward achieving a desired, useful system that can assist with evidence-based policy development. Before efforts to enumerate and characterize the public health workforce can be undertaken, the COEs, along with federal partners and other stakeholders, determined that a critical first step in completing the project was establishing a working case definition to use in determining which segments of the public health workforce would be included in this first phase of the project. The report presents a case definition of the public health workforce, developed and refined solely for this project, as well as the caveats inherent in that definition. Ongoing collaboration with stakeholders will be critical to the success of an enumeration study and development of an SLS.

This report describes the efforts of the two COEs to address these five objectives.

DEFINING THE WORKFORCE

A critical first step in enumerating the public health workforce is defining who should be identified as a public health worker. DHHS has defined public health workers as "all those responsible for providing the essential services of public health regardless of the organization in which they work."[6] Gebbie, Merrill, and Tilson emphasize that a public health worker can be defined on different three dimensions: the specific profession (e.g., epidemiologist), the work setting (e.g., all local health department workers, regardless of profession), or the work or job function.[9] Further, the education and training background of the worker might not coincide with his or her profession or job function. For example, a nurse might function as an epidemiologist in a local health department but have no formal training in epidemiology. These varying definitions should all be considered simultaneously, and piecing together an accurate enumeration from existing data sources, which primarily focus on job title, will be difficult.

Case Definition Used by the 2010–2011 COE Project

We lack sufficient data sources to allow for inclusion of the entire public health workforce, as defined by DHHS, during the COEs' 1-year project; therefore, a case definition of the public health workforce was developed with partners' input to serve as a framework. The core project teams from the University of Michigan, University of Kentucky, CDC, and HRSA drafted the case definition on the basis of available data sources; NACCHO and ASTHO provided feedback on the draft.

The case definition includes public health workers employed in specific work settings who hold one of the job titles specified in this report. Although collecting workforce data on job function would be valuable, available secondary data sources that can capture this information are substantially limited. Therefore, the case definition used for this project encompasses specific job titles in governmental agencies (Box).

Box. Public health worker case definition

The case definition for a public health worker includes all persons responsible for providing any of the 10 Essential Public Health Services who are employed in the following venues:

1. traditional nontribal state, territorial, and local governmental public health agencies/departments;
2. federal agencies with a clear mandate to provide public health services;
3. non–public health state, territorial, local, or federal governmental agencies providing environmental health services; and
4. non–public health state, territorial, local, or federal governmental agencies providing public health laboratory services.

Source: Centers for Disease Control and Prevention (CDC). 10 Essential Public Health Services. National Public Health Performance Standards Program. Atlanta, GA: US Department of health and Human Services, CDC; 2010. Available at: http://www.cdc.gov/nphpsp/essentialservices.html. Accessed January 9, 2012.

The COEs, along with federal partners and project stakeholders, identified specific occupational classifications to be included as part of the project case definition. Initially, the occupations used in the *Enumeration 2000* study[7] were considered for use in this project. That study used 55 occupational titles adapted by the Center for Health Policy (CHP) at Columbia University from a taxonomy of titles developed by HRSA's Bureau of Health Professions. It included BLS Standard Occupational Classifications (SOCs), which were linked to Equal Employment Opportunity Commission occupational categories and OPM Occupational Categories.[7,10–12] The 55 occupational categories used in the HRSA study provided a starting point for developing a list of occupational classifications to be used in this project. Selected categories were modified because of changes in the SOCs during the past decade, and categories that enumerated a limited number of workers in the *Enumeration 2000* study were condensed or eliminated, resulting in 20 occupational categories.

The occupational categories were grouped into 15 occupations to match the occupational classifications developed for ASTHO and NACCHO's profile surveys,[13,14] because they were determined by consensus to be the prime data sources for this project and were developed through a structured data harmonization process. Although these classifications work well for state and local health department personnel, they are more difficult to apply to the OPM Occupational Series, which provides more specificity than the broad OPM categories used in *Enumeration 2000*. Appendix Table 1 provides a cross-match of how the COEs grouped the OPM Occupational Series within the ASTHO and NACCHO classification.[13,14] Additionally, BLS SOCs and their corresponding direct-match titles, which are developed to provide examples of job titles that fit within each SOC, also were grouped within the NACCHO/ASTHO harmonized categories. Figure 1 depicts the classification process used by the COEs for this report.

Figure 1. Summary of occupational classification grouping steps
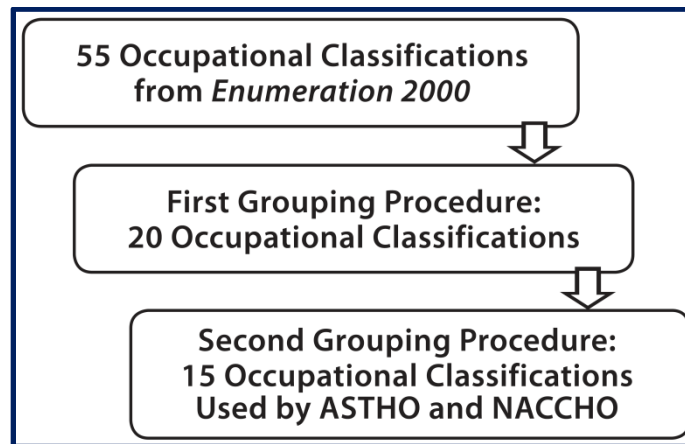
Source: Health Resources and Services Administration (HRSA)/Bureau of Health Professions. The public health work force: enumeration 2000. Gebbie KM, ed. Washington, DC: HRSA; 2000. Available at: http://www.uic.edu/sph/prepare/courses/chsc400/resources/phworkforce2000.pdf. Accessed January 17, 2012.

The final list of occupational classifications used in this case definition follow. Workers considered to be included in the case definition must be identified in one of these occupational classifications or in one of the occupational classifications that are grouped within the following classifications (see the appendix for classification definitions):

• Administrative or Clerical Personnel
• Behavioral Health Professional
• Emergency Preparedness Staff
• Environmental Health Worker
• Epidemiologist
• Health Educator
• Laboratory Worker

- Nutritionist
- Public Health Dentist
- Public Health Manager
- Public Health Nurse
- Public Health Physician
- Public Health Informatics Specialist
- Public Information Specialist
- Other Public Health Professional/Uncategorized Workers

Public Health Workers Not Included in the Project Case Definition

We believe that public health encompasses the work of all those who contribute to the health of the public, not just those employed by governmental public health agencies. However, certain groups of public health workers are not included in the working case definition used here. We intentionally limited the scope of this initial project to information that was readily accessible; thus, important sectors of the public health workforce are not considered. As better information about those groups becomes available, they can be added to the family of data systems that contribute to developing a workforce SLS. Indeed, having work settings collect substantive information about the types of workers they employ and the functions of those workers is important. The major groups that are not included in this report are listed in the following, along with our rationale for not including them at this time.

Community Health Workers

Community Health Workers (CHWs) are known to be an essential part of the public health system providing care primarily to underserved communities. CHWs are not included in the project case definition because clearly delineating how and to what extent they work with the governmental public health workforce is difficult. CHWs often work in nongovernmental organizations and private agencies and might be paid or volunteer. The definition of a CHW is as follows[15]:

> Community health workers are lay members of communities who work either for pay or as volunteers in association with the local health care system in both urban and rural environments and usually share ethnicity, language, socioeconomic status and life experiences with the community members they serve. They have been identified by many titles such as community health advisors, lay health advocates, promotores [in Hispanic and Latino communities], outreach educators, community health representatives, peer health promoters, and peer health educators. CHWs offer interpretation and translation services, provide culturally appropriate health education and information, assist people in receiving the care they need, give informal counseling and guidance on health behaviors, advocate for individual and community health needs, and provide some direct services such as first aid and blood pressure screening.

The 2007 HRSA study estimated the number of CHWs, paid and volunteer, assisting American communities by analyzing BLS data for occupational classifications deemed most likely to include CHWs as well as interviewing employers and CHWs in Arizona, Massachusetts, New York, and Texas.[15] This study produced an estimate of 85,879 CHWs nationwide. In May 2010, BLS began including CHWs as an SOC used in data collection, described as follows:

> Assist individuals and communities to adopt healthy behaviors. Conduct outreach for medical personnel or health organizations to implement programs in the community that promote, maintain, and improve individual and community health. May provide information on available resources, provide social support and informal counseling, advocate for individuals and community health needs, and provide services such as first aid and blood pressure screening. May collect data to help identify community health needs. Excludes Health Educators.

BLS includes CHW data in SOC 21-1798, Community and Social Services Specialists, All Other. The 2010 estimate for this classification is 112,010 workers. If inclusion of CHWs in a national workforce SLS is desired, BLS data provide the most promise in providing consistency. BLS data do not, however, capture unpaid volunteer workers, which is a substantial portion of the CHW workforce. A committee of stakeholders should determine how best to capture data regarding volunteer CHWs on a frequent enough basis to support surveillance efforts.

Faculty and Students in Schools and Programs of Public Health

Public health faculty and students represent a unique sector of the workforce in that they might not have positions, or be seeking positions, that support public health practice. They are excluded from the case definition because delineating their contribution to applied public health practice is difficult. Faculty play a key role in educating the future generation of public health workers and in conducting research that is translatable to public health practice.[6] Anecdotal evidence exists, however, that certain schools might be more focused on integrating student training and research activities with public health service delivery than others. For example, schools might aim to hire public health practitioners to serve as faculty and might even provide public health practice faculty tracks, whereas others might focus more on research methods and concentrate on training students for doctoral programs or research positions. Schools might also vary in how much they integrate applied practice opportunities into the curriculum. Although all students and faculty have the potential to affect public health practice, that they do so at varying degrees on the basis of interest, experience, training, and research focus should be acknowledged.

The Association of Schools of Public Health (ASPH) annually collects and reports data about faculty and students in its member schools. ASPH reported a total of 5,269 faculty (3,993.03 full-time equivalents [FTEs]) for 2009[16] and 26,340 students enrolled in its 46 member schools.[17] ASPH also reported that 11% of students who graduated during December 2008–May 2009 secured jobs in federal, state, or local governmental public health upon graduation.[18] The Council on Education for Public Health (CEPH), the organization that accredits public health programs, does not collect or maintain a database of information about faculty and students (Stephen

Wyatt, Dean, University of Kentucky College of Public Health, personal communication to F. Douglas Scutchfield, October, 2011), nor does the Association of Prevention Teaching and Research, which represents CEPH accredited public health programs that are not members of ASPH. The U.S. Department of Education provides data about the number of public health bachelor's, master's, and doctoral degrees conferred each year by sex of student and discipline. In 2009, a total of 3,671 bachelor's degrees, 12,533 master's degrees, and 698 doctoral degrees were conferred in public health-related disciplines.[19] The U.S. Department of Education also publishes faculty statistics for postsecondary schools, but does not do so by discipline; therefore, we cannot determine a count of faculty in public health programs from U.S. Department of Education data. The National Science Foundation (NSF) publishes data regarding scientists and engineers who hold a doctoral degree and are employed in academic institutions by position held, rank, and demographic characteristics. NSF reported a total of 15,350 doctoral scientists in the health field employed in educational institutions in 2006.[20] However, the data lack the specificity needed to determine the number of faculty scientists within the health field who teach in public health programs.

For this initial effort, faculty and students are not included in the analysis because the case definition specifies public health professionals practicing in governmental settings. However, future efforts to enumerate students would be helpful in forecasting worker supply. If faculty were to be counted in future enumeration, a stakeholder consensus should determine whether all faculty count as public health workers, regardless of tenure status, full-time or adjunct, teaching or research.

Public Health Workers in Private Settings

Workers often perform public health functions in private settings (e.g., health promotion employees in large business organizations, food safety inspectors in food processing plants, and environmental health workers in engineering and other organizations). They are not included in the case definition because they work outside of governmental public health. These workers might be counted as members of professional societies and be recognized as public health workers in that way, but most likely, they are included in the employment numbers reported by their employer. They are a group that is difficult to quantify and to characterize, although they provide substantial service to the nation's health. BLS data likely capture these workers, but this data source lacks enough specificity to determine what proportion has a public health job function.

Medicaid Workers

Workers providing Medicaid services are not included in the case definition because how this segment of the workforce relates to the governmental public health workforce is unknown. Medicaid workers who are state health department employees might be included in ASTHO's survey counts; however, the number of Medicaid workers cannot be separated from other health department workers.

School Health Workers

Public health workers in schools are not captured in the case definition for this project. However, obtaining a crude estimate of the number of school health workers by using BLS data reported for the elementary and secondary schools industry might be possible. For example, 7,000 community and social service specialists, 51,520 registered nurses (RNs), and 580 health educators were reported as being employed in elementary and secondary schools in May 2010, although the specific job function of these workers is unknown. HRSA's National Sample Survey of Registered Nurses (NSSRN) estimated 73,697 nurses employed in school health service settings in 2008.[21]The proportion of those employed by the school district and those by public health departments is unknown, but school health nurses providing public health services employed by local health departments probably are included in the NACCHO data. A partnership with the National Association of School Nurses will benefit efforts to refine an enumeration estimate further and characterize this segment of the workforce.

Public Health Workers Providing Clinical and Population Health Services

Public health workers who provide population health and, in certain cases, direct clinical services, in nongovernmental organizations, health care, and private organizations are an important segment of the workforce. These workers are not included in our case definition because they are not part of the governmental public health workforce. The American College of Preventive Medicine (ACPM) estimated that 50 preventive medicine physicians worked in community health centers in 2007; 128 worked in health care systems or plans; and ≥1,100 worked in occupational health. The 2008 NSSRN estimated that 8,584 RNs were working in a community mental health organization or clinic; 2,109 were working in a substance abuse center or clinic; 21,199 were working in a nonhospital community setting; 8,384 were working in governmental and nongovernmental occupational health settings; and 10,186 were working in community health centers. Data sources for additional public health occupations working in these types of settings have not been identified.[22]

Tribal Public Health Workers

Because of the lack of available data sources, the project team made no separate assessment of the tribal public health workforce by occupational classifications. On two occasions, members of the project team reached out to representatives of the National Indian Health Board (NIHB), but did not receive responses. BLS includes tribal agencies in the scope of the Occupational Employment Statistics, but they are treated as local governments. Future design changes in the BLS data collection system might allow for these agencies to be distinguished from other local government agencies. To pursue this strategy for collecting tribal public health data, a formal request and justification will need to be forwarded to BLS officials for consideration (George Stamas, Bureau of Labor Statistics, personal communication to Angela Beck, February 28, 2011).

A limited number of data sources provide information regarding tribal public health workers. As a DHHS agency, the Indian Health Service's (IHS) employees are included in the federal workforce count, but workers employed by tribal health agencies are considerably more difficult

to enumerate. The Association of State and Territorial Public Health Nutrition Directors (ASTPHND) was successful in collecting data regarding the number of tribal public health nutritionists in 2007, which they estimated at 188. BLS data capture tribal health worker information as part of the local government industry; however, separating those numbers requires formal approval and assistance from BLS officials.

The most promising data come from NIHB, which released a health profile report in 2010 that provided information about the workforce. Forty-two percent (145/346) of tribal health organizations completed the survey. A total number of workers was not reported; however, NIHB reports that 54% of tribal health organizations have <50 employees; 27% of organizations have 50–99 employees; 9% of organizations have 100–199 employees; and 10% of organizations have ≥200 employees.[23]

The organizations also reported the types of occupations they employ. Seventy-five percent or more of organizations employ health program managers (95.5%), registered nurses (85.7%), administrative/clerical personnel (82.1%), and behavioral health professionals (77.7%). Approximately 50%–74% of tribal health organizations employ physicians (69.6%), nurse practitioners/physician assistants (65.2%), community health representatives (60.7%), dentists (55.4%), and nutritionists/dieticians (53.6%). Fewer than 50% of organizations employ information systems specialists (49.1%), health educators (46.4%), emergency preparedness staff (32.1%), environmental health specialists (29.5%), traditional healers (14.3%), alternative medicine personnel (10.7%), and epidemiologists/statisticians (6.3%).[23] These data provide useful information on the profile of the tribal public health workforce, but additional enumeration data would be valuable. NIHB should be included as a stakeholder in workforce enumeration and surveillance efforts.

Volunteer Public Health Workers

Workers who volunteer their time to provide public health services are not included in the case definition, which is limited to paid workers in governmental agencies. One example of volunteer public health workers is local boards of health members, who are surveyed periodically by the National Association of Local Boards of Health.

Public Health Workers Included in the Case Definition Who Are Undercounted or Not Counted

Gaps in data collection include the limited information about the tribal public health workforce (additional data sources should be identified) and the lack of data on multiple occupations in all industries. Overall, the biggest challenge with enumerating the public health workforce by using existing data sources is filtering out those who are not public health workers in the BLS data and reconciling discrepancies in counts from different sources to determine where workers are undercounted, overcounted, and double-counted.

Federal Noncivilian Employees

OPM provides data for civilian employees only, and members of the U.S. Public Health Service Commissioned Corps are not included in those numbers. A publicly available data source has not been identified that can provide this information, but individual agencies might have this personnel data. However, access to those data will need to be requested by federal employees with approval to do so.

Contract Employees

Contract employees working for state and local governments are captured in both ASTHO and NACCHO profile surveys and cannot be distinguished from employees. The proportion of contract employees working in state health departments can be determined; however, contract employees working in local health departments cannot be disaggregated from the total number of workers.

The main source of federal workforce data — OPM's Federal Employment Statistics — does not include contractual employees. BLS uses OPM data for the federal workforce only; thus, it does not provide data regarding contract employees through the federal government industry code. BLS reports contractor numbers through their home organization (i.e., a Northrup Grumman contractor working at CDC in a public health capacity is reported and counted as a Northrup Grumman employee and therefore not classified in the BLS system as a public health professional or working in federal government). Other researchers have learned that, when working with personnel and reporting systems, distinguishing the functions of individual contract employees is extremely difficult (Carol Gotway Crawford, CDC, personal communication to Susan Webb, April 2011).

State and Local Governmental Public Health Workers

The ASTHO survey garnered a 92% response rate in 2010, and the NACCHO survey achieved an 82% response rate. Although these surveys successfully collect data from a substantial proportion of health departments, the number of workers at nonresponding health departments is unknown. NACCHO produces weighted estimates to account for nonresponse; ASTHO reports data from respondents only.

Environmental Health Workers and Sanitarians

Information about environmental public health workers within state and local health departments is captured in the ASTHO and NACCHO surveys. However, scores of environmental health workers perform public health services in different settings from the U.S. Environmental Protection Agency (EPA) to private industry. Their numbers and characteristics are therefore difficult to determine. The National Environmental Health Association (NEHA) is working on this problem but does not have reliable workforce data to report.

Laboratory Workers

ASTHO collects data regarding public health laboratory workers; however, these workers can be employed in governmental agencies that are not traditional public health departments (e.g., environmental or agricultural laboratories), which are not included in ASTHO's survey. BLS might provide selected information because it reports all laboratory workers within local, state, and federal government; however, we do not know how many are public health workers. APHL conducted a survey in 2011 to determine the number of laboratory workers employed in public health, environmental, and agricultural laboratories. Although this survey likely provides the closest approximation of the number of laboratory workers included in our project case definition, the number is an undercount of the workforce because of the 78% response rate achieved in this survey.

Public Health Workers Who Are Overcounted or Double-Counted

District of Columbia Health Department Workers

Both ASTHO and NACCHO include the District of Columbia in their profile surveys. Therefore, their workforce numbers are reported as being in both state and local health departments. Excluding data from the District of Columbia in either survey is possible, which would rectify this problem.

Federal Civilian Employees

The information provided in this report includes enumeration figures for the entire DHHS and EPA workforce. Consensus is needed regarding whether all of these agencies should be included in a public health workforce enumeration. In terms of specific job categories, public health nurses and physicians are overcounted heavily in the federal workforce numbers because no way exists to distinguish the proportion of these clinicians in the public health workforce. Overall, federal civilian employees are being counted in this report by virtue of where they are employed, rather than by their job function, which is impossible to determine from publicly available data sets.

Defining the Public Health Workforce for Long-Term Activities

The case definition developed for this project represents the first phase of a public health workforce enumeration strategy that will be enhanced and expanded as data sources become more refined and readily available. By starting the project with a focus on a core public health workforce for whom data can be identified, we can better hone a methodology for ongoing workforce enumeration and surveillance. Figure 2 depicts how the project case definition might be enhanced through multiple phases.

Figure 2. Possible phases of expansion of the public health workforce case definition

Phase IV:
Volunteer and
School-Based Workers

Phase III:
Tribal Public Health
Workers; Workers in Private
Agencies and Health Care Systems

Phase II:
Missed Governmental
Workers; Community Health
Workers; Public Health Faculty/
Students; Expanded Occupations

Phase I:
Core Workers
(Governmental
Public Health)
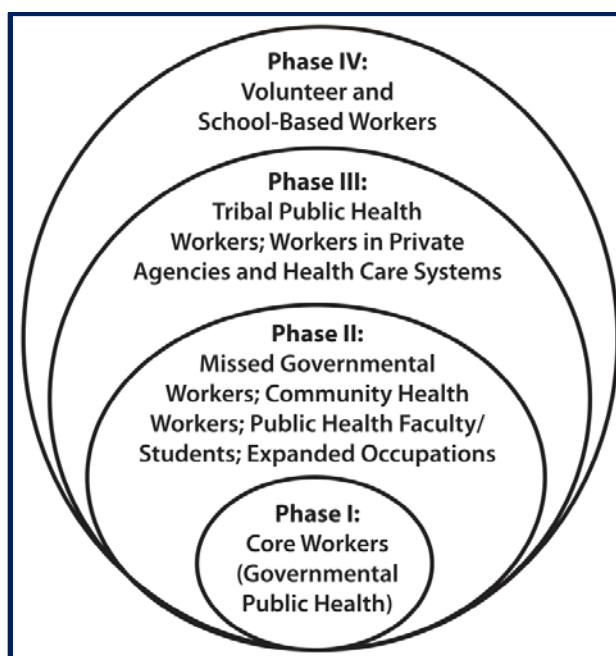
Phase I

The first phase of the public health workforce case definition includes workers in the occupational categories previously described who are employed in governmental agencies. This represents the core workforce for enumeration and surveillance.

Phase II

After the workers included in Phase I are counted and monitored effectively, the case definition should be expanded to focus on governmental workers for whom no workforce data source exists, CHWs employed in nongovernmental organizations, and public health faculty and students. Limited data sources exist that can help enumerate CHWs and public health faculty and students, although they might need to be refined to include workers whose data are not currently captured. In addition, the list of occupations developed for the Phase I case definition should be reviewed and expanded to include workers who have been excluded or grouped under other public health professionals. Examples include clinical, counseling, and school psychologists, marriage and family therapists, public health optometrists, and health economists, among others.

Phase III

The third phase of the case definition might include tribal public health workers and public health workers in private agencies and the health care system. Data specific to public health workers in these industries are extremely limited; therefore, much of the work during this phase should focus on modifying existing data sources to target a broader population or development of new data collection instruments to capture primary data.

Phase IV

Finally, the broadest phase of the case definition might capture the remaining sectors of the public health workforce that are more difficult to identify. Examples include volunteer workers (e.g., CHWs not employed by an agency or organization, local boards of health members, and public health workers in schools). Data are also limited regarding these groups, and researchers are unable to determine how many are specifically involved in the delivery of public health services. The Phase IV case definition might be expanded further to capture additional public health workforce sectors.

DATA SOURCES FOR ESTIMATING WORKFORCE SUPPLY

A total of 15 potential data sources derived from workforce surveys were identified and evaluated. Appendix Table 2 provides a summary of data elements used in 10 of the surveys. A general description of each data source follows. In addition, each of the top 10 data sources was assigned a qualitative rating of poor, fair, or good for four data quality and usability indicators, as follows:

1. **Validity** — the extent to which the data source accurately enumerates the public health workforce.
2. **Reliability** — the extent to which the data source provides consistent measures of the public health workforce across time.
3. **Frequency —** how often the data source collects public health workforce information.
4. **Accessibility —** the extent to which data are available for public use.

The following sections describe the data sources grouped by category and reflecting overall usability for future enumeration and SLS efforts.

Data Sources Available for Immediate Use

ASTHO Profile Survey (2010)

ASTHO surveys state and territorial health departments to collect information about their health agency responsibilities, structure, planning, quality-improvement activities, and workforce. The most recent survey occurred in 2010 and collected data regarding the number of full-time, part-time, and FTE and contract workers in the 15 public health occupations used in the project case definition. ASTHO provides detailed information about the state-employed public health workforce, although other professional organizations (e.g., ASTPHND, CSTE, and APHL) might have more comprehensive state-level workforce data for their respective occupations.

Data Collection Methods. The Internet-based profile survey was sent by e-mail to the senior deputy in each state and territorial public health agency. ASTHO staff followed up with nonresponding states through e-mail and telephone calls to encourage responses.

Useful Features. Strengths of the ASTHO profile survey include the following:

- The 2010 profile was completed by 50 states, as well as the District of Columbia, and two territories. Thus, the survey attained a 100% response rate among states and a 92% response rate among all entities that had the opportunity to respond to the survey.
- Salary information is provided.
- The number of regular employees, full- and part-time, versus number of contract employees can be determined.
- Factors related to shortage and demand are collected, including employees' age, turnover rate, and number of vacant positions.
- Definitions for each occupation are provided.
- Occupations closely match those included in the NACCHO profile survey.
- This data set is likely the best source of state-level public health workforce data for selected occupations, particularly those that do not benefit from assessments from other professional associations.

Limitations. The following limitations should be considered when using these data for enumeration purposes:

- The survey population is limited to those employed in state or territorial health agencies.
- Demographic information and education and professional training characteristics of the workforce are not collected.
- The profile uses occupational classification (i.e., job title) to count workers, possibly miscounting workers who perform other functions (e.g., a nurse who functions as an epidemiologist).
- The survey asks administrators to assess shortage level qualitatively for each occupation, which might be a source of bias in the study.
- Approximately 46% of the state and territorial health department workforce is grouped as other public health professionals/uncategorized public health workers either because of missing data or being employed in an occupation not selected for data collection in the profile survey.
- The workforce data might undercount public health workers if the list of occupations is not exhaustive.
- Not all states provided data for each occupational category, leading to an undercount of public health workers by occupation; the number of respondents ranged from 23 to 45 states for each occupation question. Only one U.S. territory provided workforce data.
- Continued administration of this survey and analysis of data gathered are dependent upon availability of foundation and federal funding.

Overall Usability. The project team rates the ASTHO profile survey as follows:

Validity — Fair. Workforce data are provided by the human resources director at each state or territorial health agency; therefore, the counts provided by the health departments probably are an accurate enumeration of their workforce. However, as the limitations note, the results might

undercount workers whose occupation is not listed in the survey, and workers might be misclassified if their job title and function are not the same. Qualitative assessments (e.g., workforce shortage assessments) might vary between state agencies, depending on which state official completed that section of the survey.

Reliability — Fair. Payroll and other human resources data should be able to provide replicable counts of state and territorial public health workers; however, the total number of state public health workers appears to be a crude approximation, and approximately half of the workforce is not described by occupational categories.

Frequency — Fair. ASTHO conducts profile studies at approximately 3-year intervals. Studies are timed to coincide with NACCHO profile studies.

Accessibility — Good. Data are publicly available for research within approximately 1 year of data collection; a data use agreement is required.

NACCHO National Profile of Local Health Departments (2010)

NACCHO's national profiles of local health departments began in 1989–1990. With funding support from CDC and RWJF, NACCHO has conducted 6 profile studies, the most recent of which was conducted in 2010. Workforce questions are among the seven core topics, collecting data regarding the total number of FTEs employed and contracted in 13 of the 15 case definition occupations, including an Other category, in all county and city health departments nationwide. NACCHO does not collect data on public health laboratorians or public health dentists.

Data Collection Methods. The profile questionnaire was disseminated by NACCHO staff through an e-mail sent to the top agency executive or designee of every local health department among the study population. The e-mail included a link to the Internet-based questionnaire, which was preloaded with identifying information for each local health department. Paper copies of questionnaires were provided upon request. NACCHO staff and a national group of profile study advocates made extensive efforts to encourage a high response rate. The District of Columbia's health department was counted as a local health department; Hawaii and Rhode Island were excluded from the study because the state health department provides all public health services and no substate units exist.[14] All local health departments received the core questionnaire. In addition, a stratified random sample of 625 health departments also received a module that included additional workforce and human resources questions.[14]

Useful Features. NACCHO's profile study has strengths that make it a useful data source in a national public health workforce enumeration, as follows:

- The study's 82% response rate (2,107/2,565 local health departments) provides a substantial sample of health departments.
- Definitions for each occupation are provided.
- The occupations included in the questionnaire are similar to those included in ASTHO's survey, allowing comparative and trend analyses.

- The profile provides the most comprehensive count of local health department workers of any national data source.

Limitations. Limitations to consider if using this data source in a national enumeration include the following:

- The survey population is limited to workers.
- The list of occupations is not comprehensive, with approximately 29% (45,690/160,000) of local health department workers not being categorized in any occupation either because of missing data or because of being employed in an occupation not selected for data collection.
- Contract workers are not distinguished from health department employees.
- The profile does not collect years of public health experience or educational and training characteristics of the workforce.
- The profile uses occupational classification (i.e., job title) to count workers, possibly miscounting workers who perform other functions (e.g., a nurse who functions as an epidemiologist).
- The profile study is supported heavily by foundation funds, making long-term use of this data source subject to the availability of funds.
- Not all local health departments participate in the profile study.
- The enumeration results are weighted estimates, but 95% confidence intervals are provided.

Overall Usability. The project team rates the NACCHO national profile of local health departments as follows:

Validity — Fair. Local health department administrators complete the questionnaire; therefore, the profile study probably provides an accurate count of local health department workers overall and for the 13 specified occupations in the responding jurisdictions. However, given the limitations of the data, researchers should be cautious in interpreting size and composition of the national local public health workforce from profile results.

Reliability — Fair. Workforce data typically are generated from human resources occupational data in each health department and therefore should be reliable, but weighted estimates are used for worker counts, potentially affecting estimate precision. Weight methodology has been modified by NACCHO for the 2010 survey; therefore, caution should be used when analyzing the data longitudinally.

Frequency — Fair. NACCHO has conducted profile studies at approximately 3-year intervals, which might be frequent enough to serve as a primary data source in a national enumeration or workforce SLS.

Accessibility — Good. Data are publicly available for research within 1 year of data collection; a data use agreement is required.

OPM Federal Employment Statistics (2011)

OPM publishes federal employment statistics acquired from the Central Personnel Data File (CPDF). The data provide employment trends, demographic profiles, and retirement statistics for all federal civilian employees. Approximately 100 different variables are collected on each employee. This report uses employment data from all DHHS agencies, EPA, and the U.S. Department of Agriculture (USDA).

Data Collection Methods. According to OPM, two central human resources databases are maintained, CPDF and the Enterprise Human Resources Integration. Data before and including the 2009 fiscal year come from CPDF, and after fiscal year 2009, from the Enterprise Human Resources Integration. Production data typically are released every quarter. Status data (cross-sections; used for total employment aggregates) are available 1–2 months after the end of each quarter. Dynamics data (all personnel actions; used for hiring numbers, retirement figures, and so forth) require more time, approximately 4 months from the end of the quarter, to become production data.[24]

Useful Features. OPM's federal employment data provide the following useful characteristics:

- The data source provides information for all federal civilian employees.
- OPM uses two occupational classifications that might be specifically relevant to public health workers: Public Health Educator and Public Health Program Specialist.
- The data are specific to DHHS agencies, EPA, and USDA, all of which employ public health workers.
- The data allow researchers to search for occupation, length of service, and other variables.
- The data provide comprehensive demographic information about employees.
- The data are published quarterly and easily accessible through the FedScope Internet site (available at: http://www.fedscope.opm.gov/).

Limitations. Although OPM provides extensive data about the federal civilian workforce, the following data limitations should be considered:

- The majority of the occupations used by OPM include both public health and non–public health workers.
- The occupational classifications of workers might not accurately reflect their job functions.
- U.S. Public Health Service and other noncivilian federal public health workers are not included in the statistics.
- Federal contractors, who are believed to compose a substantial portion of the federal public health workforce, are not included in OPM's data.

Overall Usability. The project team rates OPM's federal employment data as follows:

Validity — Fair. Because the data are derived from a standardized DHHS human resources management system, the data should accurately account for the number of workers in each DHHS agency by occupational series; however, the occupational classifications used by OPM rarely are specific enough to be used for a national public health enumeration or workforce SLS.

Reliability — Good. Assuming that OPM's data source provides consistent results is reasonable. OPM uses a standardized methodology for collecting and reporting human resources data. The only potential reliability concern is whether occupational classifications are redefined or otherwise modified across time, thus producing different estimates.

Frequency — Good. Data are collected continually and published quarterly.

Accessibility — Good. Data are released quarterly and easily accessible at http://www.fedscope.opm.gov/.

CDC Personnel Data

As a federal government agency, CDC collects its own personnel data, which can be useful in an enumeration of federal public health workers because the data might provide more specificity related to job function than what is available through OPM.

Data Collection Methods. Exact data collection methods are not known publicly, although internal human resources or payroll information probably is used to generate workforce data.

Useful Features. For those who can access CDC's internal personnel data, this source has certain strengths, as follows:

- The data include demographic characteristics, education level, retirement eligibility, and years of government service for all federal employees.
- The data include Commissioned Corps staff, who are not included in OPM data sets.

Limitations. CDC's internal personnel data have certain limitations.

- Classification of workers is based on job titles, not public health function.
- Job classifications do not correspond easily to public health job titles used in previous enumeration efforts.
- Accessing the data is difficult because they are not available for public research.

Overall Usability. The project team rates CDC's internal personnel data as follows:

Validity — Unknown. Data are assumed to be highly valid, however.

Reliability — Unknown. Data are assumed to be highly reliable.

Frequency — Good. Human resources/workforce data are collected continually.

Accessibility — Poor. External researchers cannot access CDC personnel data; internal personnel might have difficulty accessing data as well.

Data Sources with Potential for Future Use — Additional Research Required

Data sources included in this category either have the potential to be modified and used as continuous data sources as part of an SLS, or they provide valuable examples of survey and data collection methods that should be explored further when developing and implementing public health workforce enumeration and surveillance plans.

BLS Occupational Employment Statistics and Current Population Survey Data

According to Stamas and Wiatrowski,[25] BLS is the nation's principal fact-finding agency in regard to labor economics. BLS provides data regarding employment, compensation, and productivity for all industries and occupations and specifically for certain health-related industries and professions. BLS uses SOCs to categorize workers and produces occupational employment and wage estimates for >450 industry classifications at the national level. The industry classifications correspond to the sector 3, 4, and 5-digit North American Industry Classification System (NAICS) groups.

BLS workforce data come from two different sources — business surveys and household surveys. The majority of BLS data come from business surveys, including employment, hours, and earnings data by industry, state, and area; occupational employment and wage data by industry, state, and area; and occupational wage and benefit data by industry and area. Surveys of businesses provide accurate information on numbers of employees and wage levels. Business surveys are less successful at providing demographic details about their workforce. In contrast, surveys of households provide rich demographic detail, including age, sex, race/ethnicity, marital status, educational attainment, and other characteristics, but often provide less-precise details about industry, occupation, and wage level.

Data Collection Methods. According to the BLS[26] Current Population Survey (CPS), methods are as follows: CPS collects information on the labor force status of the civilian noninstitutionalized population aged ≥15 years, although labor force estimates are reported only for those aged ≥16 years. Persons on active duty in the U.S. armed forces are excluded from coverage. CPS is collected monthly from a probability sample of approximately 60,000 households. Respondents are assured that all information obtained is completely confidential and is used only for the purpose of statistical analysis. The survey is conducted on a voluntary basis and refusals to participate amount only to approximately 4% each month. (Another 3%–4% of eligible households are not interviewed because of other failures to make contact.)

Occupational Employment Statistics (OES) methods are as follows: The OES program conducts a semi-annual U.S. Postal Service mail survey designed to produce estimates of employment and wages for specific occupations. The OES program collects data regarding wage and salary workers in nonfarm establishments to produce employment and wage estimates for approximately 800 occupations. Data from self-employed persons are not collected and are not included in the estimates. The OES program produces these occupational estimates by geographic area, industry, and ownership.

The OES program surveys approximately 200,000 establishments per panel (every 6 months), taking 3 years to collect the sample of 1.2 million establishments fully. To reduce respondent burden, the collection is on a 3-year survey cycle that ensures that establishments are surveyed at most once every 3 years. The estimates for occupations in nonfarm establishments are based on OES data collected for the reference months of May and November.[27]

Note: Federal employee data reported by BLS comes from OPM. See the OPM section for information on data collection methods, strengths, and limitations.

Useful Features. BLS has promising features that make it an ideal system on which to base a workforce SLS in the future if changes were made to collect more data specific to public health workers.

- The data provide comprehensive employment and wage data for a considerable number of occupations.
- Data are collected regularly; therefore, national enumeration efforts can be enhanced by using more public health-specific SOC and NAICS statistics.
- Certain public health occupations (e.g., epidemiologists and health educators) have their own SOCs; therefore, strong data exist for those occupations.
- BLS is in the process of collecting data for CHWs, a group of public health workers that is difficult to enumerate.
- BLS includes data from tribal organizations in the local government industry code; it might be possible to separate those organizations out and report them separately; further work with BLS is needed.
- BLS is willing to work with the profession to modify data collection, if possible, to add classifications, and to consider analyses as requested.

Limitations. BLS data alone will not produce an accurate enumeration of the public health workforce for the following reasons:

- SOCs are specific to a limited number of public health workers only; public health workers are grouped in with other workers with the same job title and cannot be disaggregated.
- NAICS needs 5-digit codes to identify governmental agencies and departments. Our project case definition limits industries to federal, state, and local government, tribal health workers, and colleges and universities. Use of BLS data might lead to overcounting public health workers.
- Adoption of consistent classifications and job titles by reporting sectors is needed to improve accuracy of data.

Overall Usability. The project team rates the BLS Occupational Employment Statistics and CPS data as follows:

Validity — Poor. BLS data are too general to apply to public health workers, with the exception of a limited number of occupational classifications. Changes to SOCs and NAICS that might allow for greater specificity of the data can make this a promising data source, however.

Reliability — Good. BLS has been collecting data for years by using a standardized methodology. The concern is not that the counts are not replicable or reliable; rather, separating public health workers from non–public health workers is impossible.

Frequency — Good. Data are collected through a 3-year survey cycle.

Accessibility — Good. All data are available at: http://www.bls.gov.

American Community Survey (2009)

The American Community Survey (ACS) is a monthly survey conducted by the U.S. Census Bureau. ACS consists of 25 housing and 42 population questions that range from housing size and cost, demographic information, educational attainment, work status, employer, industry, occupation, and income, among other factors. Each year, >3 million housing units and group quarters (e.g., college residence halls, residential treatment centers, group homes, and military barracks) throughout the United States and Puerto Rico complete ACS questionnaires. The sampling frame is derived from the master address file maintained by the U.S. Census Bureau.[28]

Data Collection Methods. Data collection for housing units consists of mailed surveys, telephone surveys, and personal visits. First, housing units receive a questionnaire mailed to the sample address; if no response is received, the Census Bureau follows up with a computer-assisted telephone interview. Addressees who do not respond to mail or telephone requests might be selected for computer-assisted personal interviewing with a Census Bureau field representative. Among the sample addresses eligible for interview in 2007, approximately 47% were interviewed by mail, 10% by telephone, and 41% by personal interview. Two percent were not interviewed. To survey group quarters, Census Bureau field representatives conduct interviews with the facility contact person or administrator, as well as a sample of persons residing in the facility. The U.S. Department of Commerce has stated that completion of ACS is a legal requirement for residents, although the agency does not enforce completion.

Useful Features. ACS has certain unique and useful characteristics.

- Using multiple methods of data collection ensures a high response rate of approximately 98%.
- ACS collects extensive individual-level information regarding U.S. residents, including demographic and employment information.
- ACS uses the same industry codes and standard occupational classifications used by BLS, making comparability of the surveys possible.
- ACS surveys a substantial number of residents.
- ACS might provide selected information on public health workers, but those data might be difficult to disaggregate from the rest.

Limitations. The following data limitations should be considered when using ACS data:

- Industry codes and standard occupational classifications are not specific enough to provide detailed data about public health workers.

- The survey captures occupation, but not job function.
- Respondents might report a different occupation or job title than their employer reports through BLS surveys, making comparability a challenge.
- Although the response rate is high, bias is inherent in collecting data through mailed surveys and telephone or in-person interviews. Mailed questionnaires are less likely to incur response bias, which can be greater in telephone and in-person interviews when questions capture sensitive personal information and interaction with a government official is required.

Overall Usability. The project team rates the ACS data as follows:

Validity — Poor. Data are self-reported, and knowing whether data reported from housing units are accurately characterizing public health workers is difficult. The data source lacks sufficient specificity to enumerate public health workers. As previously noted, discrepancies might exist in how respondents report their occupation and how employers report occupational titles.

Reliability — Fair. Data are collected frequently through a standardized system by using a consistent methodology. The extent to which public health workforce data are consistently collected is unknown because of the concerns regarding data validity.

Frequency — Good. Surveys are conducted monthly; data regarding >3 million housing units are available yearly.

Accessibility — Good. Data are publically available from the U.S. Census Bureau at http://www.census.gov/acs/www/.

APHL National Laboratory Workforce Capacity Assessment Data (2011)

APHL developed organizational-level and individual-level survey instruments with the help of the University of Michigan's Center of Excellence in Public Health Workforce Studies in 2010. The individual-level survey was fielded in April 2011 and the organizational-level survey in July 2011. The surveys provide comprehensive data about the public health, environmental, and agricultural laboratories and are a valuable source to consider when enumerating laboratorians.

Data Collection Methods. APHL disseminated the Internet-based survey through an e-mail to laboratory directors. The directors or their designees were responsible for completing the organizational-level survey and for forwarding the individual-level survey to laboratorians employed by the state laboratory for completion. APHL promoted the survey at their annual meeting and made follow-up telephone calls to laboratory directors to improve the response rate for the organizational-level survey. The organizational-level survey achieved a 78% response rate; the individual-level survey collected data from 1,942 laboratorians (35% response rate).

Useful Features. APHL survey data include the following useful features:

- The survey captures data from laboratories with public health functions that are not captured in ASTHO data (e.g., agricultural and environmental laboratories).

- The data provide comprehensive information about demographic, educational, competency, and training characteristics of the workforce collected at an individual level.
- The survey collects information about program areas of individual laboratorians down to 0.25 FTE.
- The results enumerate scientific laboratory staff by job title, as well as administrative support staff and information technology/informatics staff.
- Organizational-level data provide the first assessments of laboratory capacity.
- The organizational-level survey had received responses from 78% (78/103) of sampled public health, environmental, and agricultural laboratories.

Limitations. Users of AHPL survey data should consider the following limitations:

- The individual-level survey garnered only a 35% response rate.
- Whether laboratories and laboratorians who chose not to respond to the survey are different from those who responded is unknown.
- Not all agricultural laboratories are performing public health functions, although the majority are involved to a degree with food regulatory activities. Determining which laboratories are primarily responsible for public health activities from the survey results might be possible, although not with absolute certainty.

Overall Usability. The project team rates the APHL survey data as follows:

Validity — Fair. APHL works closely with laboratory directors, who complete the organizational-level survey on behalf of their laboratory as well as complete and distribute the individual-level survey to ensure that the correct staff are receiving it. The employment data provided by the laboratories is generated through human resources and payroll information; therefore, they probably are accounting for all laboratory staff employed in their department accurately.

Reliability — Fair. The surveys were accompanied by thorough instructions outlining how to define, categorize, and count workers. APHL staff followed up with the majority of laboratories directly to ensure that laboratory directors understood how to complete the assessment and that workers were being categorized and counted consistently across laboratories.

Frequency — Poor. The first national assessment occurred in 2011; whether funding will permit future surveys to be conducted is unclear.

Accessibility — Fair. The University of Michigan's Center of Excellence in Public Health Workforce Studies has access to the primary data set, although no plans are in place to make data accessible to other external researchers.

CSTE National Assessment of Epidemiology Capacity Data (2009)

CSTE conducted the first of a series of five Epidemiology Capacity Assessments (ECAs) in 2001. ECAs assess epidemiologic capacity of state and territorial health departments in

providing the 10 Essential Public Health Services and in eight program areas — bioterrorism/emergency response, chronic diseases, environmental health, infectious diseases, injury, maternal and child health, occupational health, and oral health. Assessment questions focus on enumerating and describing the public health epidemiology workforce, funding, training, and ability to provide essential services. A new module was added in 2009 to assess status of implementation of important technologies that enhance surveillance capacity.[29,30]

Data Collection Methods. The 2009 ECA used core questions from the previous three ECAs. CSTE staff disseminated individual- and organizational-level surveys, both Internet-based, to state epidemiologists by e-mail. They followed up with telephone calls and e-mails to improve the response rate. A markedly abbreviated form of the ECA was administered in 2010 that focused on state and local epidemiologist enumeration and characterized the impact of cuts to epidemiology programs secondary to shortfalls in state budgets.

Useful Features. ECAs include the following useful characteristics:

- This data set provides the most comprehensive enumeration and profile of the state-level epidemiology workforce.
- CSTE classifies all workers serving an epidemiology function as epidemiologists, whereas the majority of surveys count FTEs according to job title.
- Assessment includes education, training, and competency characteristics of the epidemiology workforce.
- All 50 states and the District of Columbia completed the organizational-level survey.
- CSTE has approximately 10 years of workforce data extending from 2001 through 2010, with a 100% response rate for state participation (organizational survey) in the 2004, 2006, 2009, and 2010 surveys.

Limitations. The following limitations to the ECA data apply:

- Much of the workforce data in the 2009 assessment relied on individual-level surveys, which garnered only a 70% response rate from individual epidemiologists (although 100% from states on the organizational survey).
- The survey population is limited to epidemiologists working in state health departments.
- The attempted enumeration of local epidemiologists in 2010 was derived by asking for an estimate from the state epidemiologist.

Overall Usability. The project team rates the ECA data as follows:

Validity — Fair. Given the multiple iterations of ECA and the inclusion of a definition for an epidemiologist, survey results probably are capturing the numbers accurately. However, the 2009 assessment collected data at the individual-level to enumerate epidemiologists, but captured only 70% of the ones employed in state health departments. Also, because of the definitional differences, CSTE data probably count more workers as epidemiologists than such data sets as BLS.

Reliability — Fair. Changes in methodology in distributing the ECA in 2009 resulted in an enumeration of epidemiologists that was inconsistent with numbers from previous years. Inferences then were made from the individual-level results to characterize the whole epidemiology workforce. However, evidence exists that epidemiologists trained at the master's level or higher were more likely to complete the individual-level survey than those who were not; therefore, caution is needed when making assumptions about the general workforce from these findings.

Frequency — Good. CSTE routinely surveys the epidemiology workforce employed in state health departments every 2–3 years.

Accessibility — Fair. The University of Michigan's Center of Excellence in Public Health Workforce Studies has access to primary data for CSTE ECAs; however, CSTE requires data use agreements, and no plans have been made to release data to other external researchers despite requests for such.

NSSRN Data (2008)

HRSA conducts NSSRN every 4 years, which provides the basis for evaluating trends, availability, and future supply of nursing resources. It is the principal data source used for providing nursing workforce information to the federal government, researchers, and the public and allows supply-demand projections to be calculated.[21]

Data Collection Methods. During 2008, an Internet-based survey was distributed by e-mail to 55,151 randomly selected RNs identified through state records who held an active license as of March 10, 2008. Those who did not respond by Internet were sent the survey by mail; those who did not return the mailed survey were contacted by telephone. Missing data values were corrected by using imputation methods to reduce nonresponse. Sample weights were used to report the data.

Useful Features. NSSRN data provide the following useful features:

- Individual-level data were collected on 33,549 RNs during 2008.
- The survey is extremely comprehensive and collects data regarding demographics, education and training, licensure, job satisfaction, job function, employment type, agency type, salary, and reasons for leaving positions or changing jobs.
- Nurses working in state and local health departments can be identified.
- All data are easily accessible through HRSA.
- Sample design and data analysis methods address duplication problems (e.g., RNs licensed in multiple states).

Limitations. Certain limitations should be considered when using the NSSRN data.

- The survey garnered a 62.4% response rate.
- The data only include RNs; licensed practical nurses and other non-RNs who provide public health services are not captured in this survey.

- National estimates are weighted estimates, which can affect precision.
- Imputation of missing responses might affect precision of estimates.
- The category of Public/Community Health Nurse is a broad definition — potentially too broad for the case definition.
- An employment category for nurses working in nonclinical federal agencies appears to be missing.

Overall Usability. The project team rates the NSSRN data as follows:

Validity — Fair. Individual-level data collection and strong sampling and weighting methodology allow for national estimates to be projected from a stratified sample. Because the study population is identified from licensure data, a safe assumption is that those surveyed are, in fact, RNs. However, caution is needed when using data related to public/community health nurses, because the definition used for this category in the NSSRN is much broader than the scope of the project case definition, and the survey collects data regarding relatively few nurses who meet the case definition.

Reliability — Fair. Use of weighted estimates and imputation might result in biases in the data; the survey questions have been modified across the years; therefore, caution is required when analyzing data longitudinally.

Frequency — Fair. The survey has been conducted every 4 years, although whether future surveys will be conducted is unclear.

Accessibility — Good. Data are available from HRSA at http://datawarehouse.hrsa.gov/nssrn.aspx?layout=print.

ASTPHND Survey of the Public Health Nutrition Workforce Data (2007)

ASTPHND has completed a series of workforce surveys to identify trends among the public health nutrition workforce; determine capacity of the nutrition workforce in accomplishing program goals; identify training needs of Women, Infants, and Children (WIC) program personnel; measure qualifications of WIC staff; evaluate use of an Internet-based survey to collect data; and assist USDA and state public health agencies in planning and evaluating recruitment and retention efforts.[31]

Data Collection Methods. State and territorial public health nutrition directors, or their designees, completed the Internet-based survey, which was disseminated by ASTPHND.

Useful Features. The following useful features are provided by the ASTPHND data:

- The survey received responses from all states and garnered an 88% response rate from all nutrition positions overall.
- The data include detailed information for >10,000 public health nutrition workforce positions, including demographic information, agency type, job classifications, years of practice, salary information, funding sources, education and training, and distribution by state.

- The survey provides an example of data elements that might be useful in a national workforce SLS.
- The survey includes workers in different agency types, including governmental, tribal, nonprofit, and for-profit.

Limitations. ASTPHND data have the following limitations:

- Survey administrators struggled with which personnel to include in the survey; therefore, comparability across states might be problematic.
- Comparability of surveys (trend data) might be difficult to analyze because of use of different types of surveys and varied interpretation of definitions across states.
- Whether future enumerations or assessments will be completed is unclear.

Overall Usability. The project team rates the ASTPHND data as follows:

Validity — Fair. The data provide a detailed profile of the public health nutrition workforce. Despite the limitations noted, ASTPHND might be a useful source of data in a national enumeration.

Reliability — Fair. Whether the personnel included in the survey were consistent across states is unclear; therefore, reliability is a concern.

Frequency — Fair. Assessments have been conducted three times since 1985, but not at regular intervals.

Accessibility — Fair. A technical report of results is available, although no raw data files have been made publicly available to researchers.

ASPH Annual Data Report (2010)

ASPH is the national organization representing the deans, faculty, and students of the 48 accredited schools of public health in the United States, Puerto Rico, and Mexico. ASPH's principal purpose is to promote and improve the education and training of professional public health personnel. ASPH collects and compiles aggregate data related to applications, acceptances, new enrollments, students, and graduates in each school of public health. The information collected serves the schools and certain federal, state, and local agencies and private institutions in planning and implementing their respective public health training, research, and service activities.[18] ASPH also collects data regarding faculty, although these reports are available upon request only.[16]

Data Collection Methods. A designee of each school of public health reports data to ASPH.

Useful Features. The following two features of ASPH data are useful:

- The annual data report provides demographic and program area for students at each school of public health.

- Entrance and graduate trend data are detailed in each report.

Limitations. The following limitations of ASPH data should be considered:

- This data set undercounts faculty because, although public health schools are members of ASPH, public health programs are not.
- Program area categorizations are not always precise; variance occurs each year as a result of reclassification.
- Data do not report how many students enter the public health profession each year.
- Faculty data do not appear to be collected frequently and lack detail of tenure rank, program area, degree, and other characteristics.

Overall Usability. The project team rates the ASPH data as follows:

Validity — Fair. The data might capture the number of students in the public health pipeline accurately, but knowing how many will seek employment in public health practice is impossible, making the figures difficult to use for enumeration purposes. [**Reminder:** Faculty and students are excluded from the case definition used in this report.]

Reliability — Fair. ASPH acknowledges that categorization of program areas is difficult and changes often.

Frequency — Good. Data are collected annually from all ASPH-member schools of public health.

Accessibility — Fair. Technical reports of data are available online at http://www.asph.org/document.cfm?page=749, but raw data sets are not available for research purposes.

TRAIN Data

Twenty-three states use TRAIN as their official learning management system, but that number is increasing.

Data Collection Methods. Registrants are asked to complete basic demographic information (e.g., profession, age group, and sex). However, because these questions are optional, registrants might not answer them before using the system (available at: https://www.train.org/DesktopShell.aspx?tabid=1).

Useful Features. TRAIN data provide the following useful features:

- TRAIN is potentially the largest source of information on public health workers.
- TRAIN is the easiest system to modify to collect desired data.
- TRAIN might provide the most detailed information because it collects individual-level data.
- TRAIN classes can be matched against specific competencies.
- The system modifies users every 3 years to remove those not using the system.

- TRAIN is accessible by anyone who has Internet access, including workers in states that have not adopted TRAIN as their official learning management system.
- TRAIN has been expanded to include CDC employees.

Limitations. TRAIN data include the following limitations:

- TRAIN was not established as a surveillance system to collect information routinely; therefore, without specific efforts by users, TRAIN will not track changes in job titles or other data factors across time.
- No specific information is included about geographic areas served by workers.
- Potential exists for incomplete data because multiple questions are optional.
- Certain states do not participate in TRAIN.
- The system is voluntary.
- TRAIN includes limited representativeness of the public health workforce.

Overall Usability. The project team rates the TRAIN data as follows:

Validity — Fair. Duplicate and inactive users are culled out of TRAIN; however, this source is capturing only a limited portion of the workforce if all states are not actively using the system.

Reliability — Fair. Because TRAIN was not established as a surveillance system, user data are not updated without specific efforts by the user.

Frequency — Fair. TRAIN data are not derived from a survey collected on a periodic basis; it is an ongoing system.

Accessibility — Good. Researchers have fairly easy access to the data contained in TRAIN.

ACPM (2007)

ACPM presented data during a 2007 IOM testimony that provided estimates of physicians board-certified in preventive medicine in different settings.

Data Collection Methods. Estimates are based on extrapolation of ACPM membership profiles and survey of American Board of Preventive Medicine (ABPM) diplomates to total number of diplomates.

Useful Features. ACPM data provide the following useful features:

- ACPM data provide estimates of preventive medicine physicians employed in public health (federal, state, and local agencies), academe, and clinical and population health (community health centers, health care systems and plans, and occupational health).
- The data provide an overall estimate of how many public health physicians have formal training in public health or preventive medicine.

- Projects' need for preventive medicine physicians are identified in each setting on the basis of the ACPM database and extrapolation of surveys of federal, state, and local health agencies.
- ACPM provides example occupations or roles that preventive medicine physicians might provide in each setting.

Limitations. The following limitations should be considered when using ACPM data:

- Information is limited regarding survey methodology and analysis procedures used to generate estimates.
- ACPM membership and ABPM diplomate status do not necessarily imply active service in the public health workforce; the estimates might overcount how many physicians are in the public health workforce.
- Not all preventive medicine physicians are members of ACPM; therefore, certain segments of the workforce are undercounted.
- The data are limited to information regarding preventive medicine physicians only; not all public health physicians have preventive medicine training.
- The data do not distinguish how many preventive medicine physicians are trained in public health or general preventive medicine, occupational health, or aerospace medicine.

Overall Usability. The project team rates the ACPM data as follows:

Validity — Fair. The data probably are capturing preventive medicine physicians; however, without additional information about survey methodology and extrapolation procedures used, assessing whether accurate estimates are being provided is difficult.

Reliability — Unknown. Survey methodology is unknown.

Frequency — Fair. Although data do not appear to be produced on a consistent basis, potential exists to access membership profile data frequently with ACPM's permission or to request that the organization report data more frequently.

Accessibility — Poor. Raw data sets are unavailable for research purposes; limited data appear in the paper documenting ACPM's testimony to IOM.

Data Sources Not Recommended for Enumeration/Workforce Surveillance

Association of State and Territorial Dental Directors Data

Association of State and Territorial Dental Directors data include state dental directors who hold a public health degree. This information is of limited use because the sample is narrow and based only on educational credentials. Possibly, other dental directors function as public health dentists, despite having no formal public health degree. However, these data might be used as a starting point because BLS does not collect data specifically on public heath dentists. ASTHO likely provides more accurate data.

Membership Lists

Typically, organization membership lists (e.g., those possibly available through NEHA, the Society for Public Health Educators, the American Public Health Association, or other professional associations where individual workers retain membership) should not be used as workforce data sources. Membership in an organization does not imply activity in the public health workforce and is not a requirement of public health workers. Additionally, knowing how many members were duplicated in other counts (e.g., through ASTHO and NACCHO surveys) is impossible. Using these data might both overcount workers by including members not in the public health workforce and undercount workers by missing those who do not hold membership in a professional organization.

PROFILE OF THE GOVERNMENTAL PUBLIC HEALTH WORKFORCE BY OCCUPATIONAL CLASSIFICATION

The different data sources described previously can provide researchers a broad picture of the public health workforce. In this section, we detail the data sources that provide enumeration figures for each of the occupational categories covered by our case definition, and we provide a summary analysis of the available data. Appendix Tables 1 and 3 provide detailed information regarding the origin of the occupational classifications, with summarized data. The 2010 NACCHO and ASTHO estimates were received ahead of publication of full reports by staff at each organization (Gulzar Shah, NACCHO, personal communication to Angela Beck, August 17, 2011; Katie Sellers, ASTHO, personal communication to Angela Beck, August 22, 2011).

BLS data reported in this section represent the workers reported in all SOCs deemed relevant to the case definition (Appendix Table 1) that were reported within the federal, state, and local government industry codes. OPM data reflect all workers in occupational categories relevant to the case definition (Appendix Table 1) who are employed in all agencies and offices of DHHS, EPA, USDA, the U.S. Department of Defense (DoD), the U.S. Department of Homeland Security (DHS), and the Veterans Health Administration within the U.S. Department of Veterans Affairs (VA). Occupational counts by case definition and OPM categories is displayed in Appendix Tables 4A and B.

Administrative or Clerical Personnel

Administrative and clerical personnel compose the largest segment of the public health workforce, according to the data sources that collect enumeration information about these workers.

BLS

An estimated 543,000 administrative and clerical personnel served as government employees in 2010, including 102,010 federal, 157,470 state, and 283,520 local government workers. The number of workers specifically in health departments and federal health agencies is unknown. These workers hold occupational classifications of Financial Managers; Accountants and Auditors; Budget Analysts; Bookkeeping, Accounting and Auditing Clerks; Receptionists and Information Clerks; Secretaries and Administrative Assistants; and Word Processors and Typists.

OPM

OPM's publicly available data from 2011 indicates that 29,276 administrative and clerical workers are in the civilian federal workforce of DHHS and other agencies having the potential to employ public health workers. These workers are included in the following occupational series: Miscellaneous Clerk and Assistant, Secretary, Clerk-Typist, Financial Administration and Program, Financial Management, Financial Clerical and Assistance, Accounting, Accounting Technician, Auditing, Budget Analysis, and Budget Clerical and Assistance. As with BLS data, we cannot determine the proportion of these workers who are supporting federal public health agencies.

ASTHO

Approximately 18,481 administrative and clerical personnel worked in the 45 state and territorial health departments that responded to this question in the 2010 profile survey.

NACCHO

Approximately 40,400 administrative and clerical personnel were estimated to be employed in local health departments in 2010, which is one quarter of all local public health workers.

APHL

APHL respondents identified 894 administrative employees working in public health, agricultural, and environmental laboratories.

Summary Analysis

Approximately 58,881 administrative and clerical personnel worked in state and local health departments in 2010, equivalent to 22% of the workforce estimated by the NACCHO and ASTHO surveys. This number corresponds to approximately 13% of the state and local worker data regarding administrative and clerical occupation classifications collected by BLS. Further research is needed regarding the federal workforce, because BLS and OPM data lack the specificity necessary to determine which workers should be included in public health workforce estimates.

Behavioral Health Professional

Behavioral Health Professionals include human immunodeficiency virus/acquired immunodeficiency syndrome counselors, substance abuse counselors, and community organizers.

BLS

BLS reported no federal government workers in 2010 in the three occupational classifications that most closely relate to this job title — Substance Abuse and Behavioral Disorders Counselors; Health Care Social Workers and Counselors; and All Other. A cross-match of OPM occupational codes and BLS SOCs is needed to determine how behavioral health workers are classified and whether additional SOCs should be added to this category to account for federal workers. State governments employed 6,960 workers in these classifications and 20,620 local government workers. How many of these workers have a public health job function is unknown.

OPM

In 2011, a total of 16,027 workers within DHHS and other selected federal agencies were enumerated in the following occupational classifications: Social Work, Social Services, Social Services Aid and Assistant, Psychology, and Psychology Aid and Technician. Because BLS reported no federal workers in 2010, these workers might represent different BLS occupational classifications than those selected for this job title.

ASTHO

The ASTHO profile survey uses the term Social Worker to classify behavioral health personnel. During 2010, a total of 2,974 social workers were employed in the 30 state and territorial health departments responding to this question.

NACCHO

During 2010, approximately 5,600 local public health workers were classified as behavioral health professional, representing approximately 3.5% of the local health department workforce participating in the profile survey.

Summary Analysis

ASTHO and NACCHO report a combined number of 8,574 behavioral health professionals or social workers in state and local health departments during 2010, whereas BLS reports 27,580 social workers employed throughout state and local government in 2010. The ASTHO/NACCHO data represent 31% of the workers reported in BLS, although ASTHO reports data from only 30 states in this category. Data for federal workers should be studied more thoroughly. OPM reports a limited number of social workers in the federal agencies chosen for this review; however, those numbers are not reflected in BLS data.

Emergency Preparedness Staff

BLS

BLS added the occupational classification, Emergency Management Directors, to its data collection in 2010. Approximately 1,100 workers were enumerated in state government; 6,470 were reported in local government. This classification includes emergency management workers outside public health and might not capture public health emergency preparedness staff who are not directors. No federal government workers were reported in this classification, which is likely a result of OPM not having an equivalent occupation series in which to report these workers rather than a reflection of the federal government's emergency preparedness workforce capacity.

NACCHO

Approximately 2,700 emergency preparedness staff were enumerated in local health departments during 2010, composing 1.7% of the local public health workforce.

ASTHO

The 2010 ASTHO profile survey identified 43 staff with a title of Preparedness Director (one per responding state/territory). Other emergency preparedness staff are not included in this category.

Summary Analysis

ASTHO and NACCHO provide the only data sources for enumerating public health emergency preparedness staff. ASTHO data might undercount the number of emergency preparedness staff in state health departments if staff who do not hold the title of Preparedness Director are performing the functions of emergency preparedness staff. They might be counted in another category (e.g., Epidemiologist or Public Health Nurse), or they might be unclassified in this enumeration. No OPM occupational series exists to capture federal emergency preparedness staff; they probably are counted in other occupational categories.

Environmental Health Worker

This composite classification includes multiple BLS and OPM occupational classifications, described in the following.

BLS

In 2010, BLS estimated 17,540 environmental health workers in federal government, 37,970 in state government, and 32,930 in local government. The following SOCs are included in the environmental health worker category: Environmental Engineers; Environmental Engineering Technicians; Environmental Science and Protection Technicians, including Health; Environmental Scientists and Specialists, including Health; Occupational Health and Safety Technicians; and Occupational Health and Safety Specialists.

OPM

An estimated 7,651 environmental health workers were employed by federal government agencies in 2011 in different occupational categories, including Environmental Engineering, Environmental Protection Specialist, Environmental Protection Assistant, Environmental Health Technician, Industrial Hygiene, Sanitarian, Safety and Occupational Health Management, Safety Technician, Entomology, and Toxicology.

ASTHO

A total of 5,780 environmental health workers were reported to be working in the 41 responding state health departments in 2010. ASTHO notes that other state agencies provide environmental health services and are not captured in their survey.

NACCHO

Environmental health workers were approximately 8.6% of the local public health workforce in 2010, totaling 13,800 workers.

Summary Analysis

Although ASTHO and NACCHO provide estimates of the environmental health workforce in state and local health departments, their data do not include environmental health workers in other state or local agencies who perform critical public health functions. A better mechanism should be established for counting these workers. BLS and OPM provide enumerations of environmental health workers in different SOCs/occupational categories but do not specify which are performing public health functions. Working through a national organization comprising all environmental health workers (e.g., NEHA) to enumerate this essential component of the public health workforce might provide better estimates.

Epidemiologist

BLS

In 2010, BLS estimated that 1,430 epidemiologists were in state government and 1,160 epidemiologists were in local government. Although the workers can be located in any type of government agency, the majority of epidemiologists are believed to be in health departments. No epidemiologists were reported in federal government as a result of the way OPM classifies epidemiologists. No OPM occupational series of epidemiologist exists; therefore, epidemiologists employed in the federal government are counted in other occupational categories. To use BLS to count epidemiologists in the federal government, the OPM occupational series requires disaggregation so that epidemiologists can be reported specifically to BLS, or OPM should establish an epidemiology occupational series. This problem does not occur in state and local government because workers with a job title of Epidemiologist can be more easily identified and reported to BLS.

ASTHO

ASTHO enumerated 2,550 epidemiologists/statisticians in 45 responding state and territorial health departments in its 2010 profile.

NACCHO

An estimated 1,500 epidemiologists worked in local health departments during 2010, roughly equivalent to 0.9% of the workforce.

CSTE

The 2009 ECA conducted by CSTE enumerated 2,193 epidemiologists working in state health departments. This is a higher number than that enumerated by BLS, likely because CSTE used a functional definition of an epidemiologist to count workers, rather than counting workers solely on the basis of job title. For example, a public health nurse performing epidemiology functions on a daily basis might have been counted as an epidemiologist in this assessment and as a public health nurse in other data sources.

Summary Analysis

Epidemiologist is one of the limited number of occupational classifications with multiple data sources enumerating the workforce, all of which provide relatively similar estimates. In terms of providing an estimate of functional epidemiology capacity, CSTE likely provides the most reliable estimate of epidemiologists because it includes all workers performing epidemiology functions. ASTHO includes statisticians in their count, which might explain why the number is greater than CSTE's estimate. BLS might be a highly useful tool for enumerating state and local health departments in the future, because the data appear to be specific enough to provide an accurate estimate. The federal epidemiology workforce needs much more research. Which occupational series these workers are counted in is unknown. Ideally, OPM should establish an Epidemiology occupational series through which to count epidemiologists.

Health Educator

BLS

BLS has a specific category for health educators. Presumably, the majority of workers counted in this classification are public health workers, although health educators external to the public health workforce might be included in the BLS estimation. In 2010, BLS reported 2,750 health educators in federal government, 3,340 in state government, and 6,820 in local government.

OPM

OPM has a Public Health Educator occupational series and reported 56 federal workers in selected agencies in this area in 2011.

In 2010, a total of 2,440 health educators worked in the 43 state health departments responding to this question.

In 2010, a total of 4,900 health educators were enumerated in local health departments, which represented 3.1% of the local public health workforce.

Summary Analysis

Lack of consistency among BLS, NACCHO, and ASTHO numbers is problematic. The BLS classification for this segment of the workforce is specific enough to expect that the BLS estimates for state and local government health educators would be close to the ASTHO and NACCHO estimates, respectively. Federal BLS figures are expected to be much larger than OPM figures, because OPM data reported here are specific to workers in DHHS and other federal agencies that might employ public health workers.

Laboratory Worker

BLS

In 2010, BLS reported that 20,310 laboratory workers were in federal government, 10,830 were in state government, and 3,730 were in local government. These workers held occupational classifications of Microbiologist; Zoologist and Wildlife Biologist; Medical Scientist, except Epidemiologist; Physicist; Medical and Clinical Laboratory Technologist; and Medical and Clinical Laboratory Technician. How many of these workers are located in health departments or performing public health functions is unknown.

OPM

Approximately 13,350 federal civilians were estimated to be laboratory workers in DHHS in one of the following occupational categories in 2011: Microbiology, Zoology, Entomology, Toxicology, Chemistry, Health Physics, Medical Technologist, Medical Technician, Dental Laboratory Aid and Technician, and Pathology Technician. Possibly, workers not directly employed in a laboratory are counted within these occupational categories.

ASTHO

Approximately 3,965 laboratory workers were reported to be working in 43 responding state and territorial health departments in 2010. As with environmental health workers, laboratory workers with public health functions might be employed in other state agencies and are not captured in this survey.

The 80 public health, agricultural, and environmental laboratories that responded to APHL's organizational-level survey reported a total of 5,498 scientific laboratory workers. Job classification and education data were collected for 4,927 of these workers. Fifty-nine percent of the workforce (2,885/4,927) was classified as Laboratory Scientist; Laboratory Scientist-Supervisors comprised 13% (660/4,927); and 9% (437/4,927) were Laboratory Technicians. Other job classifications include Laboratory Aide/Assistant (7%; 338/4,927); Laboratory Scientist Manager (6%; 303/4,927); Laboratory Developmental Scientist (3%; 132/4,927); Director (2%; 103/4,927); and Assistant or Deputy Director (1%; 69/4,927). The majority of the laboratory workforce is trained at the bachelor's degree level (60%; 2,974/4,927); 701 laboratorians (14%) hold master's degrees; 529 (11%) hold doctoral degrees; 390 (8%) are trained at the high school level; 275 (6%) hold an associate's degree; and 58 laboratorians (1%) hold a professional degree (e.g., MD, DVM, or DDS).

Summary Analysis

Both APHL and ASTHO provide data collected at the organizational level to enumerate laboratorians. APHL's data were collected from a broader sample, because it includes agricultural and environmental laboratories. Although neither survey achieved a 100% response rate, these two sources provide the most accurate count of nonfederally employed laboratorians that fall within the project case definition. BLS's estimate is much higher than those generated by ASTHO or APHL; therefore, that estimate might include laboratorians employed in government agencies who are not performing public health functions. Data enumerating federally employed laboratorians are derived from OPM and should be further refined. A count was generated for this report by aggregating data from the occupational classifications that seemed most likely to employ laboratorians performing a public health function in a selected subset of federal agencies and offices. However, this number might overcount public health laboratorians by including those who are not performing public health functions, as well as undercount public health laboratorians if they are employed in occupational classifications or federal agencies that were not included in the report. More information is needed from federal partners to refine this estimate.

Nutritionist

BLS

BLS reported a total of 8,560 nutritionists and dieticians in 2010, including those working in public health. Approximately 1,830 worked in federal government, 2,760 in state government, and 3,970 in local government.

OPM

An estimated 2,166 civilian federal workers were identified as a dietician or nutritionist in 2011.

ASTHO

ASTHO enumerated 1,557 nutritionists in 44 responding state and territorial health departments in 2010.

NACCHO

Approximately 4,600 nutritionists were enumerated in local health departments during 2010, representing 2.9% of the local public health workforce.

ASTPHND

The 2007 data from ASTPHND provides the most comprehensive profile of the nation's public health nutrition workforce. This survey estimated 2,891 public health nutritionists in state health departments, 4,477 in local health departments, and 188 in tribal health agencies.

Summary Analysis

ASTPHND data likely provide the most reliable and comprehensive information by estimating a total of 7,556 public health nutritionists nationwide in governmental and tribal public health. Interestingly, the ASTHPHND data estimate 2,891 nutritionists in state health departments in 2007, whereas ASTHO's data estimate only 1,557 in 2010. The ASTPHND estimates for local public health nutritionists are highly similar to NACCHO's 2010 estimate (4,477 versus 4,600, respectively). This validation of local health department data is important, given that ASTPHND's future survey plans are unknown.

Public Health Dentist

Sources providing data regarding public health dentists are considerably limited.

BLS

BLS reported 2,010 dentists of other specialties, including Public Health Dentist, working in federal government in 2010. No such dentists were reported to be working in state or local government.

OPM

In 2011, a total of 1,673 dental officers were employed in select federal agencies. How many were specifically public health dentists is unknown.

ASTHO

ASTHO enumerated 236 public health dentists in 23 responding states in the 2010 profile survey.

Summary Analysis

ASTHO provides the only estimate of public health dentists in health departments. Fewer than half of states responded to the question about public health dentists; therefore, whether this estimate undercounts workers or if certain states have no public heath dentists employed in their state health department is unknown. OPM provides an estimate of dentists in the federal workforce, although as previously stated, these dentists might not be serving as public health dentists.

Public Health Informatics Specialist

Public health informatics specialists also might be known as public health information systems specialists or public health informaticists. BLS does not have any direct-match titles that correspond to this job title generically. Similarly, OPM does not have an occupational series that relates specifically to informatics. If this occupational category is of interest, a direct-match title should be recommended to BLS for future inclusion during data collection, because no federal government data are available.

ASTHO

An estimated 1,317 workers were reported in 32 responding state and territorial health departments in 2010.

NACCHO

Public health informatics specialists totaled 1,100, or 0.7%, of the local public health workforce in 2010.

APHL

APHL reported 207 employees identified as information technology/informatics staff in public health, environmental, and agricultural laboratories.

Summary Analysis

This occupational title is specific and represents <1% of the total state and local health department workforce. Federal occupational classifications are not specific enough to capture this workforce. Modifying this category to include other similar occupations (e.g., computer and information technology technicians) should be considered.

Public Health Manager

BLS

BLS reports Public Health Administrators among the Medical and Health Services Managers on which they collect data. In 2010, a total of 7,940 Medical and Health Services Managers worked

in federal government, 6,650 in state government, and 9,220 in local government. How many of these managers are public health administrators is unknown.

OPM

OPM uses four occupational categories with relevance to this job title: Administrative Officer, Health System Administration, Public Health Program Specialist, and Program Management. During 2011, a total of 11,239 federal DHHS workers were classified within these occupations.

ASTHO

During 2010, a total of 3,826 public health managers worked in 43 responding state and territorial health departments.

NACCHO

In 2010, approximately 9,500 workers, equivalent to 5.9% of the local public health workforce, were serving as public health managers in city and county health departments.

Summary Analysis

ASTHO, NACCHO, and OPM likely provide the best estimates of workers in this category. The NACCHO estimate is highly similar to the local government estimate provided by BLS (9,500 versus 9,220, respectively). The ASTHO estimate is approximately half the estimate reported for state government by BLS. OPM estimates can be refined further by eliminating or narrowing the count of workers reported in government agencies that are less likely to be employing managers working specifically in public health (e.g., DoD and DHS).

Public Health Nurse

Public health nurses compose the largest group of public health workers who deliver essential public health services (i.e., not administrative or clerical support staff). They represent a broad array of public health job functions and might be included in this category on the basis of job duties or by virtue of their education or training. All data sources detailed in the following require the nurse to be an RN to be included in this job classification.

BLS

BLS counts Community Health Nurses within its RN occupational classification. An estimated 65,610 RNs worked in federal government in 2010; 40,960 worked in state government; and 45,580 worked in local government. The proportion of Community Health Nurses within this classification is unknown.

OPM

OPM enumerated 60,708 nurses working in selected federal agencies in 2011. Public health nurses are counted in this occupational category, although the exact number of public health nurses is unknown.

NSSRN

NSSRN reported weighted estimates of 97,210 RNs employed in a community or public health setting. Of these, approximately 16,467 were estimated to be in state public health or mental health agencies, and 34,637 were estimated to be in county and city health departments.

ASTHO

In 2010, an estimated 11,071 public health nurses were employed in 44 responding state and territorial health departments.

NACCHO

An estimated 27,900 public health nurses were reported to be working in local public health during 2010, totaling 17.4% of the local health department workforce.

Summary Analysis

All data sources reviewed by the project team require a nurse to hold RN licensure to be considered a public health nurse. Nurses who are not RNs, although known to be active in the public health workforce, presumably are captured under other job titles. Non-RNs are not part of the NSSRN's survey population. The ASTHO and NACCHO combined estimate of public health nurses are within approximately 12,000 of the NSSRN weighted estimate for nurses working in state and mental health agencies and city and county health departments (38,921 versus 51,104, respectively).

Public Health Physician

Public health physicians might be identified as workers with a medical degree working in a public health department or agency performing multiple tasks, including service delivery or administration. Certain public health physicians are trained and board-certified in preventive medicine. Preventive medicine includes specialty areas of public health, general preventive medicine, and aerospace medicine. It is the only medical specialty with a population focus and requiring training in both clinical medicine and public health.[22,32] The following data sources provide estimates for different types of public health physicians, including preventive medicine physicians.

BLS

BLS does not include Public Health Physician as a direct-match title in its data collection system. However, public health physicians are assumed to be counted within the occupational

classifications Physicians and Surgeons, All Other, or Family and General Practitioners. Approximately 28,630 physicians in these categories were working in federal government in 2010, 2,940 in state government, and 4,230 in local government.

OPM

OPM reported 28,143 medical officers working in DHHS and related agencies during 2011. How many are public health physicians is unknown.

ASTHO

ASTHO reported 1,157 public health physicians working in 38 responding state and territorial health departments in the 2010 profile survey.

NACCHO

Approximately 1,800 public health physicians were reported in the 2010 profile survey, composing 1.1% of the local health department workforce.

ACPM

In 2007, ACPM estimated 850 preventive medicine physicians in federal health agencies serving as directors, program managers, and researchers. An estimated 419 preventive medicine physicians were employed in state health agencies and 385 in local health agencies as the agency executive/health officer, epidemiologist, program director, or similar role.

Summary Analysis

ASTHO and NACCHO provide reasonable estimates of the total number of public health physicians in state and local health departments, which are aligned closely with BLS estimates. ACPM provides an estimate of what subset of those workers are preventive medicine physicians. Approximately 36% (419/1,157) of state health department public health physicians reported by ASTHO might be preventive medicine physicians, whereas closer to 21% (385/1,800) of local public health physicians perhaps are trained in preventive medicine. OPM and BLS data aggregate public health physicians with other types of physicians, making enumeration of federal public health physicians difficult. ACPM notes that more preventive medicine physicians are needed in federal, state, and local agencies.

Public Information Specialist

BLS

BLS reports that 370 federal workers were employed as public relations and fundraising managers during 2010, which includes workers with such job titles as Communications Manager, Public Affairs Director, and Public Relations Manager. Approximately 860 state government workers held this classification, as did 3,160 local government workers. BLS does not capture the specific number that work in public health.

ASTHO

A total of 332 public information specialists were enumerated in 39 responding health and territorial departments in the 2010 ASTHO profile survey.

NACCHO

An estimated 510 public information specialists were employed in local health departments in 2010, representing 0.3% of the workforce.

Summary Analysis

This occupational classification rarely captures public health workers. Only 841 of >284,000 state and local public health workers are identified as public information specialists (<1%). This occupation is difficult to enumerate within the federal workforce because OPM classifications are not specific to this job function, and BLS occupational categories seem too broad to calculate an accurate estimate.

Other Public Health Professional/Uncategorized Public Health Workers

This category includes public health workers who are either in occupations other than those identified for data collection in the project case definition or otherwise uncategorized because of missing data. At present, separating other workers from uncategorized workers is impossible for certain data sources. BLS and OPM occupational categories that initially were selected for inclusion before the case definition grouping processes occurred were moved to this category if they could not be grouped into one of the other 14 case definition occupations. ASTHO and NACCHO workers who were not identified in one of the case definition occupations are included in this category also. Of note, workers counted in this group might be a double-count of workers counted elsewhere. As with the other occupational classifications, BLS and OPM data are not necessarily specific to the public health workforce.

BLS

The occupational classifications of Veterinarian (including Public Health Veterinarians), Licensed Practical and Vocational Nurses, and Computer Specialists (e.g., Computer Systems Analysts, Computer Programmers, Network and Computer Systems Administrators, and Data Entry Keyers) were used in this category. Approximately 27,500 federal government workers were enumerated in these occupational areas during 2010; 63,020 state government workers were reported; and 68,290 local government workers were reported.

OPM

The OPM occupational categories Veterinary Medical Science, General Health Science, Practical Nurse, Dental Assistant, Dental Hygiene, and Information Technology Management are grouped into this classification. A total of 46,329 federal workers were reported in these occupational series during 2011.

ASTHO

Of the 103,267 FTE public health workers estimated to be employed in 48 state and territorial health departments responding to the 2010 profile survey, 47,551 (46%) of them are working in occupations other than those specified in the survey or are uncategorized because of missing data.

NACCHO

Approximately 45,690 (29%) local health department workers were not categorized into a specific occupation in the 2010 profile survey either because of missing data or working in occupations other than those specified in the survey.

SUMMARY PROFILE OF THE PUBLIC HEALTH WORKFORCE, BY INDUSTRY

The case definition for this project limits the public health workforce to those working in federal, state, territorial, and local government agencies. A summary of each industry is detailed in the following sections.

Federal Government Workforce

We used OPM's March 2011 federal employment statistics to enumerate workers in federal agencies because those data allow for more specificity than the other data sources. Workers in the United States and its territories were included in the federal workforce counts; federal workers based in international locations were not included. These are the same data that are reported to BLS; however, as previously noted, OPM uses different occupational categories than BLS and other data sources used in this project; therefore, categorizing workers accurately is difficult. We were unable to find corresponding OPM occupational categories for four of the case definition occupational classifications: Emergency Preparedness Staff, Epidemiologist, Public Health Informatics Specialist, and Public Information Specialist. More research is needed with the help of OPM to determine which occupational category workers fulfilling these roles are classified.

Because separating the number of federal government workers performing public health functions from all other workers captured in the available data sources is impossible, we included workers in the OPM occupational categories that most closely match the case definition occupations in this report, as detailed in Appendix Table 1, employed in a select group of federal agencies, which included the following: all DHHS agencies and offices; EPA; USDA; DoD; DHS; and the VA's Veterans Health Administration. These agencies were chosen because they can have a substantial portion of their workforce performing public health functions, although to varying extents. For example, DHHS agencies probably have more public health workers than DoD agencies; however, determining which workers have public health functions is impossible; therefore, all workers whose occupations are relevant to the project case definition are included

in [Appendix Tables 4A](#) and [B](#) and [Appendix Tables 5A](#) and [B](#). These data might overcount the number of federal public health workers, because certain federal agencies might not have a public health-focused mission. Federal occupation data should allow for more specificity before an enumeration of the federal public health workforce can be refined.

[Appendix Tables 4A](#) and [B](#) provides detailed statistics regarding the number of workers per agency in each OPM occupational classification related to the case definition. Overall, 767,966 civilian federal workers were employed in the agencies selected for analysis; 84,372 of these workers were employed in DHHS agencies, 18,671 in EPA, 97,536 in USDA, 96,006 in DoD, 191,659 in DHS, and 279,723 in the Veteran's Health Administration. We are able to categorize 216,056 of the 767,966 workers (28%) into OPM occupational categories that are relevant to the case definition occupational classifications. Forty-one percent (34,619) of the DHHS workers held occupations relevant to the case definition occupational classifications, as did 46% (129,106) of VA workers, 41% (7,742) of EPA workers, 24% (23,366) DoD workers, 13% (12,416) of USDA workers, and 5% (8,807) of DHS workers. How many of the workers in these occupational classifications are performing public health work is unknown. The remaining workers fall into job categories that do not equate to the occupational categories used by ASTHO and NACCHO, which were adopted for this project.

Within DHHS, the National Institutes of Health had the largest employed workforce that falls within the case definition (8,843), followed by the Food and Drug Administration (5,895), a combined category of the Office of the Secretary and Office of the Assistant Secretary of Health (5,221), and IHS (5,530). CDC employed 5,511 categorized workers; the Center for Medicare and Medicaid Services employed 1,367 categorized workers; and HRSA employed 1,069 categorized workers. All other DHHS agencies and offices employed <1,000 categorized workers.

[Appendix Tables 5A](#) and [B](#) details the major OPM occupational series each agency uses to enumerate its workers. The lack of correspondence between OPM classifications and the ASTHO and NACCHO harmonized occupational categories should be considered when determining a taxonomy of job occupations to be used in a national workforce SLS.

State and Territorial Health Department Workforce

ASTHO's 2010 profile survey estimated that the state and territorial public health workforce comprises approximately 103,267 FTE workers, 55,716 of whom are enumerated into one of the specified case definition occupational categories, leaving 46% of the workforce categorized as Other Public Health Professional/Uncategorized Public Health Worker. Administrative and Clerical staff were the largest group of workers (18,481), followed by Public Health Nurses (11,071), Environmental Health Workers (5,780), Laboratory Workers (3,965), Public Health Managers (3,826), Social Workers (2,974), Epidemiologists/Statisticians (2,550), and Health Educators (2,440). All other job classifications had <2,000 workers: Nutritionists (1,557), Public Health Informatics Specialists (1,317), Public Health Physicians (1,157), Public Information Specialists (332), Public Health Dentists (236), and Preparedness Director (43).

Local Health Department Workforce

NACCHO enumerated approximately 184,000 full-time and part-time employed and contracted workers — the equivalent of 160,000 full-time staff — in local health departments during 2010. Administrative and Clerical staff composed the largest group of workers (40,400; 25%), followed by Public Health Nurses (27,900; 17%). The other 10 occupations for which enumeration data were collected each composed <10% of the local public health workforce. Approximately 30% (45,690) of local health department workers were not classified into any of the case definition occupations. Additional occupational categories should be considered when implementing a national enumeration/workforce SLS.

DEVELOPING AND IMPLEMENTING A NATIONAL PUBLIC HEALTH ENUMERATION AND WORKFORCE SURVEILLANCE-LIKE SYSTEM: FUTURE PLANS

Developing a National Public Health Workforce Enumeration Study

Although existing data sources can be used to compile a crude estimate of a defined segment of the public health workforce, a new system should be developed if a comprehensive enumeration of the total public health workforce is desired. Two options for implementing such a system are described in the following, including study design options and limitations. These study designs assume use of this report's case definition, but can be adjusted in later phases of the project if the case definition expands. In addition, the proposed study designs assume that enumeration, rather than a detailed characterization, of the public health workforce is the primary interest. Ideally, an SLS will capture both counts and characteristics of the workforce, as described in the next section.

Next Steps for Implementing a Public Health Workforce Enumeration Study

This project allowed for a thorough review of existing data sources to determine which might yield usable data and which provide examples of data collection methodologies that should be reviewed further and considered when developing a public health workforce enumeration study. We recommend the following steps be implemented during the next phase of the project:

1. **Identify a working group of public health workforce researchers and stakeholders to examine specific concerns outlined by the COEs.**

    The group can be a subcommittee of the existing national advisory committee but should have substantial representation from methodologists and researchers in public health and other health fields who have focused on workforce enumeration. The COEs will develop a list of potential working group members and share with federal partners for feedback. A finalized group of stakeholders and researchers will be invited to participate in a meeting in early 2012, convened by the COEs.

2. **Convene the working group to derive consensus on the following topics:**

- *Public health workforce taxonomy.* Until the field comes to a consensus about how we will define and classify the public health workforce, any enumeration study will have substantial limitations and comparability problems between the multiple data sources to be used for the project. If occupational categories and codes cannot be modified immediately, the group should determine how to cross-match the different occupations used in the data sources, similar to the procedure that was started for this project (Appendix Table 1). The cross-match used in this report is a helpful start, but it should be refined because a substantial portion of the public health workforce is uncategorized, whereas other occupational classifications enumerate only a limited number of workers and should be collapsed into broader categories. A facilitator will be identified to lead the group through a discussion process and develop an agreed-upon workforce taxonomy.

- *Implementation methods.* Because we are relying on secondary data sources to collect enumeration information, we should have agreement among the stakeholders developing and fielding the surveys as to how the methodology can be modified to allow for more detailed and timely data collection. For example, if the enumeration study relies on ASTHO and NACCHO surveys for substantial portions of data, we should discuss the following six questions:

  A. Do the ASTHO and NACCHO surveys need to be modified?
  B. Are ASTHO and NACCHO willing to modify their surveys?
  C. Will modification involve changing the profile surveys or developing a supplemental module to collect more detailed workforce information?
  D. Should the organizations field the surveys more frequently than previously done?
  E. Will the organizations be willing to field the survey more frequently?
  F. How quickly can data be cleaned, analyzed, and eventually integrated into an SLS?

- *Modification of national data collection systems.* BLS data can be valuable to public health workforce enumeration efforts but should be modified to allow for more specificity during data analysis. The working group should come to consensus regarding how problems related to BLS SOCs and NAICS codes best can be changed to allow for better data collection and analysis. A formal communication should be sent on behalf of the working group to BLS officials recommending changes when SOCs are modified in 2018.

3. **Work with federal officials on further refining BLS and OPM workforce estimates.**

- For BLS, COEs will work closely with CDC staff assigned to BLS during the 2011–2012 project period. As BLS data are extracted further, we can determine how extensive modifications to SOCs should be in the future and make recommendations. Special attention should be given to whether tribal workforce data can be disaggregated from local government workforce data, and whether BLS captures, or can capture, occupational data for workers in the NAICS code 923120 — Administration of Public

Health Programs. The data reviewed for this project were limited to the NAICS codes for local, state, and federal government, excluding schools and hospitals, because of the parameters of the case definition.

- Two initiatives should be undertaken related to OPM. First, a more detailed cross-match of OPM classifications and SOCs should be obtained. The cross-match provided does not address critical sectors of the workforce that are difficult to identify within the OPM occupational classifications (e.g., epidemiologists and emergency management directors). Second, OPM estimates projected in Appendix Tables 4A and B should be refined further by eliminating or narrowing the count of workers reported in government agencies that are less likely to be employing managers working specifically in public health (e.g., DoD and DHS). For example, instead of including all DoD workers employed in occupational classifications identified by the case definition in the public health workforce count, perhaps specific divisions within the department that are most likely to employ public health workers can be identified. COEs will need assistance from federal officials in making these determinations.

- Identify which public health agencies or which occupations within public health agencies are within the study's target population.

- Extract data from OPM and BLS and analyze and aggregate those data to follow case definition occupational categories. For example, data can be analyzed to estimate staffing ratios of public health workers in federal agencies.

- Agree on an annual extraction method.

  A. Who is responsible for submitting data?
  B. What time of year should data be reported?
  C. Through what mechanism can reporting occur most easily?

4. **Assist public health organizations with data collection and analysis.**

One strength of the COEs is their ability to partner with organizations to collect and analyze public health workforce data. Personnel at the University of Kentucky COE have long working relationships with both NACCHO and ASTHO and have worked extensively with both organizations to harmonize and integrate their surveys, including the portions dealing with the public health workforce. In addition, the COE at Michigan has worked with CSTE and APHL to collect and analyze public health workforce data. We recommend continuing this strategy to enhance the depth and breadth of data available for the public heath workforce.

5. **Produce an enumeration estimate.**

The overall goal of the next phase of the study is to produce an estimated number of public health workers who can be included in the project's case definition after the necessary

decisions have been made by the working group and modifications made to data collection instruments. Any estimate will have limitations, which will be noted expressly. In the event data collection does not occur during the next year (e.g., the public health organizations need additional time to field modified surveys), COEs will provide an updated count as displayed in Appendix Table 3 and establish a timeline and methodology for producing a more accurate enumeration estimate.

Future Phases of the Public Health Workforce Enumeration Project

When a method for collecting public health workforce enumeration data for the Phase I case definition has been developed and refined, the project can expand to encompass workers included in case definition Phases II–IV (see Figure 2), which will address enumeration of workers for workforce groups not sufficiently counted in the current project.

Federal Noncivilian Employees. Data regarding this segment of the federal workforce almost certainly exist, but those data are unavailable to external researchers and therefore cannot be included in this report. If DHHS and the Office of the Surgeon General cannot release data related to Commissioned Corps members and U.S. Public Health Service staff, a mechanism for identifying and surveying workers within federal agencies will need to be established. We recommend having federal workers contact the U.S. Public Health Service directly to inquire about workforce data.

Contract Employees. Data regarding contract employees can be accessed for state and local government workers through ASTHO and NACCHO profile surveys, although NACCHO will need to collect data differently to allow contract employees to be disaggregated from regular employees. Federal contract employees present a different challenge because they are not captured in OPM data and therefore are not classified as federal workers in BLS. If primary data collection were undertaken, one could contact each federal agency considered to have a public health mission and develop a list of companies supplying contractors. Those companies would then be contacted for workforce information.

Environmental Health Workers. Environmental health workers employed outside of public health departments are undercounted, particularly at the state and local government levels. Apparently, no secondary data source exists to capture this information easily. A data collection effort can be undertaken that surveys state departments with responsibility for agriculture, natural resources, and environment to determine the number of workers, job occupation, and job function. Similarly, at the local government level, departments with similar missions can be surveyed on the basis of a randomized sample stratified by jurisdiction size (e.g., by city or county population). Assistance from NEHA will be valuable in developing and implementing such a study.

Laboratory Workers. APHL and ASTHO both provide information on public health laboratorians, with APHL also surveying laboratorians in agricultural and environmental laboratories. Future workforce research should verify whether the laboratories surveyed by APHL represent all laboratories employing staff who perform a public health function. In

addition, the enumeration estimate for federal public health laboratorians needs much more refinement, because how many of the workers counted in this report work in public health and how many public health laboratorians might be employed in occupational categories or federal agencies not counted in this report are unknown.

Tribal Public Health Workers. Review of existing data sources reveals relatively inadequate availability of data regarding tribal health workers. NIHB has surveyed tribal health agencies, but their workforce data are limited and the survey response rate has been insufficient. Any type of primary data collection on tribal health workers should be done in partnership with NIHB. Because NIHB has not been consulted thus far, we cannot make recommendations on how data collection will be handled most efficiently. Engaging NIHB through a cooperative agreement or an advisory role in public health worker enumeration should be the first step in establishing a study that allows continuous data collection. Given the difficulty in obtaining a strong response rate in previous NIHB surveys, selecting a sample of tribal health agencies and attempting to extrapolate findings by using weighted estimates might be the most effective method. Another option, although less preferable, can be to work with IHS in establishing a way to survey tribal health workers directly, depending on the extent of IHS's relationship with the tribal health agencies with whom they interact.

Limitations
Any public health workforce enumeration study will have underlying methodologic limitations.

- Occupational classifications in use might not reflect the duties and qualifications expected of the incumbents.
- Boundaries between public health occupational categories are often not delineated; categories are not mutually exclusive and overlap extensively with regard to knowledge base, skills, and tasks.
- Classification systems lack consistency; certain occupations are defined by what employees do, whereas others are defined by the populations they serve or by the required underlying skills.
- Position descriptions and job titles for public health professionals lack uniformity across states and organizations.
- No comprehensive public health professional licensure or certification requirement provides categories for data collection.[6]

If existing data sources are used, comparability of data is a concern and potential limitation. Creating another survey to be used with all public health sectors will help with standardization but can duplicate efforts of organizations already generating public heath workforce data.

Enumeration data by occupation (defined by job title) can be collected at the organizational level; however, individual-level data collection should be considered for obtaining information about job function, educational background, retirement intention, and other crucial characteristics, which requires a comprehensive sampling methodology. HRSA's NSSRN provides an excellent example of how individual-level data can be collected and weighted estimates produced. However, NSSRN has the benefit of state licensure data from which to

construct a sampling frame. Individual information on workers needs to be collected either from the agencies employing them or through a registry developed for the public health workforce.

Implementing a National Public Health Workforce SLS

CDC defines surveillance as the "ongoing, systematic collection, analysis, interpretation, and dissemination of data regarding a health-related event for use in . . . action to reduce morbidity and mortality and to improve health."[33] Continual monitoring of the size and composition of the public health workforce is a critical step in identifying ways to address concerns of worker shortage, lack of training, and effective delivery of public health services, among others. A method for systematically collecting and disseminating public health workforce data in a format accessible to health officials, researchers, and policymakers has never been developed. This report highlights key characteristics and elements that should be considered in implementing a public health workforce SLS.

Feasibility of SLS Implementation

A 2007 report contracted by the U.S. Department of Transportation/NHTSA detailed the feasibility of developing a workforce safety and health SLS for emergency medical service (EMS) workers. Although the report focused on capturing injury and safety data for the workforce rather than characteristics of size and composition, barriers to implementing an SLS with the EMS workforce are similar to concerns that apply to the public health workforce. The report states that "a limited understanding of the size of the EMS workforce contributes to the difficulty of conducting adequate surveillance . . . among this population." Additionally, the researchers concluded that no single data system exists that can serve as an effective surveillance data source, and an integration of data systems should be used to develop a comprehensive surveillance program.[34]

The NHTSA feasibility study reported the findings of a panel of experts who reached consensus on ideal characteristics and elements of a workforce SLS, which included

- integration or linkage with existing data systems;
- ability to capture information at the time of the event;
- ability to capture denominator data;
- use of standardized coding schemes;
- ability to facilitate systematic analysis;
- user-friendliness of resulting data products; and
- provisions for evaluation of the SLS.

The panel also developed a conceptual model for workforce surveillance (Figure 3). The methodology used to determine feasibility of implementing an SLS might be useful in implementing a national public health workforce SLS. First, a consensus panel of public health workforce researchers and stakeholders should be established and consulted to determine the most desirable elements of an SLS. Next, an action plan for implementing an SLS by using existing data sources should be developed with input of the consensus panel. Finally, a model

system should be implemented with a subset of local, state, and federal government agencies. After becoming functional and a preliminary evaluation of system performance is complete, the system can be expanded to include data for additional government agencies, a broader case definition, and additional data elements.

Figure 3. Conceptual model for a workforce surveillance-like system
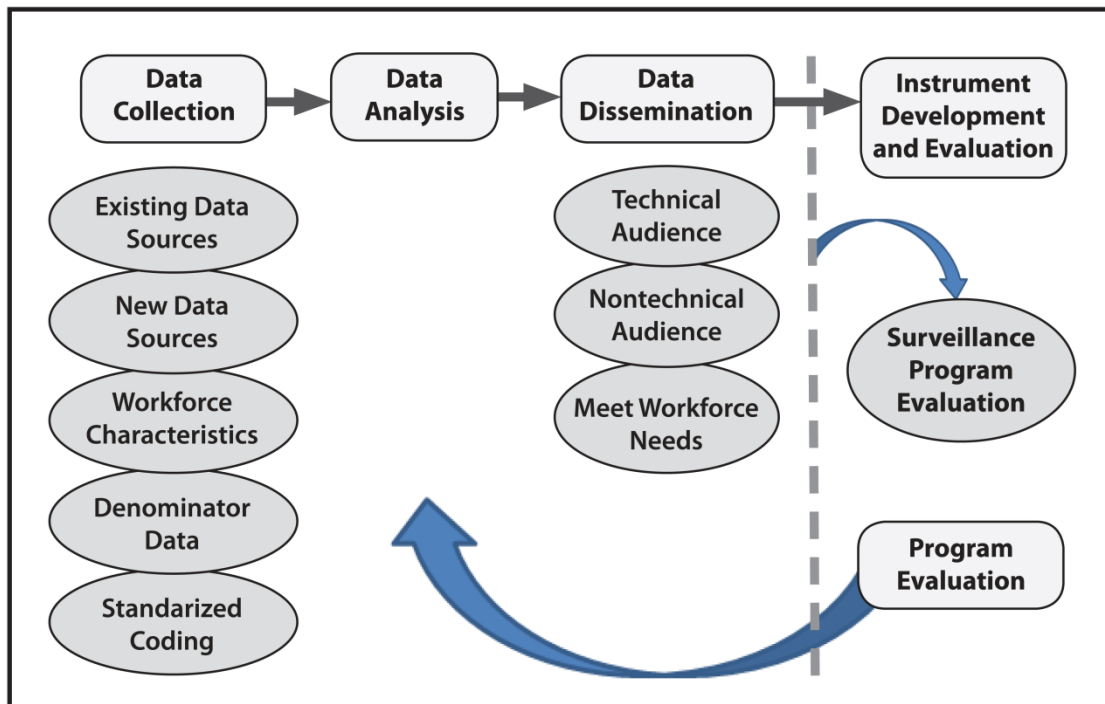
Adapted from: US Department of Transportation/National Highway Traffic Safety Administration (NHTSA). Feasibility for an EMS Workforce Safety and Health Surveillance System. Washington, DC: NHTSA; 2007. Available at: http://www.ems.gov/pdf/EMSWorkforceFeasibility3.pdf. Accessed January 13, 2012.

Minimum Data Elements Recommended for Workforce Surveillance

Ideally, an SLS that can characterize the portion of the public health workforce contained in the case definition previously outlined will contain the following basic elements, which can facilitate developing a profile of who is delivering the essential services of public health (e.g., race/ethnicity, age, and sex), their qualifications for doing so (academic degrees and training), and where they are practicing (geographically and within each health department). The table lists the basic elements of an ideal system, along with a brief description of the rationale for including them. Note that this list of data elements assumes that data collection will occur at the organizational level. Other useful data elements to incorporate will require individual workers to provide personal data, including elements related to recruitment and retention factors (e.g., job satisfaction, intention to leave position or public health, and ways workers were recruited into

public health). Additionally, workers can provide details regarding previous public health training, whether it is degree-based, attained through continuing education courses, or primarily on-the-job training. These elements might be incorporated in a later phase, if data collection is expanded.

Table. Recommended minimum data elements for a workforce surveillance-like system

Worker characteristics	Element	Rationale/Purpose
Demographic characteristics	Birthdate/age	Analyze diversity factors Forecast retirements Estimate trends in workforce aging
	Sex	Analyze diversity factors Project employment trends
	Race/ethnicity	Identify diversity factors Analyze employment trends Provide useful information for studies of health disparities and access
	Annual income	Track salary trends by job classification Analyze recruitment and retention factors
Education and training, background, and experience	Academic degree(s)	Characterize educational trends
	Licensure/certification	Track number of licensed providers Obtain certification or additional credentials as a reflection of level of training
	Years of experience in current position	Track turnover trends
Job characteristics	Agency type	Count how many workers employed in public health departments, other governmental agencies, and nongovernmental organizations
	Percentage of full-time equivalent employees	Determine how many full-time versus part-time workers
	Employment type (regular versus contract employee)	Determine the proportion of contract workers in the governmental public health workforce Analyze trends
	Job function(s)	Percentage of time devoted to different functions within a worker's job to provide a picture of effort devoted to provision of essential services
	Job classification	Identify on the basis of an agreed-upon taxonomy to help determine composition of workforce and identify gaps
	Service area zip code(s)	Provide information regarding geographic distribution of workforce and provision of services Assist in determining underserved areas

SLS Data Sources

An SLS integrating the following sources of workforce data will permit development of a profile of the state and local public health workforce that satisfies the case definition discussed previously and addresses elements of the ideal system outlined. An important next step for the project is to map the data sources against the desired data elements to determine how many are addressed through available data, where the gaps are, and how the data can be collected.

BLS Reports. Publicly available BLS data are not specific enough to allow for an enumeration of public health workers. However, if modified, BLS data can be of considerable utility because they are collected continuously and provide information about a substantial proportion of U.S. workers. Certain strategies can be employed to make BLS data more useful for public health enumeration.

- CDC will embed a staff member at BLS to determine whether disaggregating the occupational data further is possible through extraction.
- CDC and HRSA have expressed interest in exploring the feasibility of a BLS supplement that collects data regarding certain public health job occupations.
- The federal partners and stakeholders advising COEs should arrive at a consensus regarding how BLS should be modified to enhance its use for public health workforce enumeration and surveillance and draft a joint letter to BLS officials requesting a series of changes.

Improvements in BLS data collection can focus on identifying specific industries and agencies associated with public health practice and on gathering data about professional preparation (academic degrees, licensure, and credentials). Changes to the BLS system will require a corresponding mandate to the agency to modify its procedures and the funding to allow it to do so.

NACCHO Profile of Local Health Departments. NACCHO periodically collects information from local governmental public health agencies. Although a substantial gap in data collection existed previously (data were collected in 1990, 1992, 1997, 1999, 2005, 2008, and 2010), NACCHO has begun to collect data more regularly because of RWJF and CDC funding support. NACCHO's profile data set contains data regarding the local public health agency workforce, in particular the characteristics of the top agency executives, gross workforce numbers, and number of FTEs in specific categories. The workforce classifications used by NACCHO (and ASTHO, the state public health agency equivalent of NACCHO) are well-established and form the backbone of the classification schema developed for this project. Although the schema used by NACCHO and ASTHO comprises composite titles and thus are not as descriptive as might be desired, they do provide a basic description of skills and services available in state and local governmental settings.

ASTHO Profile of State Public Health. ASTHO collects data on a periodic basis that are similar to NACCHO's data, but on state and territorial public health agencies. Previously, data collection by ASTHO has been irregular, but a commitment seems to exist, again in part driven by RWJF and CDC funding support, to more regular data collection, contemporaneous with the NACCHO profile collection. ASTHO's profile contains data regarding the characteristics of the top agency executives and the number and type of workers employed by state health agencies, as well as the number of workers in specific categories.

A Data Source To Use for Future Surveillance

TRAIN. TRAIN is a public health learning management system developed by the Public Health Foundation. As of September 2011, approximately 275,000 persons were registered TRAIN

users. Although TRAIN was not designed for research purposes, but as a system states can adopt to keep track of training accessed by their workers, it contains data elements we have identified as important for characterizing the workforce. It provides by far the most granular view of the public health workforce, but users are not required to provide responses to certain elements to complete registration.

TRAIN's utility as a data collection tool is demonstrated by the movement in multiple states to modify the TRAIN system to be more of a personnel management system, including in North Carolina and Kentucky. For example, researchers at the University of Kentucky College of Public Health are assisting the state in identifying relevant variables for the desired profile and with implementation of its use as a personnel tracking system. The general idea is that all workers in the governmental public health system in a particular state will be required to register in TRAIN and to complete a profile. Broader application of this model has the potential to advance the utility of TRAIN in supplying information about the public health workforce. One potential avenue for achieving this is for CDC to adopt not only TRAIN for use as a common learning management system throughout the country, but also to mandate use of TRAIN as part of its award requirements to the states and to require states to register all public health personnel in TRAIN and provide the funds to enable compliance. That scenario is a long-term option, but ultimately might be the seed for developing a single system to collect timely information about the numbers and characteristics of the nation's public health workforce. One strategy to encourage widespread use of TRAIN is to mandate federally funded public health training programs (e.g., the HRSA-funded Public Health Training Centers) to adopt TRAIN as a common learning management system.

Combining the Data Sources To Provide a Detailed SLS

A basic SLS to enumerate the local and state workforce should combine the four data sources discussed to provide a detailed picture of the U.S. governmental public health workforce. The system should examine the four data sources to give a multi-tiered view of the U.S. public health workforce and be implemented in concert with data collection for the NACCHO and ASTHO profiles. The scope of the NACCHO and ASTHO profiles can be complemented by the depth of BLS and other data sources. After each round of the profiles is collected from NACCHO and ASTHO, those data, along with BLS and TRAIN data for the years covered by the profiles, can be integrated into a data set that yields a more detailed picture of the U.S. public health workforce.

One gap in the SLS proposed here might be the lack of specific data regarding the federal public health workforce. Thus, supplementing these data with contemporaneous data from the OPM federal employment statistics that include workers in DHHS, EPA, DoD, DHS, and VA, is desirable. Although the data might suffer from the problems noted in the previous section of this report, they can provide comprehensive information on the federal civilian public health workforce. Gebbie et al. also included military personnel who fit the definition of public health worker in their enumeration effort; these data, if desired, will have to be obtained from the armed services branches.[7]

Additional streams of data can be used to supplement the data discussed in this report and thus substantially increase knowledge about the public health workforce. These come from the different discipline-specific organizations in public health and can be integrated into this SLS easily. However, they come with strengths and weaknesses, as discussed previously. For example, CSTE and APHL have both recently conducted surveys of the national epidemiology workforce and the national laboratory workforce. Both the surveys yield information (e.g., number of workers, worker characteristics and competencies, and information about organization structure and factors affecting the work environment). However, CSTE has been collecting data on a regular basis; APHL has only collected one round of surveys, and the frequently with which they plan to collect survey data is unknown. Including APHL data in future attempts at workforce surveillance might not be possible. ASTPHND also has conducted a survey of their membership. Although it too might provide detailed information regarding this aspect of the public health workforce, the survey was administered in 2007, and the frequency with which they plan to collect survey data is unknown. Even though these instruments alone can yield a detailed description of the specific areas of public health practice that they examine, they will not address much of the workforce, and thus might be too narrow in scope to facilitate a detailed enumeration of the workforce. However, they do demonstrate how the ASTHO and NACCHO surveys can be enhanced to gather richer information about the composition of the workforce. Other discipline-specific organizations periodically conduct membership surveys and can be included (e.g., NEHA and the Society of Public Health Education).

A well-designed survey with commonly agreed-upon elements to be used by different professional societies might yield information that can fill in gaps in such broader surveys as ASTHO and NACCHO or results that can be combined with other results to obtain information about individual characteristics and training. Discipline-specific organizations can also assist in identifying numbers of workers in agencies other than traditional governmental public health organizations, which can enhance the detail of enumeration efforts.

RECOMMENDATIONS

Seven broad recommendations for improving enumeration and characterization and for monitoring the public health workforce are as follows:

1. **Secure stable funding for enumeration and workforce monitoring efforts.** The data sources reviewed for this project are supported by varying funding sources. Two of the most critical data sources — ASTHO and NACCHO profile surveys — are funded primarily by a private foundation, with federal funding to support certain activities. Other data produced by professional organizations (e.g., CSTE, ASTPHND, and APHL) are dependent on the availability of federal grants and cooperative agreements to undertake studies. Although such organizations as ASTHO and NACCHO have demonstrated strong commitment to conducting their respective surveys, the possibility always exists that the priorities of funders will change. Thus, the lack of long-term funding leaves the long-range viability of these crucial data sources in question. If professional organizations will continue to be a primary data collection source, continuous funding should be secured.

2. **Identify a lead agency or organization for public health workforce enumeration and monitoring efforts.** Multiple organizations and agencies contribute to providing workforce data, but no clear leader has been established or recognized as being responsible for monitoring the national public health workforce, making development of an organized, systematic approach to workforce surveillance difficult. HRSA is mandated to collect data and monitor the health workforce. CDC also has interest in public health workforce development and surveillance, as do other public health organizations and foundations, as evidenced by the commitment of funding and primary data collection activities. Identification of a specific agency or organization to provide leadership will benefit workforce activities.

3. **Develop a consensus definition of the public health workforce and adopt a common taxonomy to describe public health workers.** This project received input from stakeholders relative to the case definition; however, the problem of a common taxonomy for public health workers and the functions they perform is one that has been highlighted for longer than a decade and was not solved through this 1-year project.[6,35,36] Not all public health worker job titles correspond to job function or education and training. In addition, considerable variation exists between job titles in state and local government, compared with federal government. Inclusion of nongovernmental public health workers in the case definition is assumed to add complexity. For a national SLS to be successful, the field should first agree on who is considered a public health worker and what occupations they hold. One deliverable of this project is a cross-match between federal occupation classifications and occupations used in state and local public health (Appendix Table 1). This work should be expanded further with input from OPM, BLS, and human resources personnel familiar with job titles and labor union requirements.

4. **Engage federal agency partners who have extensive knowledge of federally supported data sources.** Although this report provides a cursory overview of how publicly available data sources (e.g., BLS and NSSRN) can be useful in a national enumeration, staff who work closely with these data should be engaged in developing a workforce SLS. Additionally, if further detail about CDC employees is of interest, staff with access to primary data should be consulted, because these data are not publicly available and are inaccessible by external partners.

5. **Work toward modifying existing data sources to help support enumeration efforts.** Certain existing data sources can be modified to enhance their use for enumeration.

   • ASTHO and NACCHO — Occupational categories can be modified to include additional occupations as determined by stakeholders.
   • NSSRN — The definition of public/community health nurse can be modified to correspond to the expanded case definition developed by stakeholders.
   • BLS — A formal request can be made to BLS officials recommending that (a) more specific NAICS be developed and used to identify public health settings; (b) the local and state government NAICS codes be further subdivided so that data collected specifically from health departments can be disaggregated; (c) tribal workers be disaggregated from the local government NAICS; and (d) additional SOCs specific to public health be developed and employed in the next data collection cycle.

6. **Identify ways to encourage public health organizations and workers to participate in a workforce surveillance process.** Although such projects as the one resulting in this report can include recommendations for developing an enumeration study or an SLS, unless data reporting is encouraged, or somehow mandated, low response rates because of survey fatigue or competing priorities can undermine national public health workforce monitoring efforts. Buy-in from stakeholders — both those interested in workforce data and those expected to report workforce data — should be consulted to ensure that the system that is developed and implemented will be successful.

7. **Develop and test methods to examine the impact of variations in workforce characteristics, including those captured by enumeration, on public health systems output and community health outcomes.** Although enumeration of the public health workforce is an important step in any efforts to gain a better understanding of the public health system, what is ultimately needed is a better understanding of what workforce characteristics lead to improved community health. This will provide public health agencies with data to make evidence-based arguments to preserve or attain a workforce that is able to guard and promote public health effectively.

CONCLUSIONS

Studies of the public health workforce remain fragmented, are largely uncoordinated, and use multiple survey methodologies, depending on the agency or public health specialty group involved. The field of public health has not adopted an overarching definition for who constitutes the national public health workforce, a consensus-driven listing of occupations and disciplines included in that workforce, or a common taxonomy for describing them. The results of this project demonstrate that the harmonized occupational categories used in the ASTHO and NACCHO profile surveys might need to be modified to improve their utility for enumerating and characterizing the public health workforce. The occupational categories might not encompass the breadth of occupations filled by federal workers. In addition, substantial portions of the local public health workforce and the state public health workforce hold occupations other than those described by the occupational categories used by those two groups.

Reliable, quantifiable data that accurately depict the number and characteristics of those providing the essential public health services, and the impact of variations in workforce characteristics on community health, are necessary for developing constructive, relevant workforce policy. In simple terms, we need to know who, trained in what, is practicing where and in which types of settings, and how workforce differences affect health. The Public Health Functions Steering Committee noted in their 1998 report the major concerns involved in identifying, classifying, and enumerating the public health workforce; these still hold true today — lack of clear, concise, mutually exclusive public health profession classification schemes and categories; an absence of consistent public health professional credentialing requirements; and a professional workforce educated in such specific disciplines as medicine, nursing, dentistry, or administration but lacking formal public health training.[6] These major problems remain unsolved. Until the field comes to consensus on these problems, researchers will continue to struggle with accurately estimating workforce composition and supply.

We urge sustained funding so that work in this field can continue. Expanding efforts to harmonize surveys and data gathering by NACCHO and ASTHO to include other practice organizations is key. Such consensus can provide impetus for BLS and researchers to work toward an improved, more inclusive classification of public health workers, supported by better streams of information used to compile national characterization and reporting.

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APPENDIX

OCCUPATIONAL CLASSIFICATIONS USED IN THIS REPORT

The occupational classifications selected for the original working case definition have been collapsed into a grouping of 15 classes. In this listing, which has been created to reflect titles used in the most recent Association of State and Territorial Health Officials (ASTHO) and National Association of County and City Health Officials (NACCHO) surveys, we display the revised classifications and the subclassifications that populate them. The Bureau of Labor Statistics (BLS) Standard Occupational Classifications (SOCs) were identified from listings at http://www.bls.gov. The Office of Personnel Management (OPM) occupational series categories were identified from http://www.fedscope.opm.gov. The groupings of BLS SOCs and OPM occupational categories within case-definition occupational classifications are a reflection of the authors' interpretation of best fit. This list might be refined with additional information from OPM that better defines federal occupational series and how they cross-match with BLS SOCs. Certain OPM occupational categories might be relevant to more than one occupational classification because occupations with the same titles sometimes differ by job function.

1.0 Administrative or Clerical Personnel

1.1. Administrative/Business Professional

Definition: Performs work in business, finance, auditing, management, and accounting; trained at a professional level in their field of expertise before entry into public health. Can include BLS SOCs 11-3031, Financial Managers; 13-2011, Accountants and Auditors; and 13-2031, Budget Analysts. Includes OPM occupational categories 0501–Financial Administration and Program, 0505–Financial Management, 0510–Accounting, 0511–Auditing, and 0560–Budget Analysis.

1.2. Administrative Business Staff

Definition: Performs support work in areas of business and financial operations. Includes Bookkeeper, Accounting Clerk, and Auditing Clerk. Can include BLS SOCs 43-3031, Bookkeeping, Accounting, and Auditing Clerks, and OPM occupation categories 0561–Budget Clerical and Assistance, 0503–Financial Clerical and Assistance, and 0525–Accounting Technician.

1.3. Administrative Support Staff

Definition: Performs nontechnical support work in all areas of management and program administration. Includes Typist, Receptionist, and Stenographer. Includes BLS SOCs 43-4171, Receptionists and Information Clerks; 43-6014, Secretaries and Administrative Assistants; and 43-9022, Word Processors and Typists. Includes the OPM occupational categories 0318–Secretary, 0322–Clerk-Typist, and 0303–Miscellaneous Clerk and Assistant.

2.0 Behavioral Health Professional

Definition: Provides psychological support and assesses, coordinates, and monitors provision of community services for patients/clients. Includes Community Organizers, Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome Counselors, Public Health Social Workers, and Mental Health and Substance Abuse Counselors. Includes BLS SOCs 21-1011, Substance Abuse and Behavioral Disorder Counselors; 21-1022, Healthcare Social Workers; 21-1019, Counselors, All Other; and OPM occupational categories 0185–Social Work, 0186–Social Services Aid and Assistant, 0187–Social Services, 0180–Psychology, and 0181–Psychology Aid and Technician.

3.0 Emergency Preparedness Staff

Definition: Staff whose regular job duties involve preparing for (e.g., developing plans, procedures, and training programs) and managing the public health response to all-hazards events. Includes the ASTHO job title Preparedness Director and BLS SOC 11-9161, Emergency Management Director.

4.0 Environmental Health Worker

4.1 Environmental Engineer

Definition: Applies engineering principles to control, eliminate, ameliorate, or prevent environmental health hazards. Includes all environmental positions identified as Engineer, which is assumed to require preparation at least at the baccalaureate level (e.g., Water Supply/Waste Water Engineer, Solid Waste Engineer, Air Pollution Engineer, or Sanitary Engineer). Includes BLS SOC 17-2081, Environmental Engineers, and OPM occupational category 0819–Environmental Engineering.

4.2 Environmental Engineering Technician

Definition: Assists environmental engineers and other environmental health professionals in the control, elimination, amelioration, or prevention of environmental health hazards. Might collect data and implement procedures or programs developed by environmental engineers and other environmental health professionals. This category includes such job titles as Air Pollution Technician, Water/Waste Water Plant Operator, and Testing Technician. Includes BLS SOC 17-3025, Environmental Engineering Technicians.

4.3 Environmental Science and Protection Technician

Definition: Assists environmental scientists and specialists and other environmental health professionals in the control, elimination, or prevention of environmental health hazards. Includes air pollution technicians and vector control workers. Includes BLS SOC 19-4091, Environmental Science and Protection Technicians, including Health, and OPM occupational categories 0029–Environmental Protection Assistant and 0698–Environmental Health Technician.

4.4 Environmental Scientist and Specialist

Definition: Applies biologic, chemical, and public health principles to control, eliminate, ameliorate, or prevent environmental health hazards. Includes Environmental Researcher, Environmental Health Specialist, Food Scientist, Soil and Plant Scientist, Air Pollution Specialist, Hazardous Materials Specialist, Toxicologist, Water/Waste Water Solid Waste Specialist, Sanitarian, and Entomologist. Includes OPM occupational categories 0414–Entomology, 0415–Toxicology, and 0688–Sanitarian.

4.5 Environmental Health and Protection Specialist

Definition: Plans, develops, implements, and evaluates standards and systems to improve the quality of the physical environment as it affects health; manages environmental health programs; does research on environmental health problems; and promotes public awareness of the need to prevent and eliminate environmental health hazards. Includes Environmentalist, Environmental Scientist, Sanitarian, Radiation Control Specialist, Air Pollution Control Specialist, Vector Control Specialist, Sanitary Engineer, Air Pollution Engineer, and Chemical Engineer. Use of this title is superseded by 1998 SOC titles Environmental Engineer and Environmental Scientist and Specialist. Includes OPM occupational categories 0028–Environmental Protection Specialist and 0688–Sanitarian.

4.6 Occupational Health and Safety Workers

Definition: Collects data on workplace environments and exposures for analysis. Reviews, evaluates, and analyzes workplace environments and exposures and designs and implements programs and procedures to control, eliminate, ameliorate, or prevent disease and injury caused by chemical, physical, biologic, and ergonomic risks to workers. Includes Industrial Hygienist, Occupational Medicine Specialist, and Safety Specialist, and Occupational Health and Safety Technicians. Includes BLS SOCs 29-9012, Occupational Health and Safety Technicians, and 29-9011, Occupational Health and Safety Specialists, and OPM occupational categories 0690–Industrial Hygiene, 0018–Safety and Occupational Health Management, and 0019–Safety Technician.

5.0 Epidemiologist

Definition: Investigates, describes, and analyzes the distribution and determinants of disease, disability, and other health outcomes, and develops the means for disease prevention and control; investigates, describes, and analyzes the efficacy of programs and interventions. Includes persons specifically trained as Epidemiologists and those trained in another discipline (e.g., Medicine, Nursing, or Environmental Health) working as epidemiologists under such job titles as Nurse Epidemiologist. Includes BLS SOC 19-1041, Epidemiologist.

6.0 Health Educator

Definition: Designs, organizes, implements, communicates, and provides advice on and evaluates the effect of educational programs and strategies designed to support and modify health-related behaviors of persons, families, organizations, and communities. This job title includes Health Educators, unless specified in another specific category (e.g., Dental Health Educator or Occupational Health Educator). Includes BLS SOC 21-1091, Health Educators, and OPM occupational category 1725–Public Health Educator.

7.0 Laboratory Worker

7.1 Public Health Laboratory Professional

Definition: Plans, designs, and implements laboratory procedures to identify and quantify agents in the environment that might be hazardous to human health, biologic agents believed to be involved in the etiology of diseases among animals or humans (e.g., bacteria, viruses, and parasites), or other physical, chemical, and biologic hazards. Might be involved in research and development or production of antimicrobial agents. Includes Microbiologist, Chemist, Toxicologist, Physicist, Virologist, Entomologist, and unspecified laboratory professionals. Laboratory staff with less than baccalaureate-level education are classified with technical occupational titles. Includes BLS SOCs 19-1022, Microbiologists; 19-1023, Zoologists and Wildlife Biologists; 19-1042, Medical Scientists, except Epidemiologists; 19-2012, Physicists; 29-2011, Medical and Clinical Laboratory Technologists, and OPM occupational categories 0644–Medical Technologist, 0403–Microbiology, 0410–Zoology, 0414–Entomology, 0415–Toxicology, 1320–Chemistry, and 1306–Health Physics.

7.2 Public Health Laboratory Specialist

Definition: Plans, performs, and evaluates laboratory analyses and procedures not elsewhere classified. Performs routine tests in medical laboratory for use in disease treatment and diagnosis. Prepares vaccines, biologics, and serums for disease prevention. Prepares tissue samples for pathologists, takes blood samples, and executes such laboratory tests as urinalysis and blood counts. Might work under the general supervision of a medical laboratory technologist. Includes Medical Laboratory Technician, Histologic Technician, Cytotechnologist, Forensic Evidence Technician, or Specimen Control and Receiving Technician. Includes BLS SOC 29-2012, Medical and Clinical Laboratory Technicians, and OPM occupational categories 0683–Dental Laboratory Aid and Technician, 0645–Medical Technician, and 0646–Pathology Technician.

8.0 Nutritionist

Definition: Plans, develops, implements, and evaluates programs or scientific studies to promote and maintain optimum health through improved nutrition; collaborates with programs that have nutrition components; might involve clinical practice as a dietitian. Includes such titles as

Community Nutritionist, Community Dietitian, Nutrition Scientist, and Registered Dietician. Includes BLS SOC 29-1031, Dieticians and Nutritionists, and OPM occupational category 0630–Dietician and Nutritionist.

9.0 Public Health Dentist

Definition: Plans, develops, implements, and evaluates dental health programs to promote and maintain the public's optimum oral health. Public Health Dentists might provide comprehensive dental care; the Dental Hygienist might provide limited dental services under professional supervision. Includes BLS SOC 29-1029, Dentists, All Other Specialties; and OPM occupational category 0680–Dental Officer.

10.0 Public Health Informatics Specialist

Definition: Systematically applies information and computer science and technology to public health practice, research, and learning. Also known as Public Health Information Systems Specialists or Public Health Informaticists.

11.0 Public Health Manager

Definition: Health service managers, administrators, and health directors overseeing the operations of the agency or of a department or division. Includes the top agency executive, regardless of education or licensing.

11.1 Health Administrator

Definition: Plans, analyzes, organizes, directs, coordinates, and evaluates the use of resources to deliver health services education or policy in such establishments as clinics, public health agencies, managed care organizations, industrial and other types of businesses, or related entities; manages or regulates health agencies and facilities. Includes such job titles as Director, Administrator, Chief, Manager, or another title indicating chief public health official of a jurisdiction (e.g., Secretary of Health, Health Officer, or Health Official). Titles including the term *coordinating* or *senior* were classified with the profession referenced (e.g., Coordinating Nutritionist with Public Health Nutritionist or Senior Public Health Nurse with Public Health Nurse). Includes BLS SOC 11-9111, Medical and Health Services Managers, and OPM occupational categories 0340–Program Management, 0341–Administrative Officer, 0685–Public Health Program Specialist, and 0670–Health System Administration.

12.0 Public Health Nurse

Definition: Plans, develops, implements, and evaluates nursing and public health interventions for persons, families, and populations at risk for illness or disability. This title covers all positions identified at the registered nurse level, unless specified as performing work defined under another professional title (Epidemiology or Occupational Health). Includes graduates of diploma and associate degree programs with the registered nurse license. Includes Community

Health Nurse, Nurse Practitioner, Nurse Specialist, School Nurse, Public Health Nurse, and Nurse Clinician. Positions specified as Licensed Practical Nurse are classified as Other Public Health Technician. Includes BLS SOC 29-1111, Registered Nurses, and OPM occupational category 0610–Nurse.

13.0 Public Health Physician

Definition: Identifies persons or groups at risk for illness or disability and who develop, implement, and evaluate programs or interventions designed to prevent, treat, or ameliorate such risks; might provide direct medical services within the context of such programs. Includes MD and DO generalists and specialists, some of whom have training in public health or preventive medicine. Undercounts physicians working in public health because of the substantial number working in administrative positions (Health Administrator or Official) or specialty areas (Epidemiology or Occupational Health). Includes BLS SOC 29-1069, Physicians and Surgeons, All Other; 29-1062, Family and General Practitioners; and the OPM occupational category 0602–Medical Officer.

14.0 Public Information Specialist (Public Relations or Media Specialist)

Definition: Represents public health topics to the media and public. Acts as a spokesperson for public health agencies. Engages in promoting or creating good will for public health organizations by writing or selecting favorable publicity material and releasing it through different communications media. Prepares and arranges displays, makes speeches, and performs related publicity efforts. In addition to the job titles associated with media spokesperson, this category also includes titles associated with other aspects of public relations and media (e.g., Graphic Artist). Includes BLS SOC 11-2031, Public Relations and Fundraising Managers.

15.0 Other Public Health Professional

Definition: A general category that includes all positions, professional and nonprofessional, that do not fit in specific categories. Positions in a public health setting occupied by professionals (preparation at the baccalaureate level or higher) that do not fall under the specific categories listed in occupational categories 1.0–14.0). Used to classify what an agency reports as other professionals if the report typically specifies professionals into a wide range of the Center for Health Policy (CHP)/Bureau of Health Professions classifications. If the report specifies only one or two professions (e.g., Nurses and Physicians) and all others are listed as other professionals, the other professionals would be classified only at the Equal Employment Opportunity-4 level, not within CHP/Bureau of Health Professions level. Includes BLS SOCs 29-1131, Veterinarians (for Public Health Veterinarians); 29-2021, Dental Hygienists; 31-9091, Dental Assistants; 15-1121, Computer Systems Analyst; 15-1131, Computer Programmers; 15-1142, Network and Computer Systems Administrators; and 43-9021 Data Entry Keyers. Also includes OPM occupational categories 0701–Veterinary Medical Science, 0620–Practical Nurse, 0681–Dental Assistant, 0682–Dental Hygiene, 0601–General Health Science, and 2210–Information Technology Management.

Appendix Table 1. Bureau of Labor Statistics and Office of Personnel Management occupational classifications grouped into case definition occupational categories*

Case definition category	Bureau of Labor Statistics		Office of Personnel Management occupation series
	Direct-match titles	Standard Occupational Classification	
Administrative or Clerical Personnel	Financial Officer, Financial Director	11-3031, Financial Managers	0303–Miscellaneous Clerk and Assistant
	Accountant, Auditor	13-2011, Accountants and Auditors	0318–Secretary
	Cost Analyst, Budget Coordinator	13-2031, Budget Analysts	0322–Clerk-Typist
	Bookkeeper, Auditing Clerk	43-3031, Bookkeeping, Accounting, and Auditing Clerks	0501–Financial Administration and Program
	Receptionist	43-4171, Receptionists and Information Clerks	0503–Financial Clerical and Assistance
	Office Secretary	43-6014, Secretaries and Administrative Assistants	0505–Financial Management
			0510–Accounting
	Typist, Word Processor, Clerk Typist	43-9022, Word Processors and Typists	0511–Auditing
			0525–Accounting Technician
			0560–Budget Analysis
			0561–Budget Clerical and Assistance
Behavioral Health Professional	Alcohol and Drug Counselor, Substance Abuse Counselor	21-1011, Substance Abuse and Behavioral Disorders Counselors	0180–Psychology
	Public Health Social Worker	21-1022, Healthcare Social Workers	0181–Psychology Aid and Technician
	HIV/AIDS Counselor	21-1019, Counselors, All Other	0185–Social Work
			0186–Social Services Aid and Assistant
			0187–Social Services
Emergency Preparedness Staff	Emergency Preparedness Coordinator	11-9161, Emergency Management Directors	N/A
Environmental Health Worker	Air Pollution Engineer, Hazardous Substances Engineer, Waste Management Engineer, Waste Water Engineer	17-2081, Environmental Engineers	0018–Safety and Occupational Health Management
			0019–Safety Technician
			0028–Environmental Protection Specialist
	Environmental Remediation Engineering Technician, Pollution Control Engineering Technician	17-3025, Environmental Engineering Technicians	0029–Environmental Protection Assistant
	Air Quality Technician, Environmental Compliance Technician, Groundwater Monitoring Technician, Infectious Waste Technician, Pollution Control Technician, Public Health Sanitarian, Technician, Radon Inspector, Waste Minimization Technician	19-4091, Environmental Science and Protection Technicians, including Health	0414–Entomology
			0415–Toxicology
			0688–Sanitarian
			0690–Industrial Hygiene
			0698–Environmental Health Technician
			0819–Environmental Engineering

Case definition category	Bureau of Labor Statistics		Office of Personnel Management occupation series
	Direct-match titles	Standard Occupational Classification	
	Ecological Modeler, Environmental Analyst, Environmental Scientist, Hazardous Substances Scientist, Health Environmentalist, Water Pollution Scientist, Water Quality Analyst	19-2041, Environmental Scientists and Specialists, including Health	
	Radiological Health Specialist, Construction Health and Safety Technician, Ergonomics Technician, Environmental Health Technician, Occupational Health and Safety Technician/Technologist	29-9012, Occupational Health and Safety Technicians	
	Certified Indoor Environmentalist, Certified Industrial Hygienist, Certified Professional Ergonomist, Health and Safety Inspector, Industrial Hygienist and Health Specialist, Occupational Health and Safety Specialist	29-9011, Occupational Health and Safety Specialists	
Epidemiologist	Clinical Epidemiologist, Communicable Disease Specialist, Environmental Epidemiologist, Epidemiology Investigator, Malariologist, Medical Epidemiologist, Pharmacoepidemiologist	19-1041, Epidemiologists	N/A
Health Educator	Certified Diabetes Educator, Certified Health Education Specialist, Community Health Education Coordinator, Public Health Educator	21-1091, Health Educators	1725–Public Health Educator
Laboratory Worker	Public Health Microbiologist Entomologist Toxicologist Health Physicist Blood Bank Lab Technologist, Chief Medical Technologist, Clinical Lab Technologist, Cytotechnologist, Histotechnologist, Immunohematologist	19-1022, Microbiologists 19-1023, Zoologists and Wildlife Biologists 19-1042, Medical Scientists, Except Epidemiologists 19-2012, Physicists 29-2011, Medical and Clinical Laboratory Technologists	0403–Microbiology 0410–Zoology 0414–Entomology 0415–Toxicology 1306–Health Physics 1320–Chemistry 0683–Dental Laboratory Aid and Technician 0644–Medical Technologist 0645–Medical Technician 0646–Pathology Technician

	Bureau of Labor Statistics		
Case definition category	**Direct-match titles**	**Standard Occupational Classification**	**Office of Personnel Management occupation series**
	Blood Bank Lab Technician, Hematology Technician, Hemodialysis Technician, Histologic Technician, Neurology Technician, Pathology Technician, Serology Technician	29-2012, Medical and Clinical Laboratory Technicians	
Nutritionist	Public Health Dietician, Public Health Nutritionist	29-1031, Dieticians and Nutritionists	0630–Dietician and Nutritionist
Public Health Dentist	Public Health Dentist	29-1029, Dentists, All Other Specialties	0680–Dental Officer
Public Health Informatics Specialist	N/A	N/A	N/A
Public Health Manager	Public Health Administrator	11-9111, Medical and Health Services Managers	0340–Program Management 0341–Administrative Officer 0670–Health System Administration 0685–Public Health Program Specialist
Public Health Nurse	Community Health Nurse	29-1111, Registered Nurses	0610–Nurse
Public Health Physician	N/A	29-1069, Physicians and Surgeons, All Other 29-1062, Family and General Practitioners	0602–Medical Officer
Public Information Specialist	Communications Manager, Public Affairs Director, Public Relations Manager	11-2031, Public Relations and Fundraising Managers	N/A
Other Public Health Professional	Public Health Veterinarian	29-1131, Veterinarians	0701–Veterinary Medical Science
	Wellness Director/Manager	N/A	0681–General Health Science
	Licensed Practical Nurse	29-2061, Licensed Practical and Vocational Nurses	0620–Practical Nurse
	Dental Assistant	31-9091, Dental Assistants	0681–Dental Assistant
	Dental Hygienist	29-2021, Dental Hygienists	0682–Dental Hygiene
	Computer Systems Analyst, Data Processing Analyst, Information Systems Analyst	15-1121, Computer Systems Analysts	2210–Information Technology Management
	Network Coordinator, Network Systems Admin	15-1142, Network and Computer Systems Administrators	

N/A = not applicable.

* National Association of County and City Health Officials and Association of State and Territorial Health Officials harmonized occupational categories.

Appendix Table 2. Data elements by source

Data source	Target population	Survey frequency	Data elements			
			Occupations	Recruit/retain	Other	Missing
Association of State and Territorial Health Officials: 2010 Profile Survey [Workforce Section D]	State and territorial public health departments (n = 55)	Every 3 years	Administrative/Clerical, Public Health (PH) Nurse, Environmental Health Worker, Laboratory Worker, PH Manager, Social Worker, Epidemiologist/Statistician, Health Educator, PH Informatics Specialist, Nutritionist, PH Physician, Public Information Specialist, Preparedness Director, PH Dentist, Other	Years of service Retirement eligibility Turnover rate Vacant positions Positions being recruited	Full-time equivalents (FTEs) Full-time, part-time, hourly, and contractual workers Age Salary Percentage of union members Assessment of shortage by occupation	Individual level data Demographics Education and training Competencies Job function
National Association of County and City Health Officials: 2010 Profile Survey	Local health departments in 48 states and the District of Columbia (no local health departments in Hawaii or Rhode Island) (n = 2,794)	Every 3 years	Administrative/Clerical, PH Nurse, Environmental Health Worker, PH Manager, Behavioral Health Professional, Epidemiologist, Health Educator, PH Informatics Specialist, Nutritionist, PH Physician, Public Information Specialist, Emergency Preparedness Staff	Number of layoffs Number lost through attrition and not replaced Number of employees with involuntarily reduced working hours Number of employees on mandatory furlough Retirement	Top executive information (demographics, education) Race/ethnicity FTEs Full-time, part-time, hourly, and contractual workers Whether competencies are used Percentage of workforce conducting activities	Individual-level data Education and training Competencies Job function
Office of Personnel Management Federal Employment Statistics, 2011 http://www.fedscope.opm.gov	Civilian federal workers	Quarterly	Refer to Appendix Table 1	Length of service Accessions Separations	Number of workers Age Sex Race/ethnicity Agency Grade level Salary	Education and training Competencies Job function Not specific to public health
Bureau of Labor Statistics, 2010 Business and household surveys http://www.bls.gov	Employed U.S. workers	Annually	Refer to Appendix Table 1		Employment Hours Salary Age Sex Race/ethnicity Educational attainment	Competencies Job function Not specific to public health

Data source	Target population	Survey frequency	Data elements			
			Occupations	Recruit/retain	Other	Missing
Association of Public Health Laboratories, 2011	Public health, agricultural, and environmental laboratories	Conducted once	Laboratory Aide/Assistant, Laboratory Technician, Laboratory Scientist, Laboratory Scientist-Supervisor, Laboratory Scientist-Manager, Laboratory Developmental Scientist, Agricultural or Environmental Assistant/Deputy Director, Public Health Assistant/Deputy Director, Public Health Director	Years of experience Work intention Job satisfaction Recruitment factors Retention factors	FTEs Age Race/ethnicity Sex Salary Experience Education, training, and certification Competency Program area Funding source Capacity	
Council of State and Territorial Epidemiologists Epidemiology Capacity Assessment, 2009	State and territorial health department epidemiologists	Every 2–3 years	Epidemiologist (defined by job function, not job title)	Years of experience Work intention Recruitment factors Retention factors	FTEs Age Race/ethnicity Sex Salary Experience Education, training, and certification Competency Program area Funding source Capacity	

Data source	Target population	Survey frequency	Data elements			
			Occupations	Recruit/retain	Other	Missing
National Sample Survey of Registered Nurses, 2008 Health Resources and Services Administration	Registered nurses nationwide	Every 4 years	Staff Nurse or Direct Care Nurse, Charge Nurse or Team Leader, First-Line Management, Middle Management/Administration, Senior Management/ Administration, Certified Registered Nurse Anesthetist, Clinical Nurse Specialist, Certified Nurse Midwife, Nurse Practitioner, School Nurse, Public Health Nurse, Community Health Nurse, Patient Educator, Staff Educator/Instructor in Clinical Setting, Staff Development Director, Instructor/Lecturer, Professor, Patient Care Coordinator, Case Manager, Discharge Planner, Quality Improvement Nurse, Utilization Review Nurse, Infection Control, Advice/Triage Nurse, Informatics Nurse, Consultant, Legal Nurse, Researcher, Surveyor/ Auditor/Regulator	Years of experience Length of employment Work intentions Reasons for leaving position/job changes Job satisfaction Retirement	Number of nurses Age Race/ethnicity Sex Languages spoken Salary Experience Education, training, and certification Employment type Funding source	Nonregistered nurse public health nurses (licensed practical nurses and others) Nonclinical nurses in federal agencies Competencies
Association of State and Territorial Public Health Nutrition Directors, 2007	PH nutritionists — governmental, for-profit, nonprofit, and tribal	Every 6–7 years	Public Health Nutrition Director, Assistant Public Health Nutrition Director, Public Health Nutrition Supervisor, Public Health Nutrition Consultant, Public Health Nutritionist, Clinical Nutritionist, Nutritionist, Nutrition Technician, Nutrition Assistant/Aide, Breastfeeding Peer Counselor	Retirement	Number of staff FTEs Agency type Race/ethnicity Sex Language Funding source Job function Location Age Education Credentials Experience Salary	Recruitment factors Retention factors Competency

Data source	Target population	Survey frequency	Data elements			
			Occupations	Recruit/retain	Other	Missing
Association of Schools of Public Health (ASPH) Annual Data Report, 2010	Member schools of public health	Annually	Students	Not applicable	Department Age Sex Race/ethnicity	Work intention Graduation placement Non-ASPH member
ASPH Data Report on Faculty, 2009	Member schools of public health	Annually	Faculty	Not applicable	Number of faculty and FTEs Sex Race/ethnicity Academic title Program area Tenure status	Education and training Years of experience Practice experience Job function (teaching, research) Recruitment/retention factors Retirement Non-ASPH member

Data source	Target population	Survey frequency	Data elements			
			Occupations	Recruit/retain	Other	Missing
TrainingFinder Real-Time Affiliate Integrated Network	U.S. public health workers	Continuously	Administrative Support Staff, Administrator/ Director/Manager, Allied Health Professional, Animal Control Specialist/ Veterinarian, Biostatistician, Childcare Provider, Communicable Disease/ Infection Control Staff, Computer/ Information Systems Specialist, Dental Professional, Emergency Responder, Environmental Health Professional, Epidemiologist/ Surveillance Staff, Food Services/Facilities Management/ Housekeeper, Government Official, Health Educator, Laboratory Professional/ Technician, Law Enforcement, Legal Professional, Librarian/Information Specialist, Licensure/Inspection/ Regulatory Specialist, Medical Examiner/Coroner, Mental and Behavioral Health Professional, Nonphysician Clinician, Nurse, Occupational Health and Safety Personnel, Other, Outreach/Field Worker, Pharmacy Professional, Physician, Policy Planner, Program Specialist, Public Health Professional, Public Relations/Media Specialist, Researcher/Analyst, Student, Teacher/Faculty, Volunteer	Not applicable	Age Education Race/ethnicity Sex Language Discipline Work setting Training Competency	

Appendix Table 3. Enumeration data for public health workforce case definition occupations, by data source

Case definition occupations	2010 BLS Federal	2010 BLS State	2010 BLS Local	2010 NACCHO* Local	2010 ASTHO State	2011 APHL State	2011 OPM Federal	2007 ASTPHND State	2007 ASTPHND Local	2007 ASTPHND Tribal	2008 NSSRN* State	2008 NSSRN* Local	2009 CSTE State	2007 ACPM F/S/L
Administrative or Clerical Personnel	102,010	157,470	283,520	40,400	18,481	894	59,486	—	—	—	—	—	—	—
Behavioral Health Professional	0	6,960	20,620	5,600	2,974	—	16,027	—	—	—	—	—	—	—
Emergency Preparedness Staff	0	1,100	6,470	2,700	43	—	—	—	—	—	—	—	—	—
Environmental Health Worker	17,540	37,970	32,930	13,800	5,780	—	7,651	—	—	—	—	—	—	—
Epidemiologist	0	1,430	1,160	1,500	2,550	—	—	—	—	—	—	—	2,193	—
Health Educator	2,750	3,340	6,820	4,900	2,440	—	56	—	—	—	—	—	—	—
Laboratory Worker	20,310	10,830	3,730	—	3,965	5,498	13,350	—	—	—	—	—	—	—
Nutritionist	1,830	2,760	3,970	4,600	1,557	—	2,166	2,891	4,477	188	—	—	—	—
Public Health Dentist	2,010	0	0	—	236	—	1,673	—	—	—	—	—	—	—
Public Health Informatics Specialist	—	—	—	1,100	1,317	207	—	—	—	—	—	—	—	—
Public Health Manager	7,940	6,650	9,220	9,500	3,826	—	11,239	—	—	—	—	—	—	—
Public Health Nurse	65,610	40,960	45,580	27,900	11,071	—	60,708	—	—	—	16,467	34,637	—	—
Public Health Physician	28,630	2,940	4,230	1,800	1,157	—	28,143	—	—	—	—	—	—	1,654
Public Information Specialist	370	860	3,160	510	332	—	—	—	—	—	—	—	—	—
Other Public Health Professional/Uncategorized Workers	27,500	63,020	68,290	45,690	47,551	—	46,329	—	—	—	—	—	—	—
TOTAL	**276,500**	**336,290**	**489,700**	**160,000**	**103,280**	**6,599**	**246,828**	**2,891**	**4,477**	**188**	**16,467**	**34,637**	**2,193**	**1,654**

ACPM = American College of Preventive Medicine; APHL= Association of Public Health Laboratories; ASTHO = Association of State and Territorial Health Officials; ASTPHND = Association of State and Territorial Public Health Nutrition Directors; BLS = Bureau of Labor Statistics; CSTE = Council of State and Territorial Epidemiologists; F/S/L = federal, state, and local combined. NACCHO = National Association of County and City Health Officials; OPM = Office of Personnel Management; NSSRN = National Survey Sample of Registered Nurses.

*   Weighted estimates.

Appendix Table 4A. Enumeration of workforce in federal agencies with public health relevance — Office of Personnel Management categories grouped, by case definition occupational classifications*

Case definition category	TOTAL[†]	AA	ACF	AHRQ	ATSDR	CDC	CMS	FDA	HRSA	IHS
Administrative or Clerical Professional										
Miscellaneous Clerk and Assistant (0303)	**24,386**	3	21	12	7	193	84	360	30	214
Secretary (0318)	**5,749**	1	5	5	9	108	45	107	37	398
Clerk-Typist (0322)	**75**	0	0	0	0	0	0	1	0	4
Financial Administration and Program (0501)	**4,984**	1	131	0	1	32	126	57	24	48
Financial Clerical and Assistance (0503)	**2,750**	0	1	0	0	4	2	0	3	111
Financial Management (0505)	**391**	0	0	0	0	1	3	1	2	11
Accounting (0510)	**5,449**	0	1	1	3	78	204	30	10	54
Auditing (0511)	**6,992**	0	39	0	0	0	37	0	3	4
Accounting Technician (0525)	**5,469**	0	0	0	0	0	12	2	0	134
Budget Analysis (0560)	**2,938**	1	28	7	0	166	44	55	25	74
Budget and Clerical Assistance (0561)	**303**	1	0	0	0	0	1	2	0	36
Total Administrative/ Clerical Professional	**59,486**	**7**	**226**	**25**	**20**	**582**	**558**	**615**	**134**	**1,088**
Behavioral Health Professional										
Psychology (0180)	**4,859**	0	0	0	0	19	0	22	0	59
Psychology Aid and Technician (0181)	**586**	0	0	0	0	0	0	0	0	0
Social Work (0185)	**9,784**	0	0	0	0	0	0	0	3	85
Social Services Aid and Assistant (0186)	**663**	0	0	0	0	0	0	0	0	40
Social Services (0187)	**135**	0	0	0	0	0	0	1	0	14
Total Behavioral Health Professional	**16,027**	**0**	**0**	**0**	**0**	**19**	**0**	**23**	**3**	**198**
Environmental Health Worker										
Safety and Occupational Health Management (0018)	**931**	0	0	0	0	40	1	11	0	17
Safety Technician (0019)	**60**	0	0	0	0	4	0	0	0	0
Environmental Protection Specialist (0028)	**3,220**	0	0	0	1	2	0	0	0	1
Environmental Protection Assistant (0029)	**96**	0	0	0	0	1	0	0	0	0
Entomology[§] (0414)[†]	**509**	0	0	0	0	0	0	0	0	0
Toxicology[§] (0415)[†]	**259**	0	0	0	0	0	0	0	0	0
Sanitarian (0688)	**39**	0	0	0	0	1	0	0	0	36
Industrial Hygiene (0690)	**358**	0	0	0	0	49	0	13	0	1

Enumerating the Public Health Workforce

Case definition category	TOTAL[†]	AA	ACF	AHRQ	ATSDR	CDC	CMS	FDA	HRSA	IHS
Environmental Health Technician (0698)	**15**	0	0	0	0	0	0	0	0	7
Environmental Engineering (0819)	**2,164**	0	0	0	1	5	0	0	0	57
Total Environmental Health Worker	**7,651**	**0**	**0**	**0**	**2**	**102**	**1**	**24**	**0**	**119**
Health Educator										
Public Health Educator (1725)	**56**	**0**	**0**	**0**	**0**	**27**	**0**	**5**	**0**	**13**
Laboratory Worker										
Microbiology (0403)	**2,294**	0	0	0	0	466	0	639	6	1
Zoology (0410)	**31**	0	0	0	0	0	0	1	0	0
Entomology[§] (0414)[†]	**33**	0	0	0	0	14	0	16	0	0
Toxicology[§] (0415)[†]	**168**	0	0	0	3	18	0	92	0	0
Health Physics (1306)	**198**	0	0	0	2	20	0	3	0	0
Chemistry (1320)	**3,217**	0	0	0	0	175	0	1,090	0	0
Dental Lab Aid and Technician (0683)	**331**	0	0	0	0	0	0	0	0	1
Medical Technologist (0644)	**5,000**	0	0	0	0	17	35	34	2	289
Medical Technician (0645)	**1,729**	0	0	0	0	1	0	0	0	135
Pathology Technician (0646)	**349**	0	0	0	0	1	0	1	0	5
Total Laboratory Worker	**13,350**	**0**	**0**	**0**	**5**	**712**	**35**	**1,876**	**8**	**431**
Nutritionist										
Dietician and Nutritionist (0630)	**2,166**	**2**	**0**	**0**	**0**	**2**	**2**	**37**	**0**	**53**
Public Health Dentist										
Dental Officer (0680)	**1,673**	**0**	**0**	**0**	**0**	**4**	**0**	**27**	**4**	**151**
Public Health Manager										
Program Management (0340)	**4,008**	3	12	0	0	46	139	10	14	21
Administrative Officer (0341)	**3,583**	1	8	0	0	53	6	20	19	29
Health System Administration (0670)	**493**	0	0	0	0	0	0	0	0	81
Public Health Program Specialist (0685)	**3,155**	0	0	11	16	1,590	1	80	817	24
Total Public Health Manager	**11,239**	**4**	**20**	**11**	**16**	**1,689**	**146**	**110**	**850**	**155**
Public Health Nurse										
Nurse (0610)	**60,708**	**0**	**0**	**0**	**0**	**22**	**127**	**66**	**20**	**2,079**
Public Health Physician										
Medical Officer (0602)	**28,143**	**0**	**0**	**27**	**2**	**324**	**42**	**2,378**	**42**	**694**
Other Public Health Professional										
General Health Science (0601)	**11,092**	0	0	58	78	1,825	40	689	14	96
Practical Nurse (0620)	**13,795**	0	0	0	0	0	0	0	0	240
Dental Assistant (0681)	**1,920**	0	0	0	0	0	0	0	0	502
Dental Hygiene (0682)	**316**	0	0	0	0	0	0	1	0	25
Veterinary Medical Science (0701)	**2,156**	0	0	0	0	17	0	117	0	0
Information Technology Management (2210)	**17,050**	2	27	6	3	487	545	395	61	302

Enumerating the Public Health Workforce

Case definition category	TOTAL†	AA	ACF	AHRQ	ATSDR	CDC	CMS	FDA	HRSA	IHS
Total Other	46,329	2	27	64	81	2,329	585	1,202	75	1,165
Total Categorized Workers	246,828	15	273	127	126	5,812	1,496	6,363	1,136	6,146
Workers Not Categorized	551,825	101	1,086	218	67	4181	3750	9,183	810	8,082
TOTAL WORKFORCE	768,443	112	1,333	328	177	9,692	5,117	15,078	1,879	13,612

Source: US Office of Personnel Management (OPM). About the Statistical Data Mart (SDM). Washington, DC: OPM; 2011. Available at: http://www.opm.gov/feddata/html/sdminfo.asp. Accessed January 26, 2012.

Agency abbreviations: AA = Administration on Aging; ACF = Administration for Children and Families; AHRQ = Agency for Healthcare Research and Quality; ATSDR = Agency for Toxic Substances and Disease Registry; CDC = Centers for Disease Control and Prevention; CMS = Centers for Medicare and Medicaid Services; EPA = U.S. Environmental Protection Agency; FDA = Food and Drug Administration; HRSA = Health Resources and Services Administration; IHS = Indian Health Service; USDA = U.S. Department of Agriculture.

*   OPM occupational categories.

†   Totals include all agencies listed in both Appendix Tables 4A and B.

§   Entomologists and Toxicologists are included as both Environmental Health Workers and Laboratory Workers. We designated workers in these occupations from EPA and USDA as Environmental Health Workers and all others as Laboratory Workers.

Appendix Table 4B. Enumeration of workforce in federal agencies with public health relevance — Office of Personnel Management categories grouped, by case definition occupational classifications*

Case definition category	TOTAL[†]	NIH	OS/ OASH	PSC	SAMHSA	EPA	USDA	DoD	DHS	VA
Administrative or Clerical Professional										
Miscellaneous Clerk and Assistant (0303)	**24,386**	1,132	597	44	38	254	2,715	1,749	2,230	14,703
Secretary (0318)	**5,749**	241	42	2	24	347	1,010	709	400	2,259
Clerk-Typist (0322)	**75**	0	0	0	0	1	5	1	1	62
Financial Administration and Program (0501)	**4,984**	53	14	32	0	129	481	2870	638	347
Financial Clerical and Assistance (0503)	**2,750**	6	2	1	0	36	445	256	23	1,860
Financial Management (0505)	**391**	4	0	1	0	9	26	80	35	218
Accounting (0510)	**5,449**	70	22	177	4	162	775	2,846	518	494
Auditing (0511)	**6,992**	35	712	0	0	143	311	4,917	670	121
Accounting Technician (0525)	**5,469**	49	0	8	0	9	255	3,819	425	756
Budget Analysis (0560)	**2,938**	149	72	7	6	102	754	661	330	457
Budget and Clerical Assistance (0561)	**303**	4	1	0	0	3	106	19	9	121
Total Administrative/ Clerical Professional	**59,486**	**1,743**	**1,462**	**272**	**72**	**1,195**	**6,883**	**17,927**	**5,279**	**21,398**
Behavioral Health Professional										
Psychology (0180)	**4,859**	154	53	0	1	13	10	64	43	4,421
Psychology Aid and Technician (0181)	**586**	2	0	0	0	0	0	5	0	579
Social Work (0185)	**9,784**	35	0	0	0	0	2	8	2	9,649
Social Services Aid and Assistant (0186)	**663**	0	0	0	0	0	404	0	0	219
Social Services (0187)	**135**	2	0	0	0	0	1	0	1	116
Total Behavioral Health Professional	**16,027**	**193**	**53**	**0**	**1**	**13**	**417**	**77**	**46**	**14,984**
Environmental Health Worker										
Safety and Occupational Health Management (0018)	**931**	26	12	0	0	19	169	177	116	343
Safety Technician (0019)	**60**	1	0	0	0	0	8	12	2	33
Environmental Protection Specialist (0028)	**3,220**	10	1	0	0	2,751	44	201	182	27
Environmental Protection Assistant (0029)	**96**	0	0	0	0	65	7	19	4	0
Entomology[§] (0414)	**509**	0	0	0	0	21	486	2	0	0
Toxicology[§] (0415)	**259**	0	0	0	0	248	7	3	0	1
Sanitarian (0688)	**39**	2	0	0	0	0	0	0	0	0
Industrial Hygiene (0690)	**358**	7	0	0	0	29	8	18	18	215

Case definition category	TOTAL[†]	NIH	OS/ OASH	PSC	SAMHSA	EPA	USDA	DoD	DHS	VA
Environmental Health Technician (0698)	**15**	0	7	0	0	0	0	0	0	1
Environmental Engineering (0819)	**2,164**	9	0	0	0	1,960	68	14	19	31
Total Environmental Health Worker	**7,651**	**55**	**20**	**0**	**0**	**5,093**	**797**	**446**	**341**	**651**
Health Educator										
Public Health Educator (1725)	**56**	**6**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**2**
Laboratory Worker										
Microbiology (0403)	**2,294**	408	1	0	0	110	503	55	11	94
Zoology (0410)	**31**	5	0	0	0	17	8	0	0	0
Entomology[§] (0414)[†]	**33**	3	0	0	0	0	0	0	0	0
Toxicology[§] (0415)[†]	**168**	44	0	0	11	0	0	0	0	0
Health Physics (1306)	**198**	26	0	0	0	38	4	11	9	85
Chemistry (1320)	**3,217**	549	0	0	2	582	472	60	171	116
Dental Lab Aid and Technician (0683)	**331**	0	0	0	0	0	0	0	0	330
Medical Technologist (0644)	**5,000**	200	0	0	0	0	0	1	0	4,422
Medical Technician (0645)	**1,729**	4	63	0	0	0	0	1	0	1,525
Pathology Technician (0646)	**349**	16	0	0	0	0	0	0	1	325
Total Laboratory Worker	**13,350**	**1,255**	**64**	**0**	**13**	**747**	**987**	**128**	**192**	**6,897**
Nutritionist										
Dietician and Nutritionist (0630)	**2,166**	**23**	**3**	**0**	**0**	**1**	**143**	**3**	**0**	**1,897**
Public Health Dentist										
Dental Officer (0680)	**1,673**	**26**	**233**	**0**	**0**	**0**	**0**	**0**	**0**	**1,228**
Public Health Manager										
Program Management (0340)	**4,008**	11	12	21	2	357	1,031	241	1,705	383
Administrative Officer (0341)	**3,583**	605	432	0	7	53	416	233	409	1,292
Health System Administration (0670)	**493**	5	0	0	0	0	0	0	2	405
Public Health Program Specialist (0685)	**3,155**	136	182	0	298	0	0	0	0	0
Total Public Health Manager	**11,239**	**757**	**626**	**21**	**307**	**410**	**1,447**	**474**	**2,116**	**2,080**
Public Health Nurse										
Nurse (0610)	**60,708**	**1,086**	**2,299**	**2**	**0**	**2**	**50**	**122**	**37**	**54,796**
Public Health Physician										
Medical Officer (0602)	**28,143**	**1,699**	**1,200**	**5**	**2**	**22**	**2**	**85**	**11**	**21,608**
Other Public Health Professional										
General Health Science (0601)	**11,092**	2,541	46	0	0	185	21	56	34	5,409
Practical Nurse (0620)	**13,795**	2	52	0	0	0	14	1	0	13,486
Dental Assistant (0681)	**1,920**	0	43	0	0	0	0	0	2	1,373
Dental Hygiene (0682)	**316**	0	0	0	0	0	0	0	1	289
Veterinary Medical Science (0701)	**2,156**	75	142	0	0	17	1,757	0	8	23
Information Technology Management (2210)	**17,050**	755	176	108	10	659	3,628	6,506	3,371	9

Enumerating the Public Health Workforce

Case definition category	TOTAL[†]	NIH	OS/ OASH	PSC	SAMHSA	EPA	USDA	DoD	DHS	VA
Total Other	46,329	3,373	459	108	10	861	5,420	6,563	3,416	20,589
Total Categorized Workers	246,828	10,216	6,422	408	405	8,344	16,146	25,825	11,438	146,130
Workers Not Categorized	551,825	10,686	10,811	476	217	10,929	85,120	72,640	182,851	150,617
TOTAL WORKFORCE	768,443	19,529	16,594	838	560	18,671	97,536	96,006	191,658	279,723

Source: US Office of Personnel Management (OPM). About the Statistical Data Mart (SDM). Washington, DC: OPM; 2011. Available at: http://www.opm.gov/feddata/html/sdminfo.asp. Accessed January 26, 2012.

Agency abbreviations: NIH = National Institutes of Health; OS/OASH = Office of the Secretary of Health and Human Services and Office of the Assistant Secretary for Health; PSC = Program Support Center; SAMHSA = Substance Abuse and Mental Health Services Administration; EPA = U.S. Environmental Protection Agency; USDA = U.S. Department of Agriculture; DoD = U.S. Department of Defense; DHS = U.S. Department of Homeland Security; VA = Veterans Health Administration (Veterans Affairs).

[*]   OPM occupational categories.
[†]   Totals include all agencies listed in both Appendix Tables 4A and B.
[§]   Entomologists and Toxicologists are included as both Environmental Health Workers and Laboratory Workers. We designated workers in these occupations from EPA and USDA as Environmental Health Workers and all others as Laboratory Workers.

Appendix Table 5A. Enumeration of federal U.S. Department of Health of Human Services, U.S. Environmental Prevention Agency, and U.S. Department Agriculture Workforce, by the Office of Personal Management white-collar occupational series

Occupational series	AA	ACF	AHRQ	ATSDR	CDC	CMS	FDA	HRSA	IHS
Miscellaneous occupations	0	1	0	1	112	17	29	1	213
Social Science, Psychology, and Welfare	73	657	39	6	284	2,618	84	8	358
Personnel Management and Industrial Relations	0	0	0	0	15	12	17	10	212
General Administration, Clerical, and Office Services	26	378	99	30	1,472	868	2,943	616	1,116
Natural Resources Management and Biological Science Group	0	0	0	3	893	0	1,944	16	2
Accounting and Budget	3	201	8	4	281	429	147	67	545
Medical, Hospital, Dental, and Public Health	2	0	97	97	3,870	266	6,476	906	8,375
Veterinary Medicine Science	0	0	0	0	22	0	118	0	0
Engineering and Architecture	0	1	0	1	337	10	371	12	337
Legal and Kindred	0	0	0	0	16	31	187	1	232
Information and Arts	0	10	33	16	528	45	153	17	21
Business and Industry	4	47	22	3	277	139	111	135	206
Copyright, Patent, and Trademark	0	0	0	0	2	0	0	0	0
Physical Sciences	0	0	0	3	293	0	1,222	0	0
Library and Archives	0	0	0	0	37	1	82	2	1
Mathematics and Statistics	2	7	22	4	413	81	401	8	13
Equipment, Facilities, and Services	0	1	0	0	6	30	2	0	47
Education	0	2	0	6	188	9	66	7	36
Investigation	0	0	0	0	0	1	267	0	0
Quality Assurance Inspection and Grading	0	0	0	0	11	0	12	0	0
Supply	0	0	0	0	53	7	9	4	192
Transportation	0	0	0	0	32	0	1	0	7
Information Technology	2	27	6	3	491	550	398	61	302
Total	**112**	**1,332**	**326**	**177**	**9,633**	**5,114**	**15,040**	**1,871**	**12,215**

Source: US Office of Personnel Management (OPM). About the Statistical Data Mart (SDM). Washington, DC: OPM; 2011. Available at: http://www.opm.gov/feddata/html/sdminfo.asp. Accessed January 26, 2012.

Agency abbreviations: AA = Administration on Aging; ACF = Administration for Children and Families; AHRQ = Agency for Healthcare Research and Quality; ATSDR = Agency for Toxic Substances and Disease Registry; CDC = Centers for Disease Control and Prevention; CMS = Centers for Medicare and Medicaid Services; FDA = Food and Drug Administration; HRSA = Health Resources and Services Administration; IHS = Indian Health Service.

Appendix Table 5B. Enumeration of federal U.S. Department of Health of Human Services, U.S. Environmental Prevention Agency, and U.S. Department Agriculture Workforce, by the Office of Personal Management white-collar occupational series

Occupational series	NIH	OS/OASH	PSC	SAMHSA	EPA	USDA	DoD	DHS	VA
Miscellaneous occupations	197	694	17	0	2921	403	3,027	4,021	5,063
Social Science, Psychology, and Welfare	238	421	2	18	219	2,010	966	1,435	16,972
Personnel Management and Industrial Relations	332	470	11	0	264	2,016	1,887	1,668	3,839
General Administration, Clerical, and Office Services	4,006	3,806	270	140	3,729	12,983	14,883	33,122	31,038
Natural Resources Management and Biological Science Group	3,517	46	0	13	1,809	34,776	195	2,369	776
Accounting and Budget	372	835	233	11	603	3,212	17,511	2,790	7,213
Medical, Hospital, Dental, and Public Health	6,214	7,266	13	300	240	576	470	131	171,976
Veterinary Medicine Science	79	248	0	0	17	2,202	0	13	47
Engineering and Architecture	335	6	0	0	2,387	3,728	3,316	1,063	1,796
Legal and Kindred	9	896	0	0	1,204	568	1,107	3,332	1,971
Information and Arts	345	69	5	9	253	1,334	639	577	826
Business and Industry	1,039	110	110	33	563	10,448	18,821	2,244	3,153
Copyright, Patent, and Trademark	0	0	0	0	3	12	0	0	0
Physical Sciences	688	0	0	2	3,256	2,376	264	412	252
Library and Archives	355	10	2	1	16	150	199	38	259
Mathematics and Statistics	366	8	0	22	135	929	822	140	176
Equipment, Facilities, and Services	69	0	11	0	24	115	346	230	987
Education	23	129	0	0	5	637	5,158	775	1,396
Investigation	0	591	0	0	326	8,611	587	130,595	629
Quality Assurance Inspection and Grading	32	0	6	0	0	3,240	3,743	36	42
Supply	80	283	23	1	15	141	5,755	373	3,716
Transportation	23	6	2	0	1	329	653	441	302
Information Technology	757	176	108	10	670	3662	6569	3382	18
Total	**19,076**	**16,070**	**813**	**560**	**18,660**	**94,458**	**86,918**	**189,187**	**252,447**

Source: US Office of Personnel Management (OPM). About the Statistical Data Mart (SDM). Washington, DC: OPM; 2011. Available at: http://www.opm.gov/feddata/html/sdminfo.asp. Accessed January 26, 2012.

Agency abbreviations: NIH = National Institutes of Health; OS/OASH = Office of the Secretary of Health and Human Services and Office of the Assistant Secretary for Health; PSC = Program Support Center; SAMHSA = Substance Abuse and Mental Health Services Administration; EPA = U.S. Environmental Protection Agency; USDA = U.S. Department of Agriculture; DoD = U.S. Department of Defense; DHS = U.S. Department of Homeland Security; VA = Veterans Health Administration (Veterans Affairs).