Strategies for Enumerating the Public Health Workforce
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### Acronym List

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<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>AIA</td>
<td>Aerospace Industries Association</td>
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<tr>
<td>ASTHO</td>
<td>Association of State and Territorial Health Officials</td>
</tr>
<tr>
<td>APA</td>
<td>American Psychological Association</td>
</tr>
<tr>
<td>BLS</td>
<td>Bureau of Labor Statistics</td>
</tr>
<tr>
<td>BHPr</td>
<td>Bureau of Health Professions</td>
</tr>
<tr>
<td>CCW</td>
<td>Center for the Child Care Workforce</td>
</tr>
<tr>
<td>CES</td>
<td>Current Employment Statistics Survey</td>
</tr>
<tr>
<td>CDC</td>
<td>Centers for Disease Control and Prevention</td>
</tr>
<tr>
<td>CMHS</td>
<td>Center for Mental Health Services</td>
</tr>
<tr>
<td>CPS</td>
<td>Current Population Survey</td>
</tr>
<tr>
<td>CTA</td>
<td>Critical Technology Assessment of Biotechnology in U.S. Industry</td>
</tr>
<tr>
<td>DHHS</td>
<td>Department of Health and Human Services</td>
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<tr>
<td>DOC</td>
<td>Department of Commerce</td>
</tr>
<tr>
<td>FAA</td>
<td>Federal Aviation Administration</td>
</tr>
<tr>
<td>FTE</td>
<td>Full time equivalent</td>
</tr>
<tr>
<td>HRSA</td>
<td>Human Resource and Service Administration</td>
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<tr>
<td>HSPC</td>
<td>Human Services Policy Center at the University of Washington</td>
</tr>
<tr>
<td>NACCHO</td>
<td>National Association of County and City Health Officials</td>
</tr>
<tr>
<td>NAICS</td>
<td>North American Industrial Classification System</td>
</tr>
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<td>NASS</td>
<td>National Agricultural Statistic</td>
</tr>
<tr>
<td>NATCA</td>
<td>National Air Traffic Controllers Association</td>
</tr>
<tr>
<td>NHES-99</td>
<td>1999 National Household Education Survey</td>
</tr>
<tr>
<td>NIOEM</td>
<td>National Industry-Occupation Employment Matrix</td>
</tr>
<tr>
<td>NSF</td>
<td>National Science Foundation</td>
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<tr>
<td>NSSRN</td>
<td>National Sample Survey of Registered Nurses</td>
</tr>
<tr>
<td>OECD</td>
<td>Organization for Economic and Cooperative Development</td>
</tr>
<tr>
<td>OES</td>
<td>Occupational Employment Survey</td>
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<tr>
<td>S&amp;E</td>
<td>Science and Engineering</td>
</tr>
<tr>
<td>SAMHSA</td>
<td>Substance Abuse and Mental Health Services Administration</td>
</tr>
<tr>
<td>SESTAT</td>
<td>Scientists and Engineers Statistical Data System</td>
</tr>
<tr>
<td>SOC</td>
<td>Standard Occupational Classification</td>
</tr>
</tbody>
</table>
Acknowledgements

This project would not have been possible without the support and assistance of many organizations and individuals who shared their knowledge of workforce enumeration. The Association of State and Territorial Health Officials would like to thank Kristine M. Gebbie, the Elizabeth Standish Gill Associate Professor of Nursing and the Director of the Center for Health Policy and Health Services Research at the Columbia University School of Nursing for moderating the focus group.

Thanks also to the individuals who participated in the focus group and provided valuable insight during the entire project. A full list of focus group participants is available in Appendix C. In addition, thanks to the members of the Public Health Workforce Development Collaborative for their suggestions as to the professions, industries, and occupations to profile: Christopher A. Atchison, Associate Dean for Public Health Practice, University of Iowa, College for Public Health; Georges Benjamin, Executive Director, American Public Health Association; Ron Bialek, President, Public Health Foundation; Kathy Cahill, Associate Director, Office of Program Planning and Evaluation, Centers for Disease Control and Prevention; Joan P. Cioffi, Director, Strategic Workforce Activity, Office of Workforce and Career Development, Centers for Disease Control and Prevention; Shepard Cohen, North Atlantic Regional Director, National Association of Local Boards of Health; Marie Fallon, Executive Director, National Association of Local Boards of Health; Grace Gorenflo, Senior Advisor, Workforce Development, National Association of County and City Health Officials; Barbara Hatcher, Director, Scientific and Professional Affairs, American Public Health Association; Douglas S. Lloyd, Acting Director, Center for Public Health, Bureau of Health Professions, Health Resources and Services Administration; Patrick M. Libbey, Executive Director, National Association of County and City Health Officials; Charles Mahan, Chiles Center; Harrison C. Spencer, President and CEO, Association of Schools of Public Health; Suzanne Smith, Acting Director, Public Health Practice Program Office, Centers for Disease Control and Prevention; Antigone Vickery, Director, Education and Practice Programs, Association of Schools of Public Health; Kathy Vincent, Staff Assistant to the State Health Officer, Alabama Department of Public Health; Carol S. Woltring, Executive Director, Center for Health Leadership & Practice; and Kathleen Wright, Network Chair/Associate Dean for Practice, St. Louis University School of Public Health. Additional thanks to the members of the Partners in Information Access for the Public Health Workforce Steering Committee for their input. Special thanks to Marjorie A. Cahn, Head, National Information Center on Health Services Research, National Library of Medicine, for all her support.

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Strategies for Enumerating the Public Health Workforce

Executive Summary

How many workers are currently employed in public health? In 2005 public health faces the challenge of not knowing the size of its workforce. That information is needed to describe current demographics, identify shortages and surpluses, track trends over time, forecast future needs, and advocate for resources. It is needed to better understand and monitor the public health workforce shortage reported in the 2004 Association of State and Territorial Health Officials (ASTHO) publication, State Public Health Employee Worker Shortage Report: A Civil Service Recruitment and Retention Crisis. Counting workers presents challenges to many professions, occupations, and industries; these challenges have been met in different ways in the last five years. Public health can use valuable lessons learned from areas outside public health to inform its workforce enumeration strategies.

Project Objectives

ASTHO researched workforce enumeration in a set of ten professions, occupations, and industries from December 2004 to June 2005. Profiles of the ten areas and a matrix of key information were developed (Profiles can be found in Appendix A; the Matrix can be found on page 10). In May 2005, a focus group was conducted with participation of representatives from six of the ten industries, occupations, and professions; representatives from public health; and a representative from the Bureau of Labor Statistics. The project goal was to gather experiences, strategies, and recommendations from areas outside public health to inform future public health enumeration.

Major Themes from the Literature Review

Review of workforce enumeration efforts in child care, science and engineering, nursing, pharmacy, environmental health, mental health, aerospace, air traffic control, biotechnology, and agriculture highlighted four major themes:

1. Definition of the worker. How workers are defined reflects the priorities and data needs of the group conducting the enumeration.
2. Data sources and collection methods. Advantages and disadvantages exist to the variety of data sources and collection methods used by professions, occupations, and industries.
3. The role of enumeration in workforce activities. Enumeration data are used in workforce development activities to describe, monitor, forecast, plan, and advocate.
4. Institutionalization of enumeration. Various factors have led to long histories of workforce enumeration in some areas and less experience in others.

Priority Action Items from the Focus Group

The recommendations of the focus group emphasized the importance of a thorough planning and preparation process prior to enumeration. Focus group members offered five priority action items for public health to consider:

1. Mine prior work. Looking at prior workforce enumeration policy and program research on national, state, and local levels will benefit any potential enumeration. Making better use of existing data will facilitate new efforts.
2. Begin with a clear purpose. A vision is critical. What question should the enumeration ultimately answer? What are the information needs of highest priority?
3. Define public health and the public health worker. Enumeration efforts should
reference a good, but not necessarily perfect, definition of public health.

4. **Set boundaries.** Regardless of how the public health worker is defined, resources and practicality will limit the detail of data that can be collected. Therefore, pick the realistic point at which the priority needs can be met with the definitions, data collection methods, and strategies chosen.

5. **Count regularly.** Regular counting is the only way to describe workforce trends and estimate future needs.

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**Project Background, Objectives, and Approach**

This project grew out of ASTHO’s participation in the Partners in Information Access for the Public Health Workforce (PIAPHW). The strategic plan of the PIAPHW calls for partners to identify and develop collaborative projects to meet the information needs of the public health workforce. One important information need of public health is basic data on the size and composition of its workforce. Because much research and work has been done in other areas outside public health on workforce enumeration, learning from others’ efforts was deemed a priority. The goal of the current project was to gather experiences, strategies, and recommendations from areas outside public health to inform future public health enumeration efforts.

The project was also influenced by findings from the 2004 ASTHO publication, *State Public Health Employee Worker Shortage Report: A Civil Service Recruitment and Retention Crisis* that indicate that current state public health workforce is a rapidly aging population, with retirement rates as high as 45% over the next four years. State public health agencies face high vacancy and turnover rates. Up-to-date on the size and nature of the public health workforce is critical to responding to the public health workforce shortage.

Ten industries, occupations, and professions were selected to be researched. The ten were chosen to form a diverse mix of workforce enumeration histories, methods, and styles. They represented a balance between areas that overlap with public health, such as nursing, mental health, and environmental health, and areas that are, at first glance, unrelated to public health, but that might offer valuable insights and lessons learned, such as aerospace, science and engineering, and agriculture. The Public Health Workforce Development Collaborative gave suggestions as to the professions, industries, and occupations to study. Information was gathered on set aspects of the workforce enumeration processes in the ten industries, occupations, and professions, including total size of the workforce, defining characteristics of the workforce, and workforce data collection methods.

The literature search consisted of searching the Internet for resources related to workforce enumeration in industries, occupations, and professions. It also included extensive searching of the Bureau of Labor Statistics Web site. As the search narrowed to the ten selected industries, occupations, and professions, key works and organizations were identified, and contacts at the organizations were interviewed via telephone and invited to participate in the
May focus group. The profiles of the ten industries, occupations, and professions found in Appendix A are a result of the literature search.

In May 2005, representatives from public health, mental health, environmental health, pharmacy, nursing, aerospace, biotechnology, and the Bureau of Labor Statistics met for a half-day focus group. The moderator was Kristine M. Gebbie, the principal investigator for the most recent national public health workforce enumeration report, *The Public Health Workforce: Enumeration 2000.* The first half of the meeting focused on the non-public health representatives’ experiences, challenges, and concerns regarding enumeration in their respective areas; in the second half of the meeting, the moderator guided the group in development of recommendations, and ultimately, five priority action items for public health with regard to a future workforce enumeration.

This report will describe the findings from the literature search as well as the workforce enumeration focus group. In addition, profiles of the ten professions, industries, and occupations selected, as well as a matrix describing lessons learned for public health and a more detailed summary of the focus group meeting, are included.

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**Findings from the Literature**

**1. Definition of the worker**
Defining the worker is an important first step in counting the worker. Workers may be defined by a characteristic they have individually, for example, education, job function, professional association membership, or certification. They may also be defined by industry: by type of employer or by the type of products the employer produces.

The reference body used to define the worker also varies. The references used by the federal government in its enumeration of the national workforce, Bureau of Labor Statistics’ (BLS) Standard Occupational Classifications (SOC) and North American Industrial Classification System (NAICS), fit some areas better than others. For the aerospace industry, the NAICS is the only definition used. However, it is not practical for the biotechnology industry. In some areas, the SOC gives a fairly good representation of a job function, but, in areas like child care, at least one study finds it does not reflect the reality of the workforce adequately.

**2. Data collection methods**
Workforce data are collected in many ways. The aerospace industry mines the BLS databases for its reports. In the mental health area, data from professional association databases are compiled, using some estimation, in one comprehensive multi-discipline report. Many areas, like science and engineering, nursing, agriculture, and biotechnology conduct surveys. Pharmacy and child care use mathematical models to estimate workforce numbers based on known variables. These models rely on data from other methods, like surveys and professional registries, for validation. Resources limit some of these methods, such as the size of the survey and the availability of validation sources for a model. In some cases, data come from multiple surveys or other sources and are integrated into one system that provides the workforce numbers.

**3. The role of enumeration in workforce activities**
Many professions and industries, including mental health, nursing, aerospace, and air traffic control, use workforce enumeration data to describe the effect of the “aging out” of the U.S. workforce on their respective areas. Data are also used to follow other trends, such as the biotechnology boom, increased security concerns regarding aviation, and shifts in the role of labor in agriculture production.
Advocating for recruiting resources and training new generations of workers are based on understanding what is happening today. Workforce enumeration data can guide schools and universities in providing the skills students need. Such data can also improve marketing campaigns to attract new workers to public health. Knowing the true size and nature of the workforce is important for all aspects of workforce planning and development.

4. Institutionalization of enumeration
Areas that have long histories of enumeration show an institutionalization of enumeration. Counting the workforce is not a one-time endeavor, but something that is undertaken at regular intervals. For the areas researched, there seems to be a common thread of federal government involvement to achieve enumeration at a regular interval, whether it is federal agencies collecting enumeration data or legislative mandates for data collection and workforce studies. Section 951 of Public Law 94-36 mandates the collection of continuous data on the national supply of nurses. Section 5 of Public Law 106-129 made a one-time request for research on the nation’s pharmacist supply, which led to the development of the 2000 Bureau of Health Professions report on the pharmacist shortage.

The National Science Foundation Act gives the National Science Foundation the charge of providing “a central clearinghouse for the collection, interpretation, and analysis of data on scientific and engineering resources, and to provide a source of information for policy formulation by other agencies of the Federal Government.” These resources have been interpreted to include the science and engineering workforce. A litmus test of this theory might be the development of enumeration practices in the biotechnology industry. Now biotechnology workforce data are bought and sold, in the broader bundles of financial survey data, as a marketable commodity in itself. From these developments arise many questions: Will a standardized enumeration system develop with time, with one organization taking the lead? Will the BLS adapt its NAICS to the needs of biotechnology or will another federal agency or trade organization become the entity that counts the workforce? It is clear that institutionalizing enumeration depends on making the need for workforce data a priority by establishing structures and allocating resources.

Applications to Public Health

Each profile of the industries, professions, and occupations found in Appendix A concludes with a section entitled Applications to Public Health. The section highlights questions raised by the literature review.

Comparisons with public health reveal similarities and contrasts that provide food for thought. The child care example shows the potential for research institutes to develop creative solutions to the workforce enumeration problem, as the Center for the Child Care Workforce and the Human Services Policy Center at the University of Washington have done with the child care workforce.

SESTAT, an integrated information system on science and engineering workforce developed by the National Science Foundation is the composite of three separate surveys of university students. What combination of surveys or other sources of data might be integrated to adequately capture the public health workforce?

Nursing and aerospace have long histories of enumeration that provide illustrations of the steps to institutionalize enumeration in a profession or industry.

The pharmacy example illustrates the use of mathematical models to estimate and project the size of the workforce. As with the science and engineering example, it is useful to consider what data sources might be needed to feed into a mathematical model that would adequately estimate the size of the public health workforce. The Substance Abuse and Mental Health Services Administration produces a compendium of mental health workforce data; how might public health produce work similar to workforce chapter in the Mental Health, United States serial?
Few similarities exist between the air traffic controller and public health workforces; public health workers do not enjoy a similar intensity of debate about workforce issues.

Public health can learn from the biotechnology industry about how to market itself for increased visibility and investment in workforce development.

Like many other industries, agriculture has made workforce enumeration a simple part of doing business, which as a long-term goal, would greatly benefit public health.
**MATRIX**

The matrix is a visual representation of key information points about the ten profiled professions, occupations, and industries. More detailed profiles can be found in Appendix A.

<table>
<thead>
<tr>
<th>Industry/Profession/Occupation</th>
<th>Workforce Size (Year)</th>
<th>Data Source</th>
<th>Definition Criteria</th>
<th>Challenges in Defining the Workforce</th>
<th>Tools Developed/Used</th>
<th>Lessons for Public Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child Care</td>
<td>2,300,000 (2002, point-in-time); 2,500,000 (2002, in one year given turnover)</td>
<td>CCW/HSPC study</td>
<td>Occupation</td>
<td>BLS occupational classification may not reflect job titles and functions used in the field. Job titles vary by state and within states.</td>
<td>Method of estimating number of child care workers based on demand for child care</td>
<td>Enumeration requires thinking creatively. It was difficult to get data on child care workers so they obtained data on child care demand and worked backwards.</td>
</tr>
<tr>
<td></td>
<td>1,692,662 (2002)</td>
<td>BLS</td>
<td>Occupation</td>
<td>Some child care workers may not consider themselves “employed.”</td>
<td>NIOEM</td>
<td>Large numbers of unpaid and informal sector workers are in child care. These groups are not included in NIOEM.</td>
</tr>
<tr>
<td></td>
<td>1,231,000 (2002)</td>
<td>BLS</td>
<td>Industry</td>
<td></td>
<td>NIOEM</td>
<td>This is less applicable as public health is not an industry.</td>
</tr>
<tr>
<td>Science and Engineering</td>
<td>10,479,800 (1999)</td>
<td>NSF</td>
<td>Education</td>
<td>Workers may not have a degree. Foreign graduates of foreign universities are not counted and do constitute a portion of the workforce.</td>
<td>SESTAT</td>
<td>Steady funding is needed for enumerations to track trends over time and ensure timely data. NSF has a collaborative relationship with survey research &quot;experts&quot; (Bureau of Census, Westat, Inc.)</td>
</tr>
<tr>
<td></td>
<td>3,540,800 (1999)</td>
<td>NSF</td>
<td>Occupation/Education</td>
<td>Job titles may be misleading as to the science and engineering skills and knowledge used. Writers and managers may actually be part of the workforce, but not counted. What &quot;sciences&quot; should be included and excluded in the enumeration of the S&amp;E workforce?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5,294,000 (1999)</td>
<td>BLS</td>
<td>Occupation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4,021,000 (1999)</td>
<td>BLS</td>
<td>Education</td>
<td></td>
<td>CPS</td>
<td>This example raises the question: Could public health workers be defined by a certain degree? Could the Schools of Public Health play a role in enumeration?</td>
</tr>
<tr>
<td>Industry/Profession/Occupation</td>
<td>Workforce Size (Year)</td>
<td>Data Source</td>
<td>Definition Criteria</td>
<td>Challenges in Defining the Workforce</td>
<td>Tools Developed</td>
<td>Lessons for Public Health</td>
</tr>
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</tr>
<tr>
<td>Nursing</td>
<td>2,714,671 (2000)</td>
<td>Division of Nursing, BHP, HRSA, DHHS</td>
<td>License</td>
<td>Few challenges exist in defining the pharmacist and registered nurse workforce due to licensing requirements and state registries of licenses.</td>
<td>NSSRN</td>
<td>Continuous collection of data is mandated by law (P.L. 94-63).</td>
</tr>
<tr>
<td></td>
<td>2,284,459 (2002)</td>
<td>BLS</td>
<td>Occupation</td>
<td></td>
<td>NIOEM</td>
<td>Fifty years of enumeration efforts in the industry; recently enumerations every four years.</td>
</tr>
<tr>
<td>Pharmacy</td>
<td>196,011 (2000)</td>
<td>BHP, HRSA, DHHS</td>
<td>License</td>
<td>Few challenges exist in defining the pharmacist and registered nurse workforce due to licensing requirements and state registries of licenses.</td>
<td>BHP, Pharmacist Supply Model</td>
<td>There is a tradeoff; BLS is less customized to the profession, but is updated more often.</td>
</tr>
<tr>
<td></td>
<td>230,200 (2002)</td>
<td>BLS</td>
<td>Occupation</td>
<td></td>
<td>NIOEM</td>
<td>Should public health look at modeling as a solution? What data could be used as variables and what data set could be used to validate a model?</td>
</tr>
<tr>
<td>Environmental Health</td>
<td>20,382 (2000)</td>
<td>PHW: Enumeration 2000</td>
<td>Occupation</td>
<td>No universal definition of environmental health exists</td>
<td>None</td>
<td>Congress mandated research on the pharmacist shortage (P.L. 106-129). Could public health advocate for a similar mandate to look at its shortage?</td>
</tr>
<tr>
<td></td>
<td>158,859 (2002)</td>
<td>BLS</td>
<td>Occupation</td>
<td></td>
<td>NIOEM</td>
<td>Because of worker shortage, one pharmacist may hold more than one position. By surveying by position, the BLS may overcount the number of pharmacists.</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Industry/Profession/Occupation</th>
<th>Workforce Size (Year)</th>
<th>Data Source</th>
<th>Definition Criteria</th>
<th>Challenges in Defining the Workforce</th>
<th>Tools Developed</th>
<th>Lessons for Public Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mental Health</td>
<td>523,440-635,339 (1996-2002)&lt;sup&gt;20&lt;/sup&gt;</td>
<td>CMHS, SAMHSA</td>
<td>Mix: Professional association membership, certification, employment at facility, NSSRN</td>
<td>Not all professionals are association members. Mixture of definition criteria across disciplines.</td>
<td>Mental Health, United States series</td>
<td>Any public health enumeration needs to collect data in a way that captures a part or the entire mental health workforce, depending on the definition of public health. Mental health and public health have siloed programs, resulting in difficulty in getting comparable data across the nine mental health disciplines. Is better to “divide and conquer”? One option is to enumerate pieces of public health and join them as in the Mental Health, United States series.</td>
</tr>
<tr>
<td>Aerospace</td>
<td>606,200 (2005)&lt;sup&gt;21&lt;/sup&gt;</td>
<td>BLS, AIA</td>
<td>Industry</td>
<td>Defining by industry excludes those who perform aerospace-related work but are employed by contracting firms not considered part of the industry.</td>
<td>AIA statistical publications</td>
<td>For industries that have a “good fit” with the BLS classification method, there may be no need to spend resources creating an alternative. Multiple data points are needed for tracking trends and forecasting.</td>
</tr>
<tr>
<td>Air Traffic Control</td>
<td>16,858 (2004)&lt;sup&gt;22&lt;/sup&gt;</td>
<td>FAA</td>
<td>Occupation</td>
<td>No large challenges because FAA sets entry requirements into the field.</td>
<td>Administrator's Factbook</td>
<td>Public health would benefit from similar level of interest in workforce issues. The FAA does not employ all air traffic controllers, therefore FAA data slightly understate workforce.</td>
</tr>
<tr>
<td></td>
<td>25,630 (2002)&lt;sup&gt;23&lt;/sup&gt;</td>
<td>BLS</td>
<td>Occupation</td>
<td></td>
<td>NIOEM</td>
<td></td>
</tr>
<tr>
<td>Industry/Profession/Occupation</td>
<td>Workforce Size (Year)</td>
<td>Data Source</td>
<td>Definition Criteria</td>
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<td>Tools Developed</td>
<td>Lessons for Public Health</td>
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</tr>
<tr>
<td>Biotechnology</td>
<td>198,300 (2004)</td>
<td>Ernst &amp; Young</td>
<td>Industry, Occupation</td>
<td>Defining by industry excludes those who perform biotechnology-related work but are employed by firms not considered part of the industry. Many definitions of biotechnology exist. Each research survey includes and excludes firms based on unique criteria and position/occupation lists.</td>
<td>Market intelligence-gathering tools</td>
<td>Workforce data are a commodity, bought and sold, because of their market value. The federal government is investing $22 million in funding biotechnology workforce development projects in 2005.</td>
</tr>
<tr>
<td></td>
<td>130,305 (2003)</td>
<td>DOC</td>
<td>Industry, Occupation</td>
<td></td>
<td>CTA</td>
<td></td>
</tr>
<tr>
<td>Agriculture</td>
<td>2,046,090 (2002)</td>
<td>BLS</td>
<td>Occupation</td>
<td>Possible discontinuity of data across sources.</td>
<td>NIOEM</td>
<td>Labor is a commodity, and its price and quantity are surveyed along with crops, livestock, etc. Changes over time in farm structure have been described and forecasted due to the existence of institutionalized tools to collect data on all levels of the agricultural workforce.</td>
</tr>
<tr>
<td></td>
<td>978,00 (2005)</td>
<td>NASS</td>
<td>Industry, Occupation</td>
<td></td>
<td>NASS survey</td>
<td></td>
</tr>
</tbody>
</table>
Findings from the Focus Group

ASTHO convened a select group of individuals with backgrounds in workforce enumeration to discuss lessons learned from past enumeration efforts within their respective areas. The areas represented were public health, mental health, environmental health, nursing, biotechnology, pharmacy, and aerospace. The focus group was moderated by Kristine M. Gebbie, Director, Center for Health Policy and Health Services Research, Columbia University School of Nursing and Elizabeth Standish Gill Associate Professor of Nursing.

Focus group participants represented the following organizations:

- Bureau of Labor Statistics (BLS), U.S. Department of Labor
- Substance Abuse and Mental Health Services Administration, U.S. Department of Health and Human Services (DHHS)
- Johns Hopkins Centers for Excellence in Environmental Public Health Tracking and Community Environmental Health Practice
- National Center for Health Workforce Analysis, Health Resources and Services Administration, U.S. Department of Health and Human Services
- Biotechnology Institute
- Aerospace Industries Association
- National Information Center on Health Services Research and Health Care Technology, National Library of Medicine
- Office of Career and Workforce Development, Centers for Disease Control and Prevention (CDC)
- The National Association of County and City Health Officials (NACCHO)

The focus group participants described how their area defines its workers, the data sources that have been developed and used, and the pros and cons of different methods of definition and data collection. They also mentioned struggles in workforce development, such as dealing with the “aging out” of the workforce and developing a workforce that is capable of dealing with current trends in their respective industries, occupations, and professions.

Priority Action Items

The priority action items were developed by asking the focus group members what items from the discussion were of greatest importance to public health when considering workforce enumeration and what recommendations they would offer directly to ASTHO. The ideas coalesced around five main points, which chiefly focused on laying solid groundwork for the enumeration process.

1. Mine prior work.

Prior studies and reports should be analyzed and understood before launching a new plan to enumerate the public health workforce. Specific resources mentioned included: the proceedings of the NACCHO committee on the Profile of Local Public Health Agencies survey; Enumerating the Public Health Workforce by The Public Health Leadership Society and the Center for Health Leadership & Practice; and work by the Center for Mental Health Services, Substance Abuse and Mental Health Services, U.S. Department of Health and Human Services Administration and the Annapolis Coalition on the Behavioral Health Workforce.28-29

2. Begin with a clear purpose.

After determining what enumeration data would ultimately be of greatest benefit to public health, create well-defined goals and objectives to guide the development and implementation of a plan to capture those data. Does public health need to know the total number of workers, or full-time equivalents (FTEs)? Does it need to know what pre-job training workers have had, or what on-the-job training workers have had? Does it need to know what workers are trained to do, or what they actually do day-to-day? Answering these questions will help to define the data priorities of an enumeration.
3. Define public health and the public health worker.
A working definition of public health is needed to guide where to begin and where to stop collecting data. In this scenario, perfection should not become an enemy of the good. If public health waits until all agencies and organizations agree on a universal definition, no enumeration will get off the ground. Therefore, the core areas of public health need to be identified as well as areas where public health overlaps with other areas, such as mental health, environmental health, nursing, and other clinical health professions. The public health worker can basically be defined in two ways: by occupation or by industry. That is, data can be collected on all workers defined by their job function—what they do—regardless of where they work, or data can be collected on the total employees that work for known public health entities (U.S. Department of Health and Human Services, State and Local Public Health Agencies) regardless of job function. In the second case, counts of industry workforce can stand alone or, if data are detailed, then researchers can drill down to which workers in those entities actually perform public health functions. How data are collected will influence how the workers are defined and vice versa.

4. Set boundaries.
Regardless of how the public health worker is defined, resources and practicality will limit the detail of data that can be collected. If surveys are long, respondents will be less likely to complete them. The more detailed questionnaires is, the more training is required for interview. If models are complex, resources will be needed to find, or develop, and clean variable data; and more resources will be needed to find or develop data sources to validate the model. A balance needs to be struck between the quality and quantity of data desired and the resources available.

5. Count regularly.
Institutionalizing the process of counting the workforce requires building a counting system that will provide public health with the data needed at the level of resources available; and then ensuring that the requisite resources are available every few years to repeat the process.

Conclusion
Public health can gain much knowledge to inform its own workforce enumeration strategy from looking at efforts in areas outside of public health. Non-public health professionals who have developed workforce enumeration strategies for their respective professions, industries, and occupations, have lessons to impart about the successful preparation and execution of an enumeration plan. Public health can use this knowledge and these lessons to develop a clear and organized plan for counting its workforce, to execute a plan, and to use the data collected to achieve its workforce development goals.
Appendix A

Profiles

This section begins with a brief overview of the methods used by the Bureau of Labor Statistics because it collects data on all aspects of the U.S. labor force and because many areas rely partially or exclusively on its data in describing employment. Profiles of ten professions, industries, and occupations follow. These profiles are the result of a literature search for information on workforce enumeration in the following areas: child care, science and engineering, nursing, pharmacy, environmental health, mental health, aerospace, air traffic control, biotechnology, and agriculture.

Bureau of Labor Statistics

The Bureau of Labor Statistics (BLS) provides employment data based on occupation and industry; it also produces an annual *Occupational Outlook Handbook* and *Career Guide to Industries*, which provide occupation and industry descriptions.


The OES program conducts a semi-annual survey of non-farm establishments, requesting information on occupational employment and wage rates. While the BLS funds and provides technical and procedural support, the State Workforce Agencies collect the data. Non-farm establishments are sampled from a list maintained by the State Workforce Agencies. Mailed surveys are followed up with telephone calls to request data from non-respondents or to clarify data. For November 2003, the response rate was 79% based on establishment units. For this survey, data collected in November 2003 were combined with data collected in May 2003, November 2002, 2001, and a subset of units sampled in 2000 to yield a sample of approximately 1.2 million establishments.

The CPS gathers general labor force data monthly and additional data on special topics periodically from approximately 60,000 households. It includes the civilian, non-institutionalized population above the age of 15. The sample population is derived from each decennial census. Normally, the first time that a household is interviewed, the interview is conducted in person; subsequent monthly surveys with a household are conducted by telephone. Response rates are 92-93%.

The CES is a monthly survey of payroll records that generates data on employment, hours, and earning from nonfarm establishments. Like the OES, State Workforce Agencies collect the data. The sample is drawn from a list of employers from the Unemployment Insurance tax account. Responses from employers are collected by telephone, touch-tone self response, computer-assisted interviews, fax technology, voice recognition, and mail. The average response rate for 2004 was 66%. Each month, the CES program surveys about 160,000 businesses and government agencies, representing approximately 400,000 individual worksites.
I. Child care

Estimated size of the workforce

The child care workforce has been enumerated by the BLS and by researchers from the Center for the Child Care Workforce (CCW) and the Human Services Policy Center (HSPC) at the University of Washington.

The BLS stated in the 2004-2005 Career Guide to Industries that 1,231,000 people worked in the child daycare industry in 2002: 734,000 were workers received wages and salaries while 514,000 were self-employed workers.35 The BLS National Industry-Occupation Employment Matrix indicates that there were 1,692,662 child care program and preschool administrators, child care workers, and preschool teachers in the United States in 2002.36

In 2002 the CCW/HSPC method estimated a total of 2,300,000 child care workers at any single point in time and 2,500,000 over the course of a year, given occupational turnover.37

Defining the workforce

The child care workforce may be defined by industry or occupation. The BLS describes the child daycare services industry workforce as those who work in “establishments that provide paid care for infants, pre-kindergarten or preschool children, or older children in after-school programs,” regardless of job title or function. Workers in the BLS-defined child daycare services industry represent at least 16 occupations.38 The BLS also groups workers according to occupation. The BLS gives the following three standard occupational classification codes for occupations directly related to child care: educational administrator, preschool and child care program (11-9031); child care worker (39-011); and preschool teacher, except special education (25-2011).

In the CCW/HSPC study, child care workers are defined by job function. Workers who teach and care for children are considered part of the workforce; personnel who work in child care centers but perform duties unrelated to children, such as clerical work, are excluded.

The two sources also define child differently. The BLS includes workers who care for children up to the age of 12. It cites nannies and after-school program personnel as examples of child care workers who care for older children. The CCW study considers child care workers to be those who care for children up to the age of 5, excluding elementary school students.

Challenges in defining the child care workforce include the observation that BLS occupational classifications are not job titles commonly used in the child care field.39 In addition, the BLS’s use of the occupations preschool teacher and child care worker—with the former’s primary focus on education and the latter’s focus on caregiving—may be a false division that does not occur among the workforce itself.40 These issues may lead to miscounting the number of child care workers by the BLS. The CCW/HSPC study attempts to define the child care workforce in a way that responds to the limitations of BLS methods.

The CCW/HSPC study defines child care workers as those who are paid for caring for children in center-based programs or in homes, including paid relatives and non-relatives that provide child care on a regular basis. In child care centers, non-teaching staff are excluded. Occupational labels director, teacher, and assistant director are used for center-based workers and primary provider and assistant for home-based workers.
The fact that some child care workers do not consider themselves employed could lead to miscounting by any supply-side method. Relatives who offer child care to young family members may consider it a familial responsibility, and not an occupation, even if it is paid work done on a consistent basis, and, therefore, they may not respond to employment surveys. Both the BLS and the CCW/HSPC study exclude unpaid child care providers and volunteers from the workforce, though the CCW/HSPC study estimates the number of unpaid child care workers to be 2,395,041 and includes unpaid child care workers in its definition of the caregiving population. Given that the estimated number of unpaid workers and volunteers equals the number of paid workers in this field, an enumeration method that captures the entire caregiving population might be illustrative and helpful for workforce planning.

Data collection methods

The CCW/HSPC study is based on data from the 1999 National Household Education Survey (NHES-99) conducted by the National Center for Education Statistics. In part of the survey, parents were asked about family demographics and child care use, including the ratio of children to adults in the care setting. The NHES-99 was a random digit dial survey of 167,347 households; the estimated response rate was 74%. Using a mathematical model, the CCW research team calculated the number of workers providing care to children aged 0 to 5, excluding those in elementary school, based on the demand reported by parents.

Challenges in collecting data

Though the CCW/HSPC study attempts to generate statistics that are more truly illustrative of the child care workforce than those of the BLS, it also highlights obstacles to any enumeration. Because federal funds for child care programs are channeled through the states and states set their own regulations about licensing child care workers and facilities, the task of enumeration currently falls on the states. While most states collect some data on the child care workforce, some do not have detailed enough data to make adequate workforce estimations. For all states, calculating the exact number of child care workers in the informal sector may not be feasible because all child care workers may not be licensed and may not declare the income they receive for their services. The CCW demand-based model is one method for approximating the workforce at a state level. Across states, different job titles may be used for positions with similar job functions, thus making aggregation at the national level difficult.

Development of resources or tools

The CCW/HSPC study first developed a methodology to estimate the child care workforce based on demand for child care data. The next step was to use this methodology to create a model to quantify the size and characteristics of the child care workforce for state or local populations. For states without the necessary demand data, general estimates were generated using the model by alerting it to take into account variations in demographics. The final step was to test the model in states where good data on the child care workforce exist.

Access to results

The child care workforce is employed in government and private sector programs. The National Institute for Early Education cites that from 1995-2001 over half of children attending preschool were in private programs, defined as those offered by businesses, independent nonprofit organizations, and religious organizations.\(^{43}\)

Head Start and Early Head Start are federally funded, comprehensive child development programs designed to increase the school readiness of low-income children. In 2003, 909,608 children aged 0 to 5 were enrolled in Head Start and Early Head Start programs; 47,000 centers and 19,200 classrooms received funding from these programs.\(^{44}\)

State pre-kindergartens generally target children with disabilities and children in low-income families. These programs may be offered through a private provider or a Head Start program, but most often appear in state public schools. State-sponsored pre-kindergarten initiatives served almost 740,000 children in 2002-2003.\(^{45}\)

**Impact and ties to future planning**

Workforce enumeration is important in the child care field because substantial resources are being made available at the federal and state level to increase the number of child care programs and to provide an adequately trained workforce for these programs. The federal Child Care Development Fund gave $4.8 billion in FY 2004 to states, territories, and tribes to fund child care programs so that in low-income families, parents were able to work or seek training or other educational opportunities outside the home.\(^{46}\)

It is important for the design, implementation and evaluation of such programs that there is a clear understanding of the size of the child care workforce in these jurisdictions. Though the BLS provides nationwide data, limitations to these data can be cited, including the above-mentioned challenges to defining the workforce. An accurate enumeration of the child care workforce would help federal, state, and local governments in planning, budgeting, and evaluating programs that seek to improve the retention and recruitment of child care workers.

**Applications to public health**

Like the child care workforce, the public health workforce is not represented adequately in the BLS set of occupational and industry classifications. Enumeration efforts in public health also rely heavily on statistics generated by states. Problems with inadequate state data, lack of uniformity in job titles within and among states, and difficulties in counting the portion of the workforce operating outside of direct government oversight are similar. The common end purpose of enumeration also resonates between the two fields: to better plan, budget, and monitor programs that seek to retain and recruit a capable workforce, with the ultimate goal of providing a higher quality service to the consumer.

**II. Science and Engineering**

**Estimated size of the workforce**

The Division of Science Resource Statistics at the National Science Foundation (NSF) estimates that in 1999 a total of 3,540,800 people worked in science and engineering (S&E) occupations and that a total of 10,479,800 workers held degrees in science and engineering disciplines.\(^{47}\)
For the same year, the Current Population Survey indicated there were 5,294,000 workers in the science and engineering field and 4,021,000 workers with a bachelor’s degree or higher in a science and/or engineering discipline.48

Defining the workforce

The National Science Foundation defines the S&E field broadly, including workers in the following disciplines: computer and mathematical sciences, life sciences, physical sciences, social sciences and engineering. NSF doesn’t include most health care professionals in its S&E workforce definition unless they hold a PhD. In general, the focus is not on the industry—that is, on organizations and companies that produce science and engineering products and services—but rather on occupation.

Members of the science and engineering workforce can be found in all BLS major occupation groups. However, most of the workforce is found in sub-categories of the executive, administrative, and managerial occupations; the professional specialty occupations; and the technicians and related support occupations.49

S&E workers are normally defined by occupation or education. When defining by education, the workforce is composed of those workers whose highest or most recent degree is in a science or engineering discipline or workers with any level of a science or engineering degree, all from an American university.

Limitations exist to both these classifications. First, job titles may not give a complete picture of a worker’s occupational responsibilities. A worker may use extensive science or engineering knowledge but be labeled “manager” or “writer”. Classifying by highest degree or any degree in science or engineering may give a better idea of the knowledge and skills being employed. However, it excludes workers who might not hold a degree, but still work in S&E. According to the 2003 Current Population Survey, more than one-fifth of all those working in S&E did not have at least a bachelor’s degree.50 Conversely, workers may hold science or engineering degrees, but not work in S&E. In addition, 15% of scientists and 17% of engineers working in the United States in 1995 were foreign-born.51 Classifying workers by educational degree obtained at American universities excludes those foreign-born workers who earned their degrees abroad but now live and work in the United States.

Data collection methods

The Scientists and Engineers Statistical Data (SESTAT) system is the integration of three surveys sponsored by the NSF: the National Survey of College Graduates, the National Survey of Recent College Graduates, and the Survey of Doctoral Recipients. These three surveys focus on a population that either has a university degree in a science or engineering discipline or works in a science and engineering occupation with a university degree in any discipline.

The National Survey of College Graduates is conducted for the NSF by the Bureau of the Census. The first survey, conducted in 1993, looked at individuals under the age of 76, living in the U.S. during the week of April 15, 1993, who indicated in the 1990 Census that they held a bachelor’s degree in any field. The survey queried these individuals on a number of demographic characteristics, including age, sex, race, occupation, education, and geographic location. The subsequent National Survey of College Graduates for 1995, 1997, and 1999 followed those respondents in the 1993 survey who indicated that they either held a bachelor’s or master’s degree in a science or engineering field or that they worked in a science or engineering occupation. The National Survey of College Graduates is a self-administered mail survey using a pre-notification letter, a first mailing, a reminder letter, and a second mailing.
Nonrespondents were followed up using computer-assisted telephone interviewing and/or a personal visit follow-up. The unweighted response rate for the 1993 survey was 78%. The response rates for subsequent surveys ranged from 91-95%. The 1993 survey sample size was 215,000; later survey sample sizes ranged from 60,000 to 40,000.

In 2001, the National Survey of Recent College Graduates was conducted for NSF by Westat, Inc. It looked at individuals who recently obtained bachelor's or master's degrees in a science or engineering field. The first stage of the survey identified higher education institutions that grant bachelor’s and/or master’s degrees in science and engineering fields from a list of institutions obtained from the Integrated Postsecondary Education Data System of the National Center for Education Statistics. The second stage was to identify science and engineering bachelor’s and master’s degree recipients from the earlier identified institutions. These degree recipients were asked a series of questions related to demographics, employment, and education. As in the earlier survey, the population had to be under the age of 76 and living in the U.S. during the reference date of the survey. Interviews were primarily done by computer-assisted telephone interviewing or by mail. In 2001, the first stage response rate was 99%, and the second stage response rate was 80%. A total of 13,516 individuals were interviewed in 2001.

Over the past ten years, the Survey of Doctorate Recipients has been conducted for NSF by several different entities: the National Research Council of the National Academy of Sciences (1995), the National Opinion Research Center (1997), and the Bureau of Census (2001). The Survey of Doctorate Recipients looks at those individuals who are under the age of 76 and have received a research doctorate in science or engineering from a U.S. institution and were residing in the United States on the reference date of the survey. The respondents were chosen from the Doctorate Records File maintained by the National Science Foundation. The Doctorate Records File consists of doctorate recipients identified in the Survey of Earned Doctorates and a National Academy of Science-developed registry of individuals who received doctorates prior to 1957, when the Survey of Earned Doctorates began. The Survey of Doctorate Recipients is carried out through a pre-notification letter, first mailing of the questionnaire, a reminder postcard, and up to two follow-up mailings. Non-respondents were followed up using computer-assisted telephone interviewing techniques. The response rate in 2001 was 82.6%. A total of 40,000 individuals with research doctoral degrees in S&E were included in the 2001 survey.

**Challenges in data collection**

The science and engineering experience highlights the importance of steady funding in enumeration efforts. Of the three surveys that generate the data available in SESTAT, one, the National Survey of College Graduates, was not funded for 2001. Therefore no complete SESTAT is available for 2001. The ability to track changes over time and provide timely data is hindered by this gap in the database.

**Development of resources or tools**

SESTAT is a comprehensive and integrated system of information created by NSF to describe the demographic, educational, and employment characteristics of scientists and engineers in order to provide data for both policy analysis and general research.

**Access to results**

Government or private sector entity

An overwhelming majority of the science and engineering workforce is employed by private sector entities. In 1999, over 70% of scientists and engineers who held at least a bachelor’s degree worked in the for-profit, private sector; 17% worked in educational institutions; and approximately 13% worked in federal, state, or local government.\textsuperscript{58}

Impact and ties to future planning

Both SESTAT data and BLS data are used, in conjunction with general demographic data and projections, to advocate for more resources and attention given to preparing for the future S&E workforce. The “aging out” of the general population affects the S&E workforce, but to-date the field has not suffered as much as other fields due to the large influx of immigrants into its workforce. Immigration restrictions imposed after the 9/11 terrorist attacks have reduced the number of immigrant S&E workers and may result in a diminished workforce in the future.

Applications for public health

Given the emphasis on definition by education in the area of science and engineering, it is useful to consider how the public health workforce might be defined by education. Considering that the public health workforce comes from a variety of educational backgrounds and includes workers without higher education, any enumeration of a public health workforce defined by education may not be as complete a reflection of the true workforce as it is for science and engineering. Following the examples set out in the three surveys that make up SESTAT, creating a list of academic majors indicative of public health skills and knowledge would be difficult, but potential methods and scopes should be explored before rejecting the SESTAT model.

Other lessons can be learned from the science and engineering example. The National Science Foundation produces S&E workforce data that are alternatives to the Bureau of Labor Statistics data. It might benefit the public health sector if one public health organization or department within an organization became the focal point for the enumeration efforts and, over time, developed a tool, like SESTAT, that is recognized within and outside public health as a reliable instrument. In addition, SESTAT is an integrated information system composed of three separate surveys. It might be helpful to consider what types and combinations of surveys might adequately capture the public health workforce. The NSF has developed these surveys, but it has also collaborated with other organizations, including the Bureau of Census and Westat, Inc., to conduct the surveys. It may be more efficient for the next public health workforce enumeration for workforce researchers to partner with agencies or companies that have long-standing experience in survey implementation.

III. Nursing

Estimated size of workforce

According to the Division of Nursing, Health Resources and Service Administration, United States Department of Health and Human Services, 2,714,671 people held current licenses to practice as registered nurses in the United States in March 2000; of this number, 2,201,813 were living in the United States and working in the nursing field.\textsuperscript{59} An estimated 2,284,459 registered nurses were working in the United States in 2002 according to the Bureau of Labor Statistics’ National Industry-Occupation Employment Matrix.\textsuperscript{60}
Defining the workforce

The registered nurse workforce is defined by credential. Nursing licenses are issued by states and the District of Columbia to individuals who complete an approved nursing program and pass a national licensing exam. At minimum, a registered nurse will have a bachelor’s degree in nursing, an associate degree in nursing, or a diploma from a hospital-administered program. Registered nurses are employed in a variety of work settings, including hospitals, physician offices, nursing homes, government agencies, and home healthcare services. In addition, registered nurses sometimes work in settings, such as insurance companies, where they do not provide direct care to patients.

Data collection methods

In 2000, the Division of Nursing, Health Resources and Service Administration, United States Department of Health and Human Services contracted with Research Triangle Institute to build upon the nursing field’s half-century history of enumeration efforts by conducting the seventh National Sample Survey of Registered Nurses (NSSRN). The sample population was selected from state lists of active licensees. Because a nurse may hold licenses from more than one state, weights were used to estimate the total number of registered nurses from the list of active licensees for each state. The survey included questions about education, employment, and demographics. It consisted of three mailings and follow-up telephone calls for nonrespondents. Overall response rate for the survey was 72%. The survey sample size was 54,125.

Challenges in data collection

A minor challenge in collecting data on the number of registered nurses is that, despite nursing’s long history of enumeration, no single unduplicated list of active licensees in the United States exists. In the 2000 NSSRN, a weighing procedure had to be introduced to estimate the number of total registered nurses given the total number of licenses.

Development of resources or tools

The National Sample Survey of Registered Nurses is “the Nation’s most extensive and comprehensive source of statistics on all those with active licenses to practice in the United States whether or not they are employed in nursing.” It collects information on the number of registered nurses as well as education, specialties, employment, geographic distribution and demographic characteristics. Although enumeration efforts in the nursing field date back to 1949, the NSSRN in its current form has been conducted every four years since 1977. The methodology has been updated over the last twenty-five years to increase response rates and efficiency, but the type of information sought has remained the same.

Using the NSSRN, the National Center for Workforce Analysis, Bureau of Health Professions, Health Resources and Services Administration, U.S. Department of Health and Human Services has created a Nursing Supply Model, which produces annual, state-level projections of the registered nurse supply through the year 2020. The model accounts for inflows and outflows of individuals in the registered nursing workforce over the course of a given year using data from various sources, but the baseline data for this model is the nursing population counted in the NSSRN.

Access to results

Government or private sector entity

According to the 2000 NSSRN, only 12.9% of the registered nurses surveyed were working in government entities, most notably federal government hospitals, public schools, and city and county health agencies. The majority of registered nurses work in the private sector; particularly hospitals, ambulatory care settings, and nursing home/extended care facilities.

Impact and ties to future planning

Data on the registered nursing workforce are vital to describing current and future nursing shortages in the country. These descriptions are subsequently used to make arguments for more in-depth data collection, resource allocation, and workforce planning in order to mediate present effects and forestall future crises in the health care industry. In fact, the United States General Accounting Office produced a report in 2001 describing the nursing shortage.

Applications to public health

Registered nurse workforce enumeration is supported by the fact that the collection of data on the national supply of registered nurses is mandated under Section 951 of Public Law 94-63. It is important to consider how public health might promote similar legislation for its enumeration activities.

Despite past cycles of nursing shortages, data gathering on the registered nurse workforce still falls short of what is ideal for communication with policymakers and planning. When offering testimony to Congress in 2001 on the current nursing shortage, Janet Heinrich, the General Accountability Office Director of Health Care—Public Health Issues stated, “National data are not adequate to describe the nature and extent of nurse workforce shortages nor are data sufficiently sensitive or current to allow a comparison of the adequacy of nurse workforce size across states, specialties, or provider types.” When looking at the nursing example, proponents of public health workforce enumeration must take stock of the enormous amount of resources required to make workforce enumeration an integral part of a field, and realize that, even when these necessary elements have been in place for decades, continuous work is needed to keep data as accurate, current, and useful as possible.

IV. Pharmacy

Estimated size of the workforce

The Bureau of Health Professions in the Health Resources and Services Administration of the Department of Health and Human Services, using its Pharmacist Supply Model 1992-2010, estimated that 196,011 pharmacists were working in the United States in 2000 and that 210,321 are working in 2005. According to the Bureau of Labor Statistics’ National Industry-Occupation Employment Matrix, there were 230,200 pharmacists working in 2002.

Defining the workforce

Pharmacists are defined by credential. Licensed pharmacists have obtained a Doctor of Pharmacy degree from a college of pharmacy accredited by the American Council on Pharmaceutical Education and passed an examination. Licenses must be renewed according to state regulation, usually every two or three years.
**Data collection methods**

The most recent national census of pharmacists was conducted from 1989 to 1991. State licensing boards issued a survey to pharmacists at the point of their license renewal. Because states vary as to the number of years a license is valid and the schedule of renewals, the census was carried out over a three year period. In 1991, 171,611 active pharmacists were counted.69

In 2000, a new Pharmacist Supply Model was developed by the Bureau of Health Professions, Health Resources and Services Administration, U.S. Department of Health and Human Services to produce annual national estimates of the number of licensed pharmacists actively working in the field of pharmacy. It included several improvements on the model used in the 1980s and 1990s. In the model, estimates are determined by first setting 1991 as the base year. The number of pharmacists is then projected forward by adding the estimated number of new entrants to the field in the following year and subtracting the estimated number of pharmacists who exited the profession due to death or retirement in that year. The result for one year is used to project estimates for the subsequent year and so on until 2020, the end of the forecast period. New entrants are defined as those who graduate from U.S. colleges of pharmacy and those who graduate from colleges of pharmacy abroad and pass the requisite U.S. license exams.

The rate of new graduates from U.S. colleges of pharmacy was determined by looking at 1991-1998 graduate data from the American Association of Colleges of Pharmacy and projecting those numbers into the future while taking into account three variables: openings of new colleges of pharmacy; fluctuations in application rates; and transitions by colleges of pharmacy during the 1980s and 1990s to the entry-level PharmD degree program.70 The loss of workers from the workforce due to death or retirement is represented by separation rates. The separation rates were selected from a series of separation rates developed by the BLS; the ones selected reflect the actual changes in the pharmacist workforce that occurred from 1978-1990, as noted in the national pharmacist census statistics from those years. More recently, the model has been adjusted to take into account FTE contributions by gender. Research shows that female pharmacists are much more likely to work part-time than male pharmacists. Gender ratios are estimated from trends found among pharmacy school graduates, and female pharmacists are assigned a .9 FTE and male pharmacists are assigned a 1.1 FTE.

**Challenges in data collection**

Successful validation is critical in order to have confidence in a model. Developers of the Pharmacist Supply Model used BLS and Census Bureau data to validate the model. However, one challenge in relying on model-generated estimates is that the larger the gap between the current year and the base year of the model, the more uncertain the reliability of the model. Funding has not been available to conduct a nationwide pharmacist census in the last fourteen years. BLS data are useful only at the most aggregate level and for purposes of validation at a national level. The pharmacy workforce is small compared to other groups, and the BLS methods do not sample enough pharmacists to track detailed changes in the workforce.

**Development of resources or tools**

While several existing surveys and tools have been created to indicate the degree of shortage of pharmacists, the Pharmacist Supply Model was developed specifically to project the number of pharmacists.
Access to results


Government or private sector entity

The majority of pharmacists work in the private sector. A 2000 report prepared by the Midwest Pharmacy Workforce Research Consortium indicated that only 6.5% of active pharmacists surveyed worked in government hospitals/health systems, the armed forces, and government agencies. The most common work settings for pharmacists are large pharmacy/drug store chains, non-government hospitals, and independent pharmacies/drug stores.

Impact of enumeration and ties to future planning

The Pharmacist Supply Model is one tool used by pharmacy workforce researchers, planners, and advocates to define the current workforce shortage. It also, according to its developers, “supports pharmacy's recent commitment to collectively look at issues that affect supply and demand.” By providing a clearer understanding of the nature of the pharmacist shortage, the model has contributed to an increased awareness of the problem.

Applications to public health

Could a model like the Pharmacist Supply Model be created to project the number of public health workers? A similar model would require similar types of information, base year population statistics, and entry and exit rates. From the pharmacist example, it is evident that identifying and quantifying the influences that affect the supply of public health workers would be a key step. Reliable sources of these variables would need to be located, or where lacking, developed. Another major element is having figures with which to validate the model. Public health currently has no sources to use to verify numbers of workers. Like earlier professions profiled, the pharmacist example re-emphasizes the difficulty—but importance—of securing sustained funding for enumeration efforts. Pharmacy also demonstrates that a strong commitment from professional associations, universities, and leaders within pharmacy to prioritize and examine workforce issues is critical to making progress toward establishing standards and protocols for generating and collecting workforce data. Public health workers also differ from pharmacists in that they do not have a single credential or credential agency.

V. Environmental Health

Estimated size of the workforce

In the last public health workforce enumeration in 2000, 20,382 environmental health professionals and technicians were counted. For 2002, the BLS NIOEM reported 158,859 workers in occupations related to environmental engineering and science.
Defining the workforce

The environmental health workforce typically is defined by occupation. The Public Health Workforce: Enumeration 2000 identified four environmental health-related occupations: environmental engineer, environmental scientist and specialist, environmental engineering technician, and environmental science and protection technician. These occupations are part of the Standard Occupational Classifications used by the BLS. Though not focused on enumeration, the National Environmental Health Association (NEHA) 2002 Nationwide Salary & Benefits Survey of Local/County Health Professionals defined the environmental health workforce using different titles. Survey respondents (local/county environmental health workers) categorized themselves as one of the following: Trainee; Field Inspector; Supervisor, Manager, or Program Coordinator; or Director. The respondents then selected the job title that most closely approximated their own from the job titles listed under each broad category. Defining the environmental health workforce presents challenges as some environmental scientists and engineers do not actually work with population health and therefore cannot be truly considered environmental health workers.

Data collection methods

Data collection for The Public Health Workforce: Enumeration 2000 was carried out in several steps. First, researchers conducted an extensive literature review of workforce composition and training needs. Health officials in the U.S. states, territories, and the District of Columbia were requested to submit any relevant materials on the public health workforce in their jurisdictions. Researchers followed up with designated contact staff members for clarification and further information. Data were synthesized into preliminary spreadsheets; the spreadsheets were then reviewed by the submitting jurisdictions. Information on the federal civilian public health workforce was obtained from the United States Office of Personnel Management, and information on the military public health workforce was obtained from the United States Department of Defense.

Challenges in collecting data

In The Public Health Workforce: Enumeration 2000, the data collection methods limit the study’s representation of the environmental health workforce. In some U.S. states and territories, the environmental health agency is part of the larger public health agency; in other U.S. states and territories, it is a separate entity. The public health agencies were encouraged to report data on the entire public health workforce, regardless of agency, but nevertheless, researchers did not follow up with entities outside the main public health agency for data. Therefore, it’s probable that the number of environmental health workers is underestimated. In addition, data reported to researchers varied by type, year, and level of detail. Not all states and territories specified the numbers of workers by sector; thus, some environmental health workers may have been lumped in the overall workforce figure. In collecting data from federal civilian agencies, the entire staff of the U.S. Department of Health and Human Services was counted, but outside of DHHS, a worker was only counted if his or her title directly suggested public health work. Thus, workers with non-public health specific titles from the Environmental Protection Agency, the Department of Agriculture, the Food and Drug Administration, and other federal agencies that deal with environmental health issues were not counted. Private and non-governmental organizations that contribute to public health were not counted. Volunteers were also not counted. These data limitations contribute to the undercounting of the environmental health workforce in this study.

Development of resources or tools

Any resources or tools developed to enumerate the environmental health workforce are unknown.
Access to results


Government or private sector entity

The Public Health Workforce: Enumeration 2000 focused exclusively on the public sector environmental health workforce. Of the 47,000 environmental engineers identified by the Bureau of Labor Statistics in 2002, 15,000 worked in federal, state, and local government agencies; the remainder worked in manufacturing and in professional, scientific, and technical services. For the same year, the Bureau of Labor Statistics shows that about 56 percent of environmental scientists were employed in federal, state, and local governments; the rest worked in architecture; engineering; management, scientific, and technical consulting services; or were self-employed.

Impact and ties to future planning

A comprehensive environmental health workforce enumeration would aid in the understanding of workforce needs and the development of future directions. A survey conducted by Association of State and Territorial Health Officials and the Council of State Governments showed that environmental health specialists were considered among the top four state public health occupational classes most affected by the workforce shortage. An environmental health workforce enumeration, called for the CDC’s 2003 National Strategy to Revitalize Environmental Public Health Services, would generate better comprehension of the workforce shortage. It would also improve knowledge of environmental health workers’ day-to-day activities, which, in turn, could be used to better tailor training and education programs to workers’ and employers’ needs. Many definitions of environmental health exist; delaying any enumeration until the fragmentation is overcome may not be viable if timely information is desired to inform current workforce development and planning efforts.

Applications to public health

Environmental health is part of public health; reports estimate that environmental public health workers make up 10-21% of the total public health workforce. A creative methodology is needed to enumerate the environmental health workforce regardless of the setting in which environmental health workers operate. An environmental health worker, especially at the local level, may hold several roles, may work part-time, and may be a contractor rather than an agency employee. These issues are not unique to environmental health workers, but they highlight the need for a prioritization of the type of information to be collected in a public health workforce enumeration. They also emphasize the need for data collection methods that take into account these issues.

VI. Mental Health

Estimated size of the workforce

In Mental Health, United States, 2002, there are an estimated 523,440-635,339 clinically trained mental health workers in the disciplines of psychiatry, psychology, social work, psychiatric nursing, counseling,
marriage and family therapy, psychosocial rehabilitation, school psychology, and pastoral counseling. Counts from the individual disciplines represent different time periods from 1996 to 2002.

**Defining the workforce**

Mental health workers may be classified by profession. A workgroup of representatives from the American Psychiatric Association, the American Psychological Association, the National Association of Social Workers, the National Institute of Mental Health, and the field of psychiatric nursing selected the disciplines to be included in the *Mental Health, United States* series: psychiatry, psychology, social work, psychiatric nursing, counseling, marriage and family therapy, psychosocial rehabilitation, school psychology, pastoral counseling, and sociology. The 2002 edition emphasizes the enumeration of personnel who are clinically trained mental health personnel.

According to *Mental Health, United States, 2002* a psychiatrist is defined in two ways: a board-certified or a board-eligible physician who has undergone psychiatric training and is a member of the American Psychiatric Association or a physician found in the American Medical Association’s Masterfile who has identified her/his specialty as psychiatry, regardless of specialty training.

A psychologist is defined as a clinically trained and clinically active professional; he/she is a U.S. resident with a doctorate in psychology and a state license for the independent practice of psychology, employed in psychology, and involved in the provision of health and mental health services.

A social worker holds a master’s of social work or doctor of social work degree and is not retired.

Counselors are National Certified Counselors. Certification requires a graduate counseling degree from an accredited institution, a specified period of supervised experience, and passage of the National Counselor Examination.

A psychiatric nurse is defined as an employed nurse with formal education as a clinical nurse specialist or nurse practitioner in psychiatric mental health nursing, with highest nursing education being at the master’s or doctoral level.

Marriage and family therapists are defined as mental health practitioners with a master’s or doctoral degree in marital and family therapy and a minimum of two years of supervised clinical experience with state license or certification or, if practicing in a state without licensure or certification, eligibility for clinical membership in the American Association for Marriage and Family Therapy. Clinical membership in the American Association of Marriage and Family Therapy requires a graduate degree in marriage and family therapy from an accredited institution and two years of supervised clinical experience.

Psychosocial rehabilitation refers to the provision of services that allow individuals with severe mental illness to function in their communities. Such services include residential services, training in community living, socialization services and crisis services. Information on psychosocial rehabilitation personnel stands out as an industry-based enumeration in contrast to the other seven disciplines, which are defined by licensure, certification, and/or professional association membership.

School psychologists are certified by state boards of education or licensed by state boards of psychological services.

Pastoral counselors are defined by certification by the American Association of Pastoral Counselor, which requires graduate-level training in theology and psychology.
Data collection methods

In *Mental Health, United States, 2002*, employment statistics are available on all disciplines except sociology; limited data are available on pastoral counseling. *Mental Health, United States, 2002* represents a compilation of data from each discipline; most information was derived or estimated from professional association directories.

Data on psychiatrists were derived from two sources: the 2000 American Psychiatric Association Membership (excluding psychiatric residents; medical students; corresponding members and fellows; inactive members, associates, and fellows; honorary and distinguished fellows; and members not practicing psychiatry in the United States) and the American Medical Association’s Masterfile records of physicians self-identified as having a psychiatric specialty. The first method of counting results in 40,867 psychiatrists; the second method results in 26,258 psychiatrists. The American Psychiatric Association membership database is reported to include a “majority” of psychiatrists in the United States.

The number of psychologists came from several sources: 2000 American Psychological Association (APA) Membership Survey with 2002 updates, the Association of State and Provincial Psychology Boards, and the 2002 Committee for the Advancement of Professional Practice. APA data do not include the entire universe of clinically trained and active psychologists; they are supplemented with state data on licensed psychologists.

Statistics on social workers were derived from membership data from the National Association of Social Workers in 2000. The National Association of Social Workers is thought to represent between 30-50% of the total population of trained social workers. The membership of the National Association of Social Worker totals 97,290; the estimated total number of social workers is 194,580.

Psychiatric nurses represent a subset of the overall nurse workforce. Researchers counted the number of nurses from the 1996 National Sample Survey for Registered Nurses who had formal education as a clinical nurse specialist or nurse practitioner in psychiatric mental health nursing, whose highest education in nursing was at the master’s or doctoral level, and who were employed. This number was used to generate an estimate of the total number of psychiatric nurses. For completion rates of the National Sample Survey for Registered Nurses, see Appendix A, section III on registered nursing.

Data on counselors was derived from the National Board for Certified Counselors database of National Certified Counselors in 2000.

The number of marriage and family therapists came from two sources. In the states where marriage and family therapists were regulated in 2000, the number of certified marriage and family therapists was obtained from state marriage and family therapy regulatory boards. In states where there was no regulation, the number was derived from the clinical membership of the American Association for Marriage and Family Therapy.

Statistics on mental health personnel in the field of psychosocial rehabilitation are estimates based on the number of facilities that identify themselves as offering psychosocial rehabilitation services. In 1996, 7,000 facilities fit this category. With an average staff of 16 per facility, *Mental Health, United States, 2002* estimates that there are 100,000 people working in psychosocial rehabilitation.

Challenges in collecting data

An overarching challenge in the enumeration of the mental health workforce is how to compile data on diverse disciplines. One purpose of the workgroup of the human resource chapter of *Mental Health,
United States has been to improve data comparability among the mental health disciplines. Some variation still exists on the time periods referenced by the collected data. Data also vary on how well professional memberships and other sources represent their indicated professions.

Development of resources or tools

Mental health professional association membership databases are institutionalized resources which can be mined for workforce numbers. The Mental Health, United States serial is a regularly published work that compiles data across the mental health field.

Access to results

Mental Health, United States, 2002 is available at www.mentalhealth.org/publications/allpubs/SMA04-3938/default.asp.

Government or private sector entity

Mental health personnel work in government and private sector facilities, including clinics, hospitals, academic settings, individual and group practices, nursing homes, and social service agencies.

Impact and ties to future planning

Mental Health, United States, 2002 represents a movement toward more detailed information about mental health service providers. Still, many questions remain about the characteristics of the human resource base of the mental health services in the United States and how these characteristics relate to other aspects of mental health, such as service delivery, clientele, and links with other social services. It is also clear from the data available that mental health personnel enumeration remains divided according to area. There is some interest in decreasing the stovepipe nature of mental health. Mental health is described as stovepiped because sometimes the individual disciplines within mental health remain isolated from each other, with unique structures, process, and funding streams and little collaboration and sharing of information.

Applications to public health

The mental health example raises a question about what strategies might make the American Public Health Association’s membership robust enough to represent the entire public health workforce. The lack of a mandatory license or certification among public health workers reduces the likelihood that any one employment registry or federation of registries would ever hold the names of all public health workers. Public health and mental health overlap. Elements of data from the human resource data sources cited in Mental Health, United States, 2002 may provide enumeration data for public health. Strategies for enumerating the public health workforce should contain ideas for defining and including the portion of mental health workforce that is public health related. Finally, public health also has stove-piped disciplines; considering the Mental Health, United States series goal of collecting data that are comparable across areas is worthwhile.
VII. Aerospace

Estimated size of the workforce

The Aerospace Industries Association (AIA), quoting Bureau of Labor Statistics data, reported 606,200 aerospace workers in March 2005.84

Defining the workforce

The aerospace workforce is defined by industry. All workers employed by firms that produce aerospace products and parts as well as search, detection, and navigation instruments are counted. The AIA lists total employment and production employment separately.85

Data collection methods

Data on the aerospace industry workforce are collected by the Current Employment Statistics program of the BLS. See the Bureau of Labor Statistics Profile at the beginning of Appendix A for detailed explanation of the Current Employment Statistics program.

Challenges in collecting data

There is little challenge for the Aerospace Industries Association in collecting data as it simply organizes and presents Bureau of Labor Statistics data.

Development of resources or tools

The AIA publishes monthly employment statistics; quarterly analyses of important economic indicators; year-end analyses, reports, and forecasts; and the annual Aerospace Facts & Figures statistical review.

Access to results


Government or private sector entity

The 2,800 aerospace firms identified by the BLS in 2002 are in the private sector, but the federal government is the largest customer of aerospace products and these firms regularly contract with the federal government to produce products such as aircraft and missile systems.

Impact and ties to future planning

The AIA is able to track, analyze, and project employment numbers because it has had a reliable, plentiful, and free data supply from the Bureau of Labor Statistics for many years. Efforts to attract young people to the industry such as rocket building competitions are based on well informed workforce development and planning agendas.

Applications to public health
Unfortunately, public health does not share many characteristics with the aerospace industry. There is no universal set of concrete goods produced by public health workers. Therefore, classifying public health by industry would prove difficult. However, the example of the aerospace industry does emphasize the importance of institutionalizing enumeration so as to have multiple data points with which to analyze trends and project future needs. The AIA is able to track its own workforce well due to this institutionalization.

**VIII. Air Traffic Control**

*Estimated size of the workforce*


*Defining the workforce*

For NIOEM purposes, air traffic controllers are defined by occupation. The Federal Aviation Administration has established the training and certification process for air traffic controllers. Eligibility for employment depends on passing a pre-employment test and completing an FAA-approved program. Selected candidates then attend training at the FAA Academy; several years of on-the-job training, classroom instruction, and independent study are required before an air traffic controller is considered fully qualified.

The FAA air traffic control workforce includes air traffic control specialists, traffic management coordinators, and operations supervisors.

*Data collection methods*

The FAA uses its own personnel data in reporting workforce numbers.

*Challenges in collecting data*

Limited challenges exist due to the FAA’s role. The Bureau of Labor Statistics Profile at the beginning of Appendix A describes data sources of the NIOEM.

*Development of resources or tools*

The FAA publishes a quarterly *Administrator’s Factbook* that reports statistics on many aspects of its work, including employment.

*Access to results*

Government or private sector entity

Of the 25,630 air traffic controllers counted in 2002, approximately 90%, or 23,008 workers, were employed by the federal government, specifically the Federal Aviation Administration.\(^8\) An additional 127, or .5%, are employed by local government.\(^9\)

Impact and ties to future planning

The air traffic control workforce is a case where the simplicity of the enumeration process is overshadowed by the intense discussion whether the size of the workforce is adequate. Air traffic control has the least complicated set of circumstances for enumeration given that one federal agency’s personnel records account for a majority of the entire workforce. The controversy lies in what the number is and how that number relates to workforce development and planning. The FAA makes plans for how many air traffic controllers are needed over a period of time and trains and hires accordingly. The National Air Traffic Controller Association (NATCA) is a union that represents the majority of air traffic control specialists, a position that accounts for the majority of the air traffic control workforce. NATCA negotiates contracts with the FAA that specify the number of positions to be hired, retirement benefits, pay scales, and other work conditions. In December 2004, the FAA announced a ten-year plan to hire 12,500 air traffic controllers to replace the over 11,000 that are expected to retire in the same period.\(^9\) NATCA has said that this number and the rate of hiring per year are inadequate.

Applications to public health

It is highly unlikely that the public health workforce would find itself in a situation similar to that of the air traffic control workforce. No federal health agency or department has authority similar to the FAA in this respect. No powerful public health union exists and negotiates with a federal agency for better working conditions or improved pensions for its members. However, there is one relevant parallel: lessons learned from the intense debate that occurs regarding the air traffic control workforce over issues like retirement separation rates and the number of workers needed to adequately meet the nation’s needs would benefit public health.

IX. Biotechnology

Estimated size of the workforce

Firms working in the biotechnology industry are the objects of much research. Market intelligence is a valuable commodity, and private companies exist that collect and sell information about the biotechnology industry. Among the intelligence collected are workforce data. The Ernst & Young Resurgence, the Americas Perspective, Global Biotechnology Report 2004 cited 198,300 employees in the biotechnology industry.\(^1\) A 2003 U.S. Commerce Department study counted 130,305 biotechnology related workers and 1,134,879 workers total in the firms it surveyed.\(^2\)

Defining the workforce

Biotechnology workers are defined by industry and by job function. Firms surveyed are first identified as being biotechnology companies. Then, surveys may look at workers that have biotechnology-related roles and those that do not.

The set of firms identified as biotechnology firms changes based on the definition of biotechnology used by the researcher. A variety of definitions exist. Ernst & Young identifies biotechnology companies as
those “that use modern biotechnological techniques to develop products or services for human health care or animal health care, agricultural productivity, food processing, renewable resources, industrial manufacturing, or environmental management.” The U.S. Department of Commerce defined biotechnology as “the application of molecular and cellular processes to solve problems, conduct research, and create goods and services.”

Research firms create position lists; for example, Radford Surveys, a division of Ana Consulting, Inc., has a comprehensive list of 650 benchmark and executive positions.

Because of varying definitions and objectives, surveys include and exclude different types of companies. For example, the Ernst & Young report excluded medical device, large pharmaceutical, large agribusinesses, and large manufacturing companies. The U.S. Department of Commerce survey excluded services firms that conduct clinical trials and certain other services firms, but includes most large pharmaceutical companies and a number of companies that produce “tools” for biotechnology firms. Definitions may be accompanied by a list of technologies that are part of biotechnology; the most extensive of these lists has more than 100 items. The scope of the survey influences the final figures; different boundaries lead to different results.

The issue of defining biotechnology reached an international level with the involvement of the Organization for Economic and Cooperative Development (OECD), an organization made up of 30 nations, including the United States. The OECD established a Working Party on Biotechnology and an ad hoc Committee on Biotechnology Statistics to address these issues and develop a universal definition and common measurements for the global industry.

Data collection methods

For the U.S. Department of Commerce study, biotechnology companies were identified through trade organization membership lists, corporate biotechnology directories, and statistical databases. Surveys were mailed to 3,189 firms. The response rate was 61%. Of this number, 53% were confirmed to be biotechnology firms based on the study definition and provided sufficient data to be included in the study. Ernst & Young, and other private research firms, survey firms as well.

Challenges in collecting data

Because of the demand for biotechnology data, the industry has been called “over-surveyed.” It is unknown if and how survey saturation has affected firms, and whether it has led to a decline in the quality of data being collected or reluctance by firms to complete surveys.

Development of resources or tools

Many private research firms have developed sophisticated survey tools, databases, and other market intelligence products. The survey “Critical Technology Assessment of Biotechnology in U.S. Industry” developed by the U.S. Department of Commerce was the first official effort to collect comprehensive statistics about the biotechnology industry and its contribution to the U.S. economy.

Access to results

The Ernst & Young annual biotechnology report is available by request from a sales contact. The U.S. Department of Commerce survey and report are available at http://www.technology.gov/reports.htm.
Government or private sector entity

Research focuses on the private sector. Reliable estimates of the ratio of government to private sector employment in the biotechnology industry are unknown.

Impact and ties to future planning

The market intelligence that biotechnology firms receive from private research firms impacts business decisions. Biotechnology has been identified as a targeted industry in the President’s High Growth Job Training Initiative. This program, implemented by the U.S. Department of Labor’s Employment and Training Administration, is designed to prepare workers to take advantage of new and increasing job opportunities in high growth/high demand and economically vital industries and sectors of the American economy. The initiative is designed to ensure that worker training and career development resources are targeted to helping workers gain the skills and competencies they need to obtain jobs and build successful careers in biotechnology. Twenty-two million dollars will be spent in a series of investments nationwide on programs that recruit, retain, train, and re-train workers for the biotechnology industry. Workforce data will be needed to monitor the effect of these investments on the industry.

Applications to public health

The profits of biotechnology firms have driven the demand for biotechnology market intelligence and the development of the surveys and other human resources tools. The same dynamics do not exist in public health. Biotechnology has been able to market itself well, for example by becoming part of the President’s High Growth Initiative, and prompting the growth of workforce groups in the geographic areas where biotechnology firms cluster. How can public health learn to market it itself in similar ways?

X. Agriculture

Estimated size of the workforce

The BLS reported 1,158,007 farmers and ranchers; 616,657 farm workers and laborers, (crop, nursery, and greenhouse); 218,039 farm, ranch, and other agricultural managers; and 53,387 farm workers (farm and ranch animals) in 2002. The National Agriculture Statistics Service (NASS) reports 978,000 hired workers on U.S. farms for the week April 10-16, 2005; 746,000 were hired by farm operators, and the remaining for agriculture service workers.

Defining the workforce

The Bureau of Labor Statistics has four main occupations related to agriculture work. NASS defines a hired worker as anyone paid for at least one hour of agricultural work on a farm or ranch. When this work is done as service on a contract or for a fee, the worker is defined as an agriculture service worker. The NASS defines a farm as a place that sells or would sell $1000 of agricultural products per year.

Data collection methods

The BLS NIOEM is discussed in the beginning of Appendix A. The NASS maintains a list of farm operations that hire laborers and annually updates and checks the validity of that list for its Farm Labor Survey. Regional office personnel conduct quarterly telephone or face-to-face surveys of farms and collect data on various topics, such as sales, expenditures, and production. Farm Labor survey published estimates are based on responses from 12,100 farm operations; response rates are typically 75%.
Agricultural service firms in Florida and California are surveyed in a similar manner. Only these states have labor laws permit the existence of agricultural service firms and agricultural service workers.

Challenges in collecting data

The response rate for the NASS survey varies based on weather conditions during the survey week; good weather conditions mean that farmers are less likely to be available for answering questions. Surveyors are given detailed definition of worker types; hired workers are registered by the tasks they were hired to do.

Development of resources or tools

The NASS system of collecting agricultural data is an established resource for data about hired workers on farms. It also has conducted a Census of Agriculture which sought to count every potential agricultural operator in the nation. The Census of Agriculture collected extensive data on farm characteristics, crops, and the operator demographics; for purposes of this project, the focus was on farm workers, not only operators.

Access to results


Government or private sector entity

Farmers and farm workers operate primarily in the private sector.

Impact and ties to future planning

The structure of the American farm has changed over the last decades resulting in a reduced demand for labor. This trend can be measured with the statistical resources and tools available. Hired labor is a commodity, like crops, that is surveyed by NASS, and can be studied for its role in productivity. Workforce development issues also exist. Succession planning is important in farms, and demographic data about farmers help to describe the current needs. Agriculture has the enumeration infrastructure due to the critical importance that agricultural products play in the U.S. economy and in the lives of Americans. The lesson that public health can learn from agriculture is that it can market itself to show that it, too, plays a critical role in society, promoting and protecting the public’s health.

Applications to public health

Definition of terms plays a vital role in the agricultural workforce enumeration: farmer, hired worker, farm manager, farm worker, agricultural service workers, and farm operator are all used to describe different roles by different data sources. Public health would benefit from maintaining clear, comprehensive definitions of roles in its workforce. As with other industries, collecting workforce data is simply part of doing business. Making counting the workforce a normal part of doing business is a simple, but powerful, long-term goal for public health.
### Appendix B: Workforce Enumeration Focus Group

**Participant List**

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<tr>
<th>Moderator</th>
<th>Substance Abuse and Mental Health Services Administration</th>
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<td>Christine J. Hager</td>
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Appendix C: Workforce Enumeration Focus Group Summary

The Association of State and Territorial Health Officials (ASTHO) convened representatives from industries, occupations, and professions on May 24, 2005, to discuss lessons learned from enumeration efforts in each area. ASTHO Alumnus Kristine M. Gebbie, Director, Center for Health Policy and Health Services Research, Columbia University School of Nursing and an Elizabeth Standish Gill associate Professor of Nursing, moderated the focus group.

Representatives of the following organizations and agencies participated:
- Substance Abuse and Mental Health Services Administration, U.S. Department of Health and Human Services
- Johns Hopkins Centers for Excellence in Environmental Public Health Tracking and Community Environmental Health Practice
- National Center for Health Workforce Analysis, Health Resources and Services Administration, U.S. Department of Health and Human Services
- Biotechnology Institute
- Aerospace Industries Association
- National Information Center on Health Services Research and Health Care Technology, National Library of Medicine
- Office of Career and Workforce Development, Centers for Disease Control and Prevention
- The National Association of County and City Health Officials

Dr. Gebbie began with a history of efforts to enumerate the public health workforce. In the past, local health departments enumerated local public health workforce, and ASTHO collected information at the state level. In 1980, there was an attempt to estimate the size of the national public health workforce, but no field work was done. The next enumeration, *The Public Health Workforce: Enumeration 2000*, was based on secondary data from state and local health departments; federal data from the Office of Personnel Management; data from schools of public health; and data from some non-governmental organizations (NGOs), such as the March of Dimes. The report classified the workforce into forty-five professions and thirty practice areas.104

The Bureau of Labor Statistics

The Bureau of Labor Statistics conducts workforce enumeration surveys, including the Occupational Employment Survey. The OES covers every metropolitan area in the United States. Its sample size is 1.2 million, making it the largest survey by the federal government. Workforce numbers are collected from employers. The BLS also collects information on salaries and wages of all occupations. The survey results are published in the *Occupational Handbook*. A revision of the Standard Occupation Classifications will be put into effect in 2008. The BLS divides the U.S. workforce into twenty-two major occupations, and two of which deal with health occupations.

Mental Health

The mental health workforce, as defined by SAMHSA, is composed of nine disciplines. SAMHSA does not survey workers. It works with each individual discipline to collect workforce data. There are an estimated 5,000 mental health organizations and 15,000 local sites where mental health services are provided. These organizations and sites employ approximately 500,000 people. They spend $35 billion and serve 10 million patients per year. A biennial human resource survey is conducted to collect detailed profiles of mental health workers. From survey responses, SAMHSA has identified a core set of
competencies for the mental health field. The agency is developing a national survey to collect additional data on these competencies. Each discipline reports in *Mental Health, United States*, a biennial publication that gives an overview of the mental health field. This report presents an analysis of the workforce needs and trends for the coming three to five years.

Major workforce issues in mental health are recruitment and retention of Generation X and Y workers because turnover is high among younger generations. The average psychiatrist completed training twenty-five years ago. Given the changes in the field in the last twenty-five years, this statistic shows the need for workforce planning and development. Another concern is that workers are not trained in evidence-based medicine. The mental health field needs competency based training with assessment tools to look at effectiveness.

**Environmental Health**

A key obstacle to environmental health workforce enumeration is the fragmentation that exists because there is no universal definition of environmental health. Though no national environmental health workforce enumeration has been completed by the Johns Hopkins Centers for Excellence in Environmental Public Health Tracking and Community Environmental Public Health Practice, they have completed a profile of local Maryland environmental health practice.

Within environmental health, the workforce is “aging out.” Difficulty in recruitment and retention of Generation X and Y environmental health workers exists. No uniformity exists among state and local jurisdictions as to what agencies employ environmental health workers or whether environmental health workers are considered state versus local employees. Many environmental health workers are employed as contractors and many environmental health workers spend part of their time working for other agencies.

**Pharmacy**

Congress directed HRSA to investigate whether or not there was a pharmacist shortage in the late 1990s. The 2000 HRSA study, *The Pharmacist Workforce: a Study of the Supply and Demand for Pharmacists*, was based on models that were created to estimate the supply and demand of pharmacists and to project that supply and demand until 2010. The baseline data for the supply model was the last pharmacist census, conducted from 1989-1991, using lists of pharmacists provided by the National Association of Boards of Pharmacy. There have been no new data since then, only estimation and projections based on the model created.

Sixty five percent of all pharmacists, a total of 127,000-128,000 professionals, work in retail settings, i.e. community pharmacies, chain drug stores and supermarkets, and internet-based suppliers. Twenty-five percent work in institutional settings, such as hospitals. Approximately 10 % work in research and manufacturing. It is estimated that there are a total of 220,000-230,000 pharmacists today. The pharmacist workforce is undergoing a feminization. Approximately 50% of pharmacists are female, and female graduates outnumber their male counterparts by 10% annually. There has been a shift in the pharmacy education pipeline from a five year Bachelor of Science degree to a six year PharmD doctorate degree. This shift resulted in no new graduates for one year for each college pharmacy, and thus, the supply of pharmacists was reduced as institutions made the transition. It has been estimated that two new pharmacy colleges open each year and that new twenty-five schools will be open by 2020.

Recently, small surveys, including one by the University of Wisconsin that surveyed 2,000 pharmacists, have shown that pharmacists typically work more than 40 hours per week, which raises the question when enumerating whether to count workers or FTEs.
Nursing
HRSA has produced *The Public Health Workforce Enumeration 2000* as well as the *U.S. Health Workforce Personnel Factbook*, which looks at health graduates in different areas of the country and racial disparities in health professions.

The 2004 National Sample Survey of Registered Nurses indicates there are 3.2 million registered nurse licenses. However, many registered nurses have more than one license. That is, they are licensed in more than one state. Currently the maximum number of states that one person has been licensed in is 19. Therefore, the number of licenses is not equal to the number of nurses. Thus, some nurses could be counted more than one time. In priority states, there are attempts to track by name.

Confusing in counting and classifying the nursing workforce sometimes results from the many types of certification nurses may receive. Some nurses list the last piece of equipment on which they were certified as their job title. Simple discrepancies with NSSRN responses also need to be addressed; some nurses say they have been working thirty years and graduated from school in 1989.

Biotechnology
Enumeration is done by biotechnology companies themselves and those data are used by organizations like the Biotechnology Industry Organization. Industry research indicates that the number of biotechnology jobs will increase over the next seven to eight years. Recruitment in the biotechnology arena focuses on all types of biotechnology related education programs, kindergarten through lifelong learning, though the focus is on high school through doctoral education, but a problem exists with worker attrition in the industry following initial training periods.

Aerospace
The Aerospace Industries Association (AIA) is focused on public policy in the industry at a national level. Data are collected on the total number of employees and total production. The AIA uses Bureau of Labor Statistics data on a national level. The Bureau of Labor Statistics categorizations of industries and occupations are sufficient for their purposes. The number of workers in the aerospace industry has declined by 50% since 1989, a peak year for the industry workforce. In the last two years, the aerospace industry has added workforce as one of its top ten issues. The industry is noticing an upswing recently. The aerospace workforce is not geographically diverse and therefore state level data are not reported, nor are they needed. Firms that work in the industry are clustered in certain states. The industry is reaching out to high school students to raise interest in the industry. For example, a rocket contest was sponsored in honor of the 100th anniversary of the First Flight.

There have been problems with the North American Industry Classification System in determining what industries are included in the aerospace industry. Aircraft/missile production is included but electronics production is excluded. The aerospace industry is looking at federal partners such as the Department of Labor, the Department of Energy, and the Department of Defense to help determine future supply and demand for the workforce and the level of shortage.

Identification of Important Themes and Messages to Remember
Dr. Gebbie asked the group members to and identify the most important idea that they had heard during morning that would help public health determine next steps. She asked, “What have you heard that would critically helpful?”

Responses included being able to forecast future workforce needs. People have an innate desire to know to know what is going to happen; estimating future needs is critical. Estimation cannot be done from a
single point of data; it requires a regular institutionalized enumeration. If public health cares about workforce issues, it needs to move toward regular counting.

Addressing the role of competency-based training in defining a core set of skills was mentioned along with clarifying what public health workers really do as opposed to what they are trained to do. Participants felt that the first step might be creating a definition of public health.

One participant asked, “Do we only need to count noses or do really we need to count FTEs? Do we only need know what pre-employment training they have gotten or do we really need to know what on-the-job training they are getting? Do we only need to know how they were trained or do we need to know how they actually function? Which of those points is really what public health needs to know to meet the emerging crisis?” Answering these questions would get at the heart of a workforce enumeration strategy.

One participant felt that the focus group discussion was interesting because such a discussion is rarely held and needs to be held more often. A coordinated public/private approach to workforce enumeration that takes advantage of the work that is going on in the field is needed to define workforce goals and objectives and look at how workforce issues relate to each other.

Other conclusions included the importance of reviewing prior enumeration work and becoming more efficient at mining the data from existing sources. Works in and around public health that were worth exploring further were identified. The work being done in mental health around core competencies was deemed important. Because of artificial divisions, mental health tends to be forgotten in the broader public health world, and it would be unfortunate not to learn from the progress mental health has made. The archives of the NACCHO committee that has been working on the Profile of Local Public Health Agencies survey includes a lot of fruitful discussion about the tradeoff between the length and complexity of surveys and achieving a good response rate. One participant mentioned that valuable information might be gleaned from State Workforce Agencies, which are required to track recipients of state funded training programs to determine whether they are still working in a field related to their training.

The moderator asked, “What do we do about boundaries?” Boundaries, or the definition of the workforce, dictate the data sources. She presented a hypothetical scenario of an enumeration plan that collected data from State Public Health Agencies, local public health agencies, and the national health agency, the Department of Health and Human Services. She posed the question, “What would be the result of an enumeration that collected data from these three categories alone?” The response was that many workers—mental health workers, environmental health workers, private and non-profit sector public health workers—would be excluded. Discussion also revolved around viewing public health as a profession versus an industry. Many public health workers hold non-degree technical jobs that are fundamental to public health achieving its mission. Viewing public health as a profession, and consequently not counting those individuals as part of the workforce, might not paint an accurate picture of the workforce.

There was overall agreement that public health still has room to improve the marketing of itself and its services to the public.

**Listing of Employers and Workers to Count**

Dr. Gebbie asked the group “What would this group put on the list of employers and workers if the group was the policy-making body? How would this group define the boundaries of the employers that we would want to collect data from or understand and what are the worker groups we would want to understand?”
The employers mentioned were:
- State public health agencies
- Local public health agencies
- State mental health departments
- Local mental health agencies
- State environmental agencies
- Local environmental agencies
- Non-governmental organizations (NGOs) that contract with government agencies
- NGOs not contracted by government agencies
- Federal agencies
  - Department of Health and Human Services
  - Environmental Protection Agency
  - Department of Agriculture
  - Department of Labor
  - Department of Homeland Security

The workers mentioned were:
- Statisticians
- Laboratorians
- Risk assessment/management professional
- Epidemiologists
- Planners
- Attorneys
- Pharmacists
- Public Information Officers
- Nurses
- Sanitarians
- Physicians
- Public health educators
- Social workers
- Policy analysts
- Dentists
- Informaticians
- Mental health workers
- Industrial hygienists
- Toxicologists

The focus group concluded with participants identifying the most important information to assist public health in determining what to do next:
- Set priorities.
- Do not let perfection become the enemy of the good.
- Find out what public health workers do in the populations that they serve.
- Pay attention to training and the roles of health professionals vs. their titles and employers.
- Focus on national numbers (or vice versa).
- Focus on training in work performed vs. training.
- Organize, organize, and organize.
- Institutionalize upfront in terms of the planning and the funding.
- Keep it simple.
- Explore standardization.
- Learn from past collection efforts.
- Clarify the overall objective while keeping in mind the institutional needs and the informational needs.
- Look at collaboratives like the Public Health Workforce Development Collaborative and the Public Health Data Standards Consortium.
- Market public health and its terminology.

The meeting concluded with thanks from ASTHO staff for the representatives’ participation in the focus group and to Dr. Gebbie for moderating the session.
2 Ibid.
3 Ibid.
5 The Pharmacist Workforce, a Study of the Supply and Demand for Pharmacists. U.S. Dept of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions. (December 2000).
9 Ibid.
11 Ibid.
13 Ibid.


The Annapolis Coalition for the Behavioral Health Workforce was founded by the American College of Mental Health Administration and the Academic Behavioral Health Consortium to build a national consensus on the nature of the workforce crisis and to promote improvements in the quality and relevance of education and training by identifying and implementing change strategies. It is currently focusing on furthering the use of competency-based approaches to building a stronger workforce. More information is available at: http://www.annapoliscoalition.org/


Occupations include education administrators, preschool and child care center/program; child, family, and school social workers; social and human service assistants; preschool teachers, except special education; kindergarten teachers, except special education; elementary school teachers, except special education; teacher assistants; cooks, institution and cafeteria; building cleaning workers; first-line supervisors/managers of personal service workers; child care workers; bookkeeping, accounting, and auditing clerks; secretaries and administrative assistants; office clerks, general; bus drivers, school, plus other occupations with small representation in the industry.


53 Ibid.


55 Ibid.


57 Ibid.


62 Ibid.

63 Ibid.

64 Ibid.


66 Ibid.

67 The Pharmacist Workforce, a Study of the Supply and Demand for Pharmacists. U.S. Dept of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions. (December 2000).
88 Ibid
89 Ibid.
95 Ibid.
96 Ibid.
102 For more detail information on the NASS multiple frame sampling methodology see Ibid.
103 Personal communication with Alexandra Riley, Statistics Methods Branch, National Agriculture Statistics Service. (October 18, 2005).