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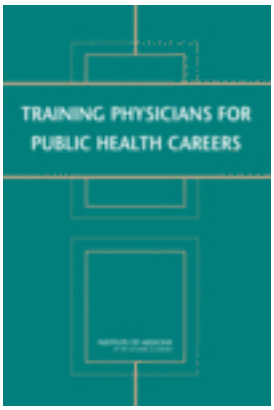

Training Physicians for Public Health Careers

Committee on Training Physicians for Public Health Careers

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TRAINING PHYSICIANS FOR PUBLIC HEALTH CAREERS

Committee on Training Physicians for Public Health Careers

Board on Population Health and Public Health Practice

Lyla M. Hernandez and A. Wezi Munthali, *Editors*

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"Knowing is not enough; we must apply.
Willing is not enough; we must do."
—Goethe

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Reviewers

This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the NRC's Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process. We wish to thank the following individuals for their review of this report:

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Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations nor did they see the final draft of the report before its release. The review of this report was overseen by **Dr. David R. Challoner,** Vice President for Health Affairs, Emeritus, University of Florida and **Dr. Linda Rosenstock,** Dean, School of Public Health, University of California, Los Angeles. Appointed by the National Research Council and Institute of Medicine, they were responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the authoring committee and the institution.

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Speakers at the three public meetings provided a broad overview of issues related to training physicians for public health careers. The committee greatly appreciates the input of those speakers: George K. Anderson, Jo Ivey Boufford, Karen Fisher, Charles Godue, Arvind Goyal, Maxine Hayes, Paul E. Jarris, Denise Koo, Patrick Libbey, Robert L. Mott, Andre-Jacques Neusy, Joel L. Nitzkin, Michael Parkinson, Tanya Pagan Raggio Ashley, Anthony L. Schlaff, Harrison C. Spencer, Hugh H. Tilson, and Michael E. Whitcomb. Joel Nitzkin made substantial additional contributions to the committee's work.

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Summary

Public health efforts have resulted in tremendous improvements in the health of individuals and communities. Vaccines, improved sanitation and hygiene, safer workplaces, enhanced food and drug safety, and preventive health services aimed at such things as alcohol and drug use have all led to improvements in the health and well-being of people of all ages and backgrounds. Public health, an interdisciplinary field of study and practice devoted to preventing illness, disease, and injury and to promoting and protecting human health with respect for human rights and dignity, is defined as "what we as a society do collectively to assure the conditions in which people can be healthy" (IOM, 1988). The foundation for effective public health interventions rests on sound scientific principles, strong organizations committed to improving the health of the public, and a well-trained workforce of sufficient numbers and diverse disciplines to address current and emerging public health needs. Unfortunately, despite the achievements of public health, there is now a growing shortage of public health workers (ASTHO, 2004), including a critical shortage of public health physicians, and many who are currently employed in public health are unevenly prepared to face today's public health challenges (Kennedy et al., 1999; Glass, 2000; Turnock, 2004).

Concerned about a lack of well-trained public health physicians, the U.S. Congress mandated that the Institute of Medicine (IOM) undertake a study to determine (1) what knowledge and skills are needed by public health physicians, (2) the number of programs needed to maintain an adequate supply of physicians trained for public health careers, and (3) how

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these programs can be funded (Consolidated Appropriations Act, 2005, Public Law 108-447, Conference Report 108-792). This report is the result of the deliberations of the committee assembled to address that charge.

A critical task for the committee was the development of a vision of the future public health physician workforce to guide the committee's work. The committee's vision has three components. First, the committee envisions a future in which sufficient numbers of well-trained public health physicians work with other public health professionals to address population issues such as health promotion and disease prevention, chronic and infectious diseases, safe food and water supplies, sanitation, and environmental exposures. Second, the committee envisions a future in which sufficient numbers of well-trained public health physicians are available to provide the scientific and clinical input along with the leadership and management necessary to link and coordinate the efforts of the many participants of a strong public health system. Third, in the face of public health emergencies, the committee envisions a future in which there will be sufficient numbers of well-trained public health professionals, including physicians, to plan for and prevent these emergencies or to respond to them. Such emergencies would include disasters such as hurricanes, bioterrorism, and emerging or reemerging infections such as pandemic influenza or multiple-antibiotic-resistant tuberculosis.

Who are public health physicians? The committee has adopted the following definition: public health physicians are physicians "whose training, practice and world view are based in large part on a population focus rather than individual practice, that is, on assuring the availability of essential public health services to a population using skills such as leadership, management, and education as well as clinical interventions" (Gebbie and Hwang, 1998).

WHAT SHOULD PUBLIC HEALTH PHYSICIANS KNOW?

The health challenges of the 21st century (e.g., the increasing burden of chronic diseases, persistent and emerging infectious diseases, and disaster response) require the medical and public health communities to work in concert. Additionally, given the increased understanding of the multiple determinants of health, physicians must be aware of not only the biological risk factors but also the behavioral and environmental factors that can affect health in order to tailor interventions for individual treatment. Training physicians in population-based medicine as well as clinical medicine holds strong promise for augmenting the quality and effectiveness of clinical practice. However, the integration of these population health content areas into an already crowded medical school curriculum necessitates the development of creative approaches to curriculum

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development and teaching (e.g., case-based learning) as well as a cadre of faculty with the requisite knowledge.

For the purposes of this report, the committee has identified three levels of physician engagement with public health. First, all physicians intersect with public health in many sectors of their practice and can be viewed as participating in public health activities, even though they are not defined as public health physicians. Second, there are physicians who practice public health for a portion of their career, full or part time, but primarily have a career trajectory in some other area of practice (e.g., a pediatrician working in school health). Finally, there are physicians with careers in public health, that is, physicians who can be identified as specializing in public health, whether they practice this specialty for an entire career or enter public health as a change in specialty at some point. These public health physicians work in a variety of settings; perform many different functions; and fulfill numerous roles, including policy development, leadership and management, programmatic expertise, and clinical services.

The committee endorses the recommendation of the IOM report on educating public health professionals, *Who Will Keep the Public Healthy?* (IOM, 2003b), that all medical students receive basic education concerning the concept of determinants of health and an introduction to the content areas identified in that report (i.e., epidemiology, biostatistics, environmental health, health services administration, social and behavioral health sciences, informatics, genomics, communication, cultural competence, community-based participatory research, global health, policy and law, and public health ethics (IOM, 2003b)).

Furthermore, **the committee recommends that**

- **three additional areas be included in this basic education: leadership, clinical and community preventive services, and public health emergency preparedness;**
- **organizational partners (including but not limited to the Association of American Medical Colleges; the Association for Prevention, Teaching, and Research; the American College of Preventive Medicine; the American Association of Colleges of Osteopathic Medicine; the Association of Schools of Public Health; the Council of Accredited MPH Programs, and the American Association of Public Health Physicians) collaborate to develop models for integrating training in public health principles and practice into physician education at both the undergraduate and graduate levels;**
- **each graduate medical education program identify and include**

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public health concepts and skills relevant to the practice of that specialty; and

- **medical schools and graduate medical education programs include faculty with appropriate public health training and experience to teach public health content and serve as role models.**

Basic competency in population and public health is important not only for physicians currently enrolled in medical education programs but also for those already practicing medicine, regardless of their specialty. For example, all physicians require basic knowledge of epidemiological principles to interpret reports of new medical and behavioral approaches to disease management. Many currently practicing physicians, however, completed a medical education that had a less than complete basic public health content. Therefore, **the committee recommends that physicians, most of whom have elements of public health in their practices, have access to a way to assess their public health competency and training needs as well as support for appropriate continuing education in public health. Medical specialty societies should provide this self-assessment and continuing medical education, including relevant emerging topics and public health practice updates. Periodic recertification examinations should include public health questions relevant to that specialty.**

Although an understanding of basic public health concepts is important for all physicians, a smaller number of physicians require a greater amount of knowledge of particular public health concepts and skills because a specific portion of their practice, practice setting, or practice role involves public health. Examples of physicians in this group include infectious disease physicians who investigate health care institution-associated disease outbreaks, pediatricians who work in school health, and emergency medicine specialists who direct emergency medical services. Additional training specific to the public health portion of practice is essential for these physicians. Therefore, **the committee recommends that**

- **schools and programs of public health, state health departments, and specialty societies develop competency-based certificate programs and other training programs in public health that are based on the recommended 16 areas, consistent with principles of adult learning, and designed to enable physicians to obtain practice-specific public health training; and**
- **employers of physicians whose practice includes some component of public health support both initial and ongoing assessments of the training needs of these physicians, the preparation**

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of personal development plans to address needed knowledge and skill areas, and funding to implement these plans.

Physicians with careers in public health may practice public health for an entire career or may enter or leave public health as a change in specialty at some midpoint in their careers. Whether they practice public health full or part time, it is essential that their public health knowledge and practice meet the current standards for public health professionals as well as any standards relevant to their specific role in public health or to the populations that they serve. To ensure that these expectations are met, these career public health physicians require specific, enhanced public health training. Therefore, **the committee recommends that**

- **physicians with careers in public health acquire a master of public health from schools or programs in public health or through preventive medicine programs; or a comparable degree or experience (e.g., through the federal or state Epidemic Intelligence Service programs). The training or experience should include the 13 content areas identified in the Institute of Medicine report on educating public health professionals (IOM, 2003b) plus the additional three content areas of leadership, clinical and community preventive services, and public health emergency preparedness recommended in this report.**
- **schools and programs of public health expand their recruitment of physicians into public health graduate programs in order to increase the number of physicians with public health training. Graduate programs should include a public health field experience.**

Revised accreditation criteria for schools and programs of public health establish 42 semester credit units as the standard length for an MPH degree. It is not known whether this increase in hours will make it more difficult for schools and programs of public health to recruit physicians into the MPH program. However, the accreditation criteria also provide for consideration of prior or concurrent academic studies or relevant work experience to be credited toward the degree requirements. It is to be hoped that other measures recommended in this report will help encourage physicians to complete an MPH.

The committee believes it is important that, at a minimum, public health physicians understand the basics of each of the recommended content areas and the application of those basics to public health. It is important to emphasize that not all physicians with careers in public health are expected to become experts in each of the content areas identi-

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fied. Beyond that, the depth of knowledge and skill in the content areas will be determined by the public health role that each physician plays.

WHAT IS AN ADEQUATE SUPPLY OF PUBLIC HEALTH PHYSICIANS?

The second part of the committee charge, determining how many programs are needed to maintain an adequate supply of physicians trained in public health, presents two difficult questions. What is an "adequate" supply, and given the various ways in which public health physicians can be trained, how is it determined "how many training programs" are needed?

To answer the supply question, one needs to know how many public health physicians currently exist, whether that number is adequate, and if that number is not adequate, what that number should be. Various attempts have been made to collect data on the number of public health physicians currently practicing in the United States by using available physician and public health databases and reports. Most of these reports have focused on governmental agencies.

The reported numbers range from a low of 1,400 to a high of 22,000, but each of the methods used to determine these numbers is flawed in different ways. For example, some methods focus only on full-time equivalents in a particular kind of agency (e.g., a local health department); others collect data only on particular kinds of positions (e.g., the program manager), which makes it impossible to separate physicians from other types of professionals in those positions. Some collect data on the numbers of physicians employed but fail to identify whether their practice is in public health, whereas others ask physicians to self-identify as a public health physician but do not verify the type of practice. The lack of a consistent definition and inclusive approach to identifying and counting public health physicians makes it extremely difficult to determine accurately both the current pool of public health physicians, much less the desired number. This, in turn, impedes efforts aimed at planning for the number and kinds of training programs needed to prepare physicians for effective public health practice. Therefore, **the committee recommends that**

- **the U.S. Congress designate funds for the Health Resources and Services Administration to conduct a periodic (every 3 to 5 years) comprehensive enumeration of the public health workforce, and filled and unfilled positions, with particular attention to physicians. The enumeration should include all civilian and military governmental agencies with public health responsibil-**

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ities, public health academia, and significant voluntary agencies contributing to the public's health. The enumeration should also include those physicians employed by private or public sector care delivery systems with public health responsibilities.

- **the information regarding public health physicians obtained in the periodic assessment of the public health workforce be used to project needs for public health physicians and public health physician education programs, and to determine the level of funding necessary to prepare physicians to fulfill those needs.**

The public health system envisioned in the 2003 IOM report *The Future of the Public's Health* (IOM, 2003a) includes governmental public health agencies at the core working with the health care delivery system, public health and health sciences academia, communities, business and employers, and the media. According to that report, governmental public health agencies form the backbone of the public health system and the actions that it takes. Without sufficient numbers of well-trained physicians in this backbone, the entire public health system is weakened. Both because of the importance and centrality of the "backbone" to assuring the public's health and because available enumerations primarily focus on physicians in governmental agencies, the central focus of this report is physicians in governmental agencies.

The tremendous differences in the data sources, time frames, and definitions used in these various reports prohibit any meaningful integration of the numbers; the easily developed challenges to any one of the methods used prohibits arbitrary use of any one of them. In determining the size of the current public health physician workforce, the committee relied most heavily on Enumeration 2000 and Bureau of Labor Statistics (BLS) data since they are most complete. These two most useful resources provide widely divergent numbers: Enumeration 2000, approximately 6,000; BLS, 22,000. Because the BLS data include physicians in other than public health positions and physicians with other than public health specialization, the committee determined this was an overestimate. However, the Enumeration most likely undercounted because categorization was by job title, and physicians are employed under titles such as commissioner, director, supervisor, epidemiologist, and surveyor as well as physician and public health physician. Taking into account the numbers and the sizes of agencies at all levels of government, the staffing patterns both reported and known to members of the committee, and indications from the agencies about the levels of vacancies, the committee's considered opinion is that an estimate of 10,000 is reasonable, and could be used until such time as an improved data system is in place.

If the estimated number of physicians currently employed in public

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health was reasonably accurate and reflected a fully met need and if these physicians followed a typical work career, it would be relatively simple to estimate the number of replacement physicians needed to be trained for public health careers over the coming decades. However, reports from public health agencies regarding the recruitment and the retention of staff indicate that there are serious gaps in the current supply of public health physicians. Furthermore, according to Glass (2000), there are decreasing numbers of physicians in public health and preventive medicine. The committee bases its estimate of need for public health physicians on the assumption that public health would best be served by physician participation in the public health leadership team, both at the agency level and in major programmatic areas.

Although estimating the number of public health physicians in practice today, as well as extrapolating that number to meet future needs, is difficult, the committee used the available information to calculate what it believes to be the most reasonable estimate of need and arrived at the conclusion that 20,000 physicians are needed in public health careers, an increase of 10,000 over the current number engaged in public health careers. The committee is very aware that greater accuracy in estimating these numbers could be achieved if regular, comprehensive enumeration efforts were undertaken.

It is also essential to plan for the replacement of physicians leaving the public health workforce for retirement or other reasons. If it is assumed that an average career path in public health is 15 years (on the basis of assumptions made about late entry into the field), approximately 1,350[1] properly prepared public health physicians are needed every year to replace those leaving the existing workforce. Therefore, once the desired number of 20,000 public health physicians in governmental agencies is reached, the system must have the capacity to train at least 1,350 new physicians per year to replace those leaving public health careers.

HOW MANY TRAINING PROGRAMS ARE NEEDED?

Education in public health can be obtained in a variety of ways and at various points in one's career, for example, through preventive medicine residencies, schools and programs of public health, the Epidemic Intelligence Service program of the Centers for Disease Control and Prevention,

[1]This figure is derived by dividing the estimated number of physicians needed (20,000) by the estimated average length of career (15 years). The resulting number of 1,333 has been rounded to 1,350. The estimate of a 15-year career is based on the considered opinion of the committee since no data exist on this issue. In future, the numbers could be adjusted if data were collected and yielded a better number.

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certificate programs, public health training networks, and public health leadership networks. It should be noted, however, that these approaches do not provide a uniform set of knowledge about and skills in public health. Furthermore, evidence indicates that the current public health workforce is inadequately trained in many respects. It is important not only to look at training future public health physicians but also to ensure that those currently engaged in public health careers are adequately trained.

Determining the training resource needs when neither the base population nor the turnover rate is accurately known is extremely difficult. Determining the training resource needs becomes even more difficult when the description of what constitutes a public health workplace or a medical practice contribution to public health is made more generous or is defined more broadly. As stated earlier, the current estimated number of physicians in governmental public health practice is 10,000, with an estimated need for 20,000 and an annual replacement need of 1,350. The committee focused particular attention on ensuring that sufficient numbers of governmental public health physicians are available and that the number of physicians pursuing careers in public health can supply this number on a routine basis. For this to happen, both the quality and the number of training programs for physicians must be increased. Therefore, **the committee recommends that:**

- **The Centers for Disease Control and Prevention (CDC) expand the Epidemic Intelligence Service program to include double the current physician enrollment without diminishing the participation of other disciplines.**
- **CDC expand its Academic Health Department (AHD) program to sustain 30 AHDs. Requirements should include partnership with medical schools in order to encourage physician participation.**
- **State and large local health departments, in conjunction with medical schools and schools of public health, expand post-residency fellowships in public health that emphasize transition into governmental public health practice.**
- **Public health/general preventive medicine (PH/GPM) residency programs expand current capacity and add additional PH/GPM residencies as needed to graduate a minimum additional 400 residents per year. This expansion should be supported by federal graduate medical education funds that are not linked to provision of clinical medical services.**
- **The Residency Review Committee for preventive medicine review the content and quality of preventive medicine train-**

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ing programs in the context of the recommendations in this and other recent IOM reports on public health to ensure that the training programs meet the needs of modern public health practice.

- **Governmental public health agencies support both initial and ongoing assessment of the training needs of physician employees, preparation of personal development plans to address needed knowledge and skill areas, and funding to implement these plans.**
- **Recognizing the multiple training tracks by which physicians may come into a full-time public health career, the American Board of Preventive Medicine, the Board of Public Health Examiners, the American College of Preventive Medicine, the American Association of Colleges of Osteopathic Medicine, the Association of State and Territorial Health Officials, the National Association of County and City Health Officials, the Association of Schools of Public Health, the American Public Health Association, and the Council of Accredited MPH Programs convene to explore the challenges and mechanisms available to assess minimum competency for physicians in public health practice.**

FUNDING

Currently, public health training of physicians is funded through a number of mechanisms. For example, federal, state and local, and private entities offer education and training at various stages of a physician's career or upon the entry of a physician into the workforce. However, funding adequate to support physician training in public health is a major issue for those practicing and seeking to enter the workforce. Reliable financial support of physician education and training in public health is lacking, as traditional funding sources are plagued by uncertain funding cycles and dwindling support.

Another problem related to funding is that preventive medicine residency training tends to occur in nonhospital settings, such as community-based outpatient clinics and state and local health departments, which are ineligible for Medicare reimbursements. This leaves many preventive medicine residency programs scrambling for resources. As a result, most preventive medicine residencies rely heavily on other funding sources, for example, the Health Resources and Services Administration (HRSA). However, overall funding levels for HRSA health professions program budgets have steadily declined over recent years, from $10,473,000 in fiscal year 2002 to $7,920,000 in fiscal year 2006 (HRSA, 2006).

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Although funding for training programs is necessary to maintain an adequate supply of well-trained public health professionals, these programs alone cannot assure sufficient numbers of trained public health physicians. This is because serious challenges to attracting the necessary numbers of qualified physicians remain. The money-saving decisions made by many local governments have severely limited the numbers of physicians employed in health departments, confining them to clinical roles or those required by law and restricting them to working for the minimum number of hours legally possible. The importance of physician contributions to all public health policy has been diminished as the qualifications for public health agency leadership have expanded to include other public health practitioners. Furthermore, once a public health physician position is designated part time, the attention to the level of public health preparation of the incumbent may be minimal. The distribution and size of governmental public health agencies also mean that many public health physicians work in relative isolation from their peers. All of these forces combined have resulted in insufficient numbers of funded positions for part-time and full-time public health physicians.

Furthermore, the salaries of public health physicians are significantly lower than those of their counterparts in private practice. Reliable financial support for physician education and training in public health is also lacking at the agency level. These challenges are more noticeable at the state level than at the federal level and are particularly acute at the local level, especially outside of major urban areas.

Finally, other practical barriers to entering public health professions exist for physicians. For many physicians, their first introduction to public health may be after they are well into the development of their clinical practices and specialty interests, making it difficult to redirect their professional paths. Alternatively, when a physician who is already trained in medicine encounters the challenges and the potential of public health at mid-career, the lack of flexible training opportunities makes the development of the needed competency extremely difficulty.

Several actions are necessary to facilitate physician training in public health and to maintain an adequate backbone public health physician workforce. **The committee recommends that**

- **the U.S. Congress fund a comprehensive educational strategy sufficient to produce the additional number of public health physicians required through the following mechanisms:**
  – Funding for residency training in public health should be equivalent to and parallel the funding streams for graduate medical education in other medical disciplines.

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– Funding to support the recommended expansion of the EIS and AHD programs.
– Reinstatement and growth of funding for health professions training through the Title VII programs.

- **Congress fund Health Resources and Services Administration and the Centers for Disease Control and Prevention to work collaboratively to develop model demonstrations and evaluation programs that explore other models than direct physician hiring by health agencies. Such models might include regional physician health agency groups, development of public health expertise in larger health systems, or creation of a national network of consultants in specific public health domains.**
- **agencies, particularly state and local public health departments, create and adequately fund additional public health physician positions (full- and part-time) to accommodate the 10,000 additional public health physicians required.**
- **the American College of Preventive Medicine, the Association of State and Territorial Health Officials, the National Association of County and City Health Officials, the U.S. Department of Health and Human Services, and the federal Office of Personnel Management regularly conduct a salary assessment of governmental public health and comparable private sector physicians. The agencies should use these results to align the salaries of their public health physicians to parity with private sector physicians performing comparable work.**
- **federal, state, and local public health agencies develop loan forgiveness programs for physicians who enter and continue to work in the public health sector.**
- **federal, state, and local public health agencies develop (or expand existing) programs that support public health training for physician employees in exchange for continued employment in that agency.**
- **employers of physicians in the public health workforce develop incentives to recruit and retain public health physicians that include**

  – discretionary benefits (e.g., leave, continuing education and conference support, portable retirement, etc.) ;
  – career development support, based upon statewide or regional analysis of long-term public health physician needs across agencies, with support for further graduate training to physicians who agree to remain in public health, potentially moving to more responsible or more technically demanding positions over time; and

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– opportunities for increased professional interaction for public health physicians practicing in remote or isolated circumstances.

- **federal and state governments develop tax incentives for individuals who train and enter governmental public health.**

Public health physicians are vital to maintaining and improving the health of the public. The United States has an opportunity to build a strong public health physician workforce, but to do so requires commitment to actions that will overcome current barriers. If such commitment is forthcoming, the beneficiaries will be the people of the United States.

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1

Fundamentals: The Health of the Public Is Threatened

In a world where health threats range from AIDS and bioterrorism to an epidemic of obesity, the need for an effective public health system is as urgent as it has ever been. An effective public health system requires well-educated public health professionals. (IOM, 2003b)

Despite the achievements that have been made in public health, there is now a growing shortage of public health workers (ASTHO, 2004). A recent study found that between 1980 and 2000, the number of public health workers in the United States decreased by more than 28 percent, from 220 to 158 workers per 100,000 Americans (Merrill et al., 2003). Furthermore, many of the workers who are currently employed in this area are unevenly prepared to face today's public health challenges (IOM, 2003a,b).

A key component of the public health workforce is physicians. The U.S. Congress, through the Consolidated Appropriations Act of 2005 (Public Law 108-447, Conference Report 108-792), authorized the Health Resources and Services Administration to contract with the Institute of Medicine to determine what knowledge and skills that public health physicians need, the number of programs needed to maintain an adequate supply of physicians trained for public health careers, and to examine how these programs can be funded.

Physicians are a vital part of the public health workforce and are the focus of this report. The committee's vision for the public health physician workforce has three components. First, the committee envisions a future in which sufficient numbers of well-trained public health physicians are working with other public health professionals to address population issues, such as health promotion and disease prevention, chronic and infectious diseases, safe food and water supplies, sanitation, and environmental exposures. Second, the committee envisions a future in which

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sufficient numbers of well-trained public health physicians are available to provide the scientific and clinical input along with the leadership and management necessary to link and coordinate the efforts of the many participants of a strong public health system, as described in *The Future of the Public's Health* (IOM, 2003a). Third, in the face of public health emergencies, the committee envisions a future with sufficient numbers of well-trained public health professionals, including physicians, to plan for and prevent these emergencies or to respond to them. Such emergencies would include disasters, such as hurricanes and threats of bioterrorism, or emerging or reemerging infectious diseases, such as pandemic influenza and multiple-antibiotic-resistant tuberculosis.

PUBLIC HEALTH IN THE UNITED STATES

Industrialization, population growth, and increasing urbanization led to worsening public health conditions in the United States in the late 1700s and early 1800s. "The mixing of dense populations living in unsanitary conditions and working long hours in unsafe and exploitative industries with wave after wave of cholera, smallpox, typhoid, tuberculosis, yellow fever, and other diseases was a formula for disaster" (Turnock, 2004). The devastating yellow fever epidemic in New York City in 1798 led the state legislature to grant the city authority to pass its own health laws (Rosen, 1963). Also in 1798, the U.S. Congress passed an "act for the relief of sick and disabled seamen" (Parascandola and Robinson, 2005) that established a federal network of hospitals for the care of merchant seamen. John Maynard Woodworth, the first Supervising Surgeon (a position later designated Surgeon General), put together a medical staff of physicians who could be assigned to the various marine hospitals on the basis of need. In 1870 these marine hospitals were reorganized into the Marine Hospital Service, which, as services and activities expanded, became the U.S. Public Health Service in 1912. Federal Public Health Service commissioned officers engaged in activities aimed at controlling the spread of contagious diseases, conducted biomedical research, and provided health care and assistance following disasters, as well as numerous other activities (USPHS, 2006).

In 1850, Lemuel Shattuck issued the *Report of the Sanitary Commission of Massachusetts*, which called for the establishment of state and local health departments to focus on improving sanitation, controlling communicable diseases, providing services for infants and children, and collecting data on the public's health (Turnock, 2004). The development of local health departments spread rapidly to address the public health needs of local communities.

The dawn of the 20th century marked the beginning of an era bur-

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geoning with new innovations and discoveries that advanced the public health objective of improving the health of individuals and populations. Improved sanitation and hygiene, safer workplaces, cleaner air, and enhanced food and drug safety led to reductions in morbidity and mortality due to infectious diseases and other illnesses. Innovative preventive health programs improved health through family planning and maternal and infant health services, along with school health programs, immunization for vaccine-preventable diseases, and behavioral health services that addressed alcohol and drug abuse and mental health problems. Innovative technological advances such as seat belts, motorcycle helmets, and smoke detectors resulted in a marked decline in the number of deaths and disabilities from injuries.

Despite the many achievements of public health, the beginning of the 21st century finds the public health system facing major problems. According to the Institute of Medicine (IOM, 2003a), governmental public health agencies are severely underfunded; obsolete and inconsistent laws and regulations hinder coordinated, effective action; information systems are inadequate; and public health laboratories suffer from insufficient staffing, training, and resources. Furthermore, the current public health workforce is poorly prepared to meet new challenges.

THE CURRENT STATE OF PUBLIC HEALTH STRUCTURE AND PRACTICE

In 2001 the Institute of Medicine undertook a study to examine the current state of public health in the United States and make recommendations for its improvement. The resulting report (IOM, 2003a) concluded that America was not as healthy as it should be nor was it as well prepared as it should be to address future health challenges. The report's central message was that to protect and promote health and well-being, the nation needs a strong governmental public health infrastructure. Although governmental public health agencies are the backbone of the public health system, they are clearly in need of support and resources and must build and maintain partnerships with other organizations and sectors of society.

Most people view health as an individual or personal issue. However, ensuring the health of the public requires an approach that recognizes there are multiple determinants of health that interact over the life course. Addressing these determinants requires the combined efforts of a "complex network of individuals and organizations that have the potential to play critical roles in creating the conditions for health" (IOM, 2003a). The public health system envisioned in the 2003 report includes governmental public health agencies at the core working with the health care delivery

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system, public health and health sciences academia, communities, businesses and employers, and the media.

Figure 1.1 lays out graphically the report's identification of the problems and the kinds of changes needed.

The 2003 Institute of Medicine report explored several areas of action and change, including adopting a focus on population health that includes multiple determinants of health, strengthening the governmental public health infrastructure, building partnerships with other sectors, developing systems of accountability, emphasizing evidence, and improving communication within the public health system (e.g., among all levels of the governmental public health infrastructure and between public health professionals and community members). The full report makes 34 recommendations (see Appendix A), several of which are most pertinent to the present study about preparing physicians for public health careers (see Box 1-1).

The recommendations in that report were directed to many parties because, as the report indicates,

> *[I]n a society as diverse and decentralized as the United States, achieving population health requires contributions from all levels of government, the private business sector, and the variety of institutions and organizations that shape opportunities, attitudes, behaviors, and resources affecting health. Government public health agencies have the responsibility to facilitate and nurture the conditions conducive to good health. But without the active collaboration of other important institutions, they cannot produce the health outcomes envisioned in Healthy People 2010.* (IOM, 2003a)

PHYSICIANS AND THE NATURE OF PUBLIC HEALTH PRACTICE

Public health is an interdisciplinary field of study and practice devoted to preventing illness, disease, and injury and to promoting and protecting human health with respect for human rights and dignity. It is defined as "what we as a society do collectively to assure the conditions in which people can be healthy" (IOM, 1988). Effective public health interventions are designed, implemented, and managed by a wide range of professionals, including physicians, nurses, engineers, dentists, veterinarians, sanitarians, community planners, attorneys, health educators, community outreach workers, and countless other professionals and volunteers. Each of these professionals works in an environment greatly influenced by public policy, which in turn is affected by economic, political, business, and community interests and concerns.

The foundation for effective public health interventions rests on sound scientific principles developed by using a broad range of scientific disciplines, such as epidemiology, statistics, environmental health, health

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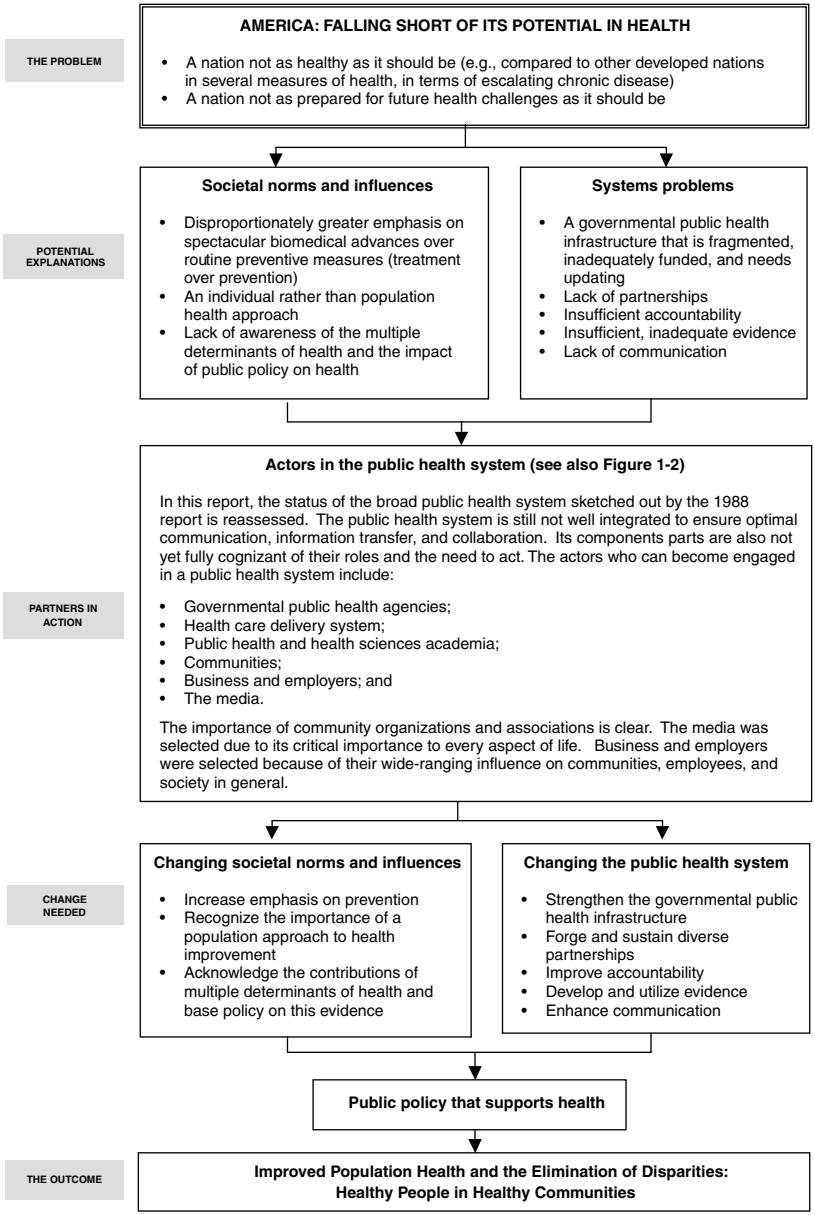

FIGURE 1.1 Framework of the report *The Future of the Public's Health in the 21st Century*.
SOURCE: IOM (2003a).

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BOX 1.1 Selected Recommendations from *The Future of the Public's Health in the 21st Century*

- All federal, state, and local governmental public health agencies should develop strategies to ensure that public health workers who are involved in the provision of essential public health services demonstrate mastery of the core public health competencies appropriate to their jobs. The Council on Linkages between Academia and Public Health practice should also encourage the competency development of public health professionals working in public health system roles in for-profit and nongovernmental entities.
- Congress should designate funds for the Centers for Disease Control and Prevention (CDC) and the Health Resources and Services Administration (HRSA) to periodically assess the preparedness of the public health workforce, to document the training necessary to meet basic competency expectations, and to advise on the funding necessary to provide such training.
- Leadership training, support, and development should be a high priority for governmental public health agencies and other organizations in the public health system and for schools of public health that supply the public health infrastructure with its professionals and leaders.
- Academic institutions should increase integrated interdisciplinary learning opportunities for students in public health and other related health science professions. Such efforts should include not only multidisciplinary education but also interdisciplinary education and appropriate incentives for faculty to undertake such activities.
- Congress should increase funding for HRSA programs that provide financial support for students enrolled in public health degree programs through mechanisms such as training grants, loan repayments, and service obligation grants. Funding should also be provided to strengthen the Public Health Training Center program to effectively meet the educational needs of the existing public health workforce and to facilitate public health worker access to the centers. Support for leadership training of state and local health department directors and local community leaders should continue through funding of the National and Regional Public Health Leadership Institutes and distance-learning materials developed by HRSA and CDC.

SOURCE: IOM (2003a).

administration, and behavioral science. In addition, clinical practitioners and researchers in basic health and social sciences work to design and implement public health interventions using the combined expertise of these diverse disciplines and professions to ensure that they have practical applicability and relevance. An effective public health system requires a well-trained workforce of sufficient numbers and diverse disciplines to address current and emerging public health needs. Despite the number and kinds of professionals, public health physicians remain central to the

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public health mission. However, given this complex environment, the unique role of public health physicians is perhaps less clear now than it was in the past.

Historically, the majority of public health professionals were physicians (Hager, 1999). In the late 19th century, physicians, who often achieved distinction by participating in public health campaigns, made up 80 percent of the membership of the American Public Health Association (Brandt and Kass, 1999). As the association between public health and medicine that existed during the 19th and the early 20th centuries began to decline and as time passed, medical and public health professionals adopted different beliefs regarding individualized health care and the promotion of wellness for populations.

However, a symbiotic relationship exists between public health physicians and medicine. For example, today's effective efforts to decrease the incidence of lung cancer through the reduction in the use of tobacco products began when epidemiologists and clinicians discovered the link between lung cancer and tobacco use. Over the years, new scientific discoveries, coupled with education and strong advocacy on the part of public health advocates, changed community norms, such that smoking is now widely understood to be a significant health hazard. Efforts are now designed to both prevent the initiation of tobacco use and assist with the cessation of tobacco use by people of all ages. These broad public health programs and efforts combine the most current scientific discoveries with the expertise of individuals in other disciplines—advertising and social marketing, indoor air quality assessment, legal enforcement, and public opinion—that have become synonymous with public health practice.

Nevertheless, as mentioned earlier, there is a growing shortage of public health workers (ASTHO, 2004), and many of the existing public health workers are ill prepared to meet the public health challenges of the 21st century (IOM, 2003a,b). Kennedy and colleagues conducted an 18-month study of the public health workforce in Texas and found that only 7 percent of public health professionals had formal education in public health (Kennedy et al., 1999). The Centers for Disease Control and Prevention estimated that 80 percent of public health workers lacked basic training in public health (CDC, 2001), and Turnock (2004) stated that only 22 percent of local health department chief executives have graduate degrees in public health. According to Glass (2000), a large number of physicians who engage in public health activities have no formal training in public health. Although specific data are scarce, expert opinion and testimony to the committee show that many current physicians do not have training in population or preventive health and are ill prepared to undertake public health careers.

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PHYSICIAN CONTRIBUTIONS TO PUBLIC HEALTH

The medical paradigm is focused on providing individualized medical care. This approach requires the practitioner to weigh the benefits of a particular course of treatment or other health care services for the well-being of the individual. Population-based issues such as income and social supports may influence the treatment plan, but treatment has been viewed through the lens of the individual. Furthermore, specialization in the medical paradigm segments the individual into organ systems or body parts and provides focused care to that system as a component of the whole. The success of a medical treatment(s) is thus defined as the wellness of the individual.

Public health professionals, on the other hand, focus on population health broadly by using interventions designed to improve public health through changes to the environments in which people live and work, by making concerted efforts to modify human behavior and lifestyles to improve their health, and by ensuring that all individuals in society receive uniform medical care. Public health professionals specialize in population-based areas, such as epidemiology, environmental health, disease control, maternal and child health, injury control, occupational health, and nutrition (Fineberg et al., 1994). Success in public health is thus defined as the reduction, delay, or prevention of a disease or disability for a group of individuals or a community as a whole. Although individuals are the beneficiaries of the interventions, they are not usually the primary focus.

Physicians contribute to public health in many important and unique ways. The medical education that physicians receive provides them with a deep understanding of molecular biology, human anatomy, pathophysiology, pharmacology, and other basic sciences that are essential to understanding the interaction between people and their environment. For example, physicians must understand the interactions between diet and cardiovascular disease. Medical education encourages the gathering of data from a myriad of sources, whether it be by clinical examination, the taking of patient history, or laboratory tests. Their medical education teaches physicians to formulate the nature of the health problem, craft solutions, and monitor their patients to the conclusion of the particular health event. In addition, optimal medical care requires frequent reassessments and midcourse corrections to solve clinical problems. Physicians often work in multidisciplinary teams as well. These experiences on teams provide physicians with the basic leadership skills for team building, which is an essential skill in the field of public health. These skills reflect the three core public health roles of assessment (problem list), policy development (treatment plan), and assurance (reevaluation and retreatment).

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Physicians must often make decisions, despite unsettling and irresolvable uncertainties. This demand for action in the presence of insufficient or conflicting data can be directly applied to the public health domain when there are major threats to the health of populations, such as disasters or disease outbreaks. Physicians are taught to deal with cause and effect to remedy what are often contentious or life or death situations. This valuable combination of skills and strategic thinking makes them highly qualified to help protect and ensure the public's health and could prove invaluable if a natural or human-made disaster were to occur. Physicians who have supplemented their medical training with formal training in public health (in certificate or degree programs) or appropriate public health experience have the added benefit, from a public health perspective, of being able to draw upon their medical training while addressing issues using a more population-based approach.

Furthermore, physicians are the front line in disease recognition and diagnosis efforts that form the backbone of current community surveillance activities. Astute clinicians have alerted public health authorities to disease clusters or outbreaks. For example, in 1974, a physician diagnosed hemangiosarcoma of the liver in three patients. Knowing their occupations, he made the link between this highly unusual cancer and their exposure to vinyl chloride at their workplace. This led to the redesign of the workplace to provide a safer work environment. In another instance, surveillance data in New York City in 1999 did not show an increase in the number of reported cases of either meningitis or encephalitis. It was not until an alert clinician reported a case of encephalitis associated with severe muscle weakness that the city health department first became aware of the existence of the West Nile virus outbreak. Without that first call, the outbreak might have lingered for weeks without being recognized. Finally, in October 2001, an infectious disease physician in Palm Beach, Florida alerted authorities to the fact that severe health problems experienced by Bob Stevens, a newspaper employee, were the result of anthrax poisoning. The outcome of this event might well have been much more severe were it not for the intervention of this physician. In these cases, the physicians' specialized knowledge and skills enabled them to recognize and identify illnesses that could threaten the health and well-being of the general public. The availability of physicians with specialized knowledge and skills is therefore especially important when public health actions that require advanced medical knowledge of disease processes, such as drug-resistant tuberculosis or emerging or reemerging infectious diseases, must be addressed.

Physicians are also spokespeople and champions for public health. Because of their knowledge and experience, they are often trusted and are effective voices that can address the health problems that might be occur-

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ring within a community. The public also finds physicians to be credible experts with the most comprehensive backgrounds in health and disease prevention. This leadership role is vital in times of emergency when there is an urgent need to explain risks, contend with fear, and galvanize groups to contend with the emergency. Furthermore, when the collaboration of the entire community is needed to address significant health problems, a physician who is trained in public health can more easily leverage his or her relationships with people within the medical community and gain cooperation and commitment from those individuals.

Physicians can also help bridge gaps between human medicine and other disciplines, such as nutrition, biostatistics, epidemiology, psychology, veterinary medicine, and public health through collaboration with their counterparts. Their in-depth knowledge of medically related health issues make them important allies when partnerships are formed to investigate and study areas of interest to public health professionals. Physicians are therefore vital to the public health enterprise and bring unique knowledge, skills, and competencies that add value to addressing public health problems.

Attracting Physicians to Public Health

Ensuring that an appropriate number of physicians choose careers in public heath helps build a public health infrastructure that will provide benefits for all members of society. In addition, increasing the number of public health physicians who are members of minority and other underrepresented groups could help create and reinforce access to ethnically and culturally diverse communities that can otherwise become marginalized if they lack physicians whom community members believe can relate to their special circumstances.

Unfortunately, for many disparate reasons, it is difficult to attract physicians to the public health workforce. For many physicians, their first introduction to public health topics or concerns may be after they are well into their medical school training. Although many medical schools include public health among their required classes, medical students often do not recognize the relevance of public health to the care of patients. When such courses are offered, they often lack the visibility and importance that are given to other areas of medical specialization. Additionally, both in medical school and in general, few medical students are exposed to recognizable and respected public health physicians during their training. This lack of exposure contributes to the inability of physicians in training to identify public health practitioners or researchers whom they could emulate in their pursuit of a career in public health.

Once they have completed medical school, additional concerns influ-

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ence the choices that graduating physicians make when they choose careers in areas other than public health. Currently, the major mechanism for funding graduate medical education (GME) relies on federal funds provided by reimbursements for clinical services and additional add-ons for training in clinical settings through the Medicare and Medicaid programs. Because public health settings often do not include direct clinical care activities, no direct or indirect GME funding is therefore available. This lack of funding for graduate training in public health means that training programs in public health must obtain funding from alternative sources, which may result in an increased burden of loans for physicians receiving graduate training in public health that those in other specialties do not have.

Furthermore, physicians who choose more traditional medical careers command high salaries and are typically rewarded with the respect of their peers and their communities. Public health physicians, on the other hand, have a more diffuse public image and are therefore often regarded as having less prestigious careers. They also receive salaries significantly lower than those that their counterparts in private practice receive. In 2005, for example, the mean salary for state health officer positions requiring a medical degree was $150,295 (ASTHO, 2005), whereas the mean compensation for medical directors in health plans (health maintenance organizations, hospitals, multispecialty groups, and single-specialty groups) was $239,630 (ACPE, 2005). Additionally, public health physicians have the added burden of working in a heavily politicized environment where uncertainty about stability and funding is ever present. For example, data show that the average tenure of state health officers between 1990 and 2006 was 3.76 years.[1]

CONTEXT

Physicians are a crucial component of the workforce, and it is therefore imperative that adequate numbers of physicians with training in public health be available to support the broader public health community. All physicians engage in public health activities some of the time; and their training in public health is important to excellence in public health practice, teaching, and research. Other physicians, however, are engaged in careers in public health. These public health physicians are defined as those "whose training, practice and world view are based in large part on a population focus rather than individual practice, that is, on assuring the availability of essential public health services to a population using

[1]Personal communication, L. M. Fehrenbach, Association of State and Territorial Health Officials, May 2, 2007.

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skills such as leadership, management and education as well as clinical interventions" (Gebbie and Hwang, 1998).

Physicians engaged in public health activities work in a variety of settings. However, governmental actions and agencies are recognized as constituting "the backbone of all efforts to assure the health of the public" (IOM, 2003a). Yet, in 2005, less than one-half (43 percent) of local health departments (LHDs) employed full-time or part-time physicians. For LHDs serving populations of less than 25,000 people (930 LHDs), only 20 percent employed a physician. Furthermore, for LHDs serving populations of more than 500,000, 46 percent had top executives with medical degrees,[2] whereas only 9 percent of LHDs with populations less than 25,000 were led by individuals with medical degrees (NACCHO, 2006).

CONCLUSION

The public health system must be prepared to respond to, prevent, and detect health threats that range from natural disasters, bioterrorism, and emerging infections to chronic health threats, such as obesity. An effective public health system requires a well-educated public health workforce that includes sufficient numbers of physicians in a variety of positions. However, predicting the future needs for public health physicians is an imperfect science. Events or significant changes in health care could dramatically alter the estimates of the numbers of physicians needed in the public health workforce. Factors that could alter future needs include

- the emergence of new, as yet unknown environmental risks, such as emergent infectious disease agents or environmental toxins;
- dramatic changes in the delivery of health care that reduce the risk of disease onset and the progression of diseases that demand a significant effort by public health physicians, such as the development of a vaccine or the implication of a therapy that derives from genomic medicine;
- the discovery of behaviors that could significantly increase or reduce the risk of disease and disease progression that requires significant input from public health physicians to implement the behavior;
- a dramatic change in or fragmentation of the existing health care system that places an increased burden upon public health physicians; and
- a natural or human-made disaster (perhaps much more severe than recent disasters encountered in the United States) that requires a

[2]In this study, medical degrees were defined as including M.D., D.V.M., and D.D.S.

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coordinated and rapid mobilization of public health physicians to a site (or multiple sites) around the country.

Physicians need to be trained to be part of the first line of defense against future health threats and also need to be groomed to take on leadership roles in the public health community. This report explores and presents conclusions about educating physicians for careers in public health and identifies issues and approaches to the question of funding physician education in public health. Chapter 2 describes roles for public health physicians, the areas of knowledge that these physicians need, and estimates of the numbers of physicians needed to maintain an adequate public health physician workforce. Chapter 3 focuses on the different pathways by which physicians come to careers in public health and describes both the degree and the nondegree options for training in public health for physicians. Chapter 4 addresses the funding of physician training for careers in public health. Chapter 5 presents some concluding thoughts.

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2
Physicians in Public Health: Their Roles, Knowledge Needed, and Numbers

This chapter examines the roles of physicians in public health, describes the knowledge that they need to practice public health, and estimates the number of physicians needed to maintain an adequate public health physician workforce.

ROLES AND LEVELS OF ENGAGEMENT

Since the inception of organized public health programs, physicians have been seen as essential to the delivery of good public health services. In any list of the multiple professions needed for the high-quality practice of public health, physicians are included with nurses, dentists, veterinarians, environmental health specialists, laboratorians, epidemiologists, health educators, and others. In the early years of the 20th century, statutes that established public health departments at the state and local levels required that the public health official (the public health officer or health commissioner) be a duly licensed physician. The size and complexity of the public health workforce have grown over the intervening century, many statutes have been rewritten without specifying the professional discipline of the agency leadership that is required, and the unique role of physicians in public health has become more difficult to describe.

Many more physicians than are currently recognized engage in public health activities at some point in their careers. First, all physicians intersect with public health in many activities of their practice and can be viewed as participating in public health activities. Second, the practices of

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some physicians include some public health elements. These physicians include infectious disease physicians investigating health care-associated disease outbreaks, pediatricians working in school health, and emergency medicine specialists serving as the medical directors of emergency medical services. Beyond their day-to-day duties, the stories that they can tell of prevention efforts that have not been practiced may be a critical factor in public policy making. It was the voice of a practicing pediatrician, for example, that launched the national effort to place every child in an appropriate restraint when the child was traveling in a moving vehicle.

Finally, some physicians have careers in public health; that is, they can be identified as specializing in public health, whether they practice this specialty for their entire career or enter it as a change in specialty at some point in their career. These public health physicians work in a variety of settings, including nongovernmental organizations, managed care organizations, occupational medicine, aerospace medicine, academia, public hospitals, and governmental agencies. Figure 2.1 illustrates these different levels of physician engagement with public health. Movement upward in the figure, as indicated by the arrow, indicates the need for higher levels of public health knowledge and practice.

A public health physician policy maker involved in the development of population health policies might work with legislators to ensure that

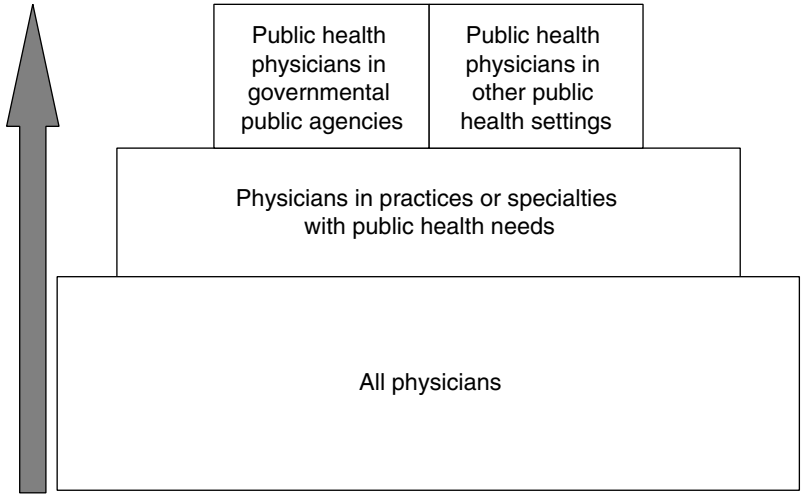

FIGURE 2.1 Physician involvement in public health.

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they understand the health implications of proposed legislation, present the health implications of public health programs to the public, or ensure that public health programs are structured to use the best emerging public health science. A public health physician leader or manager may be found to be the head of a managed care organization, a director of a state health department, or the manager of epidemiological surveillance in a hospital. At each of these levels the public health physician leader and manager is responsible for developing clear goals, using resources efficiently and effectively, and ensuring that the workforce for which he or she is responsible is well trained and well organized to fulfill its responsibilities.

Public health physicians also play a key role in a number of practice areas that require both public health perspectives and extensive clinical expertise. Mental health, occupational health, and corrections health are a few of these. At least at the level of leadership, these require the participation of well-trained public health physicians.

As described above, all physicians are a part of the public health system; for a smaller number of physicians, a portion of their practice involves public health, while career public health physicians practice in a wide range of settings, including governmental public health agencies.

WHAT DO PHYSICIANS NEED TO KNOW?

Concurrently with the Institute of Medicine (IOM) study examining the public health system discussed earlier (IOM, 2003a), IOM undertook a study to develop a framework for strengthening education, training, and research to improve population health. That report (IOM, 2003b) discussed the need for an ecological approach to addressing health problems[1] and identified several key content areas for public health professionals during their training. Public health professionals come from a wide variety of disciplines including nursing, dentistry, social work, pharmacy, law, epidemiology, laboratory sciences, and, of course, medicine. Physicians are a key component of the public health professional workforce and, as such, must be as well prepared as other public health professionals to meet the challenges of public health practice in the 21st century. Therefore, the current committee endorses the recommendations of the earlier report, agreeing that physicians must be prepared to base their actions on an ecological approach to problem solving, as well as be educated in the

[1]The report states that "an ecological model assumes that health and well being are affected by *interaction* among multiple determinants including biology, behavior, and the environment. Interaction unfolds over the life course of individuals, families, and communities, and evidence is emerging that societal level factors are critical to understanding and improving the health of the public" (IOM, 2003b).

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key content areas identified for training public health professionals. Table 2.1 lists the content areas recommended for public health professionals (IOM, 2003b). These content areas have been expanded by this committee to identify how each area applies to physicians. These essential areas are epidemiology, biostatistics, environmental health, health services administration, social and behavioral sciences, informatics, genomics, communication, cultural competence, community-based participatory research, global health, policy and law, and ethics. Again, endorsing the recommendations of the 2003 report (IOM, 2003b), the introduction of this content to all physicians should occur in medical school. The mechanisms for preparation beyond that basic introduction are discussed in Chapter 3.

In reflecting more deeply on the demands facing the United States today (e.g., public health preparedness in the face of natural and human-made disasters), the committee believes that certain responsibilities may fall more directly on physicians and require knowledge and skill in three additional areas not included in the prior report that are crucial to preparing effective public health physicians. These areas are leadership, public health emergency preparedness, and clinical and community preventive service provision. Each of these areas is described in detail in the following sections.

Leadership

Physicians involved in the health of the public require leadership skills that allow analysis and planning for complex threats to the health of small groups, neighborhoods, and entire populations. Medical schools, however, generally prepare their students only for clinical medicine and medical research, with the learning of management skills and leadership taking place through on-the-job experience or during the postgraduate period. Physicians provide leadership, for example, in the rapid responses to industrial explosions or spreading infections, as well as in immunization, health promotion, disease prevention, nutrition, tobacco control, and violence prevention programs. Indeed, policy makers, the public, and other health care professionals look to physicians to be well-informed resources, guides, spokespeople, and leaders.

Leadership development has several elements, including, as John Gardner (1990) commented, "Envisioning goals, affirming values, motivating others, managing, achieving workable unity, explaining things in appropriate settings, serving as a symbol, representing the group, and in the important task of self-renewal." In the complicated world of public health, these tasks must be carried out by leaders who also demonstrate global awareness, cultural competence, respect for others, humor, per-

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TABLE 2.1 Public Health Content Areas for Physician Training

Area	Description	Application for Public Health Physicians
Biostatistics	Collection, storage, retrieval, analysis, and interpretation of health data; design and analysis of health-related surveys and experiments; and concepts and practice of statistical data analysis	Development of commentary to clarify statistical information for clinicians; accurate interpretation of statistical information in publications and reports; understanding the strengths and weakness of studies when their findings are applied to diverse communities; and ability to explain these to professionals, policy makers, and the general public
Epidemiology	Distributions and determinants of disease, disabilities, and death in human populations and the characteristics and dynamics of health and illness in human populations	Development of clinically sound case definitions for investigations and surveillance; teaching and encouraging clinicians to ensure their participation in reporting and investigations; and assessing, describing, and developing interventions for health issues in communities
Environmental health sciences	Environmental factors, including the biological, physical, and chemical factors that affect the health of a community	Accurate interpretation of environmental influences on health in responding to illnesses or outbreaks; consultation with environmental health professionals; assisting with development of programs and policies that prevent or mitigate environmental health hazards; and articulating the human health aspect of environmental issues
Health services administration	Planning, organization, administration, management, evaluation, and policy analysis of health programs	Providing assurance that health policy and management do not misuse medical information or neglect important clinical insights; developing and managing governmental or community programs; and working with governmental, hospital, and other health care systems

continued

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TABLE 2.1 Continued

Area	Description	Application for Public Health Physicians
Social and behavioral sciences	Concepts and methods of social and behavioral sciences relevant to the identification and the solution of public health problems	Integration of health promotion and health information in program planning and delivery and development of multifaceted approaches to community health issues
Informatics	Systematic application of information, computer science, and technology to public health practice, research, and learning[a]	Policy contribution to the development of informatics to ensure utility for the intersection of medicine and public health
Genomics	Application of basic public health sciences to genomic issues and studies	Interpretation of genomic information relevant to problems of public health importance and accurate provision of this information to other physicians
Communication	Skills required to interact with different groups within the public health system, including policy makers, health care providers, media, and lay citizens	Use of best practices in communication to act as a bridge between public health professionals in general and physicians from all settings and in communicating information about public health to the public, working with media, presenting information to diverse communities and to policy makers; and addressing professionals
Cultural competence	Communicating and adapting public health messages and methods in ways that respect the values, opinions, beliefs, and practices of people in various communities	Demonstration of the highest possible level of competence in dealing with the multiple cultural groups in the community, effectively identifying and responding to the needs and concerns of diverse populations, and working to address health disparities
Community-based participatory research	Research methods that emphasize communities as research coequals, collective visioning, incorporation of social ecology approaches, and using multiple data collection methods	Provide assurance that when public health engages in research, it does so as a partner with the community; sharing this perspective with medical researchers using more traditional approaches to studies

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TABLE 2.1 Continued

Area	Description	Application for Public Health Physicians
Global health	Cross-country factors that foster conditions for poor health and global environmental changes that lead to such things as depletion of fresh water supplies, loss of arable lands, and reemergence of infectious diseases	Interpretation of international information for application to domestic public health problems, collaboration with physicians internationally to foster improved health, working with immigrant and refugee populations, and preparing health professionals to work in international settings
Policy and law	Application of political science, economics, and administration to promote sound health policy, public health law, and the uses of law to promote the public's health	Consultation to ensure that proposals to change policy or law are consistent with current medical and public health science and communication about public health policy and law to medical colleagues
Ethics	Ethical basis for practice of public health, including the belief that people are interdependent on each other and the environment; the priority of addressing the root causes of health and illness; and a commitment to using the best available information in determining actions	Modeling the highest ethical standard of behavior for all colleagues in public health and clinical medicine, contributing to the ethical interpretation of proposals or events, and balancing the needs and resources for individuals and the community and among different populations

[a]Definition taken from Yasnoff, W. A., P. W. O'Carroll, D. Koo, R. W. Linkins, and E. M. Kilbourne. 2000. Public health informatics: Improving and transforming public health in the information age. *Journal of Public Health Management and Practice* 6(6):67-75.

spective, and up-to-date knowledge of the basic and clinical sciences, biostatistics, epidemiology, and other fields.

In a white paper developed for the CDC Leadership Summit of the Centers for Disease Control and Prevention in 2006, Rowitz (2006) called this approach to leadership "ecological leadership." Ecological leaders are committed to the development of their leadership skills and competencies throughout their professional careers, while at the same time they are committed to the appropriate application of these skills to their community's changing health priorities. In addition, ecological leaders are able to balance the needs of the day-to-day practice of public health in

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their organizations and communities with the special skills and applications necessary to address public health emergencies.

Within organizations, physicians need to work across programs and departments. As physicians move into public health leadership positions, they must work not only within organizational settings, but also collaboratively across organizations to address population-based programs. This requires learning to operate in terms of systems and strategies rather than the detail orientation typical of clinical work which tends to have a more linear focus (i.e., symptoms, then diagnosis, treatment, and recovery). In recent years this type of leadership, in which multi-sectoral collaboration occurs, has been called meta-leadership.

Rowitz (2001) discussed the complexities involved in leadership and pointed out that individuals learn to be leaders at the personal, team, organization, community, and professional levels. To be effective, leaders need to take a systems perspective and view the view health and illness in a comprehensive way. The physician who understands the biology of health and illness brings a special expertise to the public health field. He or she understands that what happens at a clinical level can provide much useful information about disease prevention at the community level and the importance of these issues in promoting the core public health functions of assessment, policy development, and health assurance (IOM, 1988).

Public Health Emergency Preparedness

As the nation has become more aware of the need for effective emergency preparedness and the response to emergencies in general, professionals in the medical and public health communities have also identified the need for them to pay increased attention to these special areas of practice. Although all physicians have some emergency-related responsibilities (early detection and reporting of potential problems, implementation of public health directives in patient care, and the accurate communication of risk to patients), public health physicians play a particularly important role in population-based activities in response to emergencies and disasters.

The overall management of emergency preparedness and the response to an emergency does not require medical knowledge; but almost any emergency has the potential to threaten the public's health, such as the risk of foodborne disease when power supplies are cut for extended periods, waterborne disease if water supplies are contaminated by flood waters, or hyper- and hypothermia at temperature extremes. Medical expertise may be essential to interpreting the degree of risk and ensuring that appropriate communications to the public and protective actions are

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taken. Beyond these more common challenges, epidemic diseases, chemical exposures, and other human-caused or naturally occurring threats to health require attentive physicians in the community and medical expertise on the public health response team to ensure that threat detection is handled well and the best possible interventions are put to use. Furthermore, in public communication during an emergent event with health implications, the voice of a well-prepared public health physician can be the key to the community understanding of the risks and the steps to be taken for harm reduction and a return to normal function.

Public health professionals are involved in emergency responses in a number of ways. For example, the responsibility for the regulation of state and local emergency medical services has been located in public health agencies and has always included medical oversight. Most governmental emergency preparedness and disaster plans give the responsibility for planning for and response to the health component of the plan to state and local public health entities. In addition, public health officials have specific legal authorities and police powers that they can use under emergency conditions, particularly conditions in which the potential for the transmission of a disease from person to person is encountered. The use of disease-specific information on which to base the use of such powers requires sound medical interpretation.

Over the past decade, agencies and associations in public health have developed clear statements of the competencies in emergency preparedness and response required by any clinician in a position to identify a problem early (which would include all physicians)[2] and all public health workers (including public health physicians).[3] These competencies go beyond the clinical information about the treatment of individual patients in cases of natural disasters; disease epidemics; or biological, chemical, or radiological emergencies. The competencies applicable to a physician practicing in public health include the management and operational skills essential for the individual to make a successful contribution within the context of the National Incident Management System.

Clinical and Community Preventive Services

One component of the effective practice of public health is ensuring the delivery of the appropriate public health clinical services by practicing

[2]A detailed description of these competencies can be found in the document *Core Public Health Worker Competencies for Emergency Preparedness and Response* (Columbia University School of Nursing. 2001. New York: Columbia University).

[3]A detailed description of these competencies can be found in the document *Bioterrorism & Emergency Readiness: Competencies for all Public Health Workers* (CDC [Centers for Disease Control and Prevention]. 2002. Atlanta, GA: CDC).

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clinicians. Practicing clinicians should be able to look to the public health community for relevant guidelines, professional and technical expertise, and reliable knowledge and opinions, often on a case-by-case basis.

Public health physicians are routinely required to provide advice to the practicing physician in a number of clinical domains. Among the most common are immunizations and vaccines, the diagnosis and treatment of diseases of public health importance, clinical preventive guidelines, community preventive services relevant to the clinical domain, and guidelines and precautions for international travel.

Immunizations and Vaccines

The public health system generally sets recommendations for vaccine use, and public health physicians are often viewed as the "vaccine experts" in communities. In this area, public health physicians require expertise in general vaccinology and vaccine use information, routine childhood and adult immunization schedules, knowledge and assessment of the possible adverse reactions from vaccines, and use of vaccines in special settings, such as a hepatitis A virus outbreak.

Diagnosis and Treatment of Diseases of Public Health Importance

The public health system generally sets the recommendations for the appropriate diagnosis and treatment of diseases of public health importance. Traditionally, these have included endemic infectious diseases of public health importance, such as tuberculosis and sexually transmitted diseases, as well as emerging infectious diseases at the time of first recognition (e.g., severe acute respiratory syndrome and Legionnaires' disease). In epidemic settings, for example, a cluster of cases of meningococcal meningitis or an outbreak of *Escherichia coli* O157:H7 infection, public health physicians will be called on to establish appropriate diagnostic and treatment guidelines. An additional area of public health physician expertise relates to the diagnosis and treatment of conditions not commonly seen by practicing clinicians, for example, suspect botulism, lead poisoning, malaria, or rabies.

Clinical Preventive Guidelines

Screening for a wide range of preventable conditions or conditions that are treatable if they are caught early (mammography and breast cancer, for example) is a key element of public health that is conducted by the practicing clinician. The creation and promulgation of screening guidelines are often viewed as the domains of public health, and public

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health physicians play a key role in these efforts. In addition to the establishment of clinical screening guidelines, clinicians are often asked to provide patient counseling for selected public health concerns (e.g., tobacco use reduction, firearm safety, and sexual practices), and the development and encouragement of the use of effective counseling messages by practitioners are key elements of public health physician practice.

Community Preventive Services Relevant to the Clinical Domain

Community preventive services are services delivered to populations rather than individual patients. Public health physicians should be knowledgeable and capable of providing advice to clinicians and health systems regarding relevant community preventive services, for example, strategies that can be used to improve immunization rates or the rates of diabetes detection in a patient population.

Guidelines and Precautions for International Travel

Public health physicians are responsible for developing appropriate guidelines and precautions for international travel (malaria prophylaxis recommendations, for example). Although practicing clinicians specializing in travel medicine are becoming increasingly common, individual clinicians still seek public health physicians when they apply these guidelines to individual patients and groups of travelers. Knowledge of travel precautions is thus a core expertise required of public health physicians.

Because there are indications that the current public health workforce is inadequately trained in many respects (see Chapter 1), it is important not only to look at training future public health physicians but also to ensure that those currently engaged in public health careers are adequately trained.

NUMBER OF PUBLIC HEALTH PHYSICIANS

Given the lack of any single database that identifies public health physicians and the lack of any common definition of the term "public health physician" used across more limited data sets, it is difficult to determine accurately the number of physicians engaged in public health careers today. As discussed earlier, all physicians contribute to the practice of public health some of the time, and that number is known. Physicians whose practices require public health knowledge and skills in order to make successful contributions to health promotion or disease prevention can be identified within most medical specialties, although they are not

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the major focus of this report. Under current circumstances, however, it is impossible to estimate the number of physicians in other than governmental health settings who are true public health physician specialists (or who work in positions that should require that level of public health specialization). The most reliable data are available only for physicians in governmental agencies.

Both because of the importance and centrality of governmental public health in assuring the health of the public, and because available data focus on physicians in governmental agencies, estimates of the current number of public health physicians focuses on those in governmental agencies. However, it is also difficult to estimate the numbers of physicians currently engaged in governmental public health careers, because information about physicians specializing in public health is incomplete. A number of different groups have, however, attempted to determine that number. For example,

- A National Association of City and County Health Officials 2005 survey identified up to 2,500 physicians in local public health agencies (NACCHO, 2006). This information was gathered by use of an electronic survey. It did not ask for any details about the specialty certification of the physicians and asked only for information about full-time equivalents. The survey thus underestimates the actual number of physicians involved in public health, and there is no way to extrapolate such a number from the data from that survey. The resulting information is only about the single, official local public health agency and thus excludes information about the numbers of public health physicians in local mental health or substance abuse agencies.
- The Enumeration 2000 report, commissioned by the Health Resources and Services Administration, estimated that approximately 6,000 physicians worked in federal and state health agencies in 2000, with 4,000 of these at the federal level (HRSA, 2000). The report was based on an analysis of existing data sets from state and some local health departments and was supplemented by information from the federal Office of Personnel Management and the U.S. Department of Defense. At the state level, only one state was able to report on workers throughout the state government. Categorization was by job title, when such information was available. Physicians were likely undercounted in that report for several reasons:
  - Many physicians in state and local public health are employed in job categories such as commissioner or director of health, epidemiologist, program manager, or some other generic term and could not be separated.
  - For some jurisdictions, a general category such as "professional"

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was all that was available, with no specification of the individual's training.

– For some jurisdictions, even that level of clarity was lacking, and only a single number covering all workers was available.

• Data from the American Medical Association (AMA) identified 1,400 physicians working in public health and preventive medicine (AMA, 2005). These data are drawn from a variety of sources and are not associated with board certification; therefore, there was no way to verify that the category of practice is consistent with the categories used in other systems. The extremely small number of public health and preventive medicine physicians identified from the AMA data compared with the numbers from the two previous reports suggests that these data reflect only those physicians seen as full-time employees in a public health setting and leaves out all or most of those who do not specialize in public health but practice in public health part of the time.

• Bureau of Labor Statistics (BLS) data show that 22,000 physicians work for governmental agencies, including in all specialties and for all types of agencies (BLS, 2006). These are data from employer systems used for the identification of the types or categories of worker. The BLS data include all physicians working on governmental payrolls, including those in public hospitals and community clinics, employee health clinics, and clinical research settings, as well as public health agencies. For this reason, it cannot be considered an accurate source of information about the numbers of physicians working in official public health agencies or other governmental agencies with public health functions, such as environmental, mental health, and agricultural functions.

• The American College of Preventive Medicine estimates that 1,654 preventive medicine physicians work in official health agencies (Parkinson, 2006). This represents the proportion of physicians who are known to the specialty board most relevant to public health and who can be identified as working in an official health agency. It can be considered an undercount of physicians working in public health for two reasons:

–It does not include those physicians working in other governmental agencies with public health responsibilities, a problem common to several of these reports.

–It does not include physicians with board certification in other specialties working in public health agencies, a group that includes many with specialty certification in pediatrics, infectious diseases, emergency medicine, and more.

The tremendous differences in the data sources, time frames, and definitions used in these various reports prohibit any meaningful integration or interpretation of the numbers of public health physicians; challenges

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to any one of the methods used can easily be developed and thus prohibit the arbitrary use of any one of them. In determining the size of the current public health physician workforce, the committee relied most heavily on Enumeration 2000 and BLS data since they are most complete. These two most useful resources provide widely divergent numbers: Enumeration 2000, approximately 6,000; BLS, 22,000. Because the BLS data include physicians in other than public health positions and physicians with other than public health specialization, the committee determined this was an overestimate. However, the Enumeration most likely undercounted because categorization was by job title, and physicians are employed under titles such as commissioner, director, supervisor, epidemiologist, and surveyor as well as physician and public health physician. Taking into account the number and size of agencies at all levels of government, staffing patterns both reported and known to members of the committee, and indications from agencies about levels of vacancies, the committee's considered opinion is that an estimate of 10,000 is reasonable, and could be used until such time as an improved data system is in place.

HOW MANY PUBLIC HEALTH PHYSICIANS ARE NEEDED?

If the estimated number of physicians currently employed in public health was reasonably accurate and reflected fully met need and if these physicians followed a typical work career, it would be relatively simple to estimate the number of replacement physicians who need to be trained for public health careers over the coming decades. Representatives of the U.S. Department of Defense described to the committee the annual planning that the department performs to determine the number of physicians to be recruited and trained in each specialty area and how it establishes a pipeline of physicians in specialty training programs (Mott, 2006). Although knowledge of such efforts is useful, the civilian public health world is not such a closed system with known population demands and specified resources.

Two other major caveats to estimating the national need for public health physicians exist: the current number of public health physicians does not reflect the need being met at present, and it is not clear that the career path for physicians in public health is a typical one.

Reports from public health agencies regarding the recruitment and retention of staff indicate that there are serious gaps in the current supply of public health physicians. Furthermore, according to Glass (2000), the numbers of physicians in public health and preventive medicine is decreasing.

Table 2.2 presents the committee's estimates of both the current number of public health physicians and the number needed to achieve an

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TABLE. 2.2 Estimated Present and Future Numbers of Physicians in Governmental Public Health Agencies

Agency	Present	Future
Federal (public health and other)	4,000	4,500–5000
State (public health and other)	2,000	2,500–3,500
Local		10,000–15,000
Nonspecified	4,000	
Total	10,000	17,000–23,500

adequate supply. The committee bases its estimates on the assumption that public health would be served best by physician participation in the public health leadership team, both at the agency level and in major programmatic areas. The committee believes that these figures present conservative estimates, given the continuing increase in public health-related knowledge and the demands for a high level of public health practice that cannot be accomplished without an adequate public health physician presence throughout the governmental public health system. The estimates take no account of the potential need for increases in the numbers of public health physicians in other areas of medical practice.

The committee's best estimate of the current number of physicians in state and local public health agencies is in excess of 2,000, or approximately 40 per state. Separation of the numbers of public health physicians at the state and the local levels is not possible at present. Furthermore, the current number of public health physicians working in state and local governmental positions is likely greater than 2,000 because of the large number (4,000) of public health physicians reported to work in positions not specified by level of government. Some of these physicians likely work in official public health agencies.

It is likely, however, based on the minimal data available regarding understaffing presented earlier in this report and on the committee's expert opinion, that state public health agencies, except for those serving very small populations, need more physician participation, perhaps as many as 10 more in key leadership positions in the state agency (38 states × 10 physicians = 380).[4] An additional 10 physicians might be needed in specialized programs in health departments (for example, in clinical services programs) in these same states (38 states × 10 physicians = 380).

[4]The committee chose to designate states with populations of less than 1.5 million as states that serve "very small populations." Of the 50 states in the United States, 12 have populations of less than 1.5 million (Infoplease. 2007. *Population by state. http://www.infoplease.com/ipa/AOOO4986.html* [accessed March 1, 2007]).

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Finally, a further 10 or more would be needed in other agencies in these states that perform public health functions, such as mental health and environmental health agencies (38 states × 10 physicians = 380). This would bring the estimated total number of physicians needed for state public health agencies to 3,140 (2,000 current physicians + 1,140 additional physicians). Given that these figures are not exact, the committee has chosen to adopt a range for estimated need of 2,500 to 3,500.

For local health agencies, it may be that very small health agencies might successfully be served by fewer physicians. For example, the 1,800 local health departments (LHDs) serving less than 100,000 people might have only one to two physicians (1,800 LHDs × two physicians = 3,600). However, the 500 local health departments serving larger populations might well have a need for the same 5 to 10 physicians in leadership positions needed by states (500 LHDs × 10 physicians = 5,000), as well as an additional 10 in programmatic areas (500 LHDs × 10 physicians = 5,000). The estimated total number of physicians needed for local public health agencies, then, would be 13,600. Again, because of the lack of specific data, the committee has chosen to express the estimated number of physicians needed in LHDs as a range from 10,000 to 15,000.

Such numbers would bring the estimated potential total number of public health physicians need for state and local public health agencies to between 12,500 and 18,500.

By using the same leadership and programmatic criteria outlined above, the federal public health agencies (primarily the U.S. Department of Health and Human Services and the U.S. Department of Defense, with smaller numbers in the Environmental Protection Agency and the U.S. Departments of Agriculture, Labor, and Veterans Affairs) could need 4,500 public health physicians (an increase of 500 over the current estimate). Looking at all of these estimates, the estimated number of physicians needed in governmental public health agencies ranges from 17,000 to 23,500. Given the difficulties in accurately estimating the number of public health physicians in practice today, as well as the difficulty of extrapolating that number to the number required to meet future needs, the committee has chosen to use expert opinion, as described above, to arrive at the conclusion that the country needs 20,000 physicians in public health careers, an increase of 10,000 over the current number engaged in public health careers. The number 20,000 provides a more comfortable margin that allows the inclusion of the public health physicians needed by community partner agencies, such as voluntary health associations, infection control physicians employed by hospitals or health care systems, and physicians employed by academic institutions, such as schools of medicine or public health. The committee is quite aware that greater accuracy

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in estimating these numbers could be achieved if regular, comprehensive enumeration efforts were undertaken.

It is also essential to plan for the replacement of physicians leaving the public health workforce because of retirement or for other reasons. If it is assumed that an average career path in public health is 15 years (which is based on the assumption that some physicians enter the field late in their careers),[5] the country needs approximately 1,350 properly prepared public health physicians every year to replace those leaving the existing workforce. This figure is arrived at by dividing the estimated number of physicians needed (20,000) by the estimated average length of a career in public health (15 years). The resulting number of 1,333 has been rounded to 1,350. Therefore, once the desired number of 20,000 public health physicians in governmental agencies is reached, the system must have the capacity to train at least 1, 350 new physicians each year to replace those leaving public health careers.

CONCLUSION AND RECOMMENDATIONS

Although this report is focused on education for physician careers in public health, it is important to note that many more physicians than those with public health careers engage in public health activities at some point. The committee has identified three broad groups of physicians who are considered to practice public health: all physicians, those who practice public health for a limited amount of time or in a limited role, and physicians who choose a career in public health. As can be seen from the preceding discussion in this chapter, estimating the number of physicians currently in public health careers, as well as the number needed for an adequate workforce, is hampered by a lack of data.

Although various attempts have been made to collect data on the number of public health physicians practicing in the United States, each is flawed in different ways, which makes it extremely difficult to estimate accurately both the current pool of public health physicians and the desired number. This, in turn, impedes efforts aimed at planning for the numbers and kinds of training programs needed to prepare physicians for effective public health practice. Therefore, **the committee recommends that**

- **the U.S. Congress designate funds for the Health Resources and Services Administration to conduct a periodic (every 3 to 5**

[5]The estimate of a 15-year career is based on the considered opinion of the committee since no data exist on this issue. In future, the numbers could be adjusted if data were collected and yielded a better number.

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years) comprehensive enumeration of the public health workforce, and filled and unfilled positions, with particular attention to physicians. The enumeration should include all civilian and military governmental agencies with public health responsibilities, public health academia, and significant voluntary agencies contributing to the public's health. The enumeration should also include those physicians employed by private or public sector care delivery systems with public health responsibilities.

- **the information regarding public health physicians obtained in the periodic assessment of the public health workforce be used to project needs for public health physicians and public health physician education programs, and to determine the level of funding necessary to prepare physicians to fulfill those needs.**

Using the data that are available, in addition to expert opinion, the committee has determined that the current public health physician workforce for governmental public health agencies is probably about 10,000. However, it estimates that an additional 10,000 public health physicians are needed to ensure an adequate public health physician workforce.

An effective public health system requires a well-trained workforce of sufficient numbers of individuals from diverse disciplines to address current and emerging public health needs. However, to ensure that the workforce is both sufficient in numbers and ready to act requires a basic understanding of exactly who comprises the workforce and how well they are trained. The contributions of public health to the well-being of the U.S. population are too important to allow the current uncertainty about the public health workforce to continue. Conducting the recommended periodic assessments of the public health workforce will allow much greater accuracy in developing the necessary programs and expertise for addressing important population health problems.

The next chapter explores pathways to physician public health careers and programs designed to educate physicians about public health.

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3

Physician Training

This chapter explores the different pathways by which physicians come to careers in public health, examines population health as included in the medical education curriculum, describes both the degree and the nondegree public health training options for physicians, and makes recommendations about the kinds and numbers of training programs needed for physicians with different levels of involvement in public health.

PATHWAYS TO PUBLIC HEALTH CAREERS

Physicians enter careers in public health by different paths. Some enter public health through primary specialty training early in their careers or through joint programs sponsored by medical schools and schools or programs in public health. Historically, however, many physicians practicing public health have come to the field from clinical backgrounds, particularly primary care and infectious diseases. Although some physicians trained in clinical specialties make the transition to public health relatively early in their careers, for others a mid- or late-career change takes them to the field of public health. The next section explores these various pathways in more detail.

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Early Career Paths

Preventive medicine residency is one route to a career in public health, typically taken early in a physician's career, that provides a broad scope of public health training with both significant didactic experience and significant supervised practice experience. Physicians usually enter preventive medicine residencies either because they are interested in public health practice of some type or because they have an interest in research or practice related to clinical preventive services. Medical students may also choose to obtain a master of public health degree (M.P.H.) jointly with their medical degree through either an accredited school or program in public health.

Another fairly direct route to a career in public health—and one that is frequently taken early in a physician's career—is the 2-year Epidemic Intelligence Service (EIS) training program offered by the Centers for Disease Control and Prevention (CDC) and some states. The EIS program provides physicians (and other medical professionals) focused didactic experience and supervised field practice, specifically in epidemiology. This training may be very narrow (for example, primarily injury prevention research and interventions or communicable disease research and outbreak investigation) or somewhat broader (including management and policy experience), depending on the interest of the individual and the available field placements.

Later Career Paths

Some physicians choose to focus on population health in mid-career. Such physicians may have an established clinical or research practice and then become involved in administration, policy, or advocacy, perhaps in a somewhat narrow or specialized aspect of public health. An example might be a primary care physician who moves to work in a state or local public health setting.

Other physicians may not become involved in population health until later in their careers. Such physicians may work in clinical settings within public health departments, either because they develop an interest in the population aspects of medicine because of the types of health problems that they have seen during their years of practice (e.g., excessive premature births, child injuries, or human immunodeficiency virus infections) or because they are interested in working in a setting in which they are not burdened with managing their own business.

Physicians in mid- or late career have a number of educational options through which they may obtain the training needed to prepare them for careers in public health. These include pursuit of the M.P.H. degree, participation in certificate programs and public health training networks, and

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on-the-job training. The following sections describe the population health education provided by medical schools as well as specific approaches to public health education and training.

CHANGING TRENDS IN TEACHING POPULATION HEALTH IN MEDICAL SCHOOLS

At the beginning of the 1900s, medical education contained public health components (e.g., the study of infectious diseases) but was focused on biological systems. At that time neither distinct public health education programs nor any established career patterns for individuals to become public health physicians were in existence. Public health officers were physicians with their own private practices who responded to requests for assistance with epidemic diseases and other crises (Fee, 2003). At that time, public health was viewed as complementary to medicine, offering insights into sanitation and hygiene practices, clean water supplies, immunizations against diseases such as smallpox, and the prevention and control of the spread of contagious diseases (Beck, 2004).

In 1910, the Flexner Report triggered much needed reform in medical education, including the standardization of preliminary education requirements and the development of a 4-year curriculum with 2 years of didactic training in basic science and 2 years of clinical training in a teaching hospital (Beck, 2004). With the growth in the amount of knowledge available in the field of medical science, medical education continued to develop through the biomedical model, focusing on disease, diagnosis, and cure. However, the conceptual and organizational model of medical education has remained largely unchanged over the past 100 years (Cooke et al., 2006).

After World War II, interest in public health issues and training within medical schools increased; the medical curriculum continued to expand; and departments of preventive medicine, epidemiology, and social medicine were established or enhanced to teach such concepts and methods as epidemiology and biostatistics, prevention and health risk assessment, and, in some cases, economics and policy (Fee, 2003). It is noteworthy, however, that the Liaison Committee on Medical Education Accreditation Standards (June 2006) does not specifically require any education in public health, although it does require content and clinical instruction in preventive medicine, cultural competencies, and an understanding of common societal problems and how to address them.

Most medical schools have incorporated some population health material into their curricula and have endorsed the need for medical schools to prepare physicians to respond to emerging public health challenges, such as bioterrorism events and public health emergencies. Table

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TABLE 3.1 Selected Topics Taught in U.S. Medical Schools, 2004–2005

Topic Area	Included in Required Course	Included in Elective Course
Biostatistics	125	41
Community health	113	71
Epidemiology	123	57
Nutrition	123	67
Population-based medicine	113	48
Prevention and health maintenance	118	58
Environmental health	90	43
Global health issues	74	58
Health determinants	89	36
Health policy development processes	74	42
Health care workforce	68	31

SOURCE: From the Liaison Committee on Medical Education Part II Annual Medical School Questionnaire for 2004-2005. Reprinted with permission. (AAMC, 2005).

3.1 provides self-reported information on the areas of study offered by U.S. medical schools. Unfortunately, data about the specific content or depth with which each of these topics is covered, or the quality of the information provided are not available.

Despite the incorporation of population-based concepts in medical school curricula, the pathways to public health practice are rarely direct. The next section discusses the career pathways that physicians may follow when they choose to enter public health.

PUBLIC HEALTH EDUCATION: DEGREE TRAINING

As discussed earlier, education in public health can be obtained in a variety of ways and at various points in a physician's career. However, the different approaches do not provide a uniform set of knowledge and skills about public health. Physicians may receive degree training in public health through preventive medicine residencies that offer an M.P.H., including residencies provided through the armed forces, or from schools or programs in public health that culminate in an M.P.H. or equivalent degree. However, many physicians who engage in public health activities have no formal training in public health (Glass, 2000).

Preventive Medicine Residencies

Formal training in a preventive medicine residency is an important route for physicians seeking training and competence in public health. Preventive medicine is a unique medical specialty that provides a combi-

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nation of knowledge and skills in clinical medicine with those in population health. Preventive medicine specialists are trained to be competent in a number of core population health areas: biostatistics and epidemiology, environmental and occupational medicine, planning and evaluation of health services, management of health care organizations, research into the causes of disease and injury in population groups, and the practice of prevention in clinical medicine (ACGME, 2003). Specialists assume roles in various work settings by applying the knowledge and skills necessary to improve the health and well-being of individuals and entire communities.

The preventive medicine residency model parallels that of other clinical specialties, including accredited programs with residency advisory committees and board certification. The American Board of Preventive Medicine grants certification in Public Health and General Preventive Medicine (PH/GPM), Occupational Medicine (OM), and Aerospace Medicine (AM). These disciplines or specialty areas have common core knowledge, skills, and competencies. The Preventive Medicine Review Committee of the Accreditation Council for Graduate Medical Education (ACGME) oversees the accreditation of residency programs. Currently, 79 ACGME-accredited preventive medicine and subspecialty residency programs are available in the United States and enroll nearly 400 residents (ACGME, 2006). Of these programs, 40 focus on public health and general preventive medicine and have approximately 200 residents (ACGME, 2007). These programs are generally located in schools of medicine, schools of public health, state or local health departments, federal agencies, and military bases (ACPM, 2005b).

In 2005 the American College of Preventive Medicine estimated that the average cost of residency training was $108,000 per resident per year (ACPM, 2005a). Unlike most graduate medical education programs, preventive medicine typically does not receive Medicare GME assistance through direct medical education reimbursement as most training tends to occur in non-hospital settings (ACPM, 2005c). As a result, programs often struggle to put together adequate funding packages for their residents relying on funding from a number of sources including institutional funds, Title VII (through the Health Resources and Services Administration), state and local agencies, voluntary health agencies, the Department of Veteran Affairs, foundations, and private corporations (Lane, 2000). Please see Chapter 4 for a detailed discussion of funding.

To receive board certification, preventive medicine residents must successfully complete 3 years of specialty education and training. The 3-year residency program structure includes a clinical year, an academic year, and a practicum year. Although preventive medicine residency programs require clinical training, very few actually offer such training. As a result, most residents acquire their clinical training through an accredited

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TABLE 3.2 Number of Preventive Medicine Residents in ACGME-Accredited Programs, Academic Year Ending June 30, 2007

Specialty Area	Number of Filled Positions
Public Health and General Preventive Medicine	209
Occupational Medicine	118
Aerospace Medicine	27

primary care residency program, such as pediatrics, family medicine, or internal medicine, to fulfill the clinical requirement (ACPM, 2005b). These combined residency programs are an encouraging approach to solving some of the difficulties associated with obtaining clinical training.

During the clinical segment, residents undertake a graduate year of clinical training that includes direct patient care. Preventive medicine residents must be able to demonstrate knowledge of and competence in patient care, medical knowledge, practice-based learning and improvement, interpersonal skills and communication, professionalism, and systems-based practice (AMSA, 2005).

The academic year involves training in preventive medicine, which leads to an M.P.H degree or an equivalent postgraduate degree. The final program year involves supervised field work or practical experience related to the resident's specialty area, with placements generally lasting between 2 and 3 months (ACPM, 2005b). These assignments take place in a variety of professional settings and are structured to provide hands-on training for the resident. Table 3.2 provides data on the number of physicians in preventive medicine residencies in 2007.

A graduate physician may choose a pathway to public health through a preventive medicine residency for several important reasons. Preventive medicine residencies offer established 2- to 3-year programs that can lead to board eligibility through a process analogous to the more clinically oriented residency programs. Preventive medicine residencies by their nature usually offer structured short- and long-term guidance and mentorship on the acquisition of public health practice skills in the chosen target areas, as well as career development and job placement opportunities. They also offer comradeship with other residents and coordinated didactic training. Many graduate physicians see strong value in having completed an accredited residency program that leads to board certification.

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Preventive Medicine in the Military

The U.S. Army, Navy, and Air Force provide graduate medical education in preventive medicine. Physicians assume different public health roles within the military, however, given the various structures of the public health services required in the military. The basic function of public health services in the military is to support the public health needs of individuals working at local military installations and of the deployed forces. The military public health service also has a great deal of coordination and interaction with civilian health departments and services. Therefore, public health training in the armed forces incorporates both military and civilian health, and preventive medicine serves as the primary source of public health training for physicians in the military.

The U.S. Army operates two residency programs in general preventive medicine, located at the Walter Reed Army Institute in Silver Spring, Maryland and the Madigan Army Center in Tacoma, Washington. The general preventive medicine residency is a combined program in which all residents receive additional instruction in occupational medicine, thereby facilitating board eligibility for two specialty areas in preventive medicine. Physicians in the U.S. Army tend to be placed in charge of the public health departments responsible for the local, regional, and national health services in the military. Public health physicians are also assigned to political positions, operational units, and academic and research positions. The majority of physicians assuming these roles possess a background in preventive medicine.

The uniformed services of the United States sponsors graduate medical education for Medical Corps officers through the National Capital Consortium/Uniformed Services University of the Health Sciences (USUHS). The majority of physicians who are trained are U.S. Air Force and Navy officers, since the Army manages its own residency programs. USUHS serves as the second largest source of trained health care professionals entering the armed forces and offers the only U.S. Department of Defense-sponsored preventive medicine residency program that results in certification by the American Board of Preventive Medicine. The residency is a 2-year ACGME-accredited program with training available to military physicians who have completed a clinical postgraduate year and who are eligible for a medical license. The program also provides limited training opportunities to foreign military and U.S. Public Health Service physicians.[1] Much like nonmilitary preventive medicine residency programs, residents complete an academic year at USUHS that leads to an M.P.H. or

[1]Personal communication, R. D. Bradshaw, National Capital Consortium (NCC)/Uniformed Services University (USUHS), January 22, 2007.

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a master of tropical medicine and hygiene degree, followed by a practicum year (USUHS, 2006). Public health physicians in the Navy serve not only the naval community but the Marine Corps as well. Naval preventive medicine physicians are often assigned to operational units within the Marine Corps, in addition to their standard public health roles.

In addition to the residency training at the USUHS, the Air Force offers an aerospace medicine residency program. Much like the Army, the Air Force program is a combined program that allows year-long training in general preventive medicine and occupational medicine after completion of the year of training in aerospace medicine. The majority of preventive medicine trainees are aerospace medicine residents, with a small number entering the general preventive medicine program. These residents are usually board certified in a clinical subspecialty before they enter the general preventive medicine residency. Much of the public health training in the Air Force is nonpreventive medicine residency training and focuses on short-course instruction that is much more clinically focused (Mott, 2006). There are 29 available training slots per year in military programs that train General Preventive Medicine residents. However during 2006, no Air Force trainees chose the General Preventive Medicine tract so that for 2007 there will be 19 graduates from these programs.[2]

Schools and Programs of Public Health

According to the Council on Education for Public Health, "The mission and goals of public health schools and programs are focused on preparation of individuals who will serve as practitioners, researchers, and teachers competent to carry out broad public health missions and goals, within and outside schools' and programs' institutional settings" (CEPH, 2007).

The basic public health degree, the M.P.H. degree, is offered primarily through schools and programs of public health that also offer a variety of other public health-related degrees. Most people who receive formal education in public health are graduates of programs offered by these entities (IOM, 2003b). For those who wish to obtain advanced training, the doctor of public health is offered by schools of public health. Public health disciplines, such as epidemiology, the biological sciences, biostatistics, and the social and behavioral sciences, also offer academic degrees (e.g., the master of science and doctoral degrees) as well as joint degrees, such as the doctor of medicine degree and the M.P.H. and the doctor of osteopathic medicine degree and the M.P.H.

[2]Personal communication, R. D. Bradshaw, National Capital Consortium (NCC)/ Uniformed Services University (USUHS), April 18, 2007.

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As this report is being written, the United States has 38 accredited schools of public health and 68 accredited M.P.H. programs, although nonaccredited schools and programs do exist. CEPH accredits schools of public health and public health programs offered in settings other than schools of public health. The Health Resources and Services Administration (HRSA) has been a major source of training funds for schools and programs of public health, however funding for public health workforce development has steadily declined. By 2002 health professions program funding levels had been reduced to $10,473,000. This amount was further reduced to $7,920,000 in 2006 (HRSA, 2006). For a detailed discussion of current funding please see Chapter 4.

Schools of Public Health

Of the 6,500 individuals who graduate each year from accredited schools of public health, approximately 15 percent (about 1,000) have a doctor of medicine degree (Spencer, 2006). Schools of public health vary in terms of size, organization, and the degrees that they offer. Yet, all schools have six major responsibilities (IOM, 2003b). These are to

1. educate the educators, practitioners, and researchers as well as to prepare public health leaders and managers;
2. serve as a focal point for multischool transdisciplinary research as well as traditional public health research to improve the health of the public;
3. contribute to policy that advances the health of the public;
4. work collaboratively with other professional schools to ensure a high-quality public health content in their programs;
5. ensure access to lifelong learning for the public health workforce; and
6. engage actively with various communities to improve the public's health.

All accredited schools of public health must offer courses in five core areas: biostatistics, epidemiology, environmental health sciences, health services administration, and social and behavioral sciences. The focus and content of courses within these areas vary, however. Schools also offer courses in a number of other areas, including nutrition, biomedical and laboratory sciences, disease control, and genetics. Additionally, accredited schools are required to have active research and public service programs.

The Institute of Medicine (IOM) report addressing the education of public health professionals (IOM, 2003b) reaffirmed the importance of

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the five core areas mentioned above, as well as the idea that education should be competency based. That report also emphasized, however, that all public health professionals, including physicians, need to understand the ecological nature of the determinants of health and highlighted the importance of supervised practice opportunities. Furthermore, the report identified crucial gaps in the public health education curriculum, including informatics, communications, cultural competency, genomics, community-based research, global health, policy and law, and ethics. Currently, discussions are ongoing about how the recommended changes should be incorporated into the curriculum and the approaches that schools of public health use to educate public health professionals, including physicians.

Finally, a 2002 survey of schools of public health found that most required a field placement or practicum as part of the educational experience, and more than half required a comprehensive written or oral final examination for a master's or doctoral degree (IOM, 2003b). A capstone paper or project incorporating all aspects of the degree training program was also required by most schools.

Programs in Public Health

Public health programs offer education to a significant number of professionals entering public health. Unlike schools of public health, which are stand-alone schools in university settings, programs in public health are generally housed within other academic departments, colleges, or schools in university settings (for example, schools of medicine, osteopathy, or education). CEPH has accredited 68 of these programs.

Accredited programs in public health are expected to be guided by the mission of "enhancing health in human populations, through organized community effort" and must be located within an accredited institution of higher education. These programs must also offer courses in the five core areas (biostatistics, epidemiology, environmental health sciences, health services administration, and social and behavioral sciences) and must pursue active research and public service programs (CEPH, 2007).

Data from a 1999 survey indicated that about two-thirds of students in these more practice-oriented programs were participating in the program part-time (Davis and Dandoy, 2001). A report by Bialek and Bialek (1999) indicated that during the 1990s public health programs increased their emphasis on cross-disciplinary education and the use of problem-solving and case-based approaches to learning.

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NONDEGREE PUBLIC HEALTH EDUCATION AND TRAINING

A number of physicians receive their public health education and training through informal programs and activities, such as certificate programs, public health training networks, leadership networks, and service programs and programs like the EIS. The approaches described below illustrate the growing movement to create training opportunities that accommodate the needs of the workforce.

Certificate Programs

Certificate programs are designed for those in public health practice who wish to further their knowledge or professional standing. Certificate programs may focus on one specific content area of public health or may emphasize core public health concepts in the five core areas of public health education: biostatistics, epidemiology, environmental health sciences, health services administration, and social and behavioral sciences. For example, the Graduate Certificate Program of CDC (which was begun in 1996 and, unfortunately, ended in 2001) was designed for CDC field officers, state health department personnel, and others who had at least 3 to 5 years of experience in public health practice. Those who completed the program earned a graduate certificate in public health from one of the schools through which the program was offered. Certificate programs provide a formal credential that, although it is not standardized, may be seen as indicating greater expertise than those without such training.

Public Health Training Networks

In 1993, the CDC, along with state, local, and academic partners, launched the Public Health Training Network (PHTN) to enhance the educational delivery system for the public health workforce. The PHTN was established to meet public health training and information needs through a range of instructional media and multimedia tools. Program participants are able to access network training resources through several media and multimedia options, including satellite-accessible resources, the World Wide Web, CD-ROM, videotape or DVD, audio bridge, on-site courses and conferences, and print media. The network has been quite successful in encouraging distance learning initiatives supported by state and federal agencies to address training and information needs (CDC, 2006). Several state health departments have also established training networks that serve their local workforces. Most of these networks usually link to the PHTN and partner with state and regional public health practice centers to enhance the level of instruction provided.

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Public Health Leadership Networks

Physicians with an interest in expanding their knowledge or skills in leadership and management with a public health focus can participate in programs and institutes offered by public health leadership networks. The programs encourage academic and practice collaborations to strengthen leadership skills and practice among public health practitioners, health care service providers, academia, and communities (Saint Louis University School of Public Health, 2005). More than 20 competency-based state and regional public health leadership institutes offer a 1- or 2-year educational experience for individuals who are career public health professionals or who work with public health agencies (Rowitz, 2001).

These institutes and programs are developing an extensive network of public health leaders with an increased capacity to strengthen the relationships among individuals within the public health workforce. With the development of the many state and regional leadership institutes and programs came the formation of the National Public Health Leadership Development Network (NLN). Established in 1994 with CDC sponsorship, the NLN is a cooperative agreement between the Association of Schools of Public Health and the St. Louis University School of Public Health. NLN is a consortium of organizations and individuals from academic institutions; national and international organizations; and local, state, and federal agencies committed to advancing the practice of public health leadership. NLN seeks to build leadership capacity by supporting public health leadership institutes and programs and facilitating collaborative efforts among interested parties (Saint Louis University School of Public Health, 2005).

Epidemic Intelligence Service

The CDC EIS program was established in 1951 as an early warning system of the perceived threats of biological warfare and human-made epidemics (Langmuir, 1980). Over the years the program has evolved to focus on applied epidemiology. Since its inception, more than 2,700 EIS officers have been trained; of these 77 percent are physicians. A large percentage of the graduates of EIS programs take positions in federal, state, or large local public health agencies. Most continue to work in more technical areas of public health, for example, in epidemiology programs with a focus on a specific area, such as maternal and child health, communicable diseases, and chronic diseases. Some become upper-level managers or program directors later in their careers. Unless an EIS program participant also obtains an M.P.H., the training may not include most of the content areas of traditional public health training.

The program is a 2-year postgraduate training and service program

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TABLE 3.3 Numbers of EIS Officers (1997 to 2006) and Percentage of Physicians in Each Class

Class Year	Total No. of EIS Officers	No. (%) Physicians
2006	81	40 (49.4)
2005	78	46 (59)
2004	88	50 (56.8)
2003	79	50 (63.3)
2002	88	54 (61.4)
2001	73	53 (72.6)
2000	74	49 (66.2)
1999	70	40 (57.1)
1998	75	51 (68)
1997	69	44 (63.8)

SOURCE: Personal communication, D. Hamilton, Centers for Disease Control and Prevention, July 18, 2006.

in applied epidemiology in which EIS officers work under a mentor in a state or local health department or at the CDC. Their activities include epidemiological investigations, analytical projects and surveillance activities, the preparation of scientific manuscripts, the presentation of reports and studies, communication with their peers and the general public, and the provision of technical and epidemiological assistance to states and countries worldwide. In the 1990s, the EIS program adopted a competency-based framework in which the core domains are epidemiology, communication, and professionalism.

Before September 11, 2001, each class typically had 65 to 75 EIS officers. Historically, about 25 percent of the officers from each class were assigned to state and local health departments and 75 percent were assigned to CDC headquarters. Since 2001 this distribution has shifted toward state and local health departments.[3]

Although the number of EIS officers has increased, the percentage of physicians dropped below 50 percent for the first time in 2006 (Table 3.3). The reasons for this are unclear.

During fiscal years 2006 and 2007 the CDC allocated $18.9 million per annum for the federal EIS program (CDC, 2007).

In addition to the federal EIS program, at least two states also have developed similar service and training programs to prepare epidemiologists for public health leadership positions. Since 1988, California has offered a 1-year training program to health professionals possessing a

[3]Personal communication, D. Hamilton, Centers for Disease Control and Prevention, July 18, 2006.

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master's or doctoral degree in a health-related field to gain experience in government agency-based epidemiology and public health practice. The trainees develop a detailed list of goals and objectives for the training year with their preceptor, who is a practicing epidemiologist within the state or a local health department. In addition, each trainee receives a stipend of approximately $40,000 per year (California Department of Health Services, 2007).

Much like the California EIS program, Florida has developed a postgraduate program for health care professionals with an interest in the field of epidemiology. The Florida EIS is a 2-year program offering fellows the opportunity to work with a county health department to respond to various public health concerns throughout the state (Florida Department of Health, 2007). As with California EIS fellows, the Florida EIS fellows are assigned a preceptor and receive a comparable stipend ($40,366 per annum) for their service (Florida Department of Health, 2007).

Both programs engage their trainees or fellows in the investigation, analysis, and evaluation of the frontline public health issues affecting each state. Between 1991 and 2006 the California EIS program graduated 86 students (California Department of Health Services, 2007). As of fall 2006, the Florida EIS office has trained 18 fellows (Florida Department of Health, 2007).

Postresidency Fellowships

Postresidency fellowships in public health last approximately 2 years. Fellowship programs receive accreditation from ACGME. To be eligible for placement in a fellowship program, a physician should have completed or should be in the process of completing an ACGME-accredited residency or fellowship program. One example is the Fellowship in Public Health Research at Weill Medical College of Cornell University. That program provides postgraduate training to physicians and doctoral and other advanced degree holders interested in public health or health services research. Fellows receive 1 to 2 years of training that includes mentored research. The program seeks to prepare fellows "for an academic career in the field of public health and health services research or will enable them to incorporate these disciplines into their primary specialty or area or expertise" (Cornell University, 2007).

SUPPORTING MECHANISMS

Many public health professionals receive training in public health through what are termed "alternative pathways," that is, through short courses and continuing education programs, conferences, workshops, and

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institutes offered by a variety of institutions and organizations. The next section discusses some of these approaches and provides some specific examples.

Distance Learning

Those in the public health workforce must be prepared to respond to the ever-changing health needs of individuals and entire communities. Public health professionals at all levels need access to viable continuing education options to effectively employ best practices. Among the many training approaches that exist, distance learning seeks to engage students outside traditional academic settings by the use of electronic means. Distance learning has been cited as a means to ensure lifelong learning for the public health workforce (IOM, 2003b). For physicians currently practicing in public health, distance-based learning can offer a path to strengthening and developing the necessary knowledge, skills, and attitudes (Tilson and Gebbie, 2001).

Distance learning methods offer convenient and economical alternatives for education in public health practices and skill building, making continuing education more accessible to the learner. Carefully structured programs have been shown to be effective in enhancing the knowledge and skills of workers (McDowell and Gibbs, 2006). A number of distance learning programs are offered through schools of public health and their partnerships with state and local health departments. Public health practitioners can enroll in a single course for skill development or earn credit toward a degree or certificate program.

A number of other organizations also work closely with local and state health agencies and community health initiatives to develop and enhance distance learning opportunities to meet workforce needs. One example is the TRAIN (Training Finder Real-Time Affiliate Integrated Network) program, a learning management system administered by the Public Health Foundation. TRAIN serves as a national learning resource for public health professionals and provides a collection of on-site training and distance learning resources from local, state, and national jurisdictions (Public Health Foundation, 2007). Approximately 105,000 individuals are registered in the TRAIN program, with 1,394 of those individuals listing their profession as physician.[4] With more than 1,000 courses in various public health disciplines, the participants in the TRAIN program can access a number of distance learning opportunities for continuing education and skill development. The TRAIN program serves three groups: learners, course providers, and TRAIN affiliates. The network is free of

[4]Personal communication, R. Bialek, Public Health Foundation, January 25, 2007.

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charge to professionals (learners) seeking training and the organizations providing training materials and courses (course providers). TRAIN affiliates include state public health agencies, state and regional training centers, and first-responder organizations (Public Health Foundation, 2007).

Continuing Medical Education

To maintain current medical knowledge and, in some states, to fulfill state medical licensure requirements, physicians must earn continuing medical education (CME) hours or credits throughout their careers. According to the American Medical Association, CME "consists of educational activities that serve to maintain, develop, or increase the knowledge, skills, professional performance and relationships a physician uses to provide services for patients, the public, or the profession" (AMA, 2007a). Minimum CME requirements for physicians vary according to the state where a physician practices, with some states having no requirement for CME. Other states may require physicians to earn as many as 50 hours of CME per year to meet state licensing requirements (AMA, 2007b). Some states also require physicians to dedicate a minimum number of continuing education hours to specific content areas. For example, in California physicians and surgeons are required to fulfill CME hours in the areas of pain management and the treatment of terminally ill and dying patients (AMA, 2007b). Public health-related options for CME include such topics as eliminating health disparities, obesity, alcohol and drug abuse, and violence prevention.

All CME activities receive either a Category 1 or a Category 2 designation. Category 1, the most common type of CME activity required by states, is awarded to providers who offer continuing education alternatives that have received approval from a CME accreditation body, such as the Accreditation Council for Continuing Medical Education. Activities receiving a Category 1 credit designation can include attendance at national conferences, workshops, scientific meetings, or seminars; participation in educational activities such as medical courses, manuscript review, or online learning opportunities; or education in new procedures that will allow physicians to increase their clinical privileges. Some states require that a certain percentage of CME hours be earned through participation in Category 1 activities.

Educational activities that do not receive a Category 1 designation are considered Category 2. These include activities that have not been approved by an accreditation body but that do provide educational opportunities for physicians. Examples of Category 2 activities include consultations with peers and medical experts, medical writing, research, and some teaching opportunities.

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A number of journals are now offering CME with articles in the journals as well as CME in association with World Wide Web-based daily articles. The public health-based journals and the daily web-based programs could provide CME on public health. Public health physicians could then use these CME credits to comply with education requirements for state licensure or organizational requirements.

Academic Health Departments

Partnerships between academic institutions and state and local health departments seek to enhance the capacity of the public health workforce and effectively target academic resources to the needs of local communities. The organized partnership between schools of public health and health departments is formally known as the academic health department (AHD). In 2003, IOM called for greater collaboration between academic institutions and health departments and agencies (IOM, 2003a,b). The creation of AHD sought to address the most urgent public health needs by maximizing academic resources and advancing the practice of public health. In his 2000 assessment of academic health departments, C. William Keck outlined the following key issues that academics and practitioners could address collaboratively: skill development for health professions students and public health department staff, access to expertise for community agencies, development of community-based research, and meeting the continuing education needs of health agency staff and academic institution faculty (Keck, 2000). Keck, an architect of the AHD concept, has been credited with the creation of the successful collaboration of academic institutions in northeastern Ohio and the Akron, Ohio, Health Department. Since 1976, the Northeastern Ohio Universities College of Medicine and the Akron Health Department have partnered to strengthen community health sciences in the institution and improve the health of the community. As a result of this partnership, medical students along with other health professions students have gained experience in community settings through curriculum-based assignments.

Building on the northeastern Ohio model and existing partnerships with schools of public health and health departments, the Association of Schools of Public Health (ASPH) started the AHD program in 2003 with support from CDC. ASPH served as project administrator, awarding 1-year project grants to 14 schools of public health through an independent review committee (ASPH, 2006). The initial funding levels ranged from $98,150 to $102,808.[5]

[5]Personal communication, L. C. Trahan, Association of Schools of Public Health, March 1, 2007.

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Because of their limited resources and small sizes, state and local health departments and agencies often struggle to meet programmatic goals. Through the AHD program, health departments and agencies are able to strengthen their service delivery systems by using the knowledge and expertise available in schools of public health. Similarly, academic institutions benefit from the expansion of service opportunities to examine best practices, issues in health administration, policies, and other areas (ASPH, 2007). Both types of institutions benefit from the collaborative and interactive nature of the AHD (Keck, 2000).

National Health Service Corps

According to the Health Resources and Services Administration, the number of federally designated health care professional shortage areas across the United States and its territories exceeds 3,000 (HRSA, 2007b). The National Health Service Corps (NHSC) was created in an effort to mitigate the effects associated with low health care professional retention and recruitment levels. Created in 1970 under the Emergency Health Personnel Act (Public Law 91-623) (HRSA, 2007c), NHSC seeks to increase and ensure access to basic preventive and primary health care services by individuals in medically underserved communities through site development and the recruitment and retention of primary care clinicians (COGME, 2000). NHSC works in partnership with the Health Center Program of HRSA and other programs to carry out this function. A number of health care professionals are represented in the corps, including primary care physicians and dental, mental, and behavioral health specialists. Since the start of the NHSC program, more than 27,000 health care professionals have served in areas with shortages of such professionals (HRSA, 2007c). The NHSC program assists health professions students in a number of ways to reduce the cost of their training, providing scholarships and loan repayment arrangements for physicians and other health care professionals in exchange for their service to underserved areas. In fiscal year 2006, NHSC had an overall budget of $125.5 million for program activities (HRSA, 2007a).

Washington State Public Health Officer Orientation: An Example

To strengthen local public health leadership and management, the Washington State Department of Health and the Washington State Association of Local Public Health Officials developed an orientation program to help prepare local health officers (LHOs) and other public health

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professionals[6] for their new roles and responsibilities. The state requires that LHOs be physicians licensed to practice medicine and surgery or osteopathy and surgery and hold an M.P.H. or equivalent degree. Physicians who do not hold an M.P.H. degree "must undertake three years of service as a provisionally qualified local health officer that includes an orientation to public health and annual evaluations by the Secretary of Health," and qualified LHOs may participate on a voluntary basis (Hayes, 2006). The orientation provides on-the-job training, mentoring, and a web-based resource that includes a number of applications to assist the health officer with the orientation process. Among the applications available, a self-assessment tool is used to determine priority areas for knowledge and skill development. The orientation is mainly self-guided, but meetings are held between the new LHO and his or her mentor and progress is tracked by the Office of Public Health.

CREDENTIALING

In recent years there has been much discussion about the value of credentialing public health professionals. The only current formal credentialing for physicians in public health is certification by the American Board of Preventive Medicine. Board certification has traditionally been the process by which physicians are credentialed as having knowledge and skills in an area of medical specialization. However, the number of physicians seeking board certification in general preventive medicine has been declining.

Several states have developed programs for credentialing some public health workers within their state or local public health departments. These programs are generally developed to credential the leadership or the top management within the health departments or programs, often with a focus on state laws and management skills. None of the credentialing programs, however, appears to have any component specific to the role or functions of public health physicians.

In 2005, the National Board of Public Health Examiners (NBPHE) was created to develop a voluntary certification examination for new M.P.H. graduates from CEPH-accredited schools or programs of public health. The Board is a collaboration of the American Public Health Association, the Association of Schools of Public Health, the Association for Prevention, Teaching, and Research (formerly ATPM), the Association of State and Territorial Health Officials, and the National Association of County and City Health Officials. The stated goal is to determine that the recent

[6]Orientations are also provided for local public health nursing directors, environmental health directors, public health administrators, and local health assessment staff.

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M.P.H. graduate has mastered the knowledge and skills relevant to contemporary public health practice (NBPHE, 2007).

Since public health has moved to focus on competency as a measure of work performance and educational achievement, competencies for the M.P.H. degree have been developed for each of the five core areas of knowledge (epidemiology, biostatistics, environmental health sciences, health services administration, and social and behavioral sciences). These five areas plus crosscutting areas similar to those recommended in the 2003 IOM report, *Who Will Keep the Public Healthy*, are being used by the NBPHE as they develop the voluntary certification examination for M.P.H. graduates. The Board expects to administer the certification examination in the summer of 2008. At this point it is difficult to assess the impact of this effort on physicians in public health careers.

HOW MUCH TRAINING IS NEEDED?

As discussed earlier in this report, the committee has identified three groups of physicians with different levels of involvement in public health: all physicians, those who practice public health for a limited amount of time or in a limited role, and physicians who choose a career in public health. Each of these levels requires a different amount of education about public health.

All Physicians

Training physicians in population-based medicine as well as clinical medicine holds strong promise for augmenting the quality and effectiveness of clinical practice. However, careful curriculum planning and creative approaches (e.g., case-based learning) are needed to integrate additional content areas into an already crowded medical school curriculum. Furthermore, continuous evaluation of these programs is essential to ensure that they are meeting the needs of clinicians, patients, and the public.

The IOM report on educating public health professionals (2003b) recommended that medical schools provide all medical students with basic public health training (i.e., training in the population-based prevention approaches to health), that academic health centers undertake serious efforts to provide joint classes and clinical training in public health and medicine, and that a significant proportion of medical school graduates be fully trained in the ecological approach to health. "An ecological model assumes that health and well-being are affected by interaction among multiple determinants, including biology, behavior, and the environment. Interaction unfolds over the life course of individuals, families, and com-

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munities, and evidence is emerging that societal-level factors are critical to understanding and improving the health of the public" (IOM, 2003b).

Because research has demonstrated that health is affected by multiple determinants, not just biology or medical care alone (IOM, 2006), it is important that physicians be aware of and take into account these other factors when they are deciding how best to treat patients. The view of health from an ecological perspective requires understanding of a problem or situation in terms of the multiple determinants of health. For example, a program designed to reduce high-risk pregnancies in teenagers must address family, cultural, nutritional, mental health, health care access, and even educational elements, along with challenging clinical issues. To use an ecological approach to affect health outcomes, one would develop interventions aimed at addressing the various determinants of health relevant to the desired health outcomes. For example, addressing the obesity epidemic requires cultural knowledge and leadership and community organizational skills, along with an awareness of genomics, physiology, treatment options (including surgery), and clinical complications, as well as nutritional education and programs (e.g., food stamps) aimed at ensuring an adequate supply of appropriate foods. Offering exercise facilities in the workplace may even enter the picture.

The committee endorses the recommendation of the 2003 IOM report that all medical students receive basic education concerning the concept of determinants of health and the 13 content areas identified in that report (i.e., epidemiology, biostatistics, environmental health, health services administration, social and behavioral sciences, informatics, genomics, communication, cultural competence, community-based participatory research, global health, policy and law, and public health ethics). Furthermore, **the committee recommends that**

- **three additional areas be included in this basic education: leadership, clinical and community preventive services, and public health emergency preparedness**;
- **organizational partners (including, but not limited to, the Association of American Medical Colleges, the Association for Prevention, Teaching, and Research, the American College of Preventive Medicine, the American Association of Colleges of Osteopathic Medicine, the Association of Schools of Public Health, the Council of Accredited MPH Programs, and the American Association of Public Health Physicians) collaborate to develop models for integrating training in public health principles and practice into physician education at both the undergraduate and the graduate levels;**
- **each graduate medical education program identify and include**

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the public health concepts and skills relevant to the practice of that specialty; and

- **medical schools and graduate medical education programs include faculty with appropriate public health training and experience to teach public health content and serve as role models.**

Basic competency in population and public health is important not only to physicians currently enrolled in medical education programs but also to those already practicing medicine, regardless of their specialty. Many currently practicing physicians, however, completed a medical education that had a less than complete basic public health content. **The committee recommends that physicians, most of whom have elements of public health in their practices, have access to a way to assess their public health competency and training needs as well as support for appropriate continuing education in public health. Medical specialty societies should provide this self-assessment and continuing medical education, including relevant emerging topics and public health practice updates. Periodic recertification examinations should include public health questions relevant to that specialty.**

Physicians Engaged in Some Public Health Activities

Although an understanding of basic public health concepts is important for all physicians, a smaller number of physicians require a greater amount of knowledge of public health concepts and skills because a specific portion of their practice, practice setting, or practice role involves public health. Many physicians have taken on specific public health-related roles and functions in their practices and would benefit from focused population health training. Examples of individuals in this group include infectious disease physicians who investigate health care-associated disease outbreaks, pediatricians working in school health, and emergency medicine specialists who direct emergency medical services. Therefore, **the committee recommends that**

- **schools and programs of public health, state health departments, and specialty societies develop competency-based certificate programs and other training programs in public health that are based on the recommended 16 areas, consistent with principles of adult learning, and designed to enable physicians to obtain practice-specific public health training; and**
- **employers of physicians whose practice includes some component of public health support both initial and ongoing assess-**

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ments of the training needs of these physicians, the preparation of personal development plans to address needed knowledge and skill areas, and funding to implement these plans.

Certificate programs, short-term intensive programs such as summer institutes, continuing medical education, and self-directed learning programs (e.g., distance learning) could be used to meet the training needs of this group of physicians. Although an abundance of short-term and distance learning programs on public health topics are available, an effort has not been made to develop competency-based assessment and training that could guide physicians to identify the course or program most appropriate for their specific training needs.

Physicians with Careers in Public Health

Preparing physicians for public health careers means providing training that enables them to meet the challenges facing public health today. Chronic diseases, obesity, and healthy aging are major issues at present, as are emerging infectious diseases, occupational and environmental exposures, the effects of globalization, poor mental health, and health disparities among different segments of the population. Advances in science and medical technologies and their use, which have contributed to improved health, are accompanied by important ethical, legal, and social questions. For example, new information on genomics can help identify people who are at increased risk of disease, target interventions, and be used to motivate individuals to engage in preventive behaviors; however, the use of genomic information to develop prevention and treatment plans that translate into positive behavioral changes is a tremendous challenge. Furthermore, genomics has the potential to widen disparities, "resulting in unbelievable advances and unbelievable inequities" (IOM, 2005).

Whether physicians in public health practice full or part time, it is essential that their public health practice meets the current standards for public health professionals as well as any standards for specific applications relevant to their role as a public health physician or to the population that they serve. To ensure that these expectations are met, these career public health physicians require specific, enhanced public health training.

Therefore, **the committee recommends that**

- **physicians with careers in public health acquire a master of public health degree from schools or programs in public health or through preventive medicine programs; or acquire a comparable degree or experience (e.g., through the federal or state**

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Epidemic Intelligence Service programs). The training or experience should include the 13 content areas identified in the Institute of Medicine report on educating public health professionals (IOM, 2003b) plus the additional three content areas of leadership, clinical and community preventive services, and public health emergency preparedness recommended in this report.

- **schools and programs of public health expand their recruitment of physicians into public health graduate programs in order to increase the number of physicians with public health training. Graduate programs should include a public health field experience.**

Revised accreditation criteria for schools and programs of public health establish 42 semester credit units as the standard length for an MPH degree. It is not known whether this increase in hours will make it more difficult for schools and programs of public health to recruit physicians into the MPH program. However, the accreditation criteria also provide for consideration of prior or concurrent academic studies or relevant work experience to be credited toward the degree requirements. It is to be hoped that other measures recommended in this report will help encourage physicians to complete an MPH.

The committee believes it is important that, at a minimum, public health physicians understand the basics of each of the recommended content areas and the application of those basics to public health. It is important to emphasize that not all physicians with careers in public health are expected to become experts in each of the content areas identified. Beyond that, the depth of knowledge and skill in the content areas will be determined by the public health role that each physician plays.

HOW MANY TRAINING PROGRAMS ARE NEEDED?

One component of the charge to the committee was to determine the number of training programs needed to maintain an adequate supply of physicians trained for public health careers. As discussed earlier, determining the training resource needs when neither the base population nor the turnover rate is accurately known is extremely difficult. Determining the training resource needs becomes even more difficult when the description of what constitutes a public health workplace or a medical practice contribution to public health is made more generous or is defined more broadly.

As stated in *The Future of the Public's Health* (IOM, 2003a), governmental public health agencies (i.e., federal, state, and local agencies) form

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the backbone of the public health system. These governmental agencies employ the core group of public health physicians who are the central focus of this report. As discussed in detail in Chapter 2, the estimated number of physicians currently in governmental public health practice is 10,000, with an estimated need for 20,000 physicians and an annual replacement need of 1,350. The committee focused particular attention on ensuring that sufficient numbers of governmental public health physicians are available and that the number of physicians pursuing careers in public health can supply this number on a routine basis. For this to happen, both the quality and the number of training programs must be increased.

The committee recommends that

- **The Centers for Disease Control and Prevention (CDC) expand the Epidemic Intelligence Service program to include double the current physician enrollment without diminishing the level of participation in other disciplines.**
- **CDC expand its Academic Health Department (AHD) program to sustain 30 AHDs. The requirements should include the development of partnerships between the AHDs and medical schools to encourage physician participation.**
- **State and large local health departments, in conjunction with medical schools and schools of public health, expand post-residency fellowships in public health that emphasize the transition to governmental public health practice.**
- **Public health/general preventive medicine (PH/GPM) residency programs expand current capacity and add additional PH/GPM residencies as needed to graduate a minimum of an additional 400 residents each year. This expansion should be supported by federal general medical education funds that are not linked to the provision of clinical medical services.**
- **The Residency Review Committee for preventive medicine should review the content and quality of preventive medicine training programs in the context of the recommendations presented in this and other recent IOM reports on public health to ensure that the training programs meet the needs of modern public health practice.**
- **Governmental public health agencies should support both initial and ongoing assessments of the training needs of physician employees, preparation of personal development plans to address needed knowledge and skill areas, and funding to implement these plans.**
- **Recognizing the multiple training tracks by which physicians**

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may come into a full-time public health career, the American Board of Preventive Medicine, the Board of Public Health Examiners, the American College of Preventive Medicine, the American Association of Colleges of Osteopathic Medicine, the Association of State and Territorial Health Officials, the National Association of County and City Health Officials, the Association of Schools of Public Health, the American Public Health Association, and the Council of Accredited MPH Programs convene to explore the challenges to and mechanisms available for assessing the minimum competency required for physicians in public health practice.

CONCLUSION

The committee believes that it is important to maintain the incentives for and the ability of physicians to become career public health physicians through both degree programs and alternative pathways, such as certificate programs and the EIS program. Some might argue that this approach softens the rigor of the discipline and the credibility of the public health physician through a less than complete reliance on early and formal residency training. Others may believe that a more extensive clinical grounding brings expertise and credibility not provided by a traditional preventive medicine residency and might point to the many talented public health physician practitioners and leaders who lack a preventive medicine residency and board certification as proof of the wisdom of maintaining this alternate career path mechanism.

Maintaining alternative pathways for education in public health cannot come at the expense of the training and competency of practicing public health physicians. However, it is unrealistic and potentially counterproductive to expect that all physicians, especially those making a mid- or late-career change, will take the time necessary to complete standard preventive medicine residency training or enroll in a school or program of public health.

Physicians are a crucial part of the public health system, and as indicated in this chapter, many more public health physicians are needed to help meet the public health challenges facing the United States and, indeed, the world. Increasing the numbers of public health physicians is not enough—these physicians must also be prepared with the appropriate knowledge and skills to do their jobs well. The committee believes strongly that this can best be done by maintaining and strengthening multiple approaches to training, as described in this chapter.

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4

Funding

The public health training of physicians is funded through a number of mechanisms. For example, federal, state and local, and private entities offer education and training at various stages of a physician's career or at the time a physician enters into the workforce. This chapter discusses some of the many initiatives that are used to finance public health workforce development for physicians through federal, state, and other traditional funding streams. Supplements to these approaches are also described.

Ensuring funding adequate to support public health physician education is a major issue for those practicing and seeking to enter the workforce. Furthermore, it is necessary to develop a funding system that accommodates physicians entering the public health workforce at various stages in their careers. The career structure presented in earlier chapters described the education and training pathways that a physician may undertake in pursuit of a career in public health. Each path presents several options for training, and as a result, various funding approaches and mechanisms are needed. Nevertheless, reliable financial support for physician education and training in public health is lacking because the traditional funding sources are plagued by both uncertain funding cycles and dwindling financial support. In addition, the efforts of current funding mechanisms to sustain training programs and activities often lack coordination, and the funding mechanisms do not articulate in a coherent way to support career development.

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CURRENT FUNDING APPROACHES

Undergraduate training in medicine is supported by a variety of mechanisms, including tuition, guaranteed federal and state loans, and a variety of scholarships. Medical school education provides some experiences in population health through such classes as statistics and epidemiology. In addition, electives in some of the clinical disciplines of public health practice are available through elective rotations in preventive medicine, community medicine, and occupational health. Although this exposure does provide medical students with some understanding of population-based health, it is not at the level that many believe is necessary for all physicians to achieve a basic competency in public health.

Postgraduate Training

For more than 30 years, the federal government has provided some degree of funding for postgraduate training of physicians. Acting jointly or as a primary funder, the government has influenced the structure of health professions education and training that is needed by funding several programs through the various departments of the federal government. These programs have often served as the primary means for physicians to acquire training in public health and to prepare them to enter the public health workforce, but few data exist on the number of physicians trained and the amount of funds allocated to their training.

The financing of postgraduate education for most physicians is primarily supported through Medicare Graduate Medical Education (GME). GME has two specific payment mechanisms that offer payments for education in the clinical environment: a direct GME payment that partially compensates the teaching institution for the cost of residency training and an indirect GME payment that partially compensates the teaching institution for the higher patient care cost because of the presence of medical residents. As the largest explicit contributor of GME, the Medicare program spent nearly $8 billion in fiscal year (FY) 2004 for residency education and training (GAO, 2006).

Preventive medicine residency programs (costing an average of $108,000 per resident/year [ACPM, 2005a]) typically do not receive Medicare GME funds, as most programs do not qualify for direct medical education reimbursement because preventive medicine residency training tends to occur in nonhospital settings, for example, in state and local health departments, leaving such nonclinical programs to scramble for resources. Direct medical education costs usually include salaries and fringe benefits for residents, compensation for the faculty who supervise the residents, program administration costs, and allocated institutional overhead costs associated with graduate medical education (Bruccoleri,

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2005). Typically, the teaching hospital or clinic employing the resident incurs these costs. Traditionally, teaching hospitals have been the site for residency education and training, and patient care revenues support the majority of funding for graduate medical education (COGME, 2000), but in general, because preventive medicine residency training tends to occur in nonhospital settings, such training is not supported through the GME funding mechanism.

Because the majority of preventive medicine residency programs receive minimal funding through Medicare GME assistance, the programs are often faced with the issue of how to adequately support their residents. Indeed, insufficient funding has frequently been cited as the chief reason for the decline in preventive medicine residency positions. Funds for preventive medicine residency programs are therefore obtained from a variety of sources, some of which have unpredictable funding cycles, potentially affecting the recruitment and retention of high-quality candidates (ACPM, 2005b) As a result, most preventive medicine residencies rely heavily on funding from programs of the federal Health Resources and Services Administration (HRSA) and other funding sources.

TITLE VII: A NATIONAL TRAINING RESOURCE

The workforce development programs supported under Title VII of the Public Health Service Act (42 U.S.C.) have been instrumental in the training of physicians and other health care professionals. Administered by HRSA of the U.S. Department of Health and Human Services (DHHS), Title VII was first enacted in 1963 as part of the Health Professions Educational Assistance Act (Public Law 88-129) in response to a shortage of health manpower. The purpose of Title VII was to increase the rate of enrollment in and the financial viability of health professions schools. The act authorized the financing of programs to enhance public health workforce training through (1) institutional grants and contracts and (2) assistance in the form of loans, loan guarantees, and scholarships for students enrolled in these schools. Programs constructed under Title VII supported physicians, general dentists, physician assistants, and allied health personnel by providing institutional grants for training, financial assistance to students, and funding for analyses of the health workforce (GAO, 1994). As the workforce needs changed, amendments to the Public Health Service Act expanded the focus of programs funded under Title VII to enhance minority representation, encourage the distribution of health professionals to rural or medically underserved areas, increase the number of primary care providers, and develop faculty in institutions. In more recent years, Title VII programs have funded efforts for the education of providers, education of the public health workforce, and the analysis of health workforce issues (GAO, 2006).

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In the 1992 reauthorization of the title, emphasis was placed on increasing the number of health care professionals practicing in underserved areas, and programs were specifically created for this purpose. In 1998, the U.S. Congress consolidated Title VII programs into six clusters to ensure greater administrative flexibility and simplification of the program structure. The cluster created specifically for the public health workforce sought to strengthen the workforce capacity through support of public health training, preventive medicine residencies, public health dentistry, and health administration programs (GAO, 2006). The following provides an overview of the Title VII programs relevant to physician training in public health.

Title VII Public Health Workforce Programs

A number of programs were established through the Public Health Service Act to increase the supply of well-trained physicians and health professionals in the public health workforce. The provisos of Title VII included the authorization of grants to institutions of medicine, osteopathic medicine, and public health for the development and maintenance of health professions education and training programs. Of particular interest, the legislation details the funding for preventive medicine residency programs, public health training centers, and public health traineeships. Table 4.1 provides an overview of the programs relevant to physician training.

The legislation outlined the following approaches that should be taken to strengthen preventive medicine residency programs: (1) plan and develop new residency training programs, (2) maintain or improve existing residency training programs in preventive medicine, and (3)

TABLE 4.1 Title VII Health Professions Programs Relevant to Physician Training

Program Name	Program Description	Recent Funding History
Overall Public Health Workforce Development Training	The Health Professions programs in this cluster work to strengthen the education and training of health professionals in the areas of public health, preventive medicine, and dental public health. Eligible entities are awarded grants to carry out education and training activities that address workforce needs.	2002: $10.47 million 2006: $7.92 million

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TABLE 4.1 Continued

Program Name	Program Description	Recent Funding History
Preventive Medicine Residency Training Grants Program	This program provides funding for preventive medicine residency programs in accredited public or nonprofit private schools of allopathic medicine, osteopathic medicine, and public health across the United States. In addition to supporting preventive medicine residents, HRSA grants go toward the planning and development of new residency programs and the maintenance of existing programs on a 3-year cycle.	2002: $1.96 million 2006: $1.25 million
Public Health Training Center Grant Program	Partnerships between accredited schools of public health and related academic institutions and public health agencies and organizations offer training to a number of public health workers, including physicians. The centers provide training through distance learning applications and other educational tools that are tailored to workforce learning needs. Fourteen centers currently service public health workers in 44 states and the District of Columbia with tools to strengthen workforce capacity.	2003: $5.5 million 2006: $4.3 million
Public Health Traineeship Program	Through the Public Health Traineeship Program, grants are awarded to accredited schools of public health and other public or nonprofit private institutions accredited to provide graduate or specialized training in public health (HRSA, 2006c). The awards support selected students in areas such as epidemiology, environmental health, biostatistics, toxicology, nutrition, and maternal and child health.	2002: $1.82 million 2006: $1.23 million

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provide financial assistance to residency trainees enrolled in the programs (Public Health Service Act, Title VII, §768, 42 U.S.C. 295(c)). Currently, Title VII funds represent a critical source of funding for preventive medicine residency programs, as the annual funding from HRSA represents the largest federal financing source for public health and general preventive medicine (PH/GPM) programs (ACPM, 2005b). In FY 2005, the Preventive Medicine Residency Training Grants Program managed by HRSA (through the Bureau of Health Professions) supported 31 preventive medicine residents in seven academic institutions. The program operates under a 3-year grant cycle, with only 7 of the potential 40 PH/GPM residencies receiving awards for FYs 2004 through 2007. Funding for the residency programs has declined annually from $1.96 million in 2002 to $1.25 million in 2006 (HRSA, 2006b), without adjustment for inflation. In 2005, 31 residents were in training and 36 had either graduated or completed their training (Raggio, 2006).

In addition to Title VII, current financial support for PH/GPM programs is provided by institutional funds, state and local agencies, voluntary health agencies, the U.S. Department of Veteran Affairs, foundations, and private corporations (Lane, 2000).

Another program supported by Title VII funding is the Public Health Training Center Grant Program. Established under the Health Professions Education Partnerships Act of 1998 (Public Law 105-392), the training centers were created to strengthen the technical, scientific, managerial, and leadership competencies of current and future public health professionals. The centers are partnerships between accredited schools of public health and related academic institutions and public health agencies and organizations that train workers in a range of professions, including physicians and other clinicians. Currently, 14 centers serve the public health workforce in 44 states and the District of Columbia (HRSA, 2006e).

Within the last few years, 93,278 public health workers representing more than 17 public health disciplines have been trained through this initiative (HRSA, 2006e). The majority of trainees use the distance-based applications provided by the centers, and more than 86 percent of all training offers competency-based instruction (Raggio, 2006). In FY 2003, the centers received a total of $5,500,000 for program activities (Federal Grants Wire, 2006b). Funding was reduced to $4,302,000 in FY 2006 (Raggio, 2006).

The Title VII legislation also authorizes funds to support public health traineeships in graduate health education programs for the provision of graduate or specialized training in public health. Schools of public health and other public or nonprofit private institutions receive grants to provide traineeships that target those public health fields with personnel shortages, such as epidemiology, environmental health, biostatistics, toxicol-

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ogy, nutrition, and maternal and child health. The students are selected by the awardee institutions, which are encouraged to increase minority representation and the number of graduates who serve in underserved areas (HRSA, 2006c). In FY 2002, 37 grantees were awarded a total of $1,822,957 appropriated for program activities (Federal Grants Wire, 2006a). By FY 2006, however, the financial assistance awarded to grantees for program activities totaled $1,232,510 (HRSA, 2006d). The traineeships, together with the training centers, seek to increase the number of qualified public health workers by providing the most up-to-date information and tools. Unfortunately, budget cuts continue to threaten these and other Title VII programs.

Overall funding levels for HRSA health professions program budgets have steadily declined over the years. More recently, between FYs 2002 and 2006, funding for public health, preventive medicine, and dental public health programs decreased by nearly a quarter, starting at $10,473,000 in 2002 and decreasing to $7,920,000 in 2006 (HRSA, 2006a), as shown in Table 4.2. Although funding for these and other Title VII programs increased after the 1998 reauthorization, the funding for public health workforce development programs received only a slight increase, with the majority of funds flowing to Health Professions Training for Diversity (GAO, 2006).

Over the past two decades, both Democratic and Republican administrations have recommended major reductions in funding, only to have the U.S. Congress reinstate critical funds to sustain program activities (Freeman and Kruse, 2006). Lawmakers have argued that Title VII programs support capacity building at the state and local levels and can be sustained through collaborative efforts between and among health departments, educational institutions (schools of public health and residency programs), community-based initiatives, and the private sector.

TABLE 4.2 Health Professions Program Funding Levels, FYs 2002 to 2006

FY	Funding Level ($)
2002	10,473,000
2003	10,600,000
2004	9,170,000
2005	9,097,000
2006	7,920,000

SOURCE: Adapted from *Fiscal Year 2007 Justification of Estimates for Appropriations Committees: Health Professions* (HRSA, 2006a).

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Nevertheless, existing funding from other federal sources, such as that from the U.S. Departments of Defense, Labor, and Veteran Affairs, has been cited as a key factor in the decision of various administrations to eliminate Title VII funding for health professions (HRSA, 2006a).

For FY 2007, the U.S. Senate Appropriations Committee approved $154.4 million for Title VII health professions education programs, including $8 million for public health, preventive medicine, and dental public health programs, restoring the funding to FY 2006 levels (AAMC, 2007). In its report, the Senate Committee commented on the continued need for public health training and the contributions of HRSA-administered public health workforce development programs in sustaining the nation's public health infrastructure (U.S. Senate Appropriations Committee, 2006). Despite this recognition by the U.S. Senate, the future of Title VII remains unclear.

The decreases in funds for Title VII programs have meant the reduction or elimination of vital public health training opportunities. Even though Title VII provides funds for essential training and educational services, Title VII alone cannot sustain public health training for physicians. Other funding mechanisms and approaches must be developed and strengthened to prepare public health physicians for their roles in the workforce.

OTHER FEDERAL FUNDING

While Title VII supports a large portion of public health training for physicians, several other agencies and groups have actively supported training efforts at various stages of physician engagement in public health. Among these, federal agencies such as the U.S. Departments of Defense and Veterans Affairs provide financial support for preventive medicine residency programs as well as health professions training. The following sections describe these mechanisms in greater detail and their implications for public health training of physicians.

U.S. Department of Veterans Affairs

The U.S. Department of Veterans Affairs (VA) serves as a major funder of graduate medical education, financing about 9 percent of all U.S. residency positions (VA, 2006). In 2004, VA spent $493 million on education and training programs for health professions students and residents (GAO, 2006). Approximately 28,000 medical residents along with 16,000 medical students receive a portion of their training through the VA each year (VA, 2006). Through its affiliations with schools of medicine and institutional medical centers, VA currently supports about 27 percent of all

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preventive medicine residents and approximately 11 percent of occupational medicine residents at 18 Veterans Affairs Medical Centers (Veterans Health Administration, 2007). However, a VA primary care initiative has converted about 1,000 GME specialty residency positions to generalist positions within VA, with the result that preventive medicine residency programs must now compete with other primary care programs for funds from a common source (Lane, 2000).

U.S. Department of Defense

Preventive medicine residency training is the primary means of public health training in the military, and these positions are fairly well funded. The National Capital Consortium of the Uniformed Services University of the Health Sciences is "currently capitated at about $12,000 per resident per year"[1] for its general preventive medicine residency program. The U.S. Department of Defense also supports medical education and other health professions through the Defense Health Program (DHP) for active-duty personnel, civilian medical personnel, and students. In 2004, DHP funding for health professions education totaled $318 million (GAO, 2006).

Within DHP, the Armed Forces Health Professions Scholarship Program (HPSP) provides financial assistance and training to health professions students and serves as the primary source of trained health care professionals entering the armed forces. Created under the authority of the Uniformed Services Health Professions Revitalization Act of 1972, HPSP was designed to ensure that adequate numbers of commissioned officers with health profession qualifications are on active duty. The program is supported by the U.S. Army, Navy, and Air Force and subsidizes the costs associated with training for the majority of candidates entering health professions programs. HPSP provides financial assistance to students in accredited graduate programs, including medicine, osteopathy, veterinary medicine, optometry, psychology, and other accepted disciplines (Naval Education and Training Command, 2005; U.S. Army, 2006).

Epidemic Intelligence Service

The Epidemic Intelligence Service (EIS) program of the Centers for Disease Control and Prevention (CDC), like many federal programs, operates with funds appropriated by the U.S. Congress. Currently, the EIS program supports 160 EIS officers, with the funding for each of FY 2006

[1]Personal communication, R. D. Bradshaw, National Capital Consortium (NCC)/ Uniformed Services University (USUHS), March 9, 2007.

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and FY 2007 being $18.9 million (CDC, 2007b). Training costs for the EIS program are dependent on two separate personnel systems that are used to hire EIS officers: the Title 42 Civil Service Fellows program and the Commissioned Corps program. The costs for the first year of this 2-year on-the-job training program range from $105,000 for Civil Service Fellows to nearly $139,000 for members of the Commissioned Corps; in the second year the costs are $98,000 for fellows and nearly $129,000 for the members of the corps. These figures include the costs associated with on-site training, travel to assignments, salary, and benefits, in addition to other expenses.[2]

OTHER FUNDING MECHANISMS

Governments at all levels have always made some contributions to the initial public health education, as well as continuing education and on-the-job training, of public health personnel, although governmental contributions have dwindled in the past few decades. Nevertheless, special issues are related to attracting physicians with appropriate training to careers in public health: the initial training period is long and arduous; undergraduate medical education often leads to the accumulation of substantial personal and family debt; tuition for master of public health or equivalent degrees, as for other graduate programs, has been increasing rapidly; and salaries in public health jobs are generally lower than those for other physician practice options, including academic positions. To mitigate this problem and to continue to attract physicians into public health jobs, financial as well as other incentives need to be in place. It should be noted that all agencies at all governmental levels bear some responsibility for maintaining the quality of their workforces and should contribute to this responsibility, as should the private sector.

State Funding

Other sources of funding for public health training activities and programs are the states, which have long supported public health training and medical education. By offering loan subsidies and scholarships to medical students and physicians in training, the states have worked to increase the number of physicians in underserved areas. Since the 1940s, individual states have provided this support to students and have also provided some level of institutional support (HRSA, 2000).

Health departments serve as the primary source of funding for public health training in states. Partnerships with academic institutions, federal

[2]Personal communication, D. Koo, Centers for Disease Control and Prevention, March 13, 2007.

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agencies, public health training centers and institutes, community-based organizations, and other parties enable the states to provide the necessary skills-building training and continuing education activities. However, many states fall short of providing adequate training for their public health workforces, as other activities and needs compete for limited resources. Greater collaboration among new and existing funders is thus essential to increasing the number of competent physicians in the public health workforce.

Certificate Courses and Continuing Education

Certificate courses and continuing education are designed to give physicians specific training in public health. These mechanisms offer brief training over periods ranging from weeks to months and are generally offered by a variety of schools of public health, federal public health agencies, and private nonprofit organizations. The cost for this training is usually borne by the individual or the individual's employer. On occasion, the CDC may provide some support for participation in programs, such as programs on leadership development, epidemiology, and bioterrorism.

This form of training is an important resource for ensuring that people interested in public health careers maintain and learn new skills. Additionally, it is critical as a learning mechanism for physicians who move into the public health workforce from other specialties. However, the funding for these programs is eroding. In FY 2007, CDC Public Health Improvement and Leadership activities received approximately $189.2 million for leadership and management and public health workforce development, a $74 million decrease from the previous fiscal year (DHHS, 2007). Funding for public health workforce development activities in particular has remained relatively constant over the past few fiscal years, with programs receiving approximately $19.7 million (CDC, 2007a).

RECOMMENDATIONS

Although training programs are a necessary component for ensuring an adequate supply of well-trained public health professionals, these programs cannot do it alone because serious challenges to attracting the necessary numbers of qualified physicians remain. The money-saving decisions made by many local governments have severely restricted the employment of physicians in health departments, confining them to clinical roles or those required by law and restricting them to working for the minimum number of hours legally possible. The importance of physician contributions to all public health policies has been diminished as the qualifications for agency leadership have expanded to include other

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public health practitioners. Furthermore, once a public health physician position has become less than full time, attention to public health preparation for the incumbent may be minimal. The distribution and size of governmental public health agencies also mean that many public health physicians work in relative isolation from their peers. All of these forces in combination mean that there are insufficient numbers of funded positions for part-time and full-time public health physicians.

Furthermore, the salaries of public health physicians are significantly lower than those of their counterparts in private practice. Reliable financial support for physician education and training in public health is also lacking at the agency level, as traditional funding sources are plagued by limits on educational investment, uncertain funding cycles, and dwindling support. All of these challenges are more noticeable at the state level than at the federal level and are particularly acute at the local level, especially outside of urban areas.

Finally, other practical barriers to entering public health professions exist for physicians. For many students studying to be physicians, their first introduction to public health may be after they are well into their medical school training, making it difficult to redirect their professional paths. Alternatively, when a physician who is already trained in medicine encounters the challenges and the potential of public health at mid- or late career, the lack of flexible training opportunities makes the development of the needed competency extremely difficulty.

Several actions are necessary to facilitate physician training in public health and to maintain an adequate public health physician workforce. First, the committee endorses the recommendation in the report *The Future of the Public's Health* (IOM, 2003) that the U.S. Congress increase funding for HRSA programs that provide financial support for students enrolled in public health degree programs and that the funding for Public Health Training Centers be increased. **The committee recommends that**

- **the U.S. Congress fund a comprehensive educational strategy sufficient to produce the additional number of public health physicians required through the following mechanisms**:
  – Funding for residency training in public health should be equivalent to and parallel the funding streams for graduate medical education in other medical disciplines.
  – Funding to support the recommended expansion of the EIS and AHD programs.
  – Reinstatement and growth of funding for health professions training through the Title VII programs.
- **Congress fund Health Resources and Services Administration and the Centers for Disease Control and Prevention to work**

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collaboratively to develop model demonstrations and evaluation programs that explore other models than direct physician hiring by health agencies. Such models might include regional physician health agency groups, development of public health expertise in larger health systems, or creation of a national network of consultants in specific public health domains.

- **agencies, particularly state and local public health departments, create and adequately fund additional public health physician positions (full- and part-time) to accommodate the 10,000 additional public health physicians required.**
- **the American College of Preventive Medicine, the Association of State and Territorial Health Officials, the National Association of County and City Health Officials, the U.S. Department of Health and Human Services, and the federal Office of Personnel Management regularly conduct a salary assessment of governmental public health and comparable private sector physicians. The agencies should use these results to align the salaries of their public health physicians to parity with private sector physicians performing comparable work.**
- **federal, state, and local public health agencies develop loan forgiveness programs for physicians who enter and continue to work in the public health sector.**
- **federal, state, and local public health agencies develop (or expand existing) programs that support public health training for physician employees in exchange for continued employment in that agency.**
- **employers of physicians in the public health workforce develop incentives to recruit and retain public health physicians that include**

  – discretionary benefits (e.g., leave, continuing education and conference support, portable retirement, etc.);

  – career development support, based upon statewide or regional analysis of long-term public health physician needs across agencies, with support for further graduate training to physicians who agree to remain in public health, potentially moving to more responsible or more technically demanding positions over time; and

  – opportunities for increased professional interaction for public health physicians practicing in remote or isolated circumstances.
- **federal and state governments develop tax incentives for individuals who train and enter governmental public health.**

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CONCLUSION

Physicians play key roles in ensuring the public's health and helping sustain the public health system. However, the availability of adequate funding for education, training, and related resources is crucial to building and maintaining sufficient numbers of public health physicians. Maintaining important key academic and job-related training programs and resources is a tremendous challenge, given frequent budgetary cuts in current funding mechanisms at the federal, state, and local levels. Similarly, a lack of funding and support continues to compromise the recruitment and retention of high-quality physicians in training for preventive medicine residency programs. The funding for these and other mechanisms is overstretched, and supplemental funding is needed to maintain an adequate number of well-trained public health physicians.

The committee strongly believes that these challenges must be met through a collaborative effort among stakeholders to maintain and expand existing programs and key leadership and programmatic positions in public health agencies, assess the salaries of public health physicians so that they are congruent with the salaries of individuals in similar positions in the private sector, and create incentives for physicians to enter the public health sector. Without adequate funding, sufficient numbers of public health physicians will not be engaged in keeping the public healthy.

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5

Conclusion

Great strides in reducing mortality and improving the public's health were made during the 20th century, with much of the progress due to public health efforts such as vaccines, improved sanitation and hygiene, safer workplaces, enhanced food and drug safety, and preventive health services. Effective public health actions rely upon a well-trained public health workforce. Such a workforce is composed of individuals from many disciplines, including physicians, nurses, environmental health specialists, epidemiologists, and health educators, among others. This report has focused on the critical roles that physicians play in maintaining and strengthening the public health system, identifying what these physicians need to know to engage in effective public health actions, exploring the kinds of training programs that can be used to prepare physicians for public health roles, and examining how these training programs can be funded.

The definition of a public health physician and a vision for the public health physician workforce was developed to guide the work of the committee. A public health physician is defined as a physician "whose training, practice and world view are based in large part on a population focus rather than individual practice, that is, on assuring the availability of essential public health services to a population using skills such as leadership, management, and education as well as clinical interventions" (Gebbie and Hwang, 1998). The committee's vision for the public health physician workforce is threefold. First, the committee envisions a future in which sufficient numbers of well-trained public health physicians are

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working with other public health professionals to address population issues such as health promotion and disease prevention, chronic and infectious diseases, safe food and water supplies, sanitation, and environmental exposures. Second, the committee envisions a future in which sufficient numbers of well-trained public health physicians are available to provide the scientific and clinical input along with the leadership and management necessary for linking and coordinating the efforts of the many participants of a strong public health system, as described in *The Future of the Public's Health* (IOM, 2003). Third, in the face of public health emergencies, the committee envisions a future in which there will be sufficient numbers of professionals trained in public health, including physicians, to plan for and prevent these emergencies and to respond to them. Such emergencies would include disasters such as hurricanes, bioterrorism, and emerging or reemerging infections such as pandemic influenza or mumps.

This report explores the many pathways by which physicians may enter careers in public health. The committee also identified three levels of physician involvement with public health: all physicians, physicians with limited roles in public health, and physicians with careers in public health. For each of these levels the report describes the knowledge and the skills that these physicians need for effective public health action. The report also describes various approaches to preparing physicians for careers in public health, including preventive medicine programs, schools and programs of public health, the Epidemic Intelligence Service program, certificate programs, distance learning, leadership networks, and continuing education programs.

The public health system envisioned in the 2003 IOM report *The Future of the Public's Health* includes governmental public health agencies at the core working with the health care delivery system, public health and health sciences academia, communities, businesses and employers, and the media. According to that report, governmental public health agencies form the backbone of the public health system and the actions that it takes. Without sufficient numbers of well-trained physicians in this backbone, the entire public health system is weakened.

Estimates of the current number of public health physicians range from 1,400 (American Medical Association) to 22,000 (Bureau of Labor Statistics); however, the methods used to derive all estimates have major flaws, including the lack of a consistent definition of a public health physician. Both because of the difficulty of estimating the broader number of public health physicians and because of the importance and centrality of the backbone to ensuring the public's health, the central focus of this report is physicians in governmental agencies. The committee's opinion, based on the calculations described in Chapter 2, is that as many as 10,000

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physicians are currently employed in positions in governmental agencies, with an estimated need for an additional 10,000 physicians in positions that this committee would define as requiring a properly prepared public health physician.

To meet the need to train these physicians, the committee has proposed a variety of options both for training and for funding of the training, as reliable financial support for training public health physicians is lacking. Yet, funding these training programs will not be enough to ensure an adequate public health physician workforce. In addition, the challenges to attracting physicians to careers in public health must be addressed. Such challenges include a lack of sufficient numbers of available positions, significantly lower salaries for public health physicians than for their counterparts in private practice, and a lack of flexible training options.

The public health system must be prepared to respond, prevent, and detect health threats that range from natural disasters to bioterrorism, emerging infectious diseases, and chronic health threats such as obesity. An effective public health system requires a well-educated public health workforce that includes sufficient numbers of physicians in a variety of positions. It is important to maintain the incentives and ability for physicians to become career public health physicians through a number of different pathways. Although much work remains, the recommendations contained in this report outline the beginning steps that must be taken to ensure that sufficient numbers of well-trained physicians are available to help keep the public healthy.

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APPENDIX A

Recommendations from *The Future of the Public's Health in the 21st Century*

1. The Secretary of the Department of Health and Human Services (DHHS), in consultation with states, should appoint a national commission to develop a framework and recommendations for state public health law reform. In particular, the national commission would review all existing public health law as well as the Turning Point[1] Model State Public Health Act and the Model State Emergency Health Powers Act;[2] provide guidance and technical assistance to help states reform their laws to meet modern scientific and legal standards; and help foster greater consistency within and among states, especially in their approach to different health threats (Chapter 3).
2. All federal, state, and local governmental public health agencies should develop strategies to ensure that public health workers who are involved in the provision of essential public health services demonstrate mastery of the core public health competencies appropriate to their jobs. The Council on Linkages between Academia and Public

[1]Turning Point, a program funded by the Robert Wood Johnson and the W. K. Kellogg foundations, works to strengthen the public health infrastructure at the local and state levels across the United States and spearheads the Turning Point National Collaborative on Public Health Statute Modernization.

[2]The Model State Emergency Health Powers Act (MSEHPA) provides states with the powers needed "to detect and contain bioterrorism or a naturally occurring disease outbreak. Legislative bills based on the MSEHPA have been introduced in 34 states" (Gostin et al., 2002).

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Health Practice[3] should also encourage the competency development of public health professionals working in public health system roles in for-profit and nongovernmental entities (Chapter 3).

3. Congress should designate funds for the Centers for Disease Control and Prevention (CDC) and the Health Resources and Services Administration (HRSA) to periodically assess the preparedness of the public health workforce, to document the training necessary to meet basic competency expectations, and to advise on the funding necessary to provide such training (Chapter 3).
4. Leadership training, support, and development should be a high priority for governmental public health agencies and other organizations in the public health system and for schools of public health that supply the public health infrastructure with its professionals and leaders (Chapter 3).
5. A formal national dialogue should be initiated to address the issue of public health workforce credentialing. The Secretary of DHHS should appoint a national commission on public health workforce credentialing to lead this dialogue. The commission should be charged to determine if a credentialing system would further the goal of creating a competent workforce and, if applicable, the manner and time frame for implementation by governmental public health agencies at all levels. The dialogue should include representatives from federal, state, and local public health agencies, academia, and public health professional organizations who can represent and discuss the various perspectives on the workforce credentialing debate (Chapter 3).
6. All partners within the public health system should place special emphasis on communication as a critical core competency of public health practice. Governmental public health agencies at all levels should use existing and emerging tools (including information technologies) for effective management of public health information and for internal and external communication. To be effective, such communication must be culturally appropriate and suitable to the literacy levels of the individuals in the communities they serve (Chapter 3).
7. The Secretary of DHHS should provide leadership to facilitate the development and implementation of the National Health Information Infrastructure (NHII). Implementation of NHII should take into account, where possible, the findings and recommendations of the

[3]The Council on Linkages between Academia and Public Health Practice is comprised of leaders from national organizations representing the public health practice and academic communities. The Council grew out of the Public Health Faculty/Agency Forum, which developed recommendations for improving the relevance of public health education to the demands of public health in the practice sector. The Council and its partners have focused attention on the need for a public health practice research agenda.

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National Committee on Vital and Health Statistics (NCVHS) working group on NHII. Congress should consider options for funding the development and deployment of NHII (e.g., in support of clinical care, health information for the public, and public health practice and research) through payment changes, tax credits, subsidized loans, or grants (Chapter 3).

8. DHHS should be accountable for assessing the state of the nation's governmental public health infrastructure and its capacity to provide the essential public health services to every community and for reporting that assessment annually to Congress and the nation. The assessment should include a thorough evaluation of federal, state, and local funding for the nation's governmental public health infrastructure and should be conducted in collaboration with state and local officials. The assessment should identify strengths and gaps and serve as the basis for plans to develop a funding and technical assistance plan to assure sustainability. The public availability of these reports will enable state and local public health agencies to use them for continual self-assessment and evaluation (Chapter 3).
9. DHHS should evaluate the status of the nation's public health laboratory system, including an assessment of the impact of recent increased funding. The evaluation should identify remaining gaps, and funding should be allocated to close them. Working with the states, DHHS should agree on a base funding level that will maintain the enhanced laboratory system and allow the rapid deployment of newly developed technologies (Chapter 3).
10. DHHS should develop a comprehensive investment plan for a strong national governmental public health infrastructure with a timetable, clear performance measures, and regular progress reports to the public. State and local governments should also provide adequate, consistent, and sustainable funding for the governmental public health infrastructure (Chapter 3).
11. The federal government and states should renew efforts to experiment with clustering or consolidation of categorical grants for the purpose of increasing local flexibility to address priority health concerns and enhance the efficient use of limited resources (Chapter 3).
12. The Secretary of DHHS should appoint a national commission to consider if an accreditation system would be useful for improving and building state and local public health agency capacities. If such a system is deemed useful, the commission should make recommendations on how it would be governed and develop mechanisms (e.g., incentives) to gain state and local government participation in the accreditation effort. Membership on this commission should include representatives from CDC, the Association of State and Territorial

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Health Officials, the National Association of County and City Health Officials, and nongovernmental organizations (Chapter 3).

13. CDC, in collaboration with the Council on Linkages between Academia and Public Health Practice and other public health system partners, should develop a research agenda and estimate the funding needed to build the evidence base that will guide policy making for public health practice (Chapter 3).
14. The Secretary of DHHS should review the regulatory authorities of DHHS agencies with health-related responsibilities to reduce overlap and inconsistencies, ensure that the department's management structure is best suited to coordinate among agencies within DHHS with health-related responsibilities, and, to the extent possible, simplify relationships with state and local governmental public health agencies. Similar efforts should be made to improve coordination with other federal cabinet agencies performing important public health services, such as the Department of Agriculture and the Environmental Protection Agency (Chapter 3).
15. Congress should mandate the establishment of a National Public Health Council. This National Public Health Council would bring together the Secretary of DHHS and state health commissioners at least annually to
    - Provide a forum for communication and collaboration on action to achieve national health goals as articulated in Healthy People 2010;
    - Advise the Secretary of DHHS on public health issues;
    - Advise the Secretary of DHHS on financing and regulations that affect governmental public health capacity at the state and local levels;
    - Provide a forum for overseeing the development of an incentive-based federal–state-funded system to sustain a governmental public health infrastructure that can assure the availability of essential public health services to every American community and can monitor progress toward this goal (e.g., through report cards);
    - Review and evaluate the domestic policies of other cabinet agencies for their impact on national health outcomes (e.g., through health impact reports) and on the reduction and elimination of health disparities; and
    - Submit an annual report on their deliberations and recommendations to Congress.

    The Council should be chaired by the Secretary of DHHS and cochaired by a state health director on a rotating basis. An appropriately resourced secretariat should be established in the Office of the

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Secretary to ensure that the Council has access to the information and expertise of all DHHS agencies during its deliberations (Chapter 3).

16. Local governmental public health agencies should support community-led efforts to inventory resources, assess needs, formulate collaborative responses, and evaluate outcomes for community health improvement and the elimination of health disparities. Governmental public health agencies should provide community organizations and coalitions with technical assistance and support in identifying and securing resources as needed and at all phases of the process (Chapter 4).
17. Governmental and private-sector funders of community health initiatives should plan their investments with a focus on long-lasting change. Such a focus would include realistic time lines, an emphasis on ongoing community engagement and leadership, and a final goal of institutionalizing effective project components in the local community or public health system as appropriate (Chapter 4).
18. Adequate population health cannot be achieved without making comprehensive and affordable health care available to every person residing in the United States. It is the responsibility of the federal government to lead a national effort to examine the options available to achieve stable health care coverage of individuals and families and to assure the implementation of plans to achieve that result (Chapter 5).
19. All public and privately funded insurance plans should include age-appropriate preventive services as recommended by the U.S. Preventive Services Task Force and provide evidence-based coverage of oral health, mental health, and substance abuse treatment services (Chapter 5).
20. Bold, large-scale demonstrations should be funded by the federal government and other major investors in health care to test radical new approaches to increase the efficiency and effectiveness of health care financing and delivery systems. The experiments should effectively link delivery systems with other components of the public health system and focus on improving population health while eliminating disparities. The demonstrations should be supported by adequate resources to enable innovative ideas to be fairly tested (Chapter 5).
21. The federal government should develop programs to assist small employers and employers with low-wage workers to purchase health insurance at reasonable rates (Chapter 6).
22. The corporate community and public health agencies should initiate and enhance joint efforts to strengthen health promotion and disease and injury prevention programs for employees and their communi-

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ties. As an early step, the corporate and governmental public health community should:

a. Strengthen partnership and collaboration by
   - Developing direct linkages between local public health agencies and business leaders to forge a common language and understanding of employee and community health problems and to participate in setting community health goals and strategies for achieving them, and
   - Developing innovative ways for the corporate and governmental public health communities to gather, interpret, and exchange mutually meaningful data and information, such as the translation of health information to support corporate health promotion and health care purchasing activities.

b. Enhance communication by
   - Developing effective employer and community communication and education programs focused on the benefits of and options for health promotion and disease and injury prevention, and
   - Using proven marketing and social marketing techniques to promote individual behavioral and community change.

c. Develop the evidence base for workplace and community interventions through greater public, private, and philanthropic investments in research to extend the science and improve the effectiveness of workplace and community interventions to promote health and prevent disease and injury.

d. Recognize business leadership in employee and community health by elevating the level of recognition given to corporate investment in employee and community health. The Secretaries of DHHS and the Department of Commerce, along with business leaders (e.g., chambers of commerce and business roundtables), should jointly sponsor a Corporate Investment in Health Award. The award would recognize private-sector entities that have demonstrated exemplary civic and social responsibility for improving the health of their workers and the community (Chapter 6).

23. An ongoing dialogue should be maintained between medical and public health officials and editors and journalists at the local level and their representative associations nationally. Furthermore, foundations and governmental health agencies should provide opportunities to develop and evaluate educational and training programs that provide journalists with experiences that will deepen their knowledge of public health subject matter and provide public health workers with a foundation in communication theory, messaging, and application (Chapter 7).

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24. The television networks, television stations, and cable providers should increase the amount of time they donate to public service announcements (PSAs) as partial fulfillment of the public service requirement in their Federal Communications Commission (FCC) licensing agreements (Chapter 7).
25. The FCC should review its regulations for PSA broadcasting on television and radio to ensure a more balanced broadcasting schedule that will reach a greater proportion of the viewing and listening audiences (Chapter 7).
26. Public health officials and local and national entertainment media should work together to facilitate the communication of accurate information about disease and about medical and health issues in the entertainment media (Chapter 7).
27. Public health and communication researchers should develop an evidence base on media influences on health knowledge and behavior, as well as on the promotion of healthy public policy (Chapter 7).
28. Academic institutions should increase integrated interdisciplinary learning opportunities for students in public health and other related health science professions. Such efforts should include not only multidisciplinary education but also interdisciplinary education and appropriate incentives for faculty to undertake such activities (Chapter 8).
29. Congress should increase funding for HRSA programs that provide financial support for students enrolled in public health degree programs through mechanisms such as training grants, loan repayments, and service obligation grants. Funding should also be provided to strengthen the Public Health Training Center program to effectively meet the educational needs of the existing public health workforce and to facilitate public health worker access to the centers. Support for leadership training of state and local health department directors and local community leaders should continue through funding of the National and Regional Public Health Leadership Institutes and distance-learning materials developed by HRSA and CDC (Chapter 8).
30. Federal funders of research and academic institutions should recognize and reward faculty scholarship related to public health practice research (Chapter 8).
31. The committee recommends that Congress provide funds for CDC to enhance its investigator-initiated program for prevention research while maintaining a strong Centers, Institutes, and Offices (CIO)-generated research program. CDC should take steps that include
    - Expanding the external peer review mechanism for review of investigator-initiated research;
    - Allowing research to be conducted over the more generous time lines often required by prevention research; and

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- Establishing a central mechanism for coordination of investigator-initiated proposal submissions (Chapter 8).

32. CDC should authorize an analysis of the funding levels necessary for effective Prevention Research Center functioning, taking into account the levels authorized by P.L. 98–551 as well as the amount of prevention research occurring in other institutions and organizations (Chapter 8).
33. NIH should increase the portion of its budget allocated to population- and community-based prevention research that
    - Addresses population-level health problems;
    - Involves a definable population and operates at the level of the whole person;
    - Evaluates the application and impacts of new discoveries on the actual health of the population; and
    - Focuses on the behavioral and environmental (social, economic, cultural, physical) factors associated with primary and secondary prevention of disease and disability in populations.

    Furthermore, the committee recommends that the Director of NIH report annually to the Secretary of DHHS on the scope of population and community-based prevention research activities undertaken by the NIH centers and institutes (Chapter 8).
34. Academic institutions should develop criteria for recognizing and rewarding faculty scholarship related to service activities that strengthen public health practice (Chapter 8).

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APPENDIX B

Glossary and Acronyms

AAPHP	American Association of Public Health Physicians
ACGME	Accreditation Council on Graduate Medical Education
AHD	Academic Health Department
AMA	American Medical Association
ASPH	Association of Schools of Public Health
BLS	Bureau of Labor Statistics
CDC	Centers for Disease Control and Prevention
CEPH	Council on Education for Public Health
CME	continuing medical education
DHHS	U.S. Department of Health and Human Services
DHP	Defense Health Program
EIS	Epidemic Intelligence Service
FY	fiscal year
GME	graduate medical education
Governmental public health agencies	Federal, state, and local public health agencies

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Healthy People 2010	A national health promotion and disease prevention initiative
HPSP	Armed Forces Health Professions Scholarship Program
HRSA	Health Resources and Services Administration
IOM	Institute of Medicine
LHD	local health department
LHO	local health officer
M.P.H.	master of public health degree
NHSC	National Health Service Corps
NLN	National Public Health Leadership Development Network
PH/GPM	public health/general preventive medicine
PHTN	Public Health Training Network
Public health physician	A physician "whose training, practice and world view are based in large part on a population focus rather than individual practice, that is, on assuring the availability of essential public health services to a population using skills such as leadership, management and education as well as clinical interventions."
TRAIN	Training Finder Real-Time Affiliate Integrated Network
USUHS	Uniformed Services University of the Health Sciences
VA	U.S. Department of Veterans Affairs

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APPENDIX C

Agendas of Open Session Committee Meetings

COMMITTEE ON TRAINING PHYSICIANS FOR PUBLIC HEALTH CAREERS
MEETING ONE

Agenda for Public Session

Thursday, April 27, 2006

10:00 a.m. **Welcome, Introductions, and Review of the Agenda**
Richard B. Johnston, Committee Chair

10:15 a.m. **Presentations from Sponsoring Agencies.** Each sponsor will take about 10 minutes to describe what it hopes will emerge from the study

10:15 a.m. *Tanya Pagan Raggio, Director, Division of Medicine and Dentistry, Bureau of Health Professions, Health Resources and Services Administration*

10:30 a.m. *Michael E. Whitcomb, Senior Vice President Division of Medical Education Association of American Medical Colleges*

10:45 a.m. **Discussion of Committee Charge**

11:15 a.m. **Panel Discussion.** Each panelist will give a 20-minute presentation that addresses the following three questions:
- What is a public health physician?
- What does a physician need to know or be able to do to be designated a public health physician?

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- How does the training program prepare physicians to fulfill their roles in public health?

11:15 a.m. *Denise Koo, Director, Career Development Division, Office of Workforce and Career Development, Centers for Disease Control & Prevention*

11:35 a.m. *George K. Anderson, Past President American College of Preventive Medicine Executive Director, Association of Military Surgeons of the United States (AMSUS)*

11:55 a.m. *Harrison C. Spencer, President and CEO Association of Schools of Public Health*

12:30 p.m. **LUNCH**

1:30 p.m. **Panel Discussion Continued**

1:30 p.m. *Anthony L. Schlaff, Director Master Degree Program in Public Health, Department of Public Health and Family Medicine, Tufts University School of Medicine*

1:50 p.m. *Arvind Goyal, President American Association of Public Health Physicians*

2:10 p.m. *Louis Rowitz, University of Illinois at Chicago Public Health Leadership Network*

2:30 p.m. **Discussion**

3:15 p.m. **Open Testimony**

3:30 p.m. **Public Session Adjourns**

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COMMITTEE ON TRAINING PHYSICIANS FOR PUBLIC HEALTH CAREERS
MEETING TWO

Agenda for Public Session

Monday, June 19, 2006

9:30 a.m. **Welcome and Introduction**
Richard B. Johnston, Committee Chair

9:45 a.m. **Panel Presentations:** Each speaker will have 30 minutes for presentation. Discussion will occur at the conclusion of all three presentations.

9:45 a.m. IOM Report, *The Future of the Public's Health*. What should the public health system of the future be like?
Jo Ivey Boufford, Study Co-Chair

10:15 a.m. IOM Report, *Who Will Keep the Public Healthy?* How should public health professionals be trained to meet the needs of the future public health system?
Susan Allan, Committee Member

10:45 a.m. Vision for the Future of Physicians Trained in Public Health
Hugh H. Tilson, Professor, School of Public Health, University of North Carolina

11:15 a.m. **Discussion with all three panelists**

12:00 p.m. **LUNCH**

1:00 p.m. **Panel Presentations.** Each speaker will have 20 minutes to describe:
- In this setting what areas require the combination of an MD and public health skills?
- What might attract physicians to public health?

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1:00 p.m. **State Public Health Agency**
Paul E. Jarris, Executive Director
Association of State and Territorial Health Officials

1:20 p.m. **City or County Public Health Agency**
Patrick Libbey, Executive Director
National Association of County and City Health Officials

1:40 p.m. **Military Health**
Robert L. Mott, LTC, U.S. Army
Director, Division of Preventive Medicine, Walter Reed Army Institute of Research

2:00 p.m. **International Health**
Andre-Jacques Neusy, Associate Professor of Medicine, Director, Center for Global Health, New York University School of Medicine

2:20 p.m. **Discussion**

3:00 p.m. **Open Testimony**

3:30 p.m. **Adjourn**

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Committee on Training Physicians for Public Health Careers
Meeting Three

Agenda for Public Session

Thursday, October 5, 2006

9:15 a.m. **Welcome, Introductions, and Review of the Agenda**
Richard B. Johnston, Committee Chair

9:30 a.m. **Panel Presentations and Discussion—Public Health Training Approaches:** Each speaker will have 30 minutes for presentation. Discussion will be held until after all panel members have presented.

9:30 a.m. **Sponsor Presentation**
Denise Koo, Director, Career Development Division, Office of Workforce and Career Development, Centers for Disease Control & Prevention

10:00 a.m. **Status and Future of Funding for Graduate Medical Education**
Karen Fisher, Senior Associate Vice President, Division of Health Care Affairs, Association of American Medical Colleges

10:30 a.m. **Discussion**

11:00 a.m. **Break**

11:15 a.m. **Preventive Medicine Approach**
Michael Parkinson, President-Elect American College of Preventive Medicine

11:45 a.m. **Discussion**

12:15 p.m. **LUNCH**

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1:15 p.m. **Panel Presentations and Discussion—Public Health Training Approaches:** Each speaker will have 30 minutes for presentation. Discussion will be held until after all panel members have presented.

1:15 p.m. **American Association of Public Health Physicians**
Joel L. Nitzkin, Principal Investigator and Project Manager
AAPHP Preventive Services ToolKit Project (PSTK)
Chair, AAPHP/ACPM Job Market Initiative (JMI)

1:45 p.m. **Washington State Public Health Orientation Program**
Maxine Hayes, State Health Officer
State of Washington, Department of Health

2:15 p.m. **Global Health Training**
Charles Godue, Unit Chief,
Human Resources for Health, Health Systems Strengthening (HSS/HR)
Pan American Health Organization

2:45 p.m. **Discussion**

3:15 p.m. **Adjourn**

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APPENDIX D

Committee Biographies

Richard B. Johnston, Jr., M.D. (*Chair*), is associate dean for research development and a professor in the Department of Pediatrics at the University of Colorado School of Medicine and is executive vice-president for academic affairs at the National Jewish Medical and Research Center. His research interests include the mechanisms of resistance to infection, the cell biology of neutrophils and macrophages, immune deficiency diseases, and child health. He has published more than 260 papers on these topics. Dr. Johnston has served as the chair of pediatrics at the University of Pennsylvania; medical director of the March of Dimes; chief of pediatric immunology at Yale; chair of the advisory committee on vaccines for the Food and Drug Administration; a member of the Advisory Committee for the National Center for Environmental Health, Centers for Disease Control and Prevention; and president of three academic pediatric societies. He has previously chaired six Institute of Medicine (IOM) or National Research Council committees and has served as a member on other IOM committees and on the Board of Health Promotion and Disease Prevention. He was elected to the IOM in 1994 and is a fellow of the American Association for the Advancement of Science. He received an M.D. from Vanderbilt University.

Susan M. Allan, M.D., J.D., M.P.H., is the public health director for the Oregon Department of Human Services. Prior to assuming that position, Dr. Allan worked in local public health for 20 years, including 17 years as the director for the Arlington County Department of Human Services in

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Arlington, Virginia. Dr. Allan has been very active in a number of capacities with the National Association of County and City Health Officials and now with Association of State and Territorial Health Officials, including representating them on the Council on Linkages between Academia and Public Health Practice. She participated in the inaugural year of the CDC's National Public Health Leadership Institute. She has also had medical training in small rural clinics in such developing countries as Colombia. She served on the Institute of Medicine Committee on Educating Public Health Professionals for the 21st Century. Recently she was appointed to the IOM's Board of Population Health and Public Health Practice. She earned medical and law doctoral degrees from Harvard University, and she received a master of public health degree from Johns Hopkins. She is board certified in public health and general preventive medicine by the American Board of Preventive Medicine. Dr. Allan was appointed to the governing board of the Council on Education for Public Health in 2004 by the American Public Health Association for a term that extended through 2009.

Georges C. Benjamin, M.D., F.A.C.P., has been executive director of the American Public Health Association (APHA) since December 2002. Prior to joining APHA, Dr. Benjamin was secretary of the Maryland Department of Health and Mental Hygiene, where he played a key role in developing the state's bioterrorism plan. From 1995 to 1999 he served as deputy secretary for public health services. Dr. Benjamin has also worked extensively in the field of emergency medicine. He was chief of the Acute Illness Clinic at Madigan Army Medical Center in Tacoma, Washington; chief of emergency medicine at the Walter Reed Army Medical Center; and chair of the Community Health and Ambulatory Care Department at the District of Columbia General Hospital. From 1990 to 1991 he served as the District of Columbia's Commissioner of Public Health. He has taught emergency medicine at Georgetown University in Washington, D.C., and the Uniformed Services University of the Health Sciences in Bethesda, Maryland. He is a fellow of the American College of Physicians and a former fellow of the American College of Emergency Physicians. Dr. Benjamin has held a variety of positions with the American College of Emergency Physicians, including president and vice president of the DC chapter, chair of the Injury Control Committee, a member of the Governmental Affairs Committee, and a member of the Health Policy Committee. He also served as president of the Association of State and Territorial Health Officials (2001 and 2002) and has sat on the editorial board of the *Journal of the National Medical Association*.

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Dan G. Blazer III, M.D., Ph.D., M.P.H., is J. P. Gibbons Professor of Psychiatry and Behavioral Sciences at Duke University Medical Center. During Dr. Blazer's tenure as the dean of medical education, he expanded a master of public health program for medical school students, which now attracts more than 20 percent of the medical school class. Dr. Blazer is the author or editor of more than 30 books and is the author or coauthor of more than 300 peer-reviewed articles on topics including depression, epidemiology, and consultation liaison psychiatry. He is a fellow of the American College of Psychiatry and the American Psychiatric Association and is a member of the Institute of Medicine (IOM), with expertise in medical education, religion and medicine, and preventive medicine and public health. He was elected to the IOM in 1995.

Linda Hawes Clever, M.D., is the chief of occupational health at the California Pacific Medical Center and president of the not-for-profit organization RENEW. After receiving undergraduate and medical degrees at Stanford University, she completed medical residency and fellowships in infectious diseases and community medicine at Stanford and the University of California, San Francisco. She was a regent of the American College of Physicians and is a master in that college. She served as editor of the *Western Journal of Medicine*, is a fellow of the American College of Occupational and Environmental Medicine, and is a member of the American Public Health Association. Dr. Clever serves on the University of California, Berkeley, School of Public Health Policy Advisory Council and is a clinical professor of medicine at the University of California, San Francisco. She served on the Stanford University Board of Trustees and chaired the Boards of KQED and University High School. Her publications are focused on occupational health, personal and professional renewal, ethics, and volunteerism. She was elected to the Institute of Medicine in 1981.

David W. Fleming, M.D., is director of the Department of Public Health in Seattle/King County. Prior to assuming that role, Dr. Fleming directed the Bill & Melinda Gates Foundation's Global Health Strategies Program. In this capacity, Dr. Fleming oversaw the foundation's portfolios in vaccine-preventable diseases, nutrition, newborn and child health, leadership, emergency relief, and cross-cutting strategies to improve access to health tools in developing countries. Dr. Fleming has published on a wide range of public health issues and has served on multiple boards and commissions, including the board of the Global Alliance for Vaccines and Immunization. Dr. Fleming received a medical degree from the State University of New York Upstate Medical Center in Syracuse. He is board certified in internal medicine and preventive medicine and serves on the

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faculties of the Departments of Public Health at both the University of Washington and Oregon Health Sciences University.

Kristine M. Gebbie, Dr.P.H., R.N., is the Elizabeth Standish Gill Associate Professor of Nursing and director of the Center for Health Policy at the Columbia University School of Nursing. She just completed 4 years as a senior consultant on public health initiatives to the Office of Public Health and Science, U.S. Department of Health and Human Services. She has conducted extensive research on health policy, public health nurses, and public health laws and is a recognized expert in the enumeration and development of the public health workforce. Dr. Gebbie is an Institute of Medicine (IOM) member with expertise in public health systems and infrastructures, HIV/AIDS prevention policy development, state and local public health practice, and public health nursing. She was elected to the IOM in 1992.

Lewis R. Goldfrank, M.D., has worked at the Bellevue Hospital Center and the New York University Medical Center for the last quarter century. He is currently the first chair and professor of the newly established academic Department of Emergency Medicine at New York University. He is also the medical director of the New York City Health Department's Poison Center. Educated at Clark University, the Johns Hopkins School of Medicine, and the University of Brussels in Brussels, Belgium, he graduated from the University of Brussels Medical School in 1970. He completed his residency in internal medicine at Montefiore Hospital and Medical Center in 1973. His efforts have led to the development of New York University's emergency medicine and medical toxicology residencies. He has served as the chair of the American Board of Emergency Medicine's Subboard on Medical Toxicology, the American Board of Medical Toxicology, and the Society for Academic Emergency Medicine. His entire career has been spent working in the public hospitals of New York City, emphasizing the role of emergency medicine in improving access to care, public health, public policy, and medical humanism. He is senior editor of *Goldfrank's Toxicologic Emergencies*, a standard text in medical toxicology, the eighth edition of which was published in 2006. He is a member of the Institute of Medicine (IOM) of the National Academy of Sciences. He has participated on three IOM committees on terrorism: the Committee on R&D for Improving Civilian Medical Response to Chemical and Biological Terrorism (1998 to 1999); the Committee on Assessing Metropolitan Medical Response Teams: Preparedness for Terrorism (1999 to 2002); and the Committee on Psychological Consequences of Terrorism (2002 to 2003). He chaired the last two of these committees. He currently chairs the standing committee at the IOM on Personal Protective Equip-

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ment in the Workforce. As part of his investigations on preparedness, he has developed and led a consortium on preparedness with the New York City Department of Health, led the New York University School of Medicine Consortium on Preparedness, was the principal investigator for a Large Scale Emergency Readiness grant from the U.S. Department of Health and Human Services, and was a co-principal investigator on a Public Health Research grant (Health Protection Research Initiative) from the Centers for Disease Control and Prevention.

James M. Hughes, M.D., received a B.A. in 1966 and an M.D. in 1971 from Stanford University. He completed a residency in internal medicine at the University of Washington and a fellowship in infectious diseases at the University of Virginia. He is board certified in internal medicine, infectious diseases, and preventive medicine. He first joined the Centers for Disease Control and Prevention (CDC) as an Epidemic Intelligence Service Officer in 1973. During his CDC career, he has worked primarily in the areas of food-borne and waterborne diseases, infection control in health care settings, and emerging infections. He became director of the National Center for Infectious Diseases in 1992. He is a fellow of the American College of Physicians, the Infectious Diseases Society of America, and the American Association for the Advancement of Science. He served as assistant surgeon general in the United States Public Health Service. He has directed the Program in Global Infectious Diseases and the Center for Global Safe Water at Emory University since 2005.

Nicole Lurie, M.D., M.S.P.H., is a senior natural scientist and the Paul O'Neill Alcoa Professor of Health Policy at the RAND Corporation. Before that, she had a long affiliation with the University of Minnesota, where she was professor of medicine and public health. Most recently, she has been medical advisor to the commissioner at the Minnesota Department of Health. From 1998 to 2001, she took a leave of absence to serve as principal deputy assistant secretary of health in the U.S. Department of Health and Human Services. Dr. Lurie has a long history in the health services research field, primarily in the areas of access to and quality of care, managed care, mental health, prevention, and health disparities. Dr. Lurie attended college and medical school at the University of Pennsylvania and completed her residency and master of science of public health at the University of California, Los Angeles, where she was also a Robert Wood Johnson Foundation clinical scholar. She serves as senior editor for *Health Services Research* and has served on the editorial boards and as a reviewer for numerous journals. She has served on the council and was president of the Society of General Internal Medicine, is currently on the board of directors for the Academy of Health Services Research, and

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has served on multiple other national committees. She is the recipient of numerous awards, including the Academy of Health Services Research Young Investigator Award, the Nellie Westerman Prize for Research in Ethics, and the Heroine in Health Care Award, and is a member of the Institute of Medicine. In addition to her work in health services research and health policy, Dr. Lurie continues to practice clinical medicine in the health care safety net and is the mother of three children.

Tara A. McCarthy, M.D., M.P.H., is a board-certified pediatrician with 8 years of experience in public health and clinical epidemiology. She spent 2 years as an Epidemic Intelligence Service officer for the Centers for Disease Control and Prevention and was assigned to the Connecticut Department of Public Health, conducting outbreak investigations, developing a surveillance system for West Nile virus, evaluating the latent tuberculosis HIV/AIDS surveillance system, and developing and conducting case-control and cohort studies. She currently works as the medical consultant for the Communicable Disease Control Division of the Boston Public Health Commission, dealing mainly with issues related to infectious diseases and bioterrorism. Her publications include articles on West Nile virus and infectious disease outbreaks. Dr. McCarthy received an undergraduate degree from Duke University. She graduated from Tufts University School of Medicine with an M.D., M.P.H., degree and was a member of the Alpha Omega Alpha Honor Society. She did her pediatric training at the Boston Combined Residency Program in Pediatrics at Children's Hospital Boston and the Boston Medical Center.

Louis Rowitz, Ph.D., is professor of community health sciences at the University of Illinois at Chicago. Dr. Rowitz's work has focused on public health practice with an emphasis on leadership and has authored several publications on this topic. He received his master's and doctoral degrees from the University of Illinois at Urbana in the field of sociology. Dr. Rowitz is currently director of the Mid-America Regional Public Health Leadership Institute and Mid-America Public Health Training Center.

Joseph J. Schwerha, M.D., M.P.H., is professor of occupational and environmental medicine in the Graduate School of Public Health at the University of Pittsburgh and is the director of the Occupational and Environmental Medicine Residency and the Public Health Preparedness and Disaster Response Certificate programs. He holds a bachelor's degree in chemistry from the University of Pittsburgh, a master of public health degree in environmental health and industrial hygiene from the University of Michigan, and a medical degree from West Virginia University School of Medicine. Prior to working at the University of Pittsburgh, Dr. Schwerha was general manager—health services and corporate medical director at

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the U.S. Steel Corporation for many years. In this capacity he was responsible for the Medical, Safety, Industrial Hygiene, and Employee Assistance Programs; Workers' Compensation; and Family Medical Centers (including psychiatric managed care) for the U.S. Steel Corporation world wide. He is actively involved in the editorial boards of the *Journal of Emergency Management*, *Journal of Managed Care Medicine*, and *Journal of Occupational and Environmental Medicine*, with a bimonthly column, and is a member of the *Official Disability Guidelines* (Work-Loss Data Institute) Editorial Advisory Board. He serves as chair of the Occupational and Environmental Medicine Committee of the Allegheny County Medical Society. In the past he has been involved with the Board of Directors of the American College of Occupational and Environmental Medicine, the Mine Health Research Advisory Committee of the National Institute of Occupational Safety and Health, and the Board of Directors of the National Safety Council and was clinical associate professor of medicine in the Section of Occupational Medicine and clinical associate professor of community medicine at West Virginia University. Among the honors he has received are the Federal Aviation Administration Service Award and the Knudsen Award, which is the highest international award in occupational medicine, from the American College of Occupational and Environmental Medicine (2005). His research interests are in medical administration and education as well as all aspects of environmental health and medical surveillance.

Robert Wallace, M.D., M.Sc., is professor of epidemiology and internal medicine at the University of Iowa Colleges of Public Health and Medicine and director of the university's Center on Aging. He has been a member of the U.S. Preventive Services Task Force and the National Advisory Council on Aging of the National Institutes of Health. He is a member of the Institute of Medicine (IOM) and is currently chair of IOM's developing Board on Military and Veterans Health. He is the author or coauthor of more than 250 publications and 22 book chapters and has been the editor of four books, including the current edition of *Maxcy-Rosenau-Last's Public Health and Preventive Medicine*. Dr. Wallace's research interests are in clinical and population epidemiology and focus on the causes and prevention of disabling conditions of older people. He has substantial experience in the conduct of both observational cohort studies of older people and clinical trials, including preventive interventions related to fracture, cancer, coronary disease, and women's health. He is the site principal investigator for the Women's Health Initiative, a national intervention trial exploring the prevention of breast and colon cancer and coronary disease, and a co-principal investigator of the Health and Retirement Study, a national cohort study of the health and economic status of older Americans. He has been a collaborator in several international studies of the causes and prevention of chronic illness in older people.

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