Who Will Run America's Public Health Labs?

Educating Future Laboratory Directors

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February 2002

ACKNOWLEDGEMENTS

APHL wishes to acknowledge the following members who contributed significant time and effort to ensure that this study is rigorous and addresses the important leadership issues facing our nation's public health labs: Dr. Eric Blank, Missouri Department of Health, Dr. Bruce Kleger, Pennsylvania Department of Health, Dr. Lou Turner, North Carolina State Laboratory of Public Health, and Dr. Burt Wilcke, Vermont Department of Health. Many thanks to the APHL members across the country who participated in focused discussions on this topic and who reviewed drafts of the survey instrument. Their involvement was invaluable.

Development of this report was supported under the APHL/CDC Cooperative Agreement #U60CCU303019, coordinated by the Division of Laboratory Systems, Public Health Practice Program Office, CDC. Project technical advisors include Dr. Joe Boone, Dr. John Ridderhof, Dr. Robert Martin, and APHL's CDC project officer, Mr. William Schalla, to whom we owe special thanks.

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"Today the need for leaders is too great to leave their emergence to chance."

Institute of Medicine, 1988

INTRODUCTION

As the current generation of public health laboratory directors (PHLDs) nears retirement age, it is increasingly important to train and effectively transition new professionals into these vital positions. A key component of this impending changeover will be to determine the knowledge, skills, and experience necessary for the success of PHLDs in the 21st century. The educational foundation for PHLDs in the last century encompassed studies in public health practice, research methodology, epidemiology, classic sciences, and medicine. New PHLDs will need to expand this foundation to include expertise in areas such as management, public policy, leadership, and strategic planning. Further, new PHLDs must meet the requirements of the Clinical Laboratory Improvement Amendments of 1988 (CLIA 1988), which requires PHLDs to have a PhD or an MD and at least two years of experience. CLIA also mandates that PHLDs participate in board certification programs offered by several associations.

In addition to these increased legal and managerial requirements, the field of public health in general has witnessed major structural and institutional changes over the last five decades. Dubbed "the new public health," the profession has been challenged to assess current and foreseeable trends, such as changing information technology and a new emphasis on public policy development, that will continue to redefine public health in the future. The dynamics of change within public health – and within public health laboratories – are inescapable, and are further compounded by the complex economic pressures resulting from health care reform and managed care. For example, as laboratory testing is integrated with other diagnostic services, such as imaging and electrodiagnostics, the entire laboratory paradigm must change from one with an automated core laboratory with point-of-service rapid response and outlying satellite laboratories to one comprising a consolidated diagnostic center.[1] Public health professionals must face these challenges head on by acquiring the knowledge and skills necessary to succeed in this new environment.

The goal of our study is to determine, in the face of current and evolving regulations and health care systems, what attributes the future pool of PHLDs should have. That is, what will define the "ideal" laboratory director and how will those defining characteristics be attained? Our findings are intended to guide recommendations for a program of continuing education or certification aimed at producing PHLDs that possess an effective blend of management and leadership skills, policy awareness, and public health and science expertise.

...what will define the "ideal" laboratory director and how will those defining characteristics be attained?

[1]Lien J, Steiner JW, Bissell MG. The Clinical Services Manager: A Curriculum for the 21st Century. Clinical Management Review. May/June 1998:145-9.

BACKGROUND

There are few resources available that identify specific characteristics of effective laboratory management and the pathways of professional development for PHLDs.[2] The literature covers a wide range of topics, typically under the umbrella of health care management, education, and personnel development, but does not adequately address how these topics, plus leadership and policy development, relate to PHLDs. The information is nevertheless useful to develop an overarching view of the issues that health administrators face, be they PHLDs or hospital officers, in their day-to-day operations. In the sections that follow, we will define the role of the PHLD, and the skills, education, and experience he or she must have to efficiently and effectively manage laboratory operations.

PHLDs Defined - Who They Are and What They Do

As the nature of public health laboratories has changed, so has that of the PHLD. Lien et al.[3] describes the laboratory manager of the 1950s as a chief technologist, usually one who received on-the-job training from a pathologist. As educational requirements changed throughout the 1960s, 70s, and 80s, the position of laboratory manager developed into more of an administrative directorship, reflecting the knowledge that was now needed in finance and business practices. Lien and colleagues further posit that into the 21st century, PHLDs will not only rely on core science and business skills, but also on an understanding of the public policy and other structures within which the "new public health" will operate. He or she must further understand the regulatory functions of public health, and manage the laboratory's core functions, including assessment, investigation, analysis, advocacy, prioritization, planning, management, implementation, evaluation, and public communication, among others.[4] The PHLD must establish productive working relationships within his or her own organization, as well as with external clients (e.g., the medical community and state and local health departments) to effectively communicate the laboratory's role in public health.[5]

The post-modern PHLD will have to alter or adjust operations as required to meet the goals of integrated delivery systems and must oversee the process of information delivery that supports the goals of prevention, diagnosis, and treatment.[6] The PHLD of the near future then, must build on skills such as problem-solving, financial management, team building, interpersonal skills,

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[2]This sentiment is echoed in Liang AP, Renard PG, Robinson C, Richards BR. Survey of Leadership Skills Needed for State and Territorial Health Officers. Public Health Reports.1993;108:116-20; Lammers JC, Pandita V. Applying Systems Thinking to Public Health Leadership. Journal of Public Health Management and Practice. 1997;3(4):39-49.

[3]Lien et. al. (1998)

[4]Kilpatrick KE, Romani JH. The Evolution of Health Administration education for Public Health: Responding to a Changing Environment. The Journal of Health Administration Education. Fall 1995; 13(4):585-95.

[5]Becker, et. al. Public Health Laboratory Administration. In Public Health Administration, Aspen Publishers, Inc, Novick, LF and Mays, GP, eds.; 2001:623-645.

[6]Lien et. al. (1998)

conflict resolution, stress management, communication, creativity, and critical thinking, and will be defined as one who can identify and integrate the disciplines needed to develop the appropriate systems.[7] PHLDs are "challenged to provide the highest quality services, [often] within external and organizational environments that are not structured to support that activity. They must display leadership skills and practice sound management, have the ability to promote rapid adaptability to change, and must be skilled at modern laboratory management." Davies suggests that PHLDs must "be able to relate to individuals and groups, (and) have skills of entrepreneurship and leadership."[8]

Core Functions and Skills of PHLDs

Most recent literature focuses on a single aspect of public health administration: management. As noted by Liang et al.[9] , the literature discusses general functions of public health administration and the formal education required; however, the specific skills needed at various levels of administration are rarely differentiated. In particular, skills related to science and laboratory technology, public policy, and analysis have not been addressed in great detail. Thus, we will rely here on information obtained from position descriptions we received from current PHLDs. We received such descriptions from 15 states and identified 4 broad core competencies: management, science and technical knowledge, policy development, and interpersonal skills. Each of these functions is described below.

Management

Descriptions of the management function in the literature focus on how it broadly relates to health professionals (i.e., hospital staff, public health officials, lab scientists, etc.), but not how the function expressly relates to laboratory directorship or precisely how it applies to the public health laboratory.[10] We identified the following PHLD management duties:

- **Planning/Organization:**
- Direct and manage activities of the PHL.
- Plan and organize PHL service.
- Develop and institute new and/or revised services as required.

- **Personnel/Human Resources Management:**
- Plan, organize, and evaluate work of employees.
- Make hiring recommendations and decisions.
- Resolve employee grievances in accordance with organizational policy.

[7]Becker et al, in press.
[8]Davies AM. Training professionals for the new public health. Public Health Reviews. 1996;24:205-11.
[9]Liang AP, Renard PG, Robinson C, Richards TB. Survey of Leadership Skills Needed for State and Territorial Health Officers. Public Health Reports, January/February 1993;116-20.
[10]See Liebler JG, McConnell CR. Management Principles for Health Professionals. Gaithersburg, MD: Aspen Publishers: 1999.

- **Budgeting/Fiscal Management:**
  - Develop and administer the PHL budget.
  - Direct, plan, organize and coordinate resources within the PHL.
  - Evaluate the utility, cost-benefit, and effectiveness of PHL activities.

- **Quality Improvement/Quality Assurance:**
  - Monitor analytical results and review quality control activities.
  - Ensure PHL compliance with federal/state quality assurance programs.

- **Operations Management/Regulatory Requirements:**
  - Recommend contracts for lab services and monitor compliance.
  - Supervise the preparation and maintenance of lab records and reports summarizing lab activities, accomplishments, and needs.
  - Consult with other public health agencies regarding lab and regulatory issues.

- **Program Management/Coordination:**
  - Advise the development of new programs, methodologies, tests, and products.
  - Coordinate lab services with other health programs and with other state and federal agencies.

Scientific and Technical Knowledge

Most commentary on scientific and technical knowledge is generally related to curriculum changes or improvements deemed necessary in academic public health programs.[11] They do not address those skills that are transferred and utilized on-the-job within the PHL, or specifically by the PHLD.

- **Technical Knowledge:**
  - Knowledge of all lab procedures, techniques, standards of lab practice, and methods development.
  - Experience using specialized equipment.
  - Scientific and medical skills to provide consultation.

- **Laboratory Science:**
  - Knowledge or expertise including but not limited to biology, microbiology, chemistry, bacteriology, mycology, virology, immunology, hematology, and epidemiology.

- **Health and Safety:**
  - Knowledge of biological, mechanical, chemical and environmental hazards and environmental health risk techniques.

[11] See Clark, NM, Weist, E. Mastering the New Public Health. American Journal of Public Health, August 2000;1208-11.

- **Epidemiology:**
  - Knowledge of infectious/communicable diseases and diseases resulting from environmental contamination.
  - Ability to monitor emerging infectious diseases.

- **Education:**
  - Bachelor's degree or equivalent.
  - Graduate work or advanced degree(s) (i.e., MPH, DrPH, ScD, MD, DO, PhD) in biology, chemistry, health science, public health, public health administration, microbiology.
  - Certification in anatomical and/or clinical pathology, management supervisory training programs, or by a recognized clinical or pathology board.
  - Professional license (CLIA-88 eligibility).

- **Experience:**
  - Ranges from no experience to over ten years experience.
  - Broad experience in multi-disciplinary lab.
  - Formal scientific or medical training.

- **Analytical Skills:**
  - Experience performing needs assessments.
  - Knowledge of problem-solving techniques, statistical analysis, scientific research principles, methodology, and evaluation.

Public Policy

Because policy development is a core function of public health laboratories, knowledge of public policy should be required of PHLDs. As Cordts[12] suggests, public health laboratory personnel possess unique qualifications to advise policy makers on technologic advances or limitations in implementing new policy. It is especially important today to understand the relationship between science and politics in developing and implementing public health policy. Science facilitates the discovery of new knowledge, which guides policy formulation and implementation. At the same time, the political process is needed to facilitate governmental decision-making and to implement decisions through programs.[13]

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From the position descriptions, the public policy function, as it relates to laboratory directorship, includes a knowledge of public health law and the legislative process, and the ability to make recommendations on federally and locally sanctioned public health legislation.

[12]Cordts JR. The Laboratory as a Model Public Health Function. CDC/NCID Focus, March 1995; 6-9.

[13]Roper WL. Why the Problem of Leadership in Public Health, in Leadership in Public Health. Milbank Memorial Fund, Fox DM, ed.; 1994:20-28.

Personal Skills

Here we identified the following skills:

- **Communication:**
  - Ability to communicate effectively with individuals at various professional levels.
  - Public speaking skills.

- **Computer Use/Information Management:**
  - Ability to use electronic technology.

- **Leadership:**
  - Provide workforce development.
  - Respond to trends and initiatives.
  - Have good mentoring skills.

- **General Administration:**
  - Marketing.
  - Ability to adapt to changing technology.
  - Materials management.

Of these, only leadership is discussed at any length in the literature, in a purely general sense. For Liebler and McConnell, leadership is defined as power, influence, (formal) authority, strong self-image, a vision of the future, a firm belief in the goals of the organization, the ability to influence the behavior of subordinates, and the ability to relate to and influence individuals in parallel or superior positions of authority.[14] For Roper,[15] it includes the ability to see the big picture, to think and plan strategically, to share a vision with others, and to marshal constituencies and coalitions for action.

We wish to uncover through our assessment, the amount of time that PHLDs spend on job tasks related to each core competency. In addition, we want to explore the current prioritization of the skills and knowledge areas associated with these functions and how this current allocation of time and classification of skills may evolve in the near future. Finally, we want to identify the most effective means of training future PHLDs in each core competency (e.g. on-the-job training, continuing education programs, certification programs, etc.).

[14]Liebler et. al. (1999).
[15]Roper (1994).

PHLDs on the Horizon

As McLaughlin[16] suggests, the supply and character of the workforce available to meet the demand for health care services at any given time is determined by many factors. These include the geographic location of practitioners, number and type of students in health professions education programs, number and capacity of educational facilities in the US, retention rates for health care professionals, degree of workforce participation, average retirement age, and level of professional productivity.

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We will examine here some of the factors that will affect the number of health professionals who are available and who desire a career in laboratory management in the future. Particularly important in the short-term are the phenomena that affect decisions by in-career professionals to embark on career paths leading to the position of PHLD.

Health Professions Education Programs

The number of applicants into health professions education programs has experienced an overall increase since the early 1990s. Between 1987-1997, enrollment in schools of public health increased approximately 27 percent, from 10,761 to 14,736.[17]

Factors in formal education, such as access to financial resources and increased educational/programmatic requirements, obviously have a significant impact on enrollment and, consequentially, on the future supply of health professionals. Harmon[18] and others[19] have explored these types of influences, from the application process through matriculation. Our focus here is on new graduates (mainly MDs, MPHs, PhDs) and in-career, practicing health professionals.

Continuing Education and Training Programs

The changing structure and purpose of public health laboratories will require the PHLD to stay current in the skills and knowledge necessary to manage laboratory operations. Liang et al.[20] note that effective development of public health leaders requires a systematic, interactive, ongoing process, in which training experiences are combined with on-the-job practice of new skills. Therefore, the immediate future supply of PHLDs-those currently rising through the ranks within public health laboratories-will depend in part on the pressure and/or desire they feel to participate in continuing education

[16]McLaughlin CJ. Health Workforce Issues and Policy-Makings Roles, in Health Workforce Issues for the 21st Century. Larson PF, Osterweis M, Rubin ER, eds., 1994; 1-22.

[17]1999 Annual Data Report, Association of Schools of Public Health.

[18]Harmon RG, Training and Education for Public health: The Role of the US Public Health Service. American Journal of Preventive Medicine. 1996;12(3):151-4.

[19]See Larson PF, Osterweis M, Rubin ER, eds. Health Workforce Issues for the 21st Century. Washington, DC: Association of Academic Health Centers; 1994.

[20]Laing et. al. (1993)

and other training programs. A study by Berman et al.[21] suggests that public health practitioners' interest in continuing education may arise from a need to increase skills or to stay abreast of current developments in public health. The literature indicates that institutional pressures, work habits, and perceived benefit are the factors that most influence this interest.

Institutional pressure can result from federal or local mandates that require certification or credentials in specific areas (e.g., CLIA 1988). Such pressures can also result from technological changes (e.g., changing laboratory procedures, techniques, or equipment) that compel professionals to acquire new skills. Pressure may also come from within the field of public health. The 1988 Institute of Medicine (IOM) report, *The Future of Public Health*[22] for example, caused fervor throughout the public health community by calling for a renewal of public health leadership development and enhanced management science skills.

...49 percent of public health leaders agree that credentialing or certification associated with a continuing education or training program would improve work quality.

The perceived benefit of a continuing education or training program also influences an individual's desire to participate in it. In this regard, Burke advises that institutional policies must reward acquisition of new knowledge. According to a study by Livingood and colleagues, 49 percent of public health leaders agree that credentialing or certification associated with a continuing education or training program would improve work quality.[23] An overwhelming majority of respondents also agreed that this program would distinguish public health from other health fields and would benefit practitioners (72% and 61%, respectively).

Currently, the most recognized continuing education programs for training in scientific and technical areas are those provided by the National Laboratory Training Network (NLTN), sponsored by the Association of Public Health Laboratories (APHL) and the Centers for Disease Control and Prevention (CDC). The NLTN awards continuing education units (CEUs) to participants who successfully complete training, which is offered in site-based formats (e.g., conferences, workshops, and seminars) and distance-based formats (e.g., videotape, audiotape, 35-mm slides, computer-assisted instruction, and audio/video conferences).

In the wake of the IOM report, a network of state and regional public health leadership institutes has been established to address training needs for public health professionals. Consortia of state health departments and schools of public health sponsor these one- to two-year training programs. The institutes are designed to foster leadership; provide training in critical public

[21]Berman SJ, Perkocha VA, Novotny TE. A Continuing Education Preference Survey of Public Health Graduates. American Journal of Preventive Medicine, 1995;11(1):19-25.

[22]Institute of Medicine. The Future of Public Health. Washington, DC: National Academy Press; 1988.

[23]Livingood WC Jr., Woodhouse LD, Godin SW. The Feasibility and Desirability of Public Health Credentialing: A Survey of Public Health Leaders. American Journal of Public Health, June 1995;8(6): 765-70.

health and communications technology skills; and develop leadership skills such as visioning, team building, systems thinking, and political effectiveness. Many offer CEUs and course credit. The leadership institute sponsored by the University of South Florida, for example, in addition to its one-year program, offers brief training programs in basic management methods toward a certificate of management.

At the national level, the CDC funds the National Public Health Leadership Institute, currently based at the University of North Carolina at Chapel Hill. Its mission is to "strengthen the leadership competencies of senior public health officials," including "scholars' ability to think from a system's perspective, to create and implement a vision, to facilitate meaning, and to empower followers . . . to assure they can shape responses to public health challenges in the twenty-first century."[24] This innovative, 24-month leadership development program is a decade old and offers training primarily via distance learning, although there is also an intensive, weeklong leadership development retreat.

[24]National Public Health Leadership Institute, October 2001, <http://www.phli.org.

RESEARCH DESIGN AND METHODS

The purpose of our survey was to collect information about the PHLD position as it exists currently, and how it will likely change over the next five years in response to sweeping changes in public health that signal the need for directors with more management, leadership, and public policy experience.

A total of 308 surveys were distributed to state PHLDs or managers, county/city PHLDs or managers, and county/city health officials. Our core focus for this assessment was current PHLDs, primarily those who are active members of APHL. Of the 308 surveys sent, 129 went to APHL members, including state and territorial laboratory directors (i.e., PHLDs from American Samoa, Puerto Rico, Northern Mariana Islands, and the Virgin Islands), county/city laboratory directors, laboratory managers, and retired state laboratory directors. Of the remaining surveys, 142 were sent to a random sample of the 120 largest[25] county/city health departments and their respective laboratory directors, and 37 went to county/city laboratory directors from the state of California.

A total of 78 useable responses were received, generating an overall response rate of 25%. The respondents included 83% of the nation's state and territorial laboratory directors, 24% of the county/city laboratory directors sampled for the study, and 6% of APHL members targeted for the study. As is common among voluntary self-administered surveys, results may not be representative of the full national population of state and local PHLDs because of relatively low and differential rates of response. Nonetheless, the respondent sample reflects the diversity of institutional settings and professional backgrounds that currently exist in the field of public health laboratory administration.

[25]Population is greater or equal to 500,000.

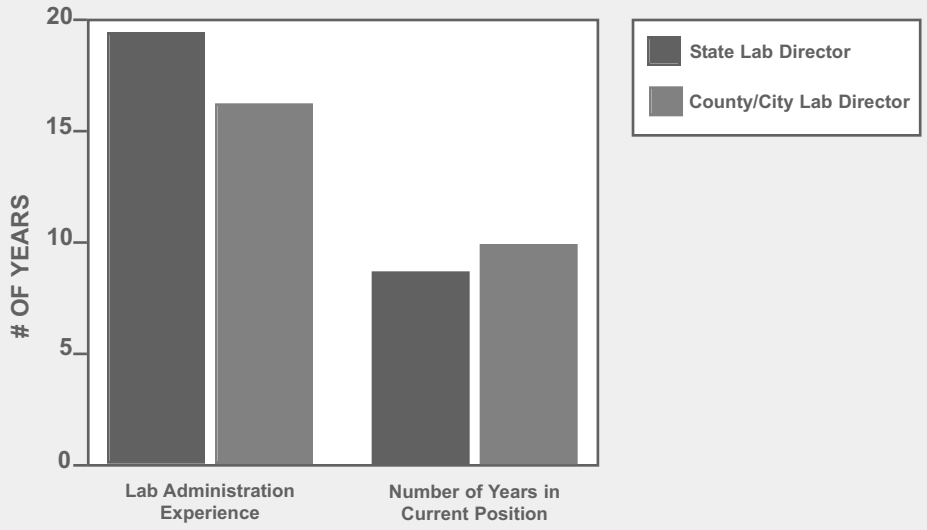
RESULTS

Current Workforce Characteristics and Skills

The typical current PHLD has acquired considerable experience and tenure within the profession. State directors have an average of 20 years experience in laboratory administration and 10 years tenure in their current position, while local directors have 17 years of experience and 11 years of tenure, on average (Table 1). Approximately two-thirds of state directors occupy positions for which a doctorate is required, whereas one-third of local directors have this job requirement. A majority of state laboratory directors (58%) have achieved board certification from a professional association recognized in the field of laboratory science, and a majority of local directors (54%) have attained CLIA certification.

Table 1.

Comparison Chart of Laboratory Administration Experience and Directorship Tenure



Most PHLDs occupy positions that are covered by civil service or merit-based government personnel systems. Directorships are filled through political appointments in only a minority of cases (8%), and state directors are more likely than local directors to attain their positions in this way (Table 2). Unsurprisingly, state directors oversee organizations that are considerably larger in capacity than their local counterparts. On average, state directors

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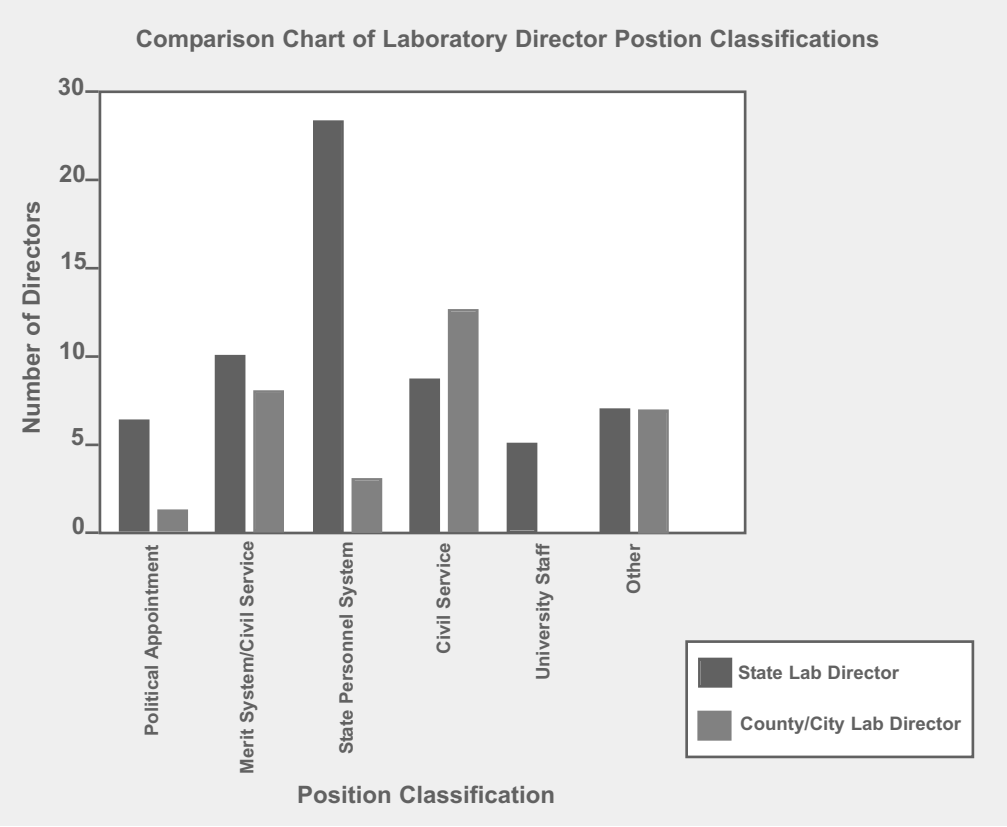
oversee a staff of 108 full-time equivalent positions and an annual budget of $11.6 million, whereas local directors manage a staff size of 27 and a budget of $1.8 million. Approximately one-third of laboratory directors oversee organizations that operate branch laboratories. Although reporting relationships vary substantially across states and localities, laboratory directors are more likely to report directly to a state or local health official (44%) than to any other category of government administrator.

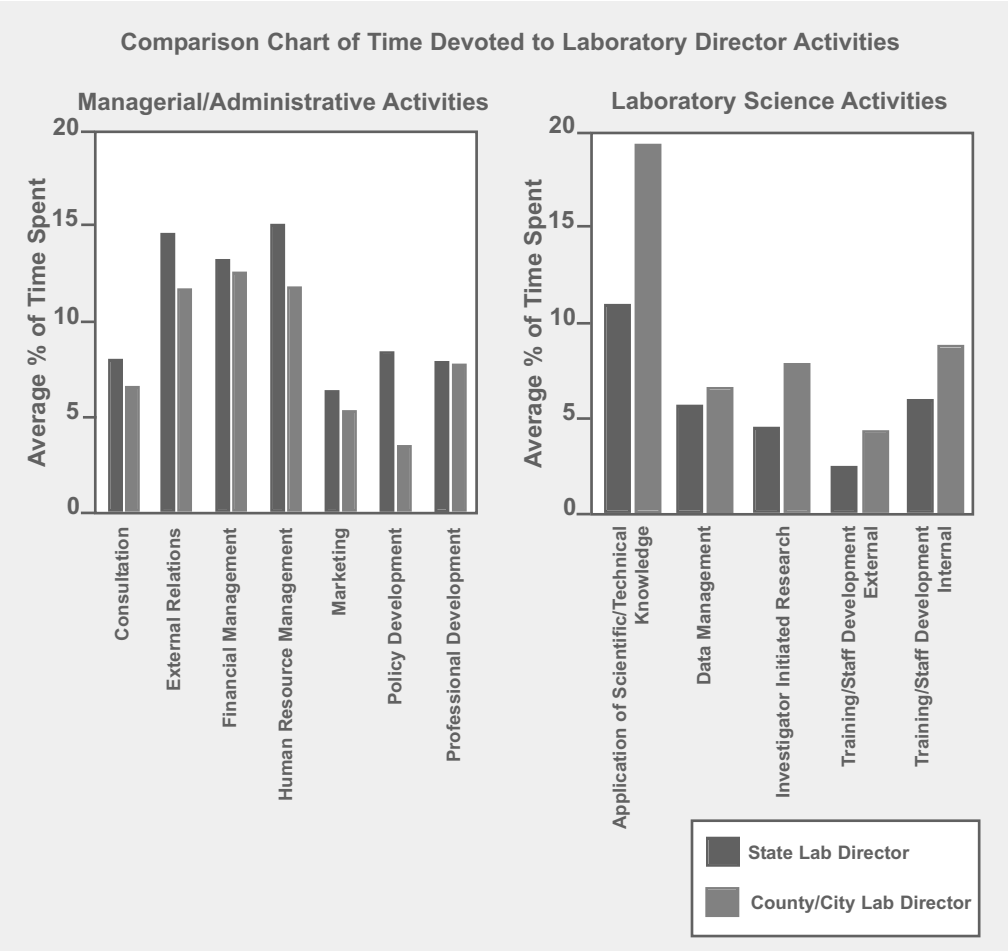
Table 2.



Directors devote an average of 66% of their time to activities considered primarily managerial and administrative in nature...

The scope of activities performed by public health laboratory directors extends to both scientific and administrative endeavors, but it is heavily weighted toward managerial responsibilities. Directors devote an average of 66% of their time to activities considered primarily managerial and administrative in nature, compared with 34% of time spent on activities related to the practice of laboratory science (Table 3). State directors appear to devote more time to managerial activities than do their local counterparts, particularly to managing human resources and maintaining external relations with constituents. By comparison, local directors spend more time on activities requiring the application of scientific and technical laboratory knowledge, such as quality assurance, laboratory safety, and investigator-initiated research.

Table 3.



Contemporary laboratory directors draw on a broad set of skills and knowledge to perform their job responsibilities. With regard to laboratory science skills, directors indicate that competencies in microbiology, bacteriology, and mycobacteriology are most important to their job performance, while competencies in hematology, cytology, and pathology are least important. As for technical skills, directors indicate that knowledge of laboratory regulations, laboratory standards and procedures, and laboratory safety procedures are of highest priority. Respondents considered research interpretation skills to be much more important than statistical analysis skills for the current job responsibilities of laboratory directors. Among the set of management and leadership tools used in laboratory administration, directors consider skills in communication, technology change management, and problem-solving to be most important.

Changes in Scope of Practice

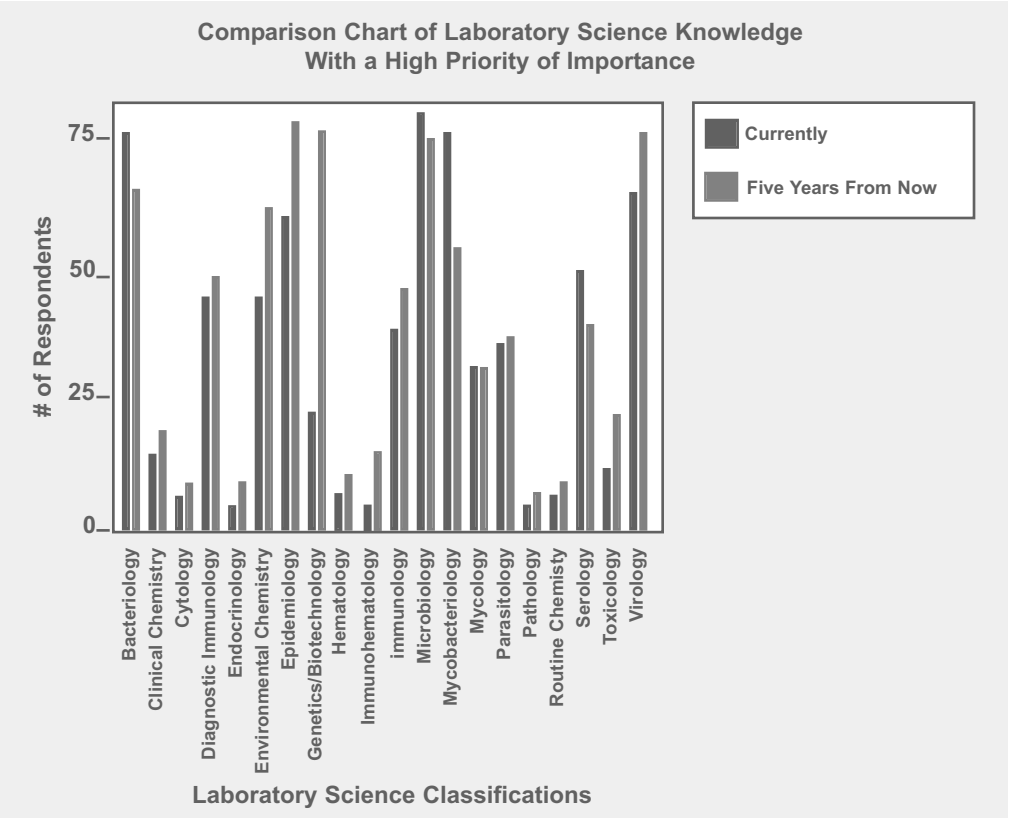
Respondents anticipate significant changes to the scope of practice among PHLDs over the next five years. Respondents identified an array of developments, including:

- The growing need for laboratories to contribute to population-based sur veillance and epidemiological monitoring activities.
- The need for laboratories to develop additional capacities in the investi gation of emerging infectious diseases and in bioterrorism preparedness.
- An increasingly diverse set of constituencies with whom laboratories must interact, including the medical community, private industry, acade mia, and policy-makers.
- The need for laboratories to assume larger roles as sources of reference, consultation, and information dissemination for other public health organ izations.
- The growing imperatives for laboratories to address issues of information privacy, confidentiality, bioethics, and public health law.

...directors practicing five years from now will devote more time to developing external relations with constituents, developing public health policy through interaction with legislators and regulators, and marketing and outreach activities that promote laboratory services.

In light of these developments, several managerial activities currently performed by laboratory directors are expected to take on added importance. Respondents indicate that directors practicing five years from now will devote more time to developing external relations with constituents, developing public health policy through interaction with legislators and regulators, and marketing and outreach activities that promote laboratory services (Table 4). Both state and local laboratory directors indicate the need to devote additional time to these activities over the next five years. At the same time, respondents expect that directors practicing five years from now will devote less time to activities involving the application of scientific and technical knowledge, such as quality assurance initiatives and laboratory safety activities. Similarly, respondents indicate that directors will devote less time to both internal and external staff development activities.

Table 5.



Among managerial and leadership skills, those most frequently cited as likely to take on added importance to laboratory directors over the next five years are marketing and outreach, communication skills, entrepreneur-ship, mentoring, and workforce development.

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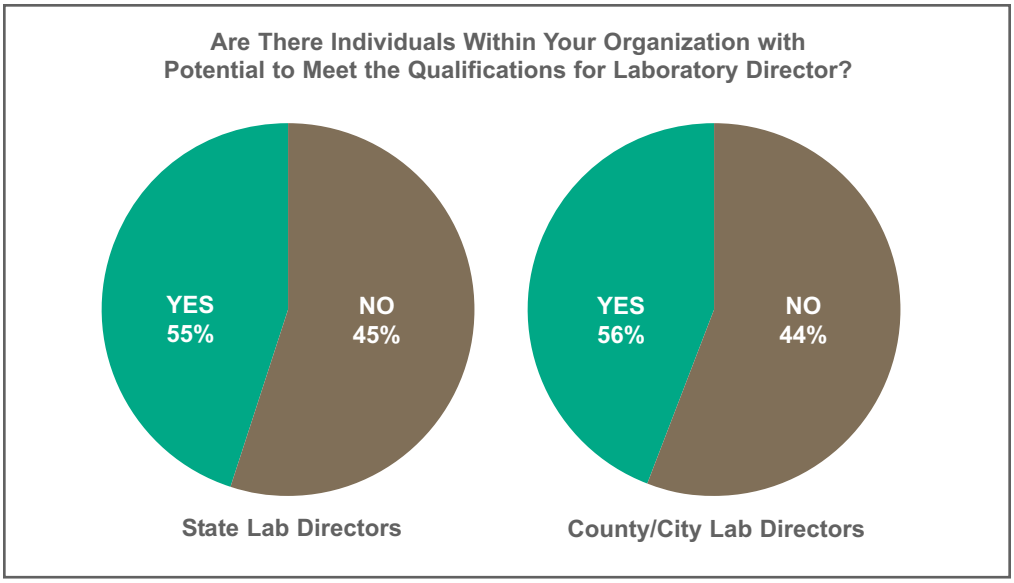
Recruiting and Training the Future Workforce

State laboratory directors anticipate that an average of 13 vacancies in state PHLD positions will emerge over the next five years. The candidate pool of PHLDs to fill these vacancies is expected to originate from a variety of institutional settings. More than half of state and local laboratory directors indicate that future candidates for the directorship currently exist within their laboratory (Table 6). Those most frequently reported to be future directorship candidates are middle managers in state laboratories (56.6%), recent doctoral graduates (29.5%), and clinical laboratory personnel (34.6%).

Table 6.



Current laboratory directors are not optimistic about the adequacy of the candidate pool that will be available to fill future vacancies in directorships. More than two-thirds of the directors indicate that this candidate pool either is not adequate or only marginally adequate in size to meet the future demand for directors. Only about half of the respondents rate the quality of the candidate pool as fully adequate or adequate. Respondents identify two pressing barriers to recruiting adequate candidates: (1) the ability to offer sufficient salary to compete for qualified candidates; and (2) CLIA provisions that force organizations to exclude good candidates because they do not meet formal education requirements (e.g. doctoral degree and board certification) or experience requirements (e.g. management experience, technical experience). These recruitment barriers are encountered in both state and local laboratory settings, but are viewed as most severe at the local level.

Formal degree programs and on-the-job training are generally viewed as the two most effective education and training modalities for the acquisition of knowledge and skills needed by future PHLDs. Most respondents consider degree programs the most effective mechanism for acquiring the technical, analytical, and epidemiological skills needed by future laboratory directors. However, they cited on-the-job training as most effective to teach leadership and managerial skills, such as strategic planning, financial management, and human resources management. Nonetheless, most respondents anticipate a decline in the amount of time directors devote to training and staff development activities over the next five years.

Most respondents consider degree programs the most effective mechanism for acquiring the technical, analytical, and epidemiological skills needed by future laboratory directors. However, they cited on-the-job training as most effective to teach leadership and managerial skills, such as strategic planning, financial management, and human resources management.

CONCLUSIONS:
STRATEGIES TO MEET FUTURE LEADERSHIP NEEDS

Survey results confirm that the nation's public health laboratories face important challenges as they seek to meet future leadership needs. The scope of work performed by public health laboratories and their directors is complex and evolving. In the midst of these changes, laboratories face an impending shortage of qualified candidates to fill their top leadership positions. Candidates can acquire the knowledge and skills needed to prepare for future laboratory directorships through a combination of formal degree programs and on-the-job training. It appears far from certain, however, that sufficient numbers of candidates can acquire the necessary skills through existing educational and job experiences in time to fill the leadership vacancies now looming on the horizon.

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In view of these challenges, public health laboratories need new strategies to accelerate the acquisition of vital scientific, technical, and managerial skills by future leadership candidates. Recognizing the ongoing importance of formal degree programs and on-the-job training, these new strategies must build on the knowledge and skills acquired through these experiences. Findings from this study indicate that at least four core elements are critical for the design of educational programs for PHLDs:

Targeting a Diverse Pool of Candidates

Promising PHLD candidates exist in a variety of institutional settings and have a variety of educational and professional experiences. An ideal education and training program must meet the needs of a diverse candidate pool. At a minimum, the training program should target (1) recent graduates of graduate programs relevant to laboratory science; (2) practicing middle managers in public health laboratories; and (3) practicing managers in clinical laboratories. This recruitment strategy implies that the education and training curriculum be designed to provide a diverse target population with a common conceptual and methodological foundation in the practice of public health laboratory science.

Emphasizing Emerging Scientific Disciplines and Their Intersection

The scientific disciplines and technologies relevant to public health laboratories continue to expand rapidly as new public health threats emerge and new technologies and applications are developed. The growing importance of disciplines such as environmental science, epidemiology, genetics, and virology is particularly notable for the public health laboratory profession. An ideal education and training program for laboratory directors will therefore provide exposure to emerging scientific disciplines and methods, and cultivate an understanding of how these seemingly diverse bases of knowledge intersect in laboratory practice. Moreover, the training program should emphasize multidisciplinary strategies for organizing and conducting laboratory research and investigation in public health. Strategies for communicating across scientific disciplines must be a particularly important component of the curriculum.

For an educational program to address the leadership gaps now looming on the horizon for public health laboratories, it must enable candidates to acquire the necessary knowledge and skills through an accelerated process that is grounded in the application of skills within current and emerging practice settings.

Emphasizing Skills for Reaching External Constituencies

Public health laboratories must interact with an increasingly diverse set of constituencies in order to fulfill their core mission. These constituencies include public health organizations at all levels of government, medical care organizations, business and industry, clinical and commercial laboratories, legislative and regulatory policy makers, and community-based organizations. Laboratories interact with these constituencies not just when designing and fielding laboratory-based investigations, but also when (1) disseminating laboratory findings and explaining their implications to relevant stakeholders; (2) providing education and informational resources around laboratory issues; and (3) securing the resources and expertise needed to maintain and develop laboratory infrastructure. An education program for laboratory directors should emphasize the specialized management and leadership skills necessary to work with such diverse constituencies for such varied purposes. These skills should include marketing and outreach, communications, entrepreneurship and strategic management, coalition building, and inter-organizational and intergovernmental relationship management.

Emphasizing Accelerated Learning and Application

For an educational program to address the leadership gaps now looming on the horizon for public health laboratories, it must enable candidates to

acquire the necessary knowledge and skills through an accelerated process that is grounded in the application of skills within current and emerging practice settings. This will require partnerships between educational institutions and public health laboratories, so that instruction and formal learning experiences are reinforced by ongoing application within the field of practice. The educational program should combine traditional educational strategies with advanced distance learning modalities in order to create learning opportunities at the site of practice. This strategy will also enable the educational program to better reach practicing public health professionals who are an important component of the candidate pool.

Unfortunately, the horrific terror attacks of September 11, 2001, and a subsequent spate of unexplained anthrax cases have underscored the need for not merely competent, but expert stewardship of the nation's public health laboratories. In the wake of these tragedies, and amidst fears of new biological, chemical, or radiological attacks, lab directors face fresh challenges. They must take precautions to protect their staff and their laboratories, now possible terrorist targets. They must muster the scientific and technological expertise necessary to analyze and safeguard specimens containing potentially exotic or lethal agents. They must deal with an array of new external constituencies, ranging from the news media to the Federal Bureau of Investigation. And they must undertake all of these actions in the face of intense public and time pressure.

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In fact, the situation is a real-life, high-stakes case study demonstrating the vital importance of appropriately trained laboratory directors. A capacity for sound laboratory management, technical knowledge, adaptability, leadership, and communications and policy skills have never been more urgently needed in the few hundred men and women who head the nation's PHLs. Yet, a recent U.S. General Accounting Office report confirms a general concern about laboratory staffing, concluding that "reductions in public health laboratory staffing and training have affected the ability of state and local authorities to identify biological agents."

If uncorrected, staffing and training deficiencies will increasingly hamper efficient laboratory operations. On the other hand, rapid implementation of the strategies outlined above will help to ensure that the United States maintains a highly trained cadre of individuals who are capable of running the nation's labs; individuals who will respond ably and swiftly to the unforeseen public health threats of the future.

[26]US General Accounting Office. Bioterrorism: Federal Research and Preparedness Activities. Washington, DC: GAO-01-915; September 2001.