Public Health Laboratories in an Age of Austerity

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The public health laboratory (PHL) system in the United States is composed of a web of local, state, and federal facilities that provide a broad scope and level of services. Supporting the workforce of the PHL network is particularly challenging due to the impact of the economic downturn, as well as pre-existing workforce shortage issues. This paper will address the composition of the U.S. PHL system and explore the sources and impact of workforce challenges.

The National Association of County and City Health Officials (NACCHO) estimated that in 2010 there were approximately 760 laboratories in local public health agencies in the United States (NACCHO, 2010). Depending on the state’s public health structure, these local PHLs can operate independently from the state public health laboratory (SPHL) or act as a local or regional affiliate of the state public health agency. There are many models of affiliations between state and local laboratories, ranging from complete financial and regulatory dependence to informal relationships. Local PHLs tend to provide testing that supports direct services for residents of the jurisdiction. Drinking-water testing and sexually transmitted disease (STD, e.g., chlamydia, gonorrhea, syphilis) and HIV screening are typical of the testing offered in local PHLs. Local needs and priorities may also lead to provision of other testing services, such as blood lead screening, substance abuse monitoring to support treatment programs, and detection of bioterrorism agents in environmental samples and isolates from humans. Funding for local PHLs comes from local and state revenues, federal funding passed through state public health agencies, or direct funding through fees for service (Inhorn et al., 2010).

The Association of Public Health Laboratories (APHL) has defined the 11 core functions of the 50 SPHLs (APHL, 2000). The core functions illustrate the increased complexity and broad scope of services and functions provided or assured by SPHLs, as compared with local PHLs. Serving as a statewide testing resource, SPHLs have responsibilities for surveillance, outbreak investigation, and screening for public health programs. Additionally, SPHLs serve as hubs in state systems of clinical, commercial, and local PHLs by convening public health testing partners and coordinating and ensuring the quality of public health testing performed throughout their jurisdictions (Inhorn et al., 2010). For example, SPHLs offer drinking-water testing and, as designated by the U.S. Environmental Protection Agency, monitor the quality of drinking-water testing in local public health and commercial laboratories. Funding for SPHLs comes from a variety of sources and the contribution of each source depends on the services and priorities of the SPHL. State tax revenues, federal funding in the form of cooperative agreements and grants, nongovernment research grants, and fees for service are common sources of funding.

Like state public health laboratories, federal laboratories serve as a source of reference-level testing, develop and vet new technologies and assays, and serve an essential coordination function by providing funding and technology access to the SPHL system. Funding at the federal level comes from the federal government but can be complicated by diverse federal funding streams and congressional restrictions on use of funds.

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1 Participant in the Forum on Microbial Threats symposium “Sustaining Public Health Capacity in an Age of Austerity.”
FINANCIAL CHALLENGES

The economic recession of 2008-2010 has had an impact on state and local public health funding. The Association of State and Territorial Health Officials and NACCHO reported a decline in funding for local public health activities. This decline is due in part to deficient state and local tax revenues resulting from loss of taxpayer jobs and income tax revenues and loss of homeowner and business property tax payments due to foreclosure, property abandonment, relocation, and payment delinquency. This decreased funding has resulted in loss of public health jobs due to layoffs and attrition, program cuts and reductions, and employee furlough (ASTHO, 2011; NACCHO, 2012). Michigan and other states hit early and hard by the recession have weathered longer and deeper financial challenges. Federal cooperative agreement funding to states has declined alongside state budgets, especially in programs like emergency preparedness and emerging infectious diseases, for which states are reliant on the federal support.

According to an APHL survey, PHL funding decreased by an average of 2 percent from 2007 to 2010. Although this overall decrease is not alarming, it represents a change in funding structure. State and local funding decreased by averages of 40 percent and 11 percent, respectively, during this period (see Figure 1), while revenues from fees and other sources increased by an average of 15 percent. Expansion of state newborn screening (NBS) programs, which are largely fee-supported, is a likely source of this increase. In hard-hit states, the declines were more drastic. For example, in 2010 Michigan’s SPHL was dealt the blow of a 20 percent cut in state funding during 1 fiscal year. This was following several years of less drastic but still significant state funding cuts (personal observation).

Decreases in federal, state, and local funding have not been the only source of financial challenges to the PHL system. Budgets woes in state and local PHLs have been exacerbated as administrators, like other employers, face the increased demands of supporting the cost of employee health insurance and other benefits. In attempts to control budgets, state and local governments have incentivized retirement. Although this measure has had the intended effect of eliminating the highest-paid employees, many of these vacated positions have not been approved to be filled. The result is loss of the most experienced, expert employees and additional burden of work for remaining employees. In Michigan, the SPHL lost more than 300 years’ worth of employee experience over the course of 3 months in 2010-2011.

During this period of austerity, the PHL system faces the perennial challenge of maintaining and replacing outdated, inefficient equipment. Especially at the SPHL level, the test menu requires sophisticated equipment that is expensive to maintain and replace. In efforts to preserve services, equipment budgets, along with travel, were some of the first places public health administrators made cuts, making laboratories increasingly dependent on federal cooperative agreements for equipment purchase and replacement. Although clinical or commercial laboratories can amortize equipment investments into fees, such an option may not be available to PHLs due to legislation or policy restrictions.
FIGURE 1 Overall funding to state and local public health laboratories decreased by only 2% during the economic downturn from 2007 to 2010. Funding from state and local revenues declined while fee revenues increased, indicating a greater reliance on self-funding of public health laboratories. Source: APHL funding survey 2010.

WORKFORCE CHALLENGES

In addition to fiscal strains on the PHL system, workforce shortages are a challenge for administrators in meeting service and function demands. The public health workforce pool, especially at the testing personnel level, is shared among public health, clinical, and commercial laboratories. Although the U.S. Bureau of Labor Statistics predicts 15 percent growth in need for clinical laboratory scientists (CLSs) between 2010 and 2020 (BLS, 2011), the traditional education and training pipeline is not producing enough graduates to meet the current need, let alone the predicted need. The limiting factor for educating CLSs is not lack of interest in the field, but lack of positions in clinical training sites. Without internship opportunities, laboratory science students are either unable to graduate or graduate without eligibility to sit for the certifying examination (personal communication, K. Doig, Michigan State University).

Additionally, the average age of a CLS is >50 years, and a large part of the current laboratory workforce is expected to retire within the next 5 years (Garcia et al., 2011), exacerbating an already challenging situation for employers (although the exodus of experienced employees may be delayed as employees postpone retirement to earn back investments and property value lost during the recession).

PHLs face challenges in recruiting managers with the education, training, and skills needed to lead a PHL. As in any laboratory performing testing on human specimens, PHL directors must hold a doctorate in a relevant field and be certified to direct a high-complexity laboratory by a Clinical Laboratory Improvement Amendments–approved program. Certification usually requires passing an examination, with or without a prerequisite postdoctoral program. A successful public health director must have additional expertise in quality-management systems, epidemiology, human resources management, government financing, and budgeting. PHL
directors also must be knowledgeable in multiple scientific fields, including microbiology, chemistry, and environmental science (DeBoy et al., 2010). There are no academic institutions in the United States that grant doctorates in a PHL practice and leadership curriculum that covers the scientific, public health, and laboratory management expertise required to be a successful PHL director. Therefore, public health agencies must compete with the broader laboratory community for board-certified directors. However, competition is limited because clinical and commercial laboratories can often offer higher salaries, more advanced research facilities, and other incentives unavailable in most public health settings.

EMERGING HEALTH THREATS AND DEMANDS ON PHLs

The mission of PHLs requires that they are both ready and able to provide testing needs for ongoing public health issues and programs and prepared to respond to emerging health events and threats. The PHL workload is often difficult to predict in terms of volume and test menus (Inhorn et al., 2010). For example, the 2009 influenza pandemic, the severe 2012-2013 flu season, fungal meningitis, and pertussis surges caused increased testing demands in recent years. While these health emergencies were unfolding, public health laboratories were enduring funding cuts and dealing with vacancies in technical and management positions. Unlike in commercial or clinical laboratories, test volume increases in PHLs do not come with increased revenues. In fact, recently the opposite has been the case.

Preparedness to respond to public health emergencies requires an investment in facilities, equipment, and trained personnel. Facilities must be flexible in function and have adequate biosafety and security levels. These specialized facilities will often have a dual routine use. For example, Biosafety Level 3 laboratories are used for routine tuberculosis culture and arbovirus testing, but can be converted for the testing of suspicious white powders in the event of a bioterrorism threat. Bioterrorism environmental sample receipt areas, in turn, may be used for routine bacterial identification. Equipment for any scenario must be in the laboratory and personnel must be trained and competent to operate the equipment prior to any event, or response will be delayed. In Michigan, the SPHL was able to provide biomonitoring of fish species in the Kalamazoo River after the July 2010 Enbridge Oil spill, which was second in scope only to the Gulf of Mexico Deep Water Horizon spill. This response was facilitated by the Michigan SPHL’s ongoing work with the state departments of Environmental Control and Natural Resources in monitoring sports fish species. When pandemic influenza A emerged in 2009, many PHLs were already using the necessary equipment and test methods and similar reagents for other testing needs. Commercial and clinical laboratories that undertook this testing de novo were delayed by the necessity of procuring equipment and training personnel before validation of testing could be initiated. However, this kind of investment in PHLs is resource-intensive, and federal funding to maintain preparedness continues to dissipate. For example, the state-funded, eminent mycology laboratory of the Michigan Department of Community Health was defunded in 2011. The state laboratory has therefore been unable to support testing required in the investigation of an ongoing outbreak of fungal meningitis (CDC, 2013), despite Michigan’s having more cases than any other state in this nationwide outbreak. Specimens must be transported and tested at the Centers for Disease Control and Prevention (CDC) in Atlanta, resulting in delays in diagnosis confirmation and stalled progress in investigation and intervention.
Medical and laboratory diagnostic technology advances have resulted in an explosion in the NBS disorder menu in state programs throughout the United States. The Uniform Screening Panel of the Secretary’s Advisory Committee on Heritable Disorders in Newborns and Children now recommends a panel of 31 core disorders and 25 secondary disorders. Candidate disorders continue to be vetted by a rigorous evaluation procedure for inclusion in the panel (HRSA, 2013). Two of the most recently added disorders to the panel, cystic fibrosis and severe combined immunodeficiency disorder, have been challenging for state NBS laboratories to initiate testing. These disorders require molecular testing that is demanding on facility space and design and requires technical expertise not routinely present in NBS laboratories. SPHLs must identify the resources to offer these tests because NBS laboratories are funded by either state revenues or fees. Increasing the fees to supported expanded NBS often requires state legislative or advisory group approval. In a period of government austerity, the need for and benefit of increasing these fees is particularly challenging for PHL leadership. The federal government provides assistance with quality assurance.

State and local public health agencies have increasingly funded testing beyond newborn screening and in some cases complete laboratory funding on fees collected from Medicaid and other insurers. This is a strategy that will become even more essential as PHL clients transition to Medicaid coverage under the Affordable Care Act (ACA). Billing capabilities, including the ability to bill third-party insurers, must be developed in many PHLs. The future role of the public health clinic is still unknown. As public health clinic clients acquire Medicaid coverage, it is still unclear if these clients will seek care in other settings or continue to rely on public health clinics. PHL administrators will need to determine the long-term viability of fee revenue dependence. In addition to the uncertain continued sustainability of fees to support PHLs, it is already clear that some of the core functions of SPHLs are not reimbursable services. Testing services like microbial strain genotyping and home environmental assessments for lead are essential for public health investigations and interventions, but do not contribute to patient care and thus are not reimbursable by Medicaid or private insurers.

**PHL RESPONSES TO THE CHALLENGING FISCAL ENVIRONMENT**

The PHL system is accustomed to change. Technology, microbes, and public health program needs constantly evolve. The system is adept and experienced with quality-improvement efforts to improve services and increase efficiencies. The PHL system has applied diverse strategies to adapt to the realities of shrinking funding while facing increased testing expectations and workforce shortages. Evidence of the shrinking workforce was reported by APHL. One hundred nine PHLs reported that they lost funding for an average of 9, but up to 30 positions between 2008/2011 (APHL survey data). The Centers for Disease Control and Prevention Laboratory Science Policy and Practice Program and APHL are partnering through the Laboratory Efficiencies Initiative (LEI) to provide PHLs tools to meet the challenges of sustaining capabilities and quality through laboratory networks. Below are listed some of the strategies that have been used by the PHL system to do more with less, do the same with less, or do less with less (APHL, 2013).²

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² [http://www.aphl.org/aphlprograms/lss/Laboratory-Efficiencies-Initiative/Pages/About-LEI.aspx](http://www.aphl.org/aphlprograms/lss/Laboratory-Efficiencies-Initiative/Pages/About-LEI.aspx)
Laboratory Closures

In some situations entire laboratories were closed by public health agencies. The Michigan Department of Community Health closed the Upper Peninsula Branch Laboratory in Houghton. This facility provided regional rabies, bioterrorism, drinking-water, and STD testing. Many of these functions were transferred to the state’s main PHL in Lansing. Transport of specimens from this Upper Peninsula region to Lansing requires overnight shipping by a single service and is not available on weekends. This means that a rabies exposure that occurs on a Friday will not have test results until Monday afternoon at the earliest, resulting in possibly unnecessary use of expensive and limited-reserve rabies vaccines. The impact of loss of local drinking-water and other public health testing services has not been studied.

The City of Detroit, which has multiple financial challenges in addition to the recession, transferred all public health functions from a city government department via a contract with the Institute for Population Health in a drastic effort to control spending. During this restructuring, the Detroit PHL was closed. Only a few point-of-care tests are now offered. In part, this was based on the decision to discontinue city-supported primary health care clinics, which eliminated the need for some testing capacity. But other public health testing, including confirmation of suspect bioterrorism agents, was transferred to the SPHL, 90 miles away.

These two examples provide a picture of a system with growing gaps. The vast distance between Michigan’s Upper Peninsula region and the state laboratory in Lansing constitutes a geographical gap. The population center of Detroit—where STD rates are the highest in the state, where emerging infections are more likely to spread quickly, and where environmental hazards have emerged—is left relying on the availability of the already resource-strapped SPHL. The elasticity and flexibility of these emerging laboratory systems will be tested. The results of this evolution should be studied to determine if the new model of service delivery has impacted public health and health care outcomes.

Service Cuts

In less draconian measures than closing entire laboratories, public health agencies have identified services for discontinuation. In situations where these cuts have occurred, local priorities and decision-making models were used. APHL surveys indicate that discontinuation of services is a strategy used by many states. The most common discontinued services include parasitology and mycology reference testing and training.

As described above, the Michigan Department of Community Health discontinued mycology laboratory services, parasitology, and some STD testing. The decision was based on input from public health programs, reliance on the state laboratory for identification of infectious diseases which must be investigated and controlled by public health authorities and alternate availability of services. After reviewing all services, these testing services were determined to have the least impact on statewide public health (albeit still a substantive impact).
Billing for Services

Collecting fees is a finance model that is not new to public health laboratories. Many states support NBS systems through fees. These fees from birthing hospitals or attendants are commonly collected prior to initiating testing, which does not require a comprehensive billing system and makes financial resources available before or at the time of testing. An emerging revenue stream for PHLs is billing for services after testing is completed. In order to be successful at this, PHLs must develop billing capacity and forge relationships with managed care organizations and other third-party insurers. When testing for diseases like HIV or other STDs, where there is considerable privacy concerns, public health providers are challenged by insurers’ policies to send an explanation of benefits (EOB) to the primary insured person. If this person is a parent, partner, or spouse of the client undergoing testing, the EOB can undermine the trust between the client seeking care and counseling and public health personnel. Additionally, insurers do not reimburse for testing not directly related to their clients’ care or core services that are not testing, e.g., applied research, training and education, and laboratory system quality improvement. Therefore, these bills are submitted to public health programs or are supported with state or local revenues. In some systems, the PHL only provides services that are reimbursed or are supported by federal grants. Although this alleviates the demands on state and local agencies to fund laboratory services, it provides no options to address local laboratory system priorities and stymies innovation.

Delaying Investments

Like other administrators faced with difficult budgeting decisions, public health laboratory leaders have delayed important investments. After the 2001 anthrax attacks in the United States, there was a flurry of PHL investment when it became evident that this important link in national security was operating in antiquated and unsafe facilities. Now that that sense of urgency has passed, facility maintenance, renovation, and construction have been delayed or cancelled, despite the need for upgraded facilities to support current and emerging laboratory technologies.

Similarly, plans for laboratory equipment purchases and maintenance contracts have been deferred until budgets can be restored or end-of-fiscal-year reserves can be allocated for purchases. Managing in this way is not consistent with the goal of developing and implementing capital investment plans that are based on obsolescence and harnessing new technologies to address public health problems.

Budgets for training and education are a final example of the way in which public health administrators have adjusted budgets to lower revenues. In some jurisdictions, entire governments are prohibited from travel regardless of the purpose of the meeting or the source of funding. Fortunately, federal cooperative agreements can support travel and registration at laboratory learning conferences. Webinar and Internet conferences are used to continue to provide access to learning opportunities.
Performance Improvement

Quality improvement is well-established practices in PHLs. Laboratory regulations require a quality-management system that includes quality-improvement policies and activities to identify and correct problems. PHLs are pushing improvement activities by adopting aggressive Lean techniques and tools. The increasing demands on employees being asked to "do more with less," require that testing systems operate at optimal efficiency to avoid compromises in quality standards and client expectations. In Michigan, data-accessioning and specimen-handling employees and clients completed a quality-improvement project that resulted in a redesigned workspace and enabled the employees to maintain and improve efficiency despite not filling a vacant position.

Workforce

The PHL community is addressing the challenge of competing for qualified candidates from a shrinking pool of qualified laboratory professionals. DeBoy et al. (2010) concluded that the lack of recognizable and transferable job titles, qualifications, duties, and career pathways was contributing to recruitment and retention challenges in the PHL workforce. They proposed common terminology to describe standard job classifications and facilitate equitable compensation across the PHL system.

The PHL system faces particular challenges in recruiting, preparing, and retaining laboratory leadership. The expertise in regulatory requirements, laboratory and public health sciences, and management required to act successfully at the director level requires extensive education and experience. Competing for director candidates requires creativity, because competitive salaries and signing packages are not widely available in government employment systems. There are no doctoral programs that specifically educate PHL directors. PHLs have confronted this challenge by hosting postdoctoral fellows, thereby providing exposure and opportunities to integrate and commit to public health. Doctoral scientists without all the needed qualifications for a director position are hired and provided opportunities to gain other skills and abilities on the job. The American Board of Bioanalysis offers a high-complexity laboratory director qualifying examination for public health microbiologists. At this time, there are no opportunities for public health chemists or environmental laboratory doctoral scientists to earn the director qualification.

SUMMARY AND CONCLUSION

Lean is a set of principles for quality improvement derived from the Toyota Production System. Originally disseminated in other manufacturing industries, healthcare organizations, especially laboratories, are increasingly embracing Lean as a quality improvement strategy. The goal of Lean is to reduce errors and increase efficiencies and quality by identifying and eliminating resource waste, organizing work areas to promote safety and efficiency, reducing errors and streamlining processes. A variety of Lean techniques are used, e.g., Six Sigma, Kaizan, in an iterative cycle of assessment, implementation, measurement of improvement and revision of implementation.

(Jason A. Coons. Beginning the Lean Improvement Journey in the Clinical Laboratory. Retrieved 4/30/2013 from ijent2.org)
Public health administrators are aware of and chagrined by the future impact of budgetary choices they have been forced to make. The new PHL system looks different today, because there are fewer laboratories and different services. But this should be considered evolution, rather than a road to extinction. In order to remain relevant, the PHL system will need to collectively determine the most efficient and responsive ways to deliver services and fulfill all core functions. Although the PHL system faces the unknown impact of the ACA, continued economic struggles, and a shrinking workforce, it has already started to develop tools and perspectives to adjust and thrive in the new reality. The changing system should be studied while it is in flux; impacts on the broad health care and public health communities should be documented and disseminated as best practices or avoided if unsuccessful. Adequate funding and support for the activities of the CDC/APHL LEI partnership and PHL system commitment and tenacity will provide the vision and structure of the future PHL system.

REFERENCES


