



PUBLIC HEALTH LABORATORIES: DIMINISHING RESOURCES IN AN ERA OF EVOLVING THREATS



THE ASSOCIATION OF PUBLIC HEALTH LABORATORIES

The Association of Public Health Laboratories (APHL) is a national non-profit organization dedicated to working with members to strengthen governmental laboratories that perform testing of public health significance. By promoting effective programs and public policy, APHL strives to provide member laboratories with the resources and infrastructure needed to protect the health of U.S. residents and to prevent and control disease globally.

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EXECUTIVE SUMMARY

The Association of Public Health Laboratories (APHL) works to assure that state and local laboratories serving the public's health have the resources and infrastructure to protect the health of U.S. residents and to prevent and control disease globally. On an annual basis, APHL assesses the ability of state public health laboratories (SPHLs) to respond to various types of emergencies, including biological, radiological or chemical terrorism as well as other public health events whether natural or accidental. This annual survey documents the contributions that SPHLs have made since the establishment of the Centers for Disease Control and Prevention (CDC) Public Health Emergency Preparedness (PHEP) Cooperative Agreement¹. In 2009, as in previous years, the survey was distributed to public health laboratories in all 50 states, the District of Columbia (DC) and Puerto Rico.

State public health laboratories serve on the front line of our public health preparedness and response system. Their value was clearly demonstrated during the 2009 Influenza A H1N1 pandemic, an event that required all components of our public health system to work together to detect, diagnose, and respond to the outbreak. Further, on a daily basis SPHLs are testing "white powder" letters sent to political officials, other environmental samples and

clinical specimens for threat agents. SPHLs performed effectively despite diminishing resources that continually challenge their capabilities.

This report addresses a number of challenges faced by SPHLs:

- Funding for laboratory preparedness continues to decline and is insufficient to sustain preparedness and response to emergencies.
- Resources to recruit, hire, retain and train a skilled and dedicated workforce are severely lacking.
- The combination of funding and staffing issues makes it difficult to bring new technologies and maintain existing instrumentation. Further, these funding shortages contribute to laboratorians being unable to attend trainings, national meetings and conferences.

Even with these challenges, SPHL's have had a number of successes, such as:

- Effective collaboration with partner organizations to provide training and conduct laboratory exercises.
- Partnerships to meet the surge requirements due to the 2009 H1N1 outbreak.
- Regional cross-border collaborations to share testing burden during emergencies and early warning surveillance data.

Declining funds coupled with growing responsibilities pose a significant threat to our nation's security and demands action. APHL calls for increased designated preparedness funding for SPHLs to ensure that the capability to execute their vital mission is not diminished.

"Local and state public health laboratories are the front line of response to public health emergencies. The partnership between local and state public health laboratories and CDC is vital to an effective nationwide system of health security. The innovation and indefatigable efforts of this workforce continues to impress me and represents a tremendous bargain as a government investment."

Dan Sosin, MD, MPH, FACP,
Acting Director, Office of Public Health Preparedness and Response

INTRODUCTION

PUBLIC HEALTH LABORATORIES: DIMINISHING RESOURCES IN AN ERA OF EVOLVING THREATS.

Last year the global community faced the first human influenza pandemic in forty years. 2009 Influenza A H1N1 stressed our healthcare systems, especially public health laboratories, with demanding response and surge requirements, revealing gaps in capabilities as well as opportunities for improvements.

The United States must take advantage of these opportunities by effectively applying lessons learned to improve preparedness and response systems. One of the roadblocks to meeting such ever-evolving public health challenges is decreasing funding for public health laboratories.

Public health laboratories conduct timely and accurate testing, provide training to prepare for and respond to emergencies, both natural and man-made. The results provide solutions for prevention and response. Responsibilities of the public health laboratory system extend into other equally vital areas such as food safety, environmental testing and newborn screening.

To meet these day-to-day challenges, and stay on the cutting edge of emerging public health threats, laboratories need qualified personnel, technological resources and support from decision makers and end-users, such as the general public.

APHL assesses the all-hazards preparedness of SPHLs on an annual basis to evaluate the progress that these laboratories have made since they began receiving funding from CDC's Public Health Emergency Preparedness (PHEP) Cooperative Agreement.

This report summarizes the 2009 survey as well as some successes and challenges experienced by SPHL's in the last year. Complete aggregate survey assessment

results are available online at <http://www.aphl.org/aphlprograms/ep/ahr/Documents/APHLAllHazWhitePaperEPR.pdf>

Recurring themes emphasize the need for:

- Laboratories as a major component of emergency responses
- Continued outreach and partnership efforts



Emergency Preparedness and Response Unit staff, Sam Tostenson and Nathan Kendrick, preparing samples for the annual Challenge Set of organisms to be sent to all of the Minnesota Laboratory Systems Labs, photo provided by Moe Sullivan, Minnesota Department of Health Public Health Laboratory.



Moe Sullivan (Emergency Preparedness and Response Unit Supervisor) and Jeff Brenner (Inorganic Chemistry Unit Supervisor), processing a threat letter in the new glovebox, photo provided by Moe Sullivan, Minnesota Department of Health Public Health Laboratory

- Adequate funding for laboratory personnel and equipment

These challenges force public health laboratories to choose between hiring highly skilled staff and maintaining equipment, thus jeopardizing the foundation of a critical national resource. Adequate human and technological resources are vital to ensure readiness for all-hazard threats.

BACKGROUND

Public health laboratory preparedness activities have been funded on a limited basis since 1999. Following the terrorist attacks of 9/11 and the subsequent anthrax attacks, Congress authorized supplemental funding via the PHEP Cooperative Agreement to support nationwide preparedness in state and local public health departments. The PHEP Cooperative Agreement is administered by the CDC; thus CDC serves as the primary mechanism for funding state and large local jurisdictions in their efforts to prepare for and respond to public health threats.

In 1999, CDC, the Federal Bureau of Investigation (FBI) and APHL formed the Laboratory Response Network² (LRN), the nation's premier system for identifying, testing and characterizing potential agents

of biological and chemical terrorism. With limited funding, the CDC initially supported a small number of laboratories for biological terrorism preparedness and even fewer, only five laboratories, for chemical terrorism preparedness.

The PHEP Cooperative Agreement initially focused the majority of resources, time and money on bioterrorism preparedness. This emphasis was natural because the 2001 incidents involved a biological agent, *Bacillus anthracis* (anthrax). In 2002, the CDC expanded funding for chemical terrorism preparedness and as such expanded the LRN for Chemical Terrorism Preparedness (LRN-C). A more detailed explanation of the Laboratory Response Network can be found on page 8-9.

In 2004, the CDC expanded the Cooperative Agreement's scope to include all-hazards preparedness recognizing the need to further broaden the focus of public health preparedness. No specific funding, however, was allocated to this change in scope. "All-hazards" refers to any public health emergency including biological, chemical, radiological or nuclear. It could involve naturally-occurring incidents such as multi-state Salmonella outbreaks, natural disasters such as Hurricane Katrina and accidents, such as an overturned chemical tanker.

The challenge is formidable and the mission is vital. SPHLs must develop and maintain the ability to continuously prepare for and respond to all-hazard threats.

METHODS

APHL collected data in the fall of 2009 during its third annual All-Hazards Laboratory Preparedness Survey. SPHLs reported on their capability and capacity to respond to biological, chemical, radiological and other threats, such as pandemic influenza. This survey covers the 12 month period from August 10, 2008 to August 9, 2009, representing the CDC PHEP Cooperative Agreement Fiscal Year (FY) 2008, also known as Budget Period 9. Reports and briefs from previous all-hazards, biological and chemical terrorism laboratory preparedness surveys are available at APHL's Web site at <http://www.aphl.org/aphlprograms/ep/ahr/pages/default.aspx>.

The 2009 All-Hazards Survey generated a 98% response rate, with fifty-one responses

received from the 50 states, DC and Puerto Rico public health laboratories. For the purposes of this report, the term "states" or "state public health laboratories" will refer to all respondents, including DC. Complete aggregate survey assessment results are available online at <http://www.aphl.org/aphlprograms/ep/ahr/Documents/APHLAllHazWhitePaperEPR.pdf>

Data were collected using mriInterview, a Web-based survey tool and data repository. Results were coded for entry into SPSS for Windows Version 15.0. Descriptive statistics were gathered for all variables. Results are reported for three categories: funding, workforce, and partnerships and outreach. Each of the three categories is further broken down into more specific areas in the sections that follow.

APHL Fellow, Nicole Podnecky, works on *Burkholderia pseudomallei* samples in her host lab, the Bacterial Zoonoses Branch, Division of Foodborne, Bacterial, and Mycotic Diseases at CDC. Photo by Heather Roney, APHL.



FINDINGS

FUNDING

Laboratory Preparedness

The PHEP Cooperative Agreement allowed states to build the necessary infrastructure to effectively meet challenges associated with public health threats, re-sourcing laboratories with skilled personnel and sophisticated equipment. Figure 1 depicts biological and chemical laboratory expenditures for SPHLs in FY08.

As the responsibilities continue to increase for public health laboratories, funding is on the decline, as demonstrated in Figure 2. For instance, there is no federal funding to support radiological analysis of clinical specimens in SPHLs. Despite the fact that this gap is a recognized issue, Congress has not appropriated funding. Public health laboratories are dedicated to protecting the public's health and are working with CDC to improve the state of radiological preparedness. This has been a struggle since the equipment required for the complex analyses is very expensive and training needs are extensive.

While there are issues with sustainable resources for public health laboratories, many are finding innovative ways to use funds to support critical training efforts. The example on page 7 highlights the collaborative efforts in Florida to provide sample collection training to first responders.



Laboratory staff in action, photo provided by Marlene Frazier, Virginia Division of Consolidated Laboratory Services.

FIGURE 1: ALLOCATION OF CDC PHEP FUNDING FOR STATE PUBLIC HEALTH LABORATORIES IN FY08

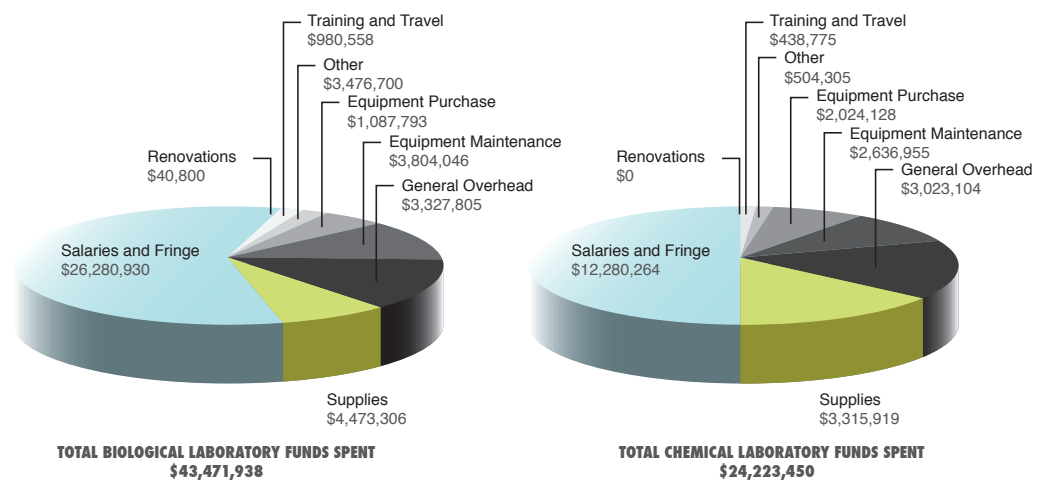
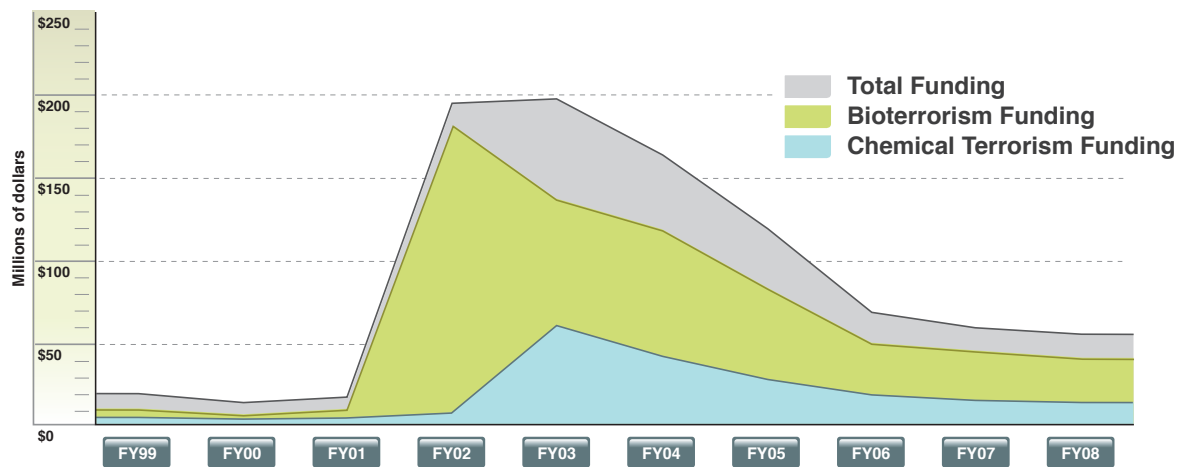


FIGURE 2: FY99 - FY08 PUBLIC HEALTH EMERGENCY PREPAREDNESS FUNDING FOR LABORATORY ACTIVITIES



• note: all funding amounts have been adjusted for inflation to 2009 dollars.

Funding Allows for the Establishment of Best Practices

The flood of “white powder” incidents in 2001 strengthened crucial partnerships in Florida between the Department of Health (DOH) Bureau of Laboratories, the University of South Florida Center for Biological Defense (USF CBD), local responder agencies, and the local Federal Bureau of Investigation (FBI) field office. This team developed and evaluated collection procedures for suspicious samples. Such collaboration ensured that the procedures addressed the needs of all agencies involved.

These partnerships later helped in the development of standardized sample collection training for responders throughout the state: in July 2003, the Florida DOH provided PHEP funds to USF CBD to provide the training. The grant has been renewed each year, allowing USF CBD to continue training responders free of charge.

The availability of training and the accompanying reference materials streamlined white powder response in Florida resulting in rapid public health actions and reducing the impact on the community during emergencies.

Increased funding for this flagship program will allow the USF CBD to hire more trainers and expand the program. This expansion will enable the USF CBD to respond to requests for this standardized training outside of the state of Florida and potentially to the entire Southeast Region.

The Laboratory Response Network Structure

Formed in 1999 by the Centers for Disease Control and Prevention (CDC), the Association of Public Health Laboratories (APHL) and the Federal Bureau of Investigation (FBI), the Laboratory Response Network (LRN) is the nation's premier system for identifying, testing and characterizing potential agents of biological and chemical terrorism. The LRN maintains an integrated national and international network of laboratories that can respond quickly to acts of chemical or biological terrorism, emerging infectious diseases and other public health threats.

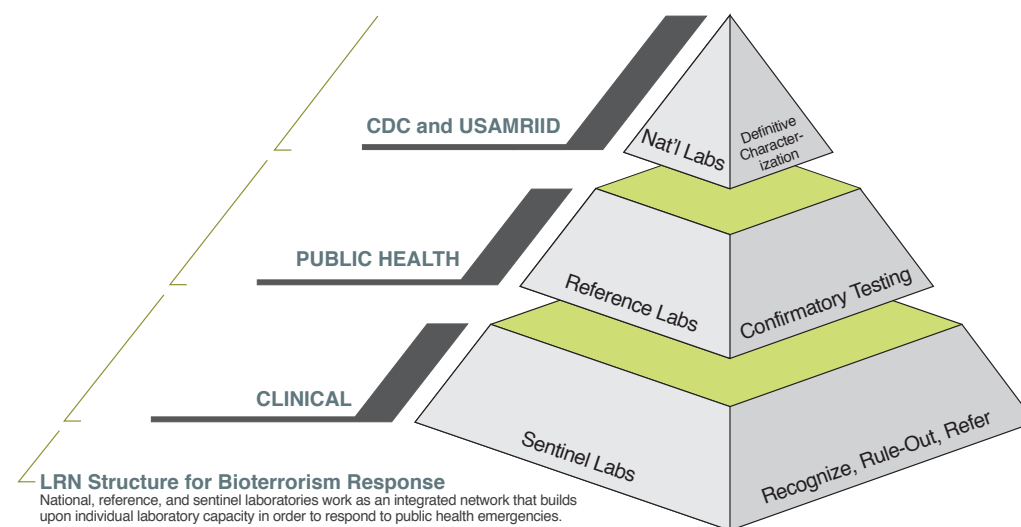
State and local public health laboratories comprise approximately 70 percent of the 169 LRN Biological Reference Laboratories and almost 100 percent of the LRN Chemical Laboratories. These laboratories produce high-confidence test results that are the basis for threat analysis and intervention by both public health and law enforcement authorities.

The LRN for Bioterrorism Preparedness is organized as a three-tiered pyramid. At the base are thousands of sentinel clinical laboratories, which perform initial screening of potential pathogens. When sentinel clinical laboratories cannot rule-out the presence of a bioterrorism agent, they refer specimens and isolates to the appro-

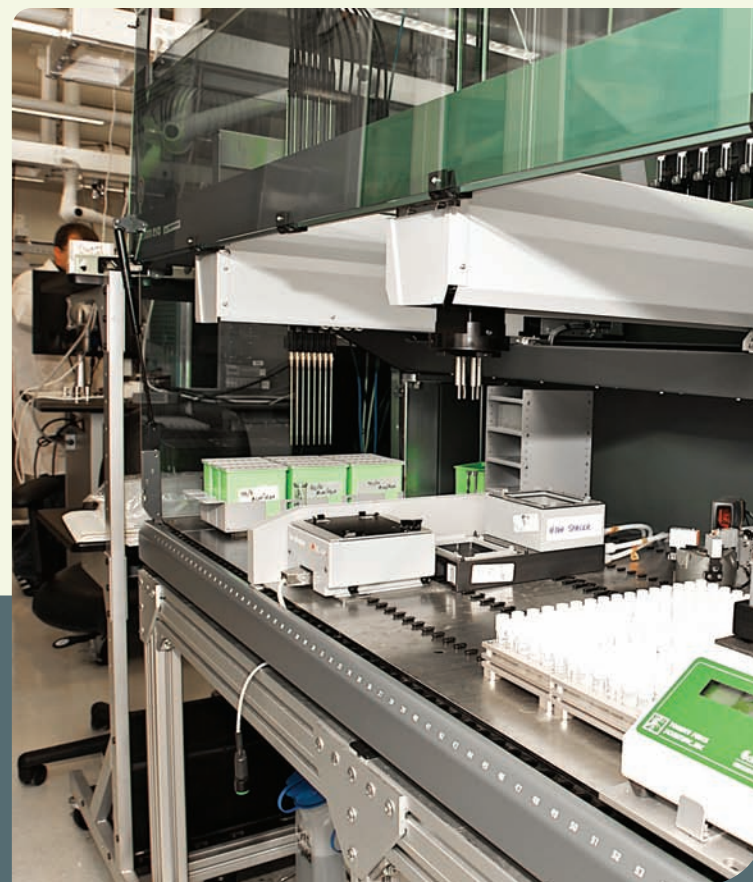
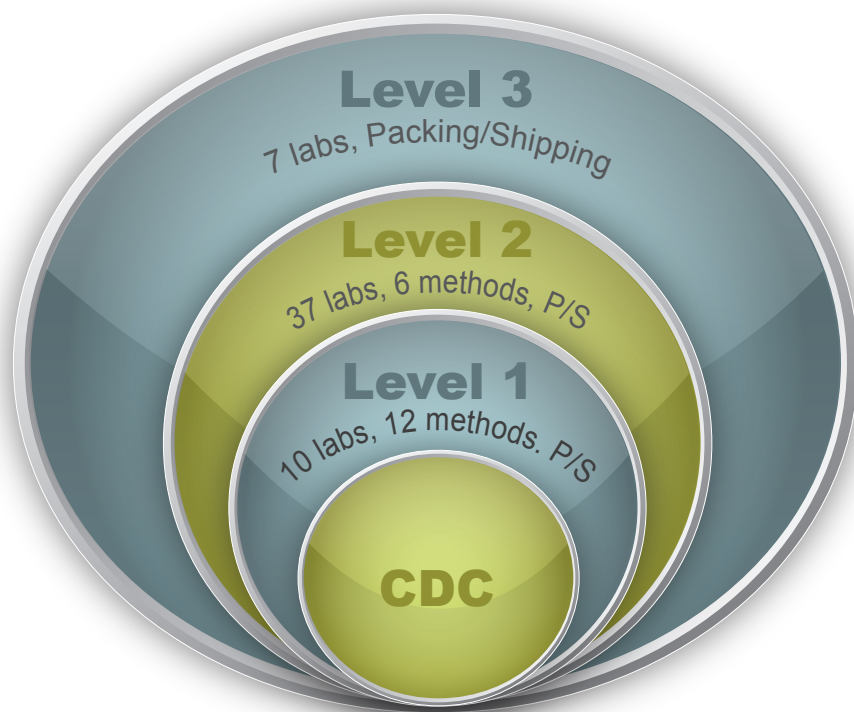
priate LRN reference laboratory. More than 160 state, local and federal facilities provide reference testing. At the apex are national laboratories, such as those at the CDC and the Department of Defense. These laboratories test and characterize samples that pose challenges beyond the capabilities of reference laboratories, and provide

support for other LRN members during a serious outbreak, public health emergency or terrorist event. The most dangerous or perplexing pathogens are handled only at BSL-4 laboratories at CDC and the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID).

THE LABORATORY RESPONSE NETWORK FOR BIOLOGICAL TERRORISM PREPAREDNESS



THE LABORATORY RESPONSE NETWORK FOR CHEMICAL TERRORISM PREPAREDNESS



Laboratory Instrumentation, photo provided by Marlene Frazier, Virginia Division of Consolidated Laboratory Services.

Level 3 Laboratories

All 62 LRN member laboratories have Level 3 characterization and are responsible for Level 3 activities. These activities include working with hospitals and first responders in their jurisdiction to maintain competency in clinical specimen collection, storage and shipment; familiarity with chemical agents and their associated health effects; and maintaining an up-to-date coordinated response plan for their respective state.

Level 2 Laboratories

Thirty-seven laboratories are designated as Level 2 laboratories within the LRN. These laboratories can detect exposure to a limited number of toxic chemicals — such as cyanide or toxic metals — in human specimens such as blood or urine.

Level 1 Laboratories

Ten laboratories in the nation are Level 1 laboratories within the chemical LRN. These laboratories can detect an expanded number of chemical agents in human specimens, including all Level 2 laboratory analyses plus analysis for mustard agents, nerve agents and other toxicants that could be used in chemical warfare. These laboratories are intended to provide the CDC with much needed surge capacity during a large scale event. However, the ten designated Level 1 laboratories are not fully funded to sustain Level 1 surge capacity and if funding levels continue to decrease, surge capacity may be lost.

Pandemic Influenza

Health officials recognized long ago that the potential for a flu pandemic was high and that its consequences would be devastating. To keep a pulse on possible mutations and in order to develop annual vaccines, public health laboratories must maintain the ability to identify circulating flu virus subtypes.

In response to the 2009 novel H1N1 virus, Congress appropriated \$1.35 billion in supplemental funds through the Public Health Emergency Response³ (PHER) grant to upgrade state and local pandemic preparedness and response capacity. In FY08, 50 SPHLs reported receiving \$15.5 M or 1.1% of funding from the PHER grant. This is despite the fact that SPHLs saw an unprec-

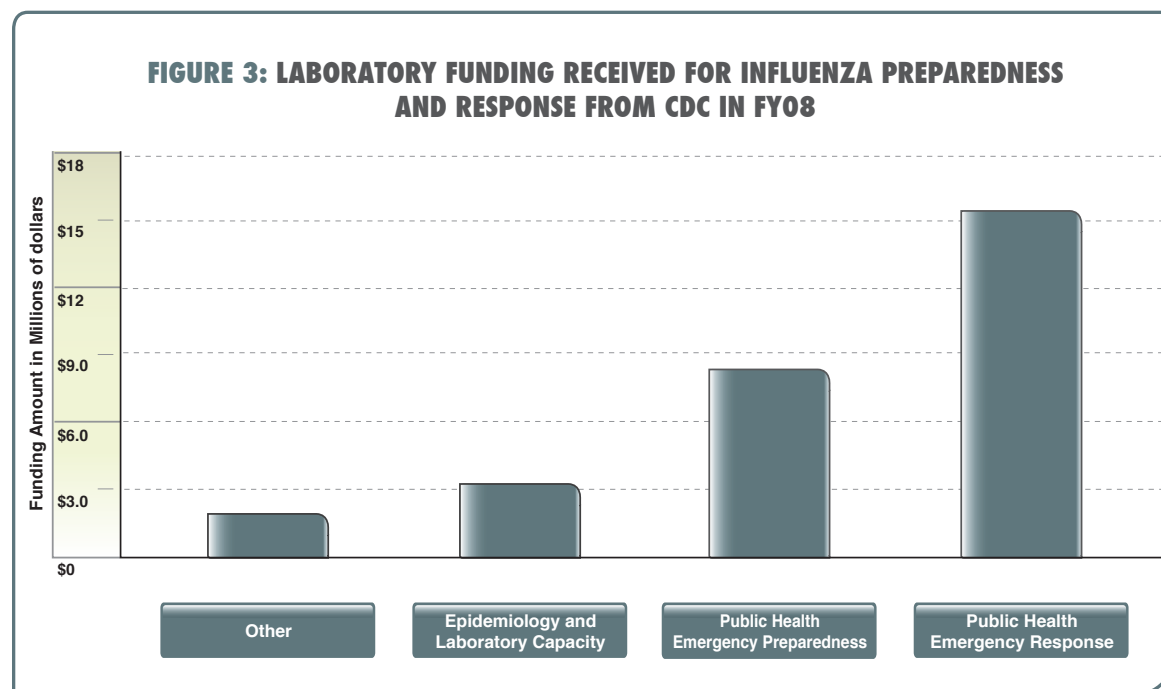
edented increase in specimen testing during the pandemic. The success of the laboratories' response to the pandemic would not have been possible had it not been for the existing CDC PHEP supported infrastructure and special assistance from CDC and APHL for the direct purchase of instrumentation and supplies.

Each year through the CDC PHEP Cooperative Agreement, money has been distributed to state and local public health agencies, whose laboratories are members of the LRN. Figure 3 displays SPHLs funding for influenza preparedness and response. During the 2009 H1N1 outbreak, the public health emergency infrastructure built as part of the LRN was key to the

response. This success was due to the availability of existing, in-place resources such as:

- Real-time PCR, automated extraction systems and communication systems
- Appropriate biosafety facilities in public health laboratories
- CDC-funded and trained molecular testing staff

This event highlighted the absolute criticality of public health laboratories in protecting health both domestically and internationally. Without dedicated and reliable resources, public health laboratories' ability to respond to the next threat will be severely limited. The following story highlights influenza preparedness and response efforts in Texas, one of the many states which experienced significant challenges during the recent pandemic.



Pandemic Requirements Stretch Resources of the Lone Star State

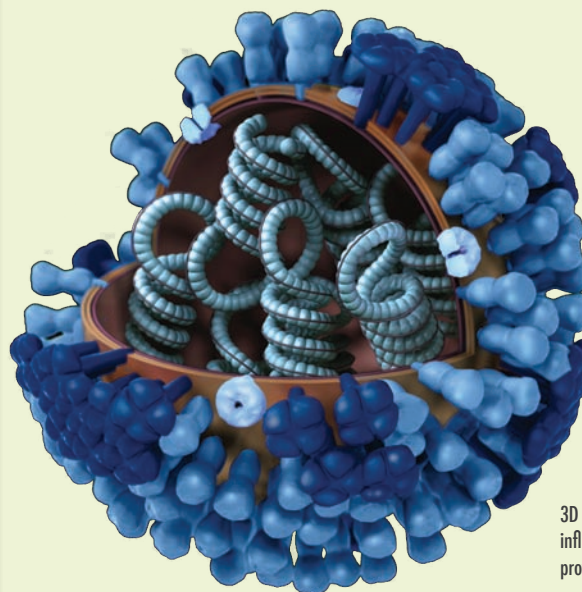
During the 2008-09 influenza season, the nine Texas-based LRN laboratories received special state funding to participate in a Texas Department of State Health Services (DSHS) laboratory-coordinated Flu Pilot Program. Participation in this program helped prepare these laboratories, which were able to quickly begin testing during the first week of the H1N1 outbreak in late April 2009. All of the laboratories pulled staff from various parts of the laboratory, and in some cases used BioWatch⁴ staff, to assist in the response. The laboratories, however, still lacked sufficient equipment and human resources to efficiently deal with the heavy specimen loads—5,701 specimens were received in the first week.

The assistance of APHL and cooperative vendors allowed the laboratories to meet the surge. APHL and the vendors provided additional equipment to help the laboratories work through a nearly 9,000 backlog of specimens. APHL worked with Applied Biosystems[™] by Life Technologies[™] to bring two more ABI 7500 FAST instruments into the laboratory. In addition, coordination with the Luminex[®] Corporation enabled DSHS to secure an instrument that could be used to pre-screen the specimens and eliminate the negatives. DSHS staff quickly implemented the new technologies which allowed them to screen over 85 specimens per run and save the limited 2009 H1N1 kit reagents for Influenza A positive specimens. To compensate for the shortage of human resources, temporary staff was hired through a scientific staffing agency to provide support in a variety of areas from triaging specimens and testing to result entry.

The 2009 H1N1 Influenza outbreak impacted the nation and the world. In Texas, preparation, cooperation and a dedicated work force combined to help the DSHS Laboratory Services meet the increased testing demands.

“The nation’s public health laboratories and CDC have long had a strong reciprocal relationship. Never has this been more apparent than with the emergence and spread of the 2009 H1N1 influenza virus, where pre-pandemic planning and capacity building efforts resulted in the ability of public health laboratories to rapidly implement the subtype specific test provided by CDC, reducing the diagnostic and surveillance testing burden on CDC. This allowed CDC to focus on further characterization of the novel virus and monitoring for changes that might impact control and vaccine strategies.” Without the work of the public health laboratories the national response would not have been possible.”

Dan Jernigan, MD, MPH
Deputy Director of the Influenza Division, CDC



3D graphical representation of a generic influenza virion's ultrastructure, photo provided by CDC/ Doug Jordan

Vital Mission – Limited Resources

The Alaska State Public Health Laboratory is one of a limited number of public health laboratories capable of performing confirmatory testing for botulism in the United States. As the prevalence of foodborne diseases continues to escalate in part due to the increased global movement of food, the level of required testing is straining the already limited laboratory resources.

An outbreak in Alaska provides a case in point. Many Alaska Natives depend on primary subsistence activities, which involve the harvesting and processing of wild resources such as seals, fish or caribou for food. Since *Clostridium botulinum* is naturally present in the environment, it is also present in some subsistence foods. Common subsistence food preparation and storage methods create an increased risk of botulism. Fortunately, laboratory and health officials were able to positively identify the botulinum toxin in a clinical investigation of one village. Destruction of contaminated foods and other health measures were immediately implemented, avoiding further spread of the illness.

The lesson learned in responding to this particular outbreak is that preparing samples and processing traditional Alaska Native foods for botulinum toxin testing provides a unique challenge. The laboratory procedures available from the LRN are designed for foods that are commercially prepared and packaged. Subsistence foods from Alaska Native resources are quite different. Food sample testing must be done by animal type, storage method, preservation method and quantity of suspect material. PHEP funding in Alaska helps train personnel, purchase and maintain equipment, obtain consumable supplies and maintain the laboratory mouse colony, which is used to conduct the confirmatory mouse bioassay.

Human and technological resources are necessary to rapidly and effectively respond to foodborne toxin outbreaks. This particular outbreak involved one scarcely populated village in one state. If multiple outbreaks occurred in densely populated areas of several states simultaneously, it begs the question: Can our limited laboratory resources adequately respond to protect the public?



Scientist prepares to test food for pathogenic bacteria, photo courtesy Patrick Luedtke of Utah Division of Epidemiology and Laboratory Services

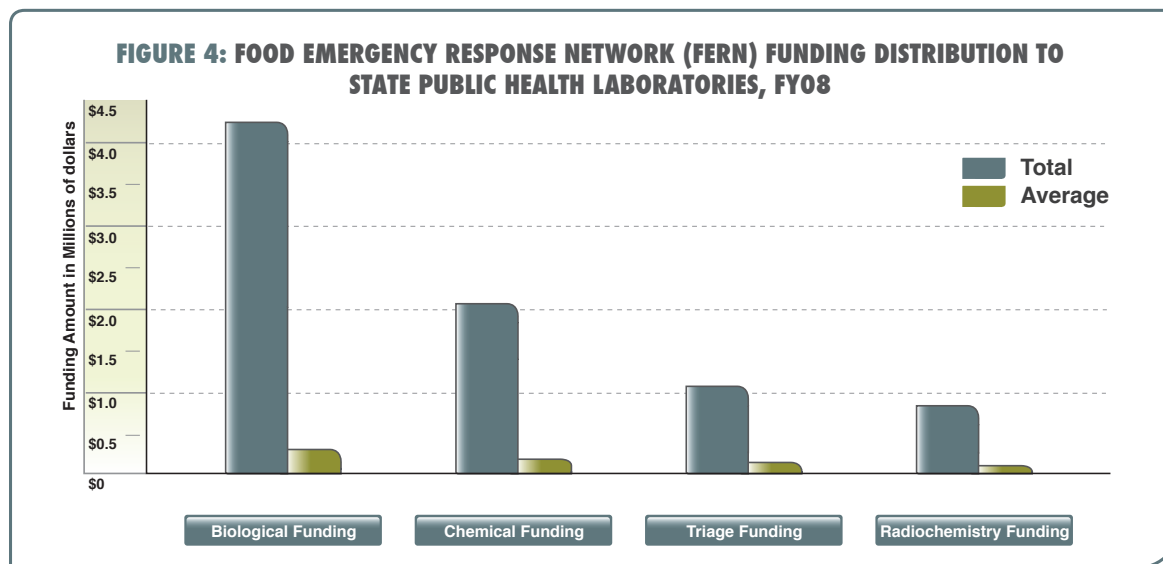
Food Safety

A critical function of the SPHLs is the ability to rapidly detect intentional and naturally occurring foodborne pathogens. SPHL's involvement with programs such as CDC's PulseNet have proven to be valuable in responding to nationwide outbreaks of foodborne illnesses including the 2006 investigation of the *Escherichia coli* (E. Coli) 0157:H7 associated with contaminated spinach and the 2008 investigation of *Salmonella* St. Paul. The CDC Epidemiology and Laboratory Capacity (ELC) Cooperative Agreement provides funding for food safety laboratory testing and in some states, the PHEP Cooperative Agreement provides limited funding for such testing.

An alternate source of funding includes the interagency-collaborative Food Emergency Response Network (FERN). This network integrates the nation's food-testing laboratories at all levels to ensure a coordinated response to food contamination. While 50 SPHLs indicated that there are members of FERN, in FY 09, only 21 received funding for food response activities. The majority of FERN funding continues to be targeted for biological agents, although FY 09 saw an increase in chemical and radiochemistry funding (see Figure 4).

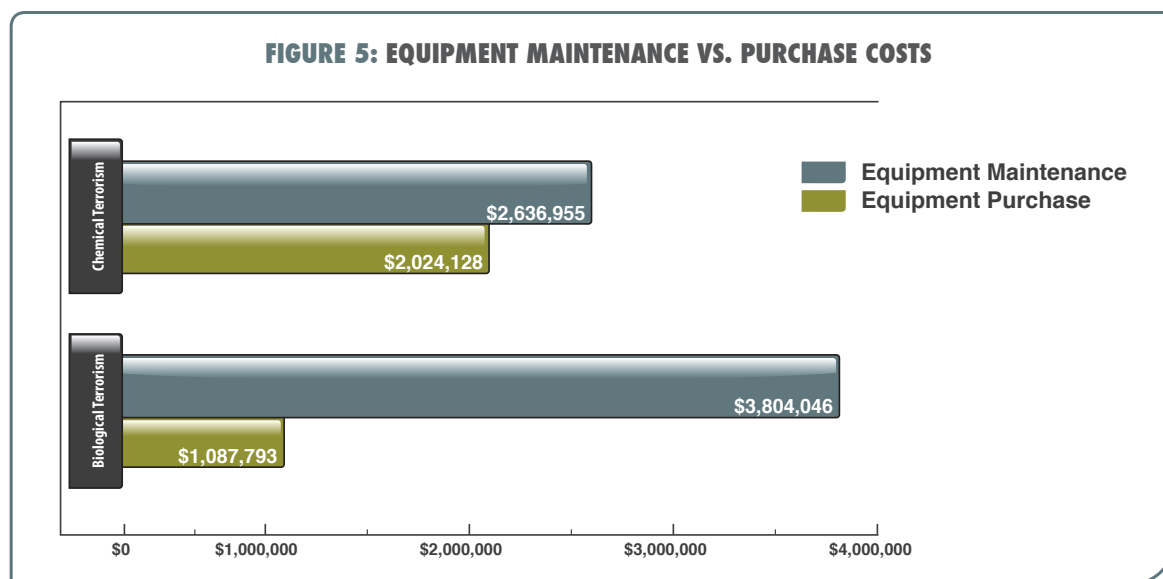
Overall Funding Impact

Maintaining highly skilled staff and functioning equipment in laboratories is critical to ensuring that SPHLs can effectively carry



out their crucial role as the surveillance and diagnostic lead in our nation's preparedness efforts. Figure 5 demonstrates the costly nature of equipment maintenance. Without the proper funding, laboratories must sacrifice critical resources that are imperative to their mission of protecting our health and safety. Laboratories are being forced to

make decisions between hiring and retaining quality scientists and support staff and procuring technology necessary to the execution of their mission. Other important functions including training, equipment maintenance and continuing education are adversely impacted as they cannot be financially supported.



WORKFORCE

Public health laboratories are facing a number of workforce challenges. It is becoming increasingly difficult to recruit, hire and retain a highly skilled workforce necessary to run and maintain the laboratories with the severely limited funding. Complicating this issue is significant discrepancy in pay between public and private laboratory positions⁵. Quality public health laboratory staff members are often forced to find positions in private laboratories to support their families in this difficult economy. SPHL directors are combining critical positions to cope with these funding issues, leading to a burdensome amount of responsibility on an already-stressed workforce. 75% of SPHLs do not have a full-time state training laboratory coordinator forcing 71% to combine this critical function with other duties. The



Peter Shult, Ph.D., Director of the Communicable Diseases Division of the Wisconsin State Laboratory of Hygiene, testifying on Shortfalls in National Pandemic Influenza Preparedness, before the US House of Representatives Committee on Homeland Security.

Arizona story on the following page depicts the struggle of the state laboratory to maintain its mission to support public health requirements with limited resources.

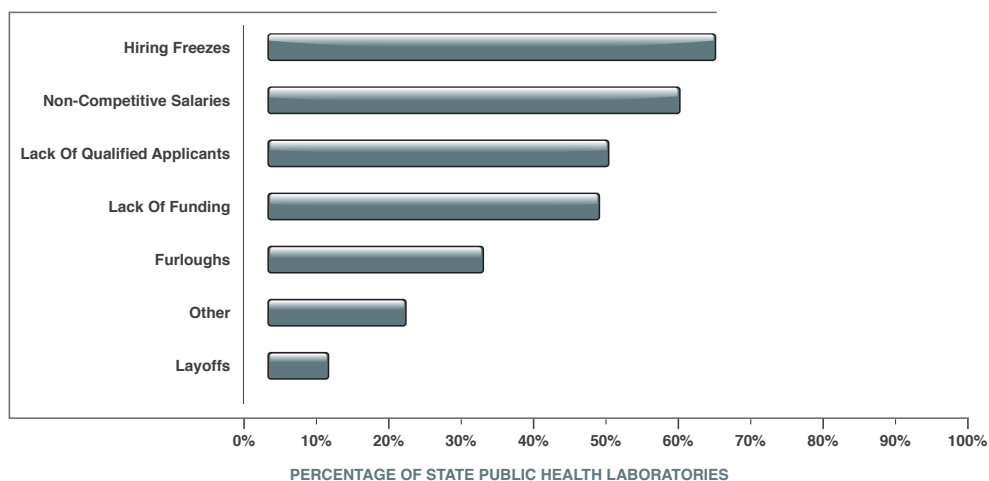
There is a scarcity of experienced and credentialed scientists who are required to fill senior management roles. Across the nation, the seasoned scientific community is quickly approaching retirement age. The challenge lies in the fact that both the quantity and quality of the workforce will steadily decline without a robust pipeline of highly trained personnel.

In the 2009 survey, states reported the need for additional trained staff. According to the data, 17 SPHLs required additional Polymerase Chain Reaction (PCR) trained staff, 16 reported needing additional Time-

Resolved Fluorescence (TRF) trained staff, and 26 needed staff trained in both. Further, 29 states indicated the need for additional training in LRN conventional methods for detecting biological threat agents.

It is critical to address this gap as it can take years to recover and rebuild the dwindling workforce. At a time when our public laboratories play such an increasingly crucial role in national safety and security, it is a risk our country cannot afford to take. Figure 6 depicts the major factors affecting state public health laboratories' ability to maintain a highly skilled workforce. Figure 7 reflects the various impacts laboratories have experienced as a result of funding cuts and workforce reduction.

FIGURE 6: WORKFORCE FACTORS AFFECTING SPHL'S ABILITY TO CARRY OUT PREPAREDNESS ACTIVITIES



Arizona State Public Health Laboratory – Surviving on Thin Resources

Practically every state has made difficult budget reduction decisions. The Arizona State Public Health Laboratory is no exception. The State of Arizona is struggling to close a \$3.4 billion budget shortfall in FY 2011. Since 2008, the state has closed its laboratories in Flagstaff and Tucson prompting a consolidation effort in the one remaining laboratory in Phoenix. The secondary effects are still resonating through a highly professional and dedicated community of skilled workers.

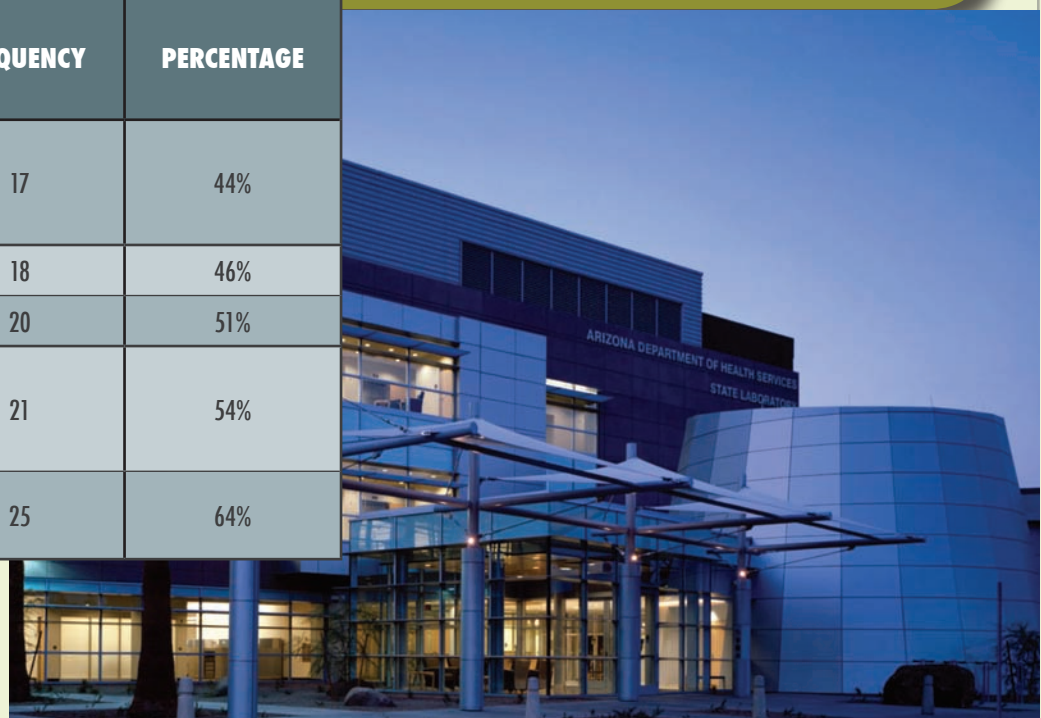
The loss of experienced scientists, researchers and technicians resulted in a huge knowledge gap between the current supervisory staff and the more seasoned staff members who have since retired. Additionally, many remaining staff members are experiencing reduction in salaries. The consolidation of the Arizona State Agriculture laboratory staff into the Phoenix Laboratory building combined with the looming pay cuts adds to work place stress and problems in morale. These circumstances necessitate that more testing is sent to the CDC. This means longer testing times and an increased turnaround time on results reporting to primary care physicians.

To combat the issues facing Arizona State Public Health Laboratories, SPHLs from neighboring states agreed to mutual cooperation and assistance. Arizona signed a second four corners memorandum of understanding (MOU) at the beginning of this year. Colorado, Utah, New Mexico and Arizona now partner to meet public health requirements. The MOU is an agreement that all four states will assist each other with testing when needed. Collectively, the states cover the gamut of all testing capability requirements. Additionally, the willingness of the staff at the Arizona SPHL to cross-train and work closely with each other is increasing testing capacity. This teamwork was tested in response to the H1N1 Influenza pandemic beginning April 2009. The collaborative efforts of staff members and their unwavering commitment to the public health mission made a huge difference in successfully serving the public during the crisis.

Clearly, the mission to provide public health testing is in jeopardy in the environment of uncertain funding. The laboratory system requires a dedicated reliable funding stream from the federal government to continue with critical public health testing.

FIGURE 7: SIGNIFICANT IMPACTS LABORATORIES HAVE EXPERIENCED	FREQUENCY	PERCENTAGE
Unable to purchase critical equipment (e.g. PCR Instrumentation, Automated Extractors, Biosafety Cabinets)	17	44%
Lost full-time staff position	18	46%
Unable to attend training courses	20	51%
Unable to provide or had to reduce the number of training courses and other outreach activities within your jurisdiction	21	54%
Unable to participate in national meetings/conferences	25	64%

Arizona State Public Health Laboratory, Phoenix, Arizona, photo courtesy of Victor Waddell, AZ SPHL.



PARTNERSHIPS AND OUTREACH

The key to the efficiency of the SPHLs in an emergency event is the ability to communicate and collaborate with other organizations in the response network. This includes other state and local laboratories, sentinel clinical laboratories, hospitals, first responders and law enforcement agencies, and other government agencies. On an ongoing basis, SPHLs conduct preparedness training and outreach activities to other laboratories and first responders within their states (see Nebraska story page 17). This partnership is vital in any response effort. Figure 8 demonstrates the breadth of SPHLs partnerships.

Another success of laboratory partnerships is reaching across the borders to work with our neighbors to the north and south.

As the H1N1 pandemic showed, diseases don't obey the sovereign lines drawn on maps. In a world where thousands of international flights are occurring simultaneously, our neighbors' diseases and emergencies are our problems too. Multiple networks of states have banded together across the northern and southern borders to address the necessary linkages and information sharing networks that must be in place before the next disaster. These networks are still developing and legal barriers to information and resource sharing must be ironed out to ensure a robust cross-border laboratory preparedness infrastructure.

SPHLs are on the forefront of the cross-border public health issues including

foodborne outbreaks, hurricanes and white powder letters. Laboratories used the pandemic preparedness experience gained through the Influenza A H5N1 planning and exercises and Influenza A H1N1 response efforts to undertake a number of activities that strengthened relationships across states and enhanced state-wide testing capacities.

Communication, collaboration and training that strengthen the relationships between SPHLs and others in the chain of preparedness enable faster, more efficient responses during an emergency event. Getting the sample to a capable laboratory in a timely manner is a critical task. State public health laboratories continued to provide outreach and training to their local first responders,

FIGURE 8: STATE PUBLIC HEALTH LABORATORIES' PARTNERSHIPS AND OUTREACH	WRITTEN EMERGENCY PLAN FOR COLLABORATION IN PLACE	CONSULTATION, ADVICE AND TRAINING	COOPERATE IN EXERCISES AND DRILLS	PROVIDE TESTING	PROVIDE FUNDING	N/A
Department of Defense	11 (22%)	28 (55%)	20 (39%)	23 (45%)	1 (2%)	21 (41%)
Sentinel Clinical Laboratories	15 (29%)	51 (100%)	45 (88%)	47 (92%)	12 (24%)	0 (0%)
National Guard Bureau CSTs	17 (33%)	47 (92%)	46 (90%)	35 (69%)	0 (0%)	0 (0%)
FBI	20 (39%)	45 (88%)	39 (76%)	44 (86%)	1 (2%)	0 (0%)
United States Postal Service	28 (55%)	39 (76%)	41 (80%)	42 (82%)	0 (0%)	0 (0%)
Local Law Enforcement	18 (35%)	44 (86%)	39 (76%)	45 (88%)	1 (2%)	0 (0%)
Local Public Health Laboratories	16 (31%)	40 (78%)	35 (69%)	36 (71%)	8 (16%)	10 (20%)
Veterinary Laboratories	12 (24%)	42 (82%)	26 (51%)	33 (65%)	4 (8%)	6 (12%)
Agricultural Laboratories	12 (24%)	32 (63%)	22 (43%)	23 (45%)	2 (4%)	16 (31%)
Environmental Laboratories	11 (22%)	31 (61%)	27 (53%)	23 (45%)	2 (4%)	13 (25%)
University Laboratories	5 (10%)	28 (55%)	12 (24%)	10 (20%)	2 (4%)	22 (43%)
Poison Control Centers	9 (18%)	30 (59%)	12 (24%)	12 (24%)	4 (8%)	17 (33%)
Cross-Border Laboratories	12 (24%)	22 (43%)	14 (27%)	11 (22%)	0 (0%)	21 (41%)
Other	1 (2%)	5 (10%)	3 (6%)	4 (8%)	0 (0%)	44 (86%)

FTIR and RAMAN Proficiency Program developed at the Nebraska Public Health Laboratory (NPHL)

Fourier Transform Infrared (FTIR) and Raman spectroscopy testing devices are commonly used by hazmat teams and other first responders in the analysis of unknown substances that may pose a threat to the public. The NPHL realized the need for a process to document the proficiency of users of these testing devices and hence formed the FTIR and Raman Proficiency Testing (PT) program. The program was offered nationwide in 2008 and has since grown steadily. There are currently 54 participating agencies, from 16 different states. International inquiry to the program prompted NPHL to offer the program to other countries as well. Participants in the program now include hazmat teams, CSTs (Civil Support Teams), firefighters, public health laboratories, forensic and environmental labs.

Proficiency Testing is defined as a means of evaluating performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. It is a means of assessing the ability of laboratories and first responders to competently perform specific tests and measurements, which is the primary goal of the program. This PT effort has been valuable in assisting the first responders in maintaining competency on these devices and has also helped them understand the limitations and applicability of hand-held instruments.

Participation in proficiency testing is a valuable continuous improvement tool which translates into improved performance and enhanced measurement quality. "Prepare. Respond. Succeed" is what NPHL strives for in the PT program.

The PT program is offered at cost to address a major unmet need and scarce financial resources have greatly limited capability for growing the program. NPHL's hope is that in the future, funding sources will be identified for maintaining and continuously improving this effort.

"Early on working with the FBI was a different experience, but it doesn't hit you until you realize your partner is carrying a gun. That's a whole new experience for public health."

Moe Sullivan, MPH

EPR Unit Supervisor,
Minnesota Department of Health
Public Health Laboratory

Cross-Border Laboratory Collaboration in the Pacific Northwest

Cross-border public health laboratory collaboration is routine in the Pacific Northwest. Since 2003, public health laboratory staff members in the Pacific Northwest have been meeting during an annual bi-national Cross-Border Public Health Workshop. This forum is designed for key Pacific Northwest public health leaders. The goal is to form and nurture professional relationships and discuss crucial bi-national cross-border preparedness and response policies. These annual workshops are funded by the CDC through the PHEP Cooperative Agreement, Early Warning Infectious Disease Surveillance (EWIDS) component and by the British Columbia Ministry of Health Services in Canada.

As a result of the relationships built through these workshops, a public health laboratory MOU was signed in 2004. The original understanding included state public health laboratories in Alaska, Idaho, Oregon, and Washington. Montana was added in 2009. Currently, the MOU is in the final stages of review by the British Columbia Centre for Disease Control Public Health Laboratory. Although it has not yet been officially signed by Canadian authorities, it is already being informally observed for cross-border collaboration. The MOU covers sharing laboratory services, procedures and responsibilities and reimbursement for testing, training, and identification of chemical agents and infectious diseases.

including training on proper methods for collecting and screening samples as well as safely transporting them to the laboratories. Data from this year's survey showed that 33 SPHLs (65%) provided training, 10 (20%) issued a proficiency test and 24 (47%) provided sampling kits/ materials and 24 (47%) provided guidance on the use and interpretation of handheld field devices/assays to their first responders. While there is ongoing outreach to first responders, there is still room for improvement in many states which indicate that increased resources will help these efforts.

Open communication lines, ongoing training and outreach are especially important with the sentinel clinical laboratories, as they serve on the frontline and will be the first to see patient specimens. One area where SPHLs have excelled is providing training to the sentinel clinical laboratories. In FY 08, states offered more than 3500 classes, training over 8000 sentinel clinical laboratorians. State public health laboratories also provided direct assistance, such as purchasing Class II Biological Safety Cabinets and other personal protective equipment, for sentinel clinical laboratories.

Providing standardized training is one of the hallmarks of the LRN. The Division of Consolidated Laboratory Services (DCLS) in Richmond, Virginia not only serves as a training location for LRN reference laboratories, but they also invest a significant amount of resources into training their sentinel clinical laboratories and assisting other laboratories. (see story)

Having plans and providing training are necessary steps in maintaining preparedness,

but even the best laid plans need to be exercised. Forty-nine SPHLs (96%) conducted exercises to assess the competency of sentinel clinical laboratories to rule out and refer potential biological terrorism agents to the appropriate LRN reference laboratory. This year's survey data showed that 44 laboratories used the Laboratory Preparedness Exercise (LPX), jointly developed by the College of American Pathologists (CAP), CDC and APHL; 14 used a state developed exercise; and three laboratories used the Wisconsin State Laboratory of Hygiene exercise to assess the preparedness competency of their sentinel clinical laboratories.

The various impacts caused by the combination of funding and workforce challenges make outreach efforts crucial to rebuilding the SPHL system. Informing policy makers and program benefactors is absolutely necessary. Labs must communicate to all levels of government about the opportunities and risks associated with current legislative agendas. They also must communicate with the American public – the stakeholders served by the public health laboratories. Information initiatives are crucial to keeping the public apprised of public health issues and to replenishing the public health laboratory workforce. The public wants to be informed about how and the extent to which their local, state and federal laboratories protect them on a daily basis. At the same time generating interest among our youth in laboratory careers is vital to rebuilding our scientific workforce. Iowa has a variety of initiatives intended to perform outreach to generate this interest (see story on page 20).



Todd Parker, Laboratory Preparedness and Response Branch, CDC, training laboratorians on LRN conventional methods for detecting biological threat agents at the Virginia Division of Consolidated Laboratory Services (DCLS).

Best Practice - Training and Partnerships

A well-trained integrated laboratory network is the cornerstone of an effective response to biological, chemical and radiological emergencies. By providing training opportunities and establishing strong traditional and non-traditional partnerships, Virginia's DCLS has strengthened local, state and national laboratory response to emergencies.

DCLS hosts 10 Sentinel Laboratory Workshops each year, training approximately 85 laboratory workers on biosafety work practices and sentinel laboratory rule-out or refer protocols. As a member of the APHL and LRN, DCLS partners with public health laboratories in need of assistance. During the emergence of the 2009 H1N1 virus, DCLS provided influenza surge testing when other states were inundated with specimens.

At the national level, DCLS collaborates with federal partners such as the CDC, USDA, FBI, and FDA to provide biosafety, rapid detection and characterization training for laboratory workers throughout the United States. On average, DCLS hosts 14 federally-sponsored trainings annually educating more than 200 laboratory workers.

Wisconsin State Lab Responds to Novel Influenza Pandemic

The Wisconsin State Laboratory of Hygiene (WSLH) learned that the years of pandemic influenza response planning at the local, state and federal levels were critical in the initial stages of response to the novel influenza pandemic in 2009.

In its role as the lead emergency response laboratory in the state, the Wisconsin State Laboratory of Hygiene at the University of Wisconsin Madison not only provided testing for the virus, it partnered with three other laboratories — the City of Milwaukee Health Department Laboratory, the Midwest Respiratory Virus Program laboratory at Medical College of Wisconsin, and the Marshfield Labs/Marshfield Clinic Research Foundation — to enhance testing capacity in the state. Having four laboratories performing testing is one of the reasons Wisconsin led the nation in the number of novel H1N1 cases identified in the months after it first appeared.

For the first several weeks of the outbreak, WSLH communicable disease scientists worked extended shifts six to seven days a week to provide test results within 24-36 hours of the patient specimen arriving at the Madison laboratory. The WSLH tested more than 9,300 patients for the virus between April 25th and July 17th. On its peak testing day, May 5th, the WSLH tested nearly 500 patient specimens.

In addition to testing, the WSLH maintains active communication with the 130 hospital and clinical laboratories in the Wisconsin Clinical Laboratory Network and with state and local public health agencies via teleconferences, lab messages, phone, email and the WSLH Web site.

WI State Lab of Hygiene microbiologist Tim Davis checks on patient sample result being tested for novel Influenza A H1N1 virus, photo provided by Charles Brokopp, Wisconsin State Laboratory of Hygiene.



Outreach Pivotal to Recruiting Skilled Workers

The public health sector is facing a nationwide shortage of more than 250,000 skilled workers by 2020⁶. In response, The Hygienic Laboratory at the University of Iowa formalized its Pathway to Adventure program to promote careers in the public health laboratory in 2009. The school welcomed its first Environmental and Public Health Ambassador, Miss Iowa Anne Michael Langguth. She meets with students, environmental and public health professionals and community groups across the state. As a Harvard graduate with an emphasis on science and governmental policy and member of the University of Iowa Carver College of Medicine, Miss Iowa shares her academic pathway while helping to educate others about laboratory endeavors.

Another recently created promotional product is the game, "Did You See That?" The game was created through funding from APHL and CDC. It is DVD-based and intended for students from junior high through college to introduce them to careers in the environmental and public health laboratory. The game, along with three new K-12 classes, can be found on the Web site, <http://www.uhl.uiowa.edu/educationoutreach/index.html>.

Finally, the school has embraced new and untapped media resources to connect to new populations. The staff created an annual report, a monthly electronic newsletter, a Facebook page, content for YouTube and various brochures to promote their programs and enhance outreach.

CONCLUSIONS

The public health laboratory is on the front line of identifying potential threats to the populations' well-being. Unfortunately, the viability of these laboratories is threatened by diminishing resources, which leads to weakened public health preparedness and response systems. Simply put: funding shortfall impacts the ability of laboratories to prepare for, respond to and recover from public health threats. From a human resources standpoint, for example, the nationwide recession only complicated on-going workforce challenges such as mandatory furlough days, hiring freezes, and non-competitive salaries for highly qualified laboratory personnel. The lack of proper resources became evident during the 2009 H1N1 pandemic when the SPHLs had difficulties providing a sustained response.

Ultimately, laboratorians remain unsung heroes as one of the nation's vital resources in facing a public health threat. Often behind the scenes, they carry out an important role of providing timely and accurate testing and outreach, thus contributing to an organized response. To ensure a robust preparedness and response system, public health laboratories must have the ability to hire and retain a qualified workforce, to procure and maintain current equipment, to support travel to relevant conferences and training events, and to sustain laboratory outreach to critical partners. Without sustained funding, the public health laboratory and its laboratorians could become the next endangered species.

RESOURCES AND ACKNOWLEDGEMENTS

RESOURCES

¹CDC Public Health Emergency Preparedness (PHEP) Cooperative Agreement; Office of Public Health Preparedness and Response (OPHPR); Funding Guidance and Technical Assistance to States; available at <http://www.bt.cdc.gov/cdcpreparredness/coopagreement/index.asp>

²CDC: the Laboratory Response Network, Partners in Preparedness, available at <http://www.bt.cdc.gov/lrn/>

³CDC Public Health Emergency Response (PHER) Grant; Office of Public Health Preparedness and Response (OPHPR); Funding Guidance and Technical Assistance to States; available at <http://www.bt.cdc.gov/cdcpreparredness/coopagreement/index.asp>

⁴BioWatch is a U.S. Government program created in response to the increased threat of bioterrorism sparked by the 2001 anthrax attacks. This environmental monitoring program is described as “the nation’s first early warning network of sensors to detect biological attack;” see Congressional Research Service report No. RL 32152; November 19, 2003; available at <http://www.fas.org/sgp/crs/terror/RL32152.html>

⁵APHL: State Public Health Laboratories: Sustaining Preparedness in an Unstable Environment, March 2009, available at http://www.aphl.org/aphlprograms/ep/ahr/Documents/APHL_SurveyFinalEPR.pdf

⁶Shortage of U.S. Public Health Workers Projected to Worsen: About 250,000 New Workers Needed; Teddi Dineley Johnson Posted: 06/02/2008; Nations Health. 2008;38(4) © 2008 American Public Health Association

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STORIES

Funding Allows for the Establishment of Best Practices (from *Funding/Laboratory Preparedness*)

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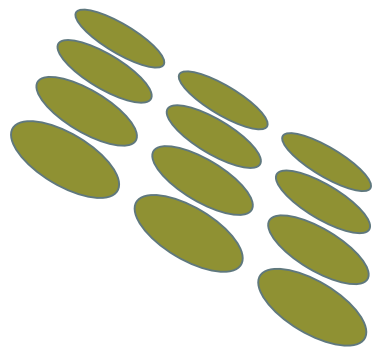
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