

**Evidence Review:**  
**Communicable Disease**  
**(Public Health Laboratories)**  
**Part 2**

*This paper is a review of the scientific evidence for this core program. Core program evidence reviews may draw from a number of sources, including scientific studies circulated in the academic literature, and observational or anecdotal reports recorded in community-based publications. By bringing together multiple forms of evidence, these reviews aim to provide a proven context through which public health workers can focus their local and provincial objectives. This document should be seen as a guide to understanding the scientific and community-based research, rather than as a formula for achieving success. The evidence presented for a core program will inform the health authorities in developing their priorities, but these priorities will be tailored by local context.*

*This Evidence Review should be read in conjunction with the accompanying Model Core Program Paper.*

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***Evidence Review accepted by:***

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## **EXECUTIVE SUMMARY**

If British Columbia as a province is to remain competitive and thrive in the global knowledge economy, then it is incumbent upon the province to embrace the topography of innovation and excellence in all sectors of its economy. The public health care sector in general and the Public Health Laboratories (PHL) in particular, must continue to develop its strong position as a responsive and leading-edge system that many other health care jurisdictions will continue to emulate.

PHLs have a much broader mandate to promote health and quality of life—their strong presence with an ethos of immediacy, is critical in determining the level of responsiveness to a populations needs.

Building on the successes that have been achieved within the current PHL system and leveraging its strengths for the health system as a whole, is a good business decision as well as a good decision for quality patient care delivery and public safety. There being no scientific literature in this area, this report was carried out to address some BC health authorities request to expand the Evidence Paper for examples of public health laboratories beyond Canada. By seeking experiences of others and building on a common language, common science and evidence spanning across existing silos) we can only enhance the quality of care provided and the oversight role of the PHL.

The key objectives to undertaking this additional jurisdictional assessment were:

- To ensure that the PHL operates within a framework of excellence and innovation in the global knowledge economy (better health/better solutions)
- To draw on lessons learned/scope of services in other primarily international jurisdictions with respect to PHLs, and assess the various operating structures within those jurisdictions
- To validate the role of the Canadian Public Health Laboratory system nationally and the BCCDC Laboratory Services (BCCDC Labs) in this province, as the steward/oversight organization that continues to provide leadership with a primary accountability role for public health laboratory needs, ensuring expeditious and appropriate crisis response.

As part of this review, an environmental scan of a cross section of various national and international jurisdictions was conducted (Canada, United Kingdom, and Australia).

This report builds on the evidence paper #1 and the model core programs papers on the prevention and control of communicable diseases. It articulates the key elements for a strong foundational base for BC's public health system – one that:

- Is responsive to outbreaks and their investigations in a timely way
- Can act as the link to the National Microbiology Laboratory

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- Can carry out clinical and environmental testing for enhanced surveillance analysis and outbreak management
- Can respond expeditiously to special requests for testing and follow up.

The findings from the review indicated the following:

- That the challenges facing BC are no different than those facing other jurisdictions; that we are all grappling with the same issues-human resources shortages and the maintenance and housing of key competencies, the definition of structures and how best to ensure that the oversight role and key functions are housed in PHLs.
- That solutions must be quality driven, community and patient focused, evidence based and in the national interest.

In an attempt to ensure system oversight for public health, various jurisdictions have made different attempts to ascertain that those elements that make up a responsive, coordinated, public health system remain intact. In this way, a solid foundational base for system oversight, which includes some or all of the critical elements of the core functions identified by the CPHLN, has been retained. Structures at the service delivery level have varied. Those elements of the laboratory system that can be provided by alternate service providers have been decentralized through purchase service agreements or other similar arrangements, to acute care facilities or private laboratories/practitioners. Each jurisdiction has customized its approach based on geography, clinical expertise, technology, demographics, economies of scale, transport capability and other similar variables.

In summary (and consistent with the findings of evidence paper #1), programs at public health laboratories, as distinct from regional acute care or private laboratories are:

- Population focused.
- Networked to allow provision of comprehensive services, including specialized reference testing.
- Established with capacity to respond to outbreaks and investigations.
- Partnered with stakeholders to create new knowledge using an appropriate health lens.
- Capable of leading, coordinating, training, and performing services in a surge capacity situation.
- Capable of carrying out clinical and environmental testing for surveillance and outbreak management.
- Capable of responding to special requests for unique testing and follow-up.
- Capable of biosafety and biohazard containment, including bioterrorism response.
- Capable of long-term biological sample storage and biosecurity of dangerous pathogens.

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- Able to respond to change quickly (e.g., to react to new emerging pathogens or bio-terrorism agents).
- Largely microbiology focused with competence in the areas of infection control and biosafety.

BC's PHL system has been built and developed over many decades, with an infrastructure that ensures that the provinces' oversight role is fulfilled. It is emulated in many jurisdictions and continues to enjoy a reputation world-wide. Building on this system strength, which transcends existing silos, and ensuring that it maintains its expertise and competencies can only enhance the quality of care in BC and its ability to ensure the prevention and control of communicable diseases. Quantifying the impact of doing otherwise, would be too high a price to pay.

## **1.0 OVERVIEW/SETTING THE CONTEXT**

In 2005, the British Columbia Ministry of Health released a policy framework to support the delivery of effective public health services. The *Framework for Core Functions in Public Health* identifies communicable disease as one of the 21 core programs that a health authority provides in a renewed and comprehensive public health system.

The process for developing performance improvement plans for each core program involves completion of an evidence review used to inform the development of a model core program paper. These resources are then utilized by the health authority in their performance improvement planning processes.

This evidence review was developed to identify the current state of the evidence-based on the research literature and accepted standards that have proven to be effective, especially at the health authority level. In addition, the evidence review identifies best practices and benchmarks where this information is available.

## **2.0 BACKGROUND**

### **2.1 Purpose**

This paper stems directly from the model core programs papers on the prevention and control of communicable diseases to substantiate its findings and recommendations.

### **2.2 Objectives**

The key objectives to undertaking this additional assessment were:

- To ensure that the British Columbia public health laboratory (BC PHL) operates within an international current best practice framework of excellence and innovation in the global knowledge economy (better health/better solutions).
- To draw on lessons learned/scope of services in other, primarily international jurisdictions with respect to BC PHLs and assess the various operating structures within those jurisdictions.
- To validate the role of the Canadian Public Health Laboratory system nationally and the BC Centre for Disease Control Laboratory Services (BCCDC Labs) in this province, as the steward/oversight organization that continues to provide leadership with a primary accountability role for public health laboratory needs, ensuring expeditious and appropriate crisis response.

### **2.2 Context**

The role of the BC PHL and BCCDC Labs, including public health in the Central Process and Receiving area on BCCDC site, is being clarified against the backdrop of a number of simultaneous initiatives occurring in the system. Each of these initiatives has identified potential opportunities for strengthening a public health system that has been built over decades. Key initiatives include:

- ***Evidence Base for Best Practices for Public Health Laboratories and their Networks, (2006)*** – British Columbia’s Provincial Health Services Authority (PHSA) Laboratories provided an evidence paper (also known as Evidence Paper #1) supporting its role in health care. Early feedback on the evidence paper led to the need for further verification and confirmation of the role and function of public health laboratories in other jurisdictions. More specifically, the need to identify the PHL’s role with respect to the overarching responsibility for core functions ensuring, as best it can, that it drives service delivery models.
- ***Model Core Programs Papers*** – In its efforts to renew and improve health care in BC, 21 model core programs papers have been, or are currently under development. Pertinent to laboratory services is the paper on the prevention and control of communicable diseases, which provides “overall direction with respect to the core elements that should be provided by BC health authorities for the prevention and control of communicable diseases.” It provides overall direction and guidance for health authorities, rather than detailed measures for implementing the range of initiatives to reduce and maintain at the

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lowest achievable level, the incidence, prevalence and complications from communicable diseases in BC. It is intended, as part of the BC core functions in public health, to reflect evidence-based practice and to support continuous performance improvement.

- ***Bill 23-2008 Public Health Act*** – First reading of the Bill has been presented to Parliament which provides greater clarity and specific powers to the Minister of Health in its mandate to ensure public health safety, including preventing disease, health hazards, infections, exposure and regulating health impediments. This further reinforces the role of a centralized oversight presence by the ministry through the Chief Medical Officer of health and the public health system reporting infrastructure.

## **3.0 METHODS**

In an attempt to provide an objective assessment of the public health laboratory (PHL) system in other jurisdictions, an environmental scan was performed in early 2008 with select public health laboratory leaders from Ontario, Alberta, the United Kingdom and Australia covering a spectrum of perspectives from acute care, academic health, government (policy and programs) public health generally and in particular, public health laboratory regional networks.

### **3.1 Interviews**

Teleconference interviews were conducted (with appropriate follow up) by a consulting team comprised of experts in laboratory technical experience and international health/laboratory systems experience. A questionnaire was developed to guide the interview process to ensure consistency of approach. The main focus of the questionnaire was on funding models, the core functions framework (as defined by the Canadian Public Health Laboratory Network) and service delivery models (Appendix 1).

In addition, specific discussion focused on issues of recruitment and retention and how the various jurisdictions are responding to the changing demographic relative to the lack of available expertise within the health system in general, and within the laboratory field, in particular.

## **4.0 RESULTS**

### **4.1 Jurisdictional Analysis: Common Themes**

#### 4.1.1 Human Resource Challenges

The shortage of human resources in the arenas of leadership, policy planning and technical expertise is becoming increasingly apparent. This is exacerbated by increased economic pressures on health systems, the growth of quaternary and tertiary care within the acute care hospital system, greater technological advancements, globalization and the movement of large numbers of people across geographic boundaries and the advent of diseases that have major ramifications if not responded to, in a timely way (e.g., SARS).

#### 4.1.2 Structures

The role of the BC PHL continues to be assessed in the face of these new realities. In some jurisdictions, decentralized models of service have been adopted with varying degrees of success. In others, a more centralized approach has been favoured.

The delicate balance between core functions (as defined by the CPHLN) and service delivery, in the face of funding cutbacks, is the challenge being faced by many jurisdictions. Common to all models has been the strengthening of its foundation by embracing the core functions, which for the purposes of this analysis are seen as critical elements to setting the foundation of a sound PHL system; one which provides the key oversight role for a nation.

Other elements of service delivery within the laboratory system, are viewed as optional elements or building blocks within the broader system, and may or may not be decentralized depending on regional and local circumstances.

With respect to the United Kingdom, it is finalizing full integration of the surveillance for public health epidemiology component with the public health microbiology (laboratory) unit to ensure oversight for outbreak control, outbreak prevention and surveillance and to inform vaccine policy.

With reference to Ontario, there is consolidation of both laboratory and non-laboratory elements into a new Public Health Agency, with the provincial Chief Medical Health Officer, as part of it. They have recognized the importance of it being located in close proximity to the downtown Toronto (key hub) teaching hospitals to ensure the maintenance of competencies and critical mass.

New South Wales (NSW) is the site for the national PHL for Australia. Core functions are divided between the various clusters linked with the NSW hub but coordinated by the Public Health Laboratories Network (PHLN). There is clear recognition that outbreaks require surge capacity within the private laboratory stream, and so the PHL system must make the necessary allowances.

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Most of the surveyed jurisdictions have opted to retain a centralized PHL. Where jurisdictions had opted to adopt decentralized models, they have now transitioned to a more centralized approach to the management of public health laboratory services either through their structural arrangements or through their operational functioning.

### **4.1.3 Functions-Common Elements across Borders**

There is a recognition that the following functions, whether targeted or ongoing in nature, be lead by the PHL hub to ensure greater integration, consistency and standardization, quality of product, evidence-based decision making, benchmarking and coordinated surveillance, analyses and response. These include:

- Provincial/Regional health surveillance activities (linked with public health units where applicable).
- Epidemiology.
- Research.
- Knowledge exchange (IM and analysis).
- Specialized and reference laboratory diagnostics (have tended to remain in the PHL arena).
- Communication (and policy advice).

Professional development and training have tended to transcend both the PHL and primary testing laboratories.

## **5.0 DISCUSSION**

In reviewing the scope of, and authority for, the prevention and control of communicable diseases in various jurisdictions, it quickly became apparent that the general thrust has been to retain the PHL as a separate entity with oversight/leadership roles within the laboratory system.

In some areas, cost pressures led authorities to critically review the need for maintenance of a PHL. Some did opt to decentralize functions and after some review, have reverted to a more centralized model.<sup>1</sup> Although the models and approaches that exist in various jurisdictions vary, typically PHLs have attempted to retain critical competencies (which are in fact PHL strengths) and maintain proficiencies as they:

- Participate in laboratory data sharing via laboratory reporting systems to ensure early warning of communicable disease outbreaks (**outbreak management**).
- Provide **prompt responses** to PH emergencies; i.e., maintain a dedicated laboratory that can respond to emergency pathogens (non routine) and have the experts that lead, coordinate, train and perform surge capacity services.
- Provide **specialized expertise** and aid in the control of communicable disease outbreaks due to known agents and outbreak due to newly emerging infectious disease agents.
- Participate in **collaborative links** between pathology laboratories that have a public health focus (including veterinary pathology).
- Strive to **promote best practice** in the various disciplines of public health laboratory practice/microbiology.
- Work collaboratively with, and provide strategic advice to, the CPHLN (or similar entity in other jurisdictions) to ensure optimal use of laboratory resources for **communicable disease surveillance** during ongoing control as well as for outbreaks of trans-jurisdictional and national or international importance.
- **Inform public health policy** at both the provincial and national levels.
- Provide non-testing consultative services such as bio-safety and bio-containment, Containment Level 3 programs or medical advice.

The PHL provides a unique and focused perspective on a wide range of microbiological and public health issues, including surveillance, emergency outbreak response, food/water safety, BBC, testing for unusual or “exotic” infectious agents as well as specimen transport and funding of public health testing. They are also generally involved in the review of regulations related to the transport of infectious materials, microbial safety, influenza pandemic planning and other broad public health problems, including new state of the art point of care testing and nucleic acid amplification testing (NAT or molecular testing).

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<sup>1</sup> A case in point is Ontario.

In summary, the assessment undertaken confirmed that PHLs are places of significant specialization where the retention and maintenance of competencies is fundamental, where critical mass is required, where costs/test will be higher given the test complexity and the concentration of scientific and technical expertise, where access to timely information through an integrated information management system is crucial, and where the effective response to both potential and real outbreaks is an essential element. Given the need for this level of specialized skills and competencies, economies of scale are then possible within PHLs rather than attempting to duplicate this level of specialization in a variety of other, distributed laboratory sites.

Further, PHL specialists are motivated to ensure public safety rather than being motivated by the bottom line and shareholder profits.

### **5.1 The Foundation Level: Oversight Stewardship**

Based on the findings from the jurisdictional assessment, it is apparent that setting the landscape for a PHL system that is responsive to the needs of its community, requires a strong foundational base to create the underpinnings, so critical to the development of a systems approach to the prevention and control of communicable diseases.

Once this is in place, then articulation of the building blocks or service delivery elements could follow based on the key factors noted above. These would essentially be optional elements that regions could engage in, depending on community needs, funding, geography, human resources and technical capability.

Critical to this analysis, is an understanding of what constitutes the various layers that make up a PHL. For purposes of this analysis, the core functions as articulated by the Canadian Public Health Network (CPHLN) provide the foundation and critical base layer of a PHL. It identifies the key oversight stewardship role so critical to the maintenance of a strong, responsive and effective, public health system for any jurisdiction.

In reviewing the core functions below, one notes that they provide the rudder for the support functions of surveillance and epidemiology, research, specialized laboratory diagnostics and knowledge exchange. They are:

1. Communicable disease surveillance, prevention and control;
2. Outbreak and emergency response to communicable diseases;
3. Environmental health and food safety;
4. Reference testing, specialized screening and diagnostic testing;
5. Biosafety, containment, and biohazard spill response programs;
6. Integrated communicable disease data management;
7. Public health policy development and evaluation;
8. Laboratory improvement and regulation (quality assurance);
9. Training and education of health care and public health workers; and,
10. Public health related research and development.

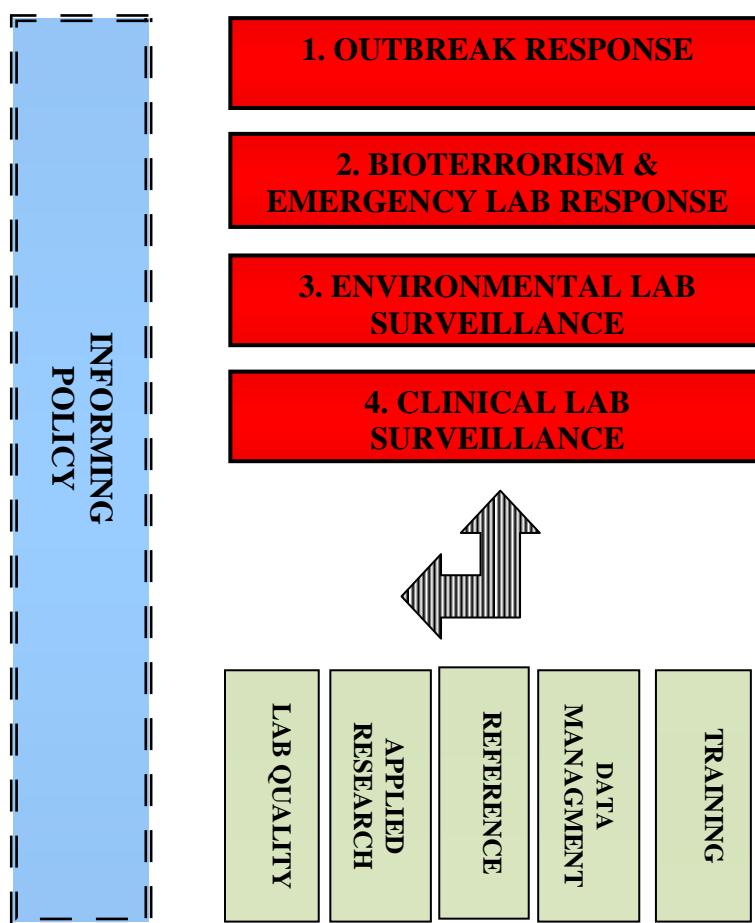
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These core functions themselves are not service delivery (laboratory testing). They are the value added that makes public health laboratories different.

The interconnectivity between the functions is highlighted in Figure 1. Five of them (quality management, applied research, reference services, information management and training/education) support four further core functions (outbreak/emergency response, biosafety/biohazard containment, environmental surveillance, and communicable disease surveillance). Together these nine support a tenth core function, public health policy development.

The identification of the core functions as being a national standard for PHLs provides the system with a significant opportunity to ensure the quality oversight role of the laboratory network is maintained intact.

**Figure 1: Ten Core Functions of Public Health Laboratories (Inter-Relationships)**



### **Notes:**

Relationships between 10 Core Functions of Public Health Laboratories (CPHLN, 2003): **ENABLING CFs** (green) are required in day-to-day leadership functions that must remain excellent in order to provide capacity for **OUTPUTS**. **KEY OUTPUT CFs** (red) are intermittent, high energy level critical functions requiring integration with flexibility that rely on a sustained excellence of ENABLING CFs. (*J Isaac-Renton, Oct 2007*).

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Furthermore, the BC *Public Health Act* (2008) articulates significant functions and system responsibilities for oversight at both a national level and a provincial level. The PHLs have the appropriate infrastructure to carry out the necessary oversight of laboratory tests of public health interest, particularly those aimed at a population level.

## **5.2 The Service Delivery Level**

The realignment of tests at the service delivery level, whether through system reconfigurations or the repatriation of tests, in isolation from its PHL counterpart, could pose a threat to the fragile balance in the system and to the oversight role of the PHLs and the integrity of the maintenance of its role relative to core functions.

In identifying the various service delivery elements for laboratory services, it is appropriate to note the following from an earlier review:

As new public health challenges arise, the effectiveness of response of the public health system will depend in part on the ability of BC's public health laboratory network to work to best practice standards. Based on the evidence, best practices in public health laboratories are sustained by:

- Strengthening the public health laboratory network through enhanced partnerships with other types of microbiology laboratories within the jurisdiction by building on current networking (such as with health authorities).
- Strengthening specific provincial public health laboratory core functions and specific nodes/functions in the national public health system.
- Enhancing efficiencies and effectiveness through clearly defined roles and responsibilities regarding service/program core functions within laboratory networks.
- Supporting the need for leadership in fundamental areas, particularly in information management and QMS development (and biosafety).<sup>2</sup>

The distinction in the role of a public health laboratory in comparison to that of a private laboratory or one in acute care is also illustrated below:

Private laboratories may test a stool specimen from a person with an enteric illness and culture it for a pathogenic bacteria from which a given species may be recovered. In doing so, this laboratory has provided the necessary information to ensure appropriate patient management is provided. In contrast, public health laboratories subtype pathogen isolates using molecular microbiology-based techniques to determine whether the patient's illness is sporadic or if other persons in the community have been infected with the same strain. In turn, the sub-typing information is often transmitted to a common national [or international] database in order to assess for common infections across geographical boundaries.<sup>3</sup>

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<sup>2</sup> BCCDC LABS. (2006, October). *Evidence base for best practices for public health laboratories and their networks*.

<sup>3</sup> McDade & Hausler. (1998). Journal of Clinical Microbiology commentary.

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This re-emphasizes the need for PHLs to have a highly trained laboratory core of technical, scientific, and medical staff, state of the art equipment and adequate budget. It is on this strong foundation built by the PHLs, that the service delivery level is built.

At the service delivery level, a critical mass of tests is required to maintain competencies in any laboratory setting. Traditionally, primary, routine diagnostic tests (for which a fast turnaround is required for quality patient care delivery), have been housed in the hospital laboratories or other private laboratories, located in close proximity, or with elaborate transportation systems, to support the community client. Any changes to the current BC PHL system (currently there is ongoing work to strengthen the 5 contractual arrangements with Health Authority laboratories), resulting from system realignments or the repatriation of tests, must be consistent with the following guiding principles which were agreed upon as a commitment to ensuring a strong public health and reference laboratory in BC:<sup>4</sup>

- At no time will laboratory responsiveness to public health needs be compromised.
- There will be a clear reporting relationship between the director of the BCCDC laboratories and the Provincial Health Officer.
- BCCDC laboratories will continue to play a central leadership role for their areas of expertise in research, education and service.
- BCCDC laboratories will continue to contribute to their areas of focus nationally and internationally.
- Public health issues will be responded to, in an expeditious and appropriate manner.

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<sup>4</sup> Communicable Diseases Policy Committee (agreed March 2005 tabled April 2006).

## **6.0 CONCLUSION**

Quantifying the impact of any intervention by a coordinated, responsive Public Health Laboratory requires accurate system modeling; i.e., identification of what the impact of the problem would have been on the public, if there was no intervention in the case of a potential outbreak. The identification of simulation measures and values (metrics) for interventions are being developed in some jurisdictions, such as the CPHLN, APHL as well as the United Kingdom and Australia, so that quantification of any changes and the potential impacts can be measured.

Given the significant experience with information technology services (data management and analysis) and the reservoir of data and information managed by the PHLs, tapping on this resource at a health authority or health systems level, could facilitate greater service coordination, strategic computing and more importantly, the systematic incorporation of best practices and the alignment of information technology investments with a much broader reach.

Building on the successes that have been achieved within the current PHL system and leveraging its strengths for the health system as a whole, is a good business decision as well as a good decision for quality patient care delivery and public safety. There being no scientific literature in this area, this report was carried out to address some BC health authorities request to expand the evidence paper for examples of public health laboratories beyond Canada. By seeking experiences of others and building on a common language, common science and evidence spanning across existing silos) we can only enhance the quality of care provided and the oversight role of the PHL.

Clearly, other jurisdictions have heeded the call for housing a critical mass of expertise in the PHL system, a system that has the public trust and enjoys immense credibility. We too, should retain what we have built over time.

## **APPENDIX 1: INTERVIEW QUESTIONNAIRE**

**Level 1: Funding model** for conducting public health laboratory testing: Role of private (for profit) labs on public lab's bill? How is funding allocated for laboratories? Is it part of a global budget? Do you have a single payer system?

**Level 2: Core functions framework:** Is there a system or framework of accountability? What are the metrics that are captured? How is this done, with what frequency, /monitoring etc.

**Level 3: Operational/service delivery model** (this may vary depending on local nuances)

1. Describe laboratory networks; past and present/ successes, challenges, and lessons learned.
2. Define PH testing (what's in/ what's out, why). How are new tests introduced? How do labs/networks remain leading edge with the economic pressures being faced? How do labs ensure that they do not become stagnant in the face of new technologies and research?
3. Where does testing take place/cross jurisdictions? If so, what transport arrangements are in place for specimens?
4. Is there a central data repository/national data base /integrated data management? How does this labs IM work? i.e., is it linked through a network to other labs...if so, how and to whom?
5. Do you have Medical staff? If so, what's their role? If not, how do you access them when needed?
6. Quality indicators (e.g., turnaround times); what other reliable measures do you have to measure the quality of your public health laboratory?
7. +/- Core functions / or other value statements / what do you see as integral to managing public health?