

Core Competencies for Public Health Epidemiologists in Ontario

A Discussion Paper for the Association of Public Health
Epidemiologists of Ontario (APHEO) and the Public Health
Agency of Canada

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Summary

Strengthening the public health work force in Canada through the establishment of core competencies for public health professionals has been a focus of activity since the public health tragedies of Walkerton and SARS. Establishing discipline-specific competencies for public health epidemiologists in Ontario was identified as a key action to be undertaken by Association of Public Health Epidemiologists in Ontario (APHEO) during the 2004 APHEO strategic planning process. This document summarizes work toward this key action and is intended to act as a background document to stimulate further discussion on the core competencies for public health epidemiologists.

Five steps, each building on the accumulated knowledge of the previous step have been completed:

- 1) Development of a “framework” for core competencies for public health epidemiologists in Ontario drawing on existing frameworks and relevant literature.
- 2) Identification of initial draft competencies using semi-structured interviews with key informants.
- 3) Validation of initial competencies through a survey of APHEO members and other key stakeholders
- 4) Drafting a working paper of core competenciesⁱ for public health epidemiologists to stimulate discussion.
- 5) Holding a consensus-building workshop of APHEO members to establish a proposed set of competencies for the association to adopt or modify.

A framework to identify and organize the competencies of public health epidemiologists in Ontario began with the five core functions for public health in Canada as defined by the Federal/Provincial/Territorial Advisory Committee on Population Health specifically:

- Disease and Injury Prevention
- Health Promotion
- Health Protection
- Health Surveillance
- Population Health Assessment

These five functions were further grouped into nine key headings following key informant interviews that were felt to better reflect specific competency groupings:

- Understanding the system
- Identifying sources of information and critical appraisal
- Databases, technology and surveillance
- Methods and analysis
- Knowledge translation
- Communication, health promotion and health protection
- Partnerships

ⁱ For the purpose of this paper, a core competency refers to the knowledge, skills and attitudes that a public health epidemiologist should have after 3-4 years of being on the job.

- Policy and communication
- Performance, leadership, socio-cultural

The specific classification of entry level versus advance managerial competencies was considered but discarded in favour of defining a single, basic-set of discipline-specific core competencies for public health epidemiologists in Ontario.

Initial draft competencies were identified under each of the five core public health functions as a result of the semi-structured interviews. In addition, a set of elements common to the five public health functions were noted including: data resourcefulness and intelligence, methodological expert, policy and program development, oral and written communication skills, information navigator/translator, knowledge translation, critical thinking and analysis/ appraisal skills, time and project management, collaboration and interpersonal skills, and knowledge of determinants of health.

Validation of the initial competencies was pursued using an electronic survey of APHEO members in March 2006. The survey was specifically designed to create a meaningful differentiation on some key points. Areas where there had been common agreement as previously identified through the semi-structured interviews, received less attention during this phase. However, where there were differing opinions or where there had been no clear correspondence with the public health competencies framework, the survey was designed to illicit greater precision. Forty-nine competency statements were included in the final survey.

Overall, most respondents agreed that the stated competency items were the core, discipline-specific competencies for public health epidemiologists. Competencies rated as highly important by public health epidemiologists included more specific and detailed competencies, relative to those listed as general core competencies. The items with medium or weak agreement were distributed through-out the nine key headings and were not clustered in any one particular area. Table 1 groups each of the items by level of agreement: strong (90+), medium (80-<90) or weak agreement (70-<80).

Survey results indicated a number of areas of agreement, and a few that will require further consultation. For example, there was fairly strong agreement on the role on providing, interpreting and translating evidence to inform decision making. However, questions remain, such as should epidemiologists be expected to take direct leadership role in determining or advocating for policy change or a different allocation of resources? What is their role in teams where decisions are made in concert with other professionals? Agreement did not yet appear to exist in a number of areas particularly in the areas of more advanced database and analytic skills including geographical information systems (GIS) as well as the role of the epidemiologist in emergency response protocols. While some saw these as important core competencies for epidemiologists, others viewed these as being more relevant to a specialist epidemiology position.

Discussion at a workshop with APHEO members was largely consistent with comments received about competency statements on the survey. A small number of items was identified as not having enough support to go forward, and others were identified as areas needing clarification. There remained some areas of disagreement. It was noted that

fairly brief competency statements need to be supplemented with far more detailed descriptions of skills before guidelines would be suitable to application in educational design, accreditation or evaluation of performance.

This report has been prepared at the completion of a consultation process and has now been delivered to the APHEO membership for their uses. It is our intention that the material be used more broadly with the hope of further validation outside of Ontario and the specific discipline of public health epidemiology.

Table 1. Competency statements grouped by domains and sub-ranked by percentage of overall agreement. Unless otherwise indicated, all calculations are based on 90 respondents

Domain	Agreement Category	Item as asked on the survey instrument	% agree or strongly agree	Synopsis of outcome at membership workshop
Understanding the system	90+	A1 Understand concepts of population health status, health determinants, disease (or injury) risk factors, and health care utilization	100.0	✓
		A2 Know about public health and public health systems	97.1	✓
	80-<90	A4 Advocate for better data and information resources	86.1	✓ Item flagged for clarification
	70-<80	A3 Know about other health care systems	70.1	✓ Item flagged for clarification
Identifying sources of information and critical appraisal	90+	B5 Critically evaluate and synthesize relevant scientific literature	98.9	✓
		B4 Identify and obtain relevant scientific literature	97.7	✓
		B2 Identify sources of health-related data, and know how to access them	96.6	✓
		B6 Constantly evaluate one's abilities, knowledge and skills, and know one's professional limitations, seeking advice and assistance where appropriate.	94.6	✓
		B3 Discuss or debate the strengths and weaknesses of existing health-related data	94.3	✓
		B1 Identify gaps in needed data and know how to fill them	93.2	✓
Databases, technology and surveillance	90+	C1 Use computers, software, the internet and other information technology	100.0	✓
		C5 Apply ethical principles to the collection, maintenance, use, and dissemination of data and information	93.3	✓
		C2 Design and implement surveillance systems e.g. for risk factors, injuries, illnesses (n=83)	91.6	✓
	80-<90	C3 Set up and manage a database	85.2	✓ Item flagged for clarification
	<70	C4 Use Geographic Information Systems (GIS) (n=81)	55.5	✗ Item not accepted to go forward without further deliberation*
Methods and analysis	90+	D2 Use statistical software to calculate measures of precision, trends and association	98.9	✓
		D1 Define problems and clarify questions	98.9	✓
		D3 Understand basic sampling methods as well as the estimation of appropriate sample sizes	97.8	✓
		D9 Recognize potential sources of bias and describe methods to reduce the impact of such bias through design and/or analysis.	96.7	✓
		D5 Interpret measures of burden, association and effectiveness	94.3	✓

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	80-<90	D11 Develop publications suitable for peer-review (e.g., presentation or poster at scientific conference, article).	86.5	✓
		D12 Design and conduct an outbreak investigation (n=85)	84.8	✓
		D13 Design and conduct an investigation into a disease cluster (e.g. cancer cluster) (n=85)	82.4	✓
	70-<80	D14 Design and conduct health risk assessments (n=85)	78.8	✓ Item flagged for clarification
		D6 Design the protocol for a new observational or hypothesis-testing research study	78.5	✓ Item flagged for clarification
		D8 Assist with design and implementation of qualitative research	77.0	✓ Item flagged for clarification
		D4 Use statistical software to carry out multivariable hypothesis-testing analyses of an original observational or experimental research study	74.4	✓ Item flagged for clarification
<70	D7 <i>Understand</i> a complex or advanced analysis plan, sampling design or sample size estimation (n=79)	64.6	✓ Wording changed†. Item flagged for clarification	
	D10 Create an application for funding to support a research /evaluation project.	58.6	✗ Item not accepted to go forward	
Knowledge translation	90+	E1 Translate epidemiologic data and scientific literature into something that <u>public health practitioners</u> can understand and use	98.9	✓
		E2 Translate epidemiologic data and scientific literature into something that <u>the general public</u> can understand and use	92.2	✓
Communication, health promotion and health protection	90+	F1 Convey information clearly in formats (reports, presentations) appropriate to the recipient	100.0	✓
	80-<90	F3 Be aware of approaches to health protection sufficient to discuss them with other public health staff	79.6	✓
	70-<80	F2 Be aware of health promotion theories sufficient to discuss them with other public health staff	73.1	✓ Item flagged for clarification
	<70	F4 Contribute to emergency response (n=65)	33.9	✓ Item flagged for clarification
Partnership	90+	G2 Effectively communicate with members of an interdisciplinary team for the purpose of information exchange, conflict resolution and the provision and receipt of feedback.	91.1	✓
	80-<90	G3 Facilitate learning of clients, co-workers, a team, your organization, and other health professionals.	82.2	✓
	70-<80	G4 Demonstrate coaching/mentoring skills (n=73)	75.3	✓ Item flagged for clarification
	<70	G1 Establish and maintain linkages with community leaders and other key stakeholders	65.9	✓ Item flagged for clarification

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Policy and communication	90+	H3 Support program and policy development with relevant data and literature	93.3	✓
		H2 Frame a public health issue and integrate the relevant data with a critical interpretive lens	92.3	✓
		H1 Help create a culture where prevention-strategies and programming are evidence-based	89.8	✓
	80-<90	H4 Make formal recommendations for further investigations or actions that should be taken	83.0	✓ Item flagged for clarification
		H6 Provide expertise in program monitoring and evaluation (n=85)	81.2	✓ Item flagged for clarification
<70	H5 Directly advocate for policies or priorities with policy-makers and stakeholders	52.8	✗ This item not accepted to go forward	
Performance Leadership, Socio-cultural				
	90+	I1 Be accurate, meticulous and organized in one's work	95.6	✓
		I4 Constantly evaluate one's abilities, knowledge and skills, and know one's professional limitations	94.5	✓
		I2 Effective time managers able to prioritize and complete multiple tasks	93.3	✓
	80-<90	I3 Interact/work sensitively and effectively with persons from diverse back-grounds, health status, and lifestyle preferences	88.9	✓

✓ Items accepted as core competencies for public health epidemiologist \

* Clarification required as to what is meant by the term 'Geographical Information Systems'. Workshop participants concluded that basic mapping and interpretation skills were core; however, analytic designs using GIS software were not core. More detailed definition is required.

† Original wording was "Design...".

Background

Recent public health tragedies in Canada including Walkerton and SARS highlighted the need to strengthen the public health system and led to a historical renewal of public health in Ontario. In September 2004, Federal/ Provincial/ Territorial Ministers of Health^{1 2} identified public health as a top priority and acknowledged the need to further develop a competent public health work force in Canada.

One of the first steps towards building public health human infrastructure is to define the skills, knowledge, and abilities required of public health personnel. These are the core competencies. The Association of Public Health Epidemiologist in Ontario (APHEO) partnered with Public Health Research, Education & Development Program (PHRED), Health Canada and Canadian Public Health Association in an early initiative that identified epidemiology as a core function in public health³. Since then, APHEO has participated in the Ontario Public Health Association's (OPHA) process⁴ to outline core competencies for public health professionals in Ontario. This work was subsequently broadened to include participants across Canada with the support of the Public Health Agency of Canada (PHAC). These core competencies will be broad and serve as the overriding capabilities for all professions in public health.

During the 2004 APHEO strategic planning process, discipline-specific core competencies for epidemiologists in Ontario were identified as a key action to further define the role and function of a public health epidemiologist. Clearly defined discipline-specific core competencies and the ability to communicate clearly the role of public health epidemiologists within the public health system will:

- Ensure the optimal use of the specialized skill of public health epidemiologists in fulfilling the core functions of public health
- Guide training and education of professional public health epidemiologists
- Standardize the practice of public health epidemiology.

In order to facilitate the process and get the necessary background information, APHEO contracted with a group of consultants at the University of Toronto. Funding was provided by PHAC to APHEO to support this work. The goal of the project was to develop and validate a set of core competencies for public health epidemiologists in Ontario. The process originally envisaged four sequential steps. These are listed below:

- 1) Development of a “framework” of core competencies for public health epidemiologists in Ontario with the existing domains developed for public health in Canada. This document should draw on the background literature review completed to date and other relevant documents.
- 2) Completion of semi-structured interviews with approximately 12 key

informants to identify the core competencies for public health epidemiologists in Ontario.

- 3) Validate the identified core competencies through a survey of APHEO members and other key stakeholders.
- 4) Draft a “Core Competencies for Public Health Epidemiologists in Ontario” Working Paper, this report.

The results of each of these steps are described in the methods section. Steps 2 and 3 required approval by the University of Toronto Research Ethics Board. While this report serves to document these activities, the more important purpose is to stimulate discussion and hopefully achieve consensusⁱⁱ among the APHEO members on the core competencies for public health epidemiologists in Ontario.

Methods

Literature review

As a first step, a review of the existing published and unpublished literature that was available on this topic was undertaken⁵. For published literature a search of MEDLINE was done using the key words “Competencies”, “Public Health”, and “Epidemiology”. The latter term was removed for one search to discover the experience of other public health disciplines.

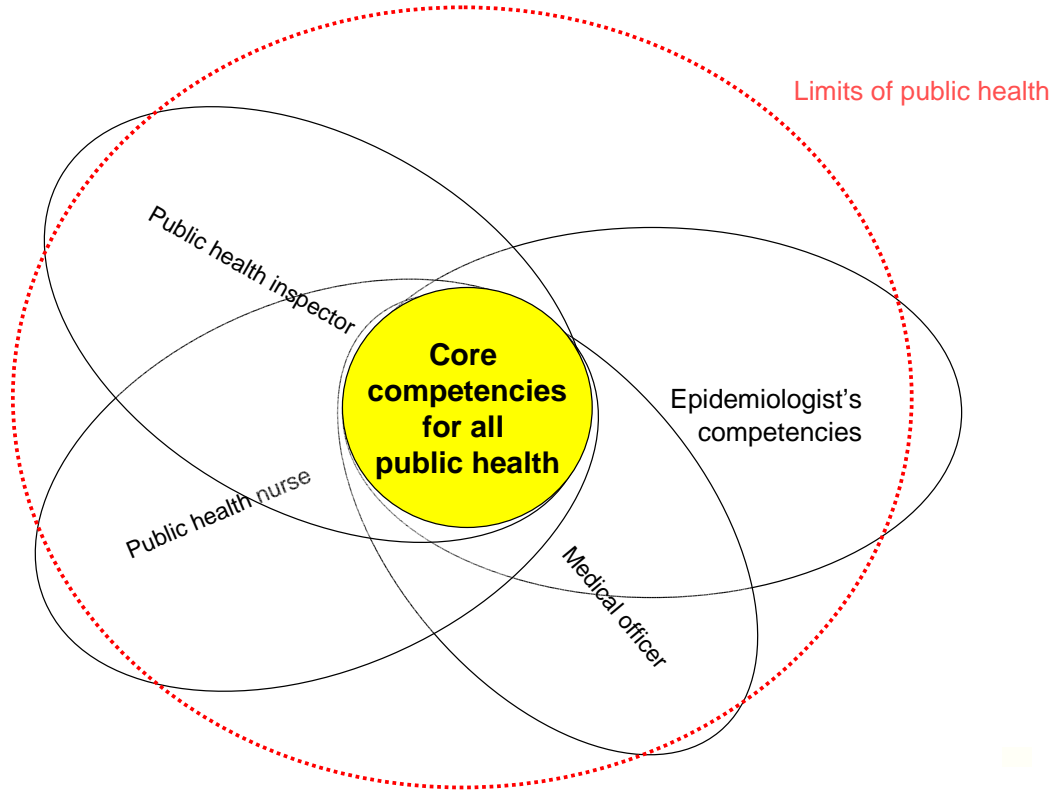
For the unpublished literature, we asked members of key organizations e.g., PHAC, for articles or reports that they felt were important. Two were provided^{6 7}. In addition, we conducted an internet search using Google to find competency documents that were published by professional organizations. We obtained “hits” to the OPHA website and to some organizations from other countries. The US core competencies for public health and the USA Council on Linkages between Academia and Public Health Practice^{8 9} were identified this way.

Due to the ongoing work by OPHA and PHAC on the core competencies^{1 2}, this framework was used as the base from which all discussions were initiated. The core competencies were seen as central to the competencies defined for all disciplines. A pictorial definition of this model is shown in Figure 1 where the core competencies represents the common central circle (like the axle of a bicycle wheel) and the discipline

ⁱⁱ The word “consensus” has many meanings to different people. For the purposes of this paper, consensus refers to agreement that the majority of members “can live” with the proposed core competencies. The authors believe that 100% total agreement will not be possible.

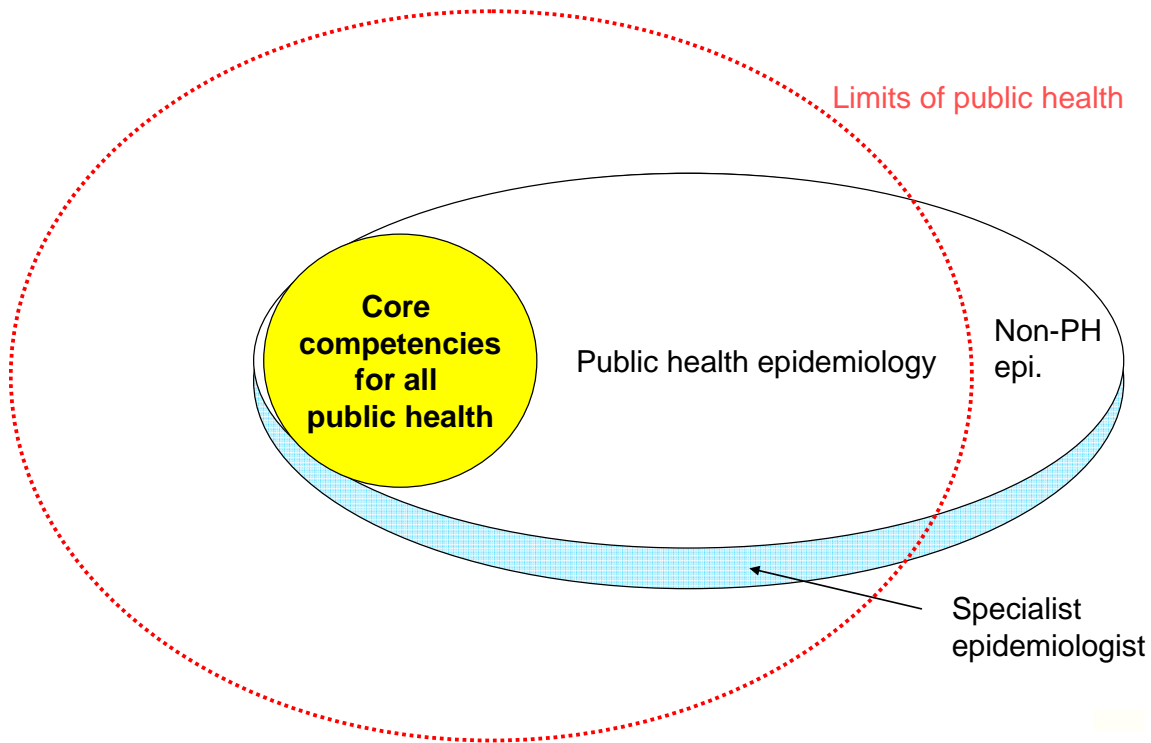
specific ones fan out from it (like the spokes of wheel). Using this model, one could argue that public health is the wheel and that each of the disciplines act as spokes that help keep the wheel rolling smoothly.

Figure 1. Pictorial view of the core competencies



Looking at the diagram above, one could imagine that the wheel is not smooth since some competencies extend beyond the red circle. This raises the idea of which competencies are specific to public health epidemiologists who work in public health, as opposed to those who worked in research or commercial settings. In this project, the focus is only on the public health competencies, so the process has to define the boundaries (the red line) of public health practice. Similarly, within the public health scope, the process needed to separate out those competencies that relate to specialists (e.g. infectious disease epidemiologists) versus being required for all epidemiologists. This model is pictorially shown in figure 2. In figure 2, the area of interest is to define the area defined as competencies for “public health epidemiology”.

Figure 2 Model showing limits of competencies related to public health plus the concept of generalist versus specialist roles



Readers should note that the report⁸ by the US Council of State and Territorial Epidemiologists (CSTE) on competencies for epidemiologists was released in June 2006, after the initial literature review and survey were completed. Hence this work is included in the discussion but it was not considered during the development and implementation of this project.

Semi-structured interviews with 12 key informants

In order to get as unbiased a view as possible, the University of Toronto consultants subcontracted the interview component of the study to a suitable qualitative researcher, Dr. Kim Bercovitz, who is familiar with public health epidemiology. The consultants believed that, since all three of them were well known to many of the key informants, an independent assessment of these qualitative comments was required. The APHEO Core Competencies working group provided a list of 18 – 20 names of the key informants. The slightly larger number allowed for confidentiality of the respondents and also

allowed for persons not being available.

In terms of the exact methodology, the qualitative researcher contacted the key informants to book an interview time and then asked a series of standard, relatively open-ended questions on the perceived nature of the core competencies. The main questions were centred on the five public health functions¹ and asked respondents to consider the unique contributions made by epidemiologists in a public health unit and also asked how this would differ from an epidemiologist working in a non-public health unit setting. All answers were transcribed and then general themes were identified. The outcome of this part of the work was a brief report that was presented to the APHEO membership on December 9, 2005 in order to obtain feedback and comments.

Creating the survey tool

The themes that emerged from the in-depth interviews were examined and merged with the competencies published by OPHA³ and PHAC¹. This work was complex and challenging since, for some areas, the competencies matched; while in other areas, there was no clear correspondence. Since the next phase of the project was to survey the membership, the survey was designed to create meaningful differentiation on some key points and yet also be manageable in terms of length and time for completion.

The following decisions were made regarding the final form of the web-based questionnaire:

- 1) Competency statements were made positive (e.g. “Advocate for better data and information resources”) and respondents had to indicate their degree of agreement with such statements. For all competency statements, respondents would be asked to indicate if they felt that it was primarily a specialty competency as opposed to a core competency. In the survey, some statements were deliberately included which some respondents might have felt were more specialty competencies than core competencies for public health epidemiologists.
- 2) It was concluded that no reference would be made to each of the five functions of public health in order to reduce the risk of repetitive and redundant questionnaire.
- 3) Since there were areas of common agreement (as defined by the in-depth interviews), there were relatively fewer competency statements in these areas of common agreement. However, where there were differing opinions and no clear correspondence in the frameworks and the results from the in-depth interviews by Bercovitz¹⁰), additional competency statements were included. The goal was to achieve greater precision in these areas of potential controversy.

Survey of the membership

Due to the view that epidemiologists are technologically savvy, a web-based survey of the APHEO membership was undertaken¹¹. The sampling frame for the survey was defined as all members of APHEO during the 2005. In addition, individuals who had taken out membership for 2006 by March 7, 2006, were included in the survey mailings. The survey was open to both Full and Affiliate Members of APHEO.

At least one mailing was sent to e-mail addresses for 165 individual APHEO members. Failed and returned e-mail message notices were reviewed by one investigator (SB) after the first mailing (to prevent identifying people who had not yet responded). Error notices were checked for address mistakes and an attempt to verify all recipients was made. Several contacts were updated. Ten individuals were removed from the mailing list after confirmation that they had left their employer, and no new address was available or they were on extended travel or other leave (e.g., maternity leave). In one instance a valid e-mail address refused the mailing. That individual was given the personal log-in instructions by telephone via a Senior Research Manager of the Research Services Unit at University of Toronto (to protect anonymity). The final list contained 155 eligible members.

On February 27th, 2006, an announcement went out on the APHEO list serve, from the APHEO president, stating that the survey would be going live that week. The first broadcast announcement including the letter of consent and login instructions was issued on March 1. A total of four additional broadcast invitations/reminders were sent. In each case, announcements were not resent to e-mail addresses of people who had already completed the questionnaire. The data collection period was extended to March 24, giving respondents the better part of four working weeks to complete the on-line questionnaire.

Statistical analysis presented for this working paper consisted primarily of descriptive reporting on the number of valid responses to each survey question. For the univariate analysis, the percent of respondents in each category of the original questionnaire are presented, including the option “Don’t Know”. For this level of analysis, the “Don’t Know” option was considered a valid category and thus included in the percentages. In tables presenting descriptive results, modal (most common) responses to the importance items were printed in bold simply for visual identification. Similarly, bolding was also used to highlight items where an arbitrary 10% or more of respondents indicated a competency item was primarily for specialists.

Selected bi-variate analyses were performed for all competency items to determine if key demographic variables were strongly associated with the observed level of agreement for each item. Only one demographic variable (Full and Affiliate APHEO membership) was defined *a priori* to be part of the specific research objective. Hence sub-group differences

in the competency ratings were examined with respect to this variable. Several other demographic variables were also studied for sub-group differences in competency ratings, though these analyses were exploratory.

For the bi-variate tests for association between the demographic variables and competency importance ratings were conducted as follows. Due to their small numbers, the “Don’t know” responses were treated as missing values in the bi-variate analyses. Where appropriate, Fisher’s exact tests for association (non-independence) were calculated. The nature of the association was not examined unless this test was statistically significant at an alpha value of 5%. For statistically significant associations, a qualitative assessment of the pattern of response differences was noted.

For analysis, the survey was treated as a simple random sample of the total population of APHEO members eligible for the study. Thus, no probability sampling weights or adjustments for complex sampling design were required. All analyses were carried out using MS Excel and Stata version 9.1.

Survey follow-up and workshop with APHEO members

During the summer of 2006, earlier drafts of this report were distributed and discussed at meetings with the APHEO Working Group. The final stage of this project was a one-day workshop with the general membership of APHEO to establish a consensus statement on the response of members to the competency items proposed in this work.

To discuss the results of the survey and move toward a consensus on final competencies, a one-day workshop was held with the general membership of APHEO. The meeting was held December 7th, 2006, in Toronto, one day prior to a regular general membership meeting. All full and affiliate members were invited and travel costs were sponsored by PHAC. In all, 26 APHEO members attended in person or by teleconference. The session was attended by all authors and facilitated by JC.

A previous draft of this report, and tables highlighting survey findings, were circulated in advance, along with lists of competency items arranged in order of degree of ‘agreement’ that the item was a core competency as indicated by respondents to the online survey. The list was broken out into three parts of roughly equal numbers of items (those with agreement of 90 % or over; from 75 to 90%, and below 75%). These materials were used to guide the discussion.

The session began with a review of the goals and progress of this project to date. There was some discussion regarding the exclusivity or overlap between competencies being discussed here and those being discussed in other contexts, notably for the overall public health human resources community¹. The group went forward with the understanding

that competency statements may be redundant with those on other lists, which were not final at the date of the meeting. Some core competencies for PH epidemiologists would be shared by other PH groups.

The group then turned to the competency items. Attendees were charged with deciding whether each competency item should go forward as a recommended core competency to APHEO as a whole. It was recognized that a clear statement of acceptance (or rejection) might not be achieved for all items. Items could go back to APHEO as unresolved. The group was also told that topics could be marked for consideration or re-consideration as core competencies at a later date. Further refinement by APHEO and subsequent adoption might ensue.

Attendees were cautioned against ‘word-smithing’ (as this could hold up proceedings) or the creation of new items during this session (new items would not have comparable survey data to support them). In areas where decision-making was hampered by wording issues (clarity of meaning, problematic wording or items which could be interpreted in different ways) this would be documented and included in this final report.

Drs. Johnson and Chiavetta led the discussion and proposed that all items with an initial agreement of 90% or over be accepted as core competencies. This was accepted unanimously. A small-group session (of approximately 50 minutes) was then held to discuss items with agreement between 75 and 90%, followed by large-group discussion to take up the findings. This process was then repeated for the remaining list of lowest agreement items.

For small-group sessions, workshop attendees were randomly assigned to working groups of four to six people. Workshop organizers (LK, RS, DC, IJ, SB and JC) worked with the groups and took notes. Groups discussed each item on the current list and made a decision as to acceptance/rejection of the item as ‘core’ along with reasons for rejection and/or disagreement within the group. The groups were also encouraged to provide suggested reasons as to why APHEO members as a group would have not agreed with specific items on the survey. Drs. Johnson and Chiavetta again led the discussion and called for votes as required. Notes taken during small-group sessions were reviewed and summary notes (from three recorders) from the full-group discussions were transcribed and reviewed in preparing this report (materials available on request).

Results

Literature review

The results of the review of the published literature were only moderately helpful. What became clear is the strong reliance on the Delphiⁱⁱⁱ and other methods of achieving consensus among experts. There was very little quantitative evidence supporting their recommendations. The actual competencies were fairly similar to those provided in other reports and reviews. The grey literature produced the most interesting papers.

One of the most challenging concepts relates to the idea of entry level versus advanced managerial competencies. A parallel set of levels is that of the USA Council on Linkages between Academia and Public Health Practice⁹ assigns levels of skill to each competency:

- Aware - Basic level of mastery of the competency. Individuals may be able to *identify* the concept or skill but have limited ability to perform the skill.
- Knowledgeable - Intermediate level of mastery of the competency. Individuals are able to *apply* and describe the skill.
- Proficient - Advanced level of mastery of the competency. Individuals are able to *synthesize*, critique or teach the skill.

There is some potential for confusion in the use of language when one is using the term “knowledgeable” to define a state where there is an ability to apply a skill. A simpler classification is the “awareness”, “ability to do” and “ability to teach”. For public health epidemiologists in Ontario, it is anticipated that the main focus in this work will be on the “ability to do” components of the competencies. Hence activities were focused on this level of competency. This does not preclude having some competencies that are in the “awareness” level and some in the “ability to teach” but they will constitute a minor portion of the competencies.

More importantly, it was considered whether or not to define competencies for public health managers in epidemiology as separate from front line public health epidemiologists. Such an action would follow the work done by the CSTE⁸. The report by the CSTE lists 4 levels (3 Tiers) of competencies. These are: entry to practice / basic epidemiologist (Tier 1), midlevel epidemiologist (Tier 2), senior level epidemiologist – manager (Tier 3a) and senior level epidemiologist – scientist or subject area specialist (Tier 3b). After due consideration, the decision was made that most epidemiologists in Ontario are at the same level and the goal is to define the basic discipline-specific competencies for public health epidemiology in Ontario where discipline-specific competencies represent a subset that are completed primarily by one group of staff, with

ⁱⁱⁱ The Delphi method is one where groups of experts repeatedly review and comment on a document. The feedback from each expert is feedback to the group in an iterative fashion until consensus is reached.

overlap among staff as required. Questions about specialist function were added in the final survey.

In terms of structuring the competencies, no one framework stood out as decidedly better. Given the current status of the OPHA standards in Ontario³, the decision was made to use the five core Canadian public health functions as the basis for the creation of the semi-structured interviews.

Semi-structured interviews with 12 key informants

In terms of overall findings, five key findings were reported¹⁰, namely:

1. *“Each of the five core public health functions was grounded in a distinct body of knowledge.”*
2. *“A set of elements common to the five public health functions [are]: data resourcefulness and intelligence, methodological expert, policy and program development, oral and written communication skills, information navigator/translator, knowledge translation, critical thinking and analysis/appraisal skills, time and project management, collaboration and interpersonal skills, and knowledge of determinants of health.”*
3. *“Post-hoc reflection of the key findings shows striking similarities to the CanMed Competencies as summarized below:*
 - a. *Methodological Expert*
 - b. *Information Expert (Information Navigators/Synthesizers)*
 - c. *Communicator (Verbal and Written Communication)*
 - d. *Collaborator*
 - e. *Scholar (Professional Development)*
 - f. *Support/Resource (Health Advocate)*
 - g. *Professional”*
4. *“Overall, key informants did not identify Manager (i.e. leadership) as a core competency. Instead, emphasis was placed on partnership, collaboration and the importance of being a team player.”*
5. *“Technology (databases systems) as well as critical thinking and analysis were regarded as critical skills for epidemiologists.”*

Along with these five overarching comments, draft competencies were outlined under these overall 5 headings. Some direct quotations that summarized the view of the respondents. Two such examples are *“being a ‘friendly cynic’”* and *“basically being able to translate highly technical and statistical information into information that front-line people can use and understand and use.”*

Survey of the membership

Of the final list of 155 confirmed eligible members, 91 completed questionnaires were received. One respondent indicated they had completed the questionnaire under two ID numbers and only the latter, updated, questionnaire was retained. Thus the final response rate was 90 completed questionnaires from 155 eligible participants or 58.1% of the target population.

1. Characteristics of the respondents.

Characteristics of the 90 survey respondents are presented in Table 2. Overall 58% of those who completed the questionnaire were Full members of APHEO and 61% worked as general public health epidemiologists. Approximately two-thirds had a degree in epidemiology, and roughly half of all respondents had two or more years of experience as an epidemiologist in a health unit. Nearly 90% indicated they had a degree involving training in quantitative methods and/or statistics. The majority (73%) had masters' level training and 11% had a doctorate.

2. Ratings of the competency statements as structured in the survey.

The competency statements were listed under 9 headings. These are:

- a) Understanding the system
- b) Identifying sources of information and critical appraisal
- c) Databases, technology and surveillance
- d) Methods and analysis
- e) Knowledge translation
- f) Communication, health promotion and health protection
- g) Partnerships
- h) Policy and communication
- i) Performance, Leadership, Socio-cultural

Communication is listed in both headings f and h due to its integral role in both areas.

Ratings on the importance of competency items using the original conceptual model are presented in Table 1. A short summary of the highlights by section are given below.

2.a Understanding the system. For this section of questions, there was strong agreement with most items. Certainly the respondents indicated very strong agreement for the item “understand concepts of population health status” and “know about public health and public health systems”. Opinions were more mixed for “know about other health care systems” (12% felt this was a specialty).

2.b Understanding sources of information and critical appraisal. There was virtually complete agreement with these competency statements. Fewer than 6% felt these competencies were specialized as opposed to core competencies.

Table 2 Characteristics of respondents to web-based survey of APHEO members.

	Total sample		Full Members of APHEO		Affiliate Members	
	Valid n	Valid %	Valid n	Valid %	Valid n	Valid %
Total sample	90	100	53	58.9	37	41.1
Gender (n=90)						
Male	23	25.8	13	25.0	10	27.0
Female	66	74.2	39	75.0	27	73.0
<i>Which of the following best describes the main type of work that you do? (n=88)</i>						
General public health	53	60.9				
Primarily infectious disease	14	16.1				
Other focused area or Other.	20	23.0				
[Collapsed]						
General public health	53	60.9	39	73.6	14	41.2
All other categories	34	39.1	14	26.4	20	58.8
<i>Have you completed a degree in epidemiology?(n=90)</i>						
Yes	65	72.2	48	90.6	17	46.1
No	25	27.8	5	9.4	20	54.1
<i>Have you completed a university degree...in any field which emphasizes or requires specific training in quantitative research design and/or statistical data analysis?(n=87)</i>						
Yes	77	88.5	47	90.4	30	85.7
No	10	11.5	5	9.6	5	14.3
<i>What is the most advanced degree that you possess? (n=90)</i>						
Bachelor's degree	6	6.7				
Masters degree (included in progress)	73	81.1				
PhD or doctoral degree	11	12.2				
<i>How long have you worked in a health unit doing epidemiology? (n=90)</i>						
I have not worked in a health unit...	25	27.8				
Less than 2 years	20	22.2				
2-4 years	17	18.9				
5-9 years	14	15.6				
10 or more years	14	15.6				
[Collapsed categories]						
Have not worked in HU as epi, or less than two years experience	45	50.0	17	32.1	28	75.7
2 or more years experience	45	50.0	36	67.9	9	24.3

2.c Databases, technology and surveillance. Respondents agreed that epidemiologists need to be computer-literate and most agreed with the competency of designing and implementing a surveillance system. To “set up and manage a database” had lower rates of agreement and just over 55% felt that “use GIS systems” was a core competency. This may reflect the challenges of using and integrating new technologies and when such methods are considered “core” competencies versus “specialized”.

2.d Methods and analysis. The areas of agreement on methods and analysis are interesting in that there appears to be some division in the degree to which epidemiologists should be involved in qualitative research and funded epidemiological research. Items which showed less strong agreement on importance were to “use statistical software to carry out multi-variable [analysis]”, “design a protocol for a new [...] study”, “design a complex [...] analysis plan”, “assist with [...] qualitative research”, and “create an application for funding[...]”. Items related to outbreak investigation and disease clusters and health risk assessment were more strongly supported but still over 15% of respondents felt these were not core competencies.

2.e Knowledge translation received high levels of agreement that these competencies are important for the core. Knowledge translation is seen as a core competency.

2.f Communication, health promotion and health protection. While the respondents indicated that the clear and concise communication of information was a core competency, the responses for being involved and knowledgeable about health promotion and health protection was lower. Respondents were decidedly neutral about the role of the epidemiologist in emergency response. These areas appear to need more discussion.

2.g Partnership As per the above section (C.2.f), the item on communication scored relatively highly but there was less consensus on other items. There was variation in opinion on the roles of mentoring and establishing linkages with stakeholders. None of these items were seen as specialty, or beyond what was expected of all public health epidemiologists. These items were just not strongly endorsed which implies some reservation among the respondents.

2.h Policy and communication. There was strong support for the role of the epidemiologist as a provider of information (data and literature) and to provide critical interpretation of this information. This is consistent with other items. There was considerably less agreement that an epidemiologist should “directly advocate for policies or priorities with policy-makers and stakeholders” (11% felt this was a specialist’s job)

and “provide expertise in program monitoring and evaluation” (28% felt this was a specialty as opposed to core competency). This is an area for further discussion.

2.i Performance, leadership, socio-cultural The majority of respondents agreed or strongly agreed that these described important core competencies and few respondents felt these were specialty attributes.

3. Looking for overall areas of agreement/disagreement: breaking down the original framework.

The ratings in the survey showed overall agreement with most sections but there were some statements within the major headings where substantial disagreement occurred. In order to explore these in more detail, these same ratings of competencies were then sorted in decreasing order of agreement (sum of percent who “agree” and “strongly agree”). These results are presented in Appendix A.

The purpose of this analysis was to determine the competencies for which there was complete agreement (100% of respondents either agreed or strongly agreed) and those for which there was more controversy. Overall, the lowest level of agreement received over 33% agreement and all the others had over 50% agreement. Due to the variation in agreements, these competencies were clustered into three main groups: those where there was over 80% agreement, those where there was 70%-79% agreement, and those where there was less than 70% agreement.

For each of the competency statements listed in the entire analysis, there was no statistically significant association between agreement ratings and the APHEO membership status (Full versus Affiliate) of the respondent¹². As well, there were no associations for the other demographic categories. While this could represent insufficient power, it is likely that the respondents’ views on core competencies were no different across these groups than was present within each group.

Among the open-ended comments, were discussion of the nature of “core” in competencies, the nature of “professionalization” in epidemiology, greater reference to Ontario specific legislation, programs and guidelines, inclusion of global/international health, and active participation in associations of epidemiologists.

Workshop of APHEO membership to determine consensus on competencies.

Results of this discussion are summarized in Table 1 and Appendix B. Among the competency statements used in the online survey, only four items, as written, were deemed to not reflect core competencies for a public health epidemiologist.

Items: “*Create an application for funding [...]*”, and “*Directly advocate for policies or priorities with policy-makers and stakeholders*”, were not seen as reflecting the role of epidemiologists *per se*, but were seen as the purview of management or the larger public health team working together.

Two items: “*Use of Geographical Information Systems (GIS)*”, and “*Design a complex or advanced analysis plan [...]*” garnered a great deal of discussion about what exactly were the skills and level of activity implied in these brief statements. The item regarding complex sampling designs was accepted once the word “design” was changed to “understand”. It was still noted that the statement encompassed a very broad range of possible specific competencies and activities, some of which would be core, and others would not. Regarding GIS, workshop participants expressed concern that the term was inadequately defined and meant different things to different people. If one meant basic use and understanding of epidemiologic maps, this was clearly a core competency. However, if one understood this to mean analytic (hypothesis testing) statistical analyses using GIS software, this was not seen as core. This was identified as an area of rapid development, and one which would have to be considered again.

For several other competency items (see Appendix B), the participants raised concern about definitions and sought a great deal more detail before they could decide if they agreed these competencies reflected their core work.

The following are conclusions and recommendations specifically from the workshop.

- From our work, we concluded that the majority of the list of competency items would be acceptable for adoption as statements of the core competencies required of an experienced public health epidemiologist, in entry-level positions and not in management or specialty roles.
- No list of competencies derived from this process should be seen as the final word, but competencies should be reviewed periodically to capture emerging areas (e.g., mapping and geographical analyses).

- Before competency guidelines, such as these, could be applied to educational design, accreditation, or performance evaluation it is necessary that far more detailed descriptions of required skills be formulated and what level of proficiency is required, by skill, for epidemiologists as described above. This is particularly true in areas of biostatistical and technical skills.
- More detailed descriptions of specific skills required should explicitly distinguish between *tasks* and *skills* to minimize confusion between the two (e.g., an epidemiologist would be expected to contribute to the methodological aspects of applications for funding, but not have the authority to engage in the management decisions around funding). Attention should be paid to what epidemiologist should be capable of, when asked to do it, in light of the mix of activities that Public Health Epidemiologists are asked to do in different health units and other settings.
- Additional and on-going training should also be available in terms of technical and analytic skills if expectations of public health epidemiologists are to be established or increased over time. Recency of training and experience, changing expectations in the field and new technology, and opportunity to use and practice these skills all vary considerably.
- Consideration should be given to the scope of training received by epidemiologists working in public health with respect to related disciplines of study, for example health promotion, program evaluation and qualitative research. However it needs to be recognized that the depth of training and level of work experience in these areas differ among public health epidemiologist. Therefore, not all public health epidemiologists may feel comfortable taking a lead role in these areas.

Discussion

The process undertaken by APHEO of asking the general membership to review and comment on the competencies may be relatively unique. Literature indicated that most other processes have relied on the Delphi technique using panels of experts. If these results are viewed positively by the membership, this may represent a novel methodology for defining core competencies.

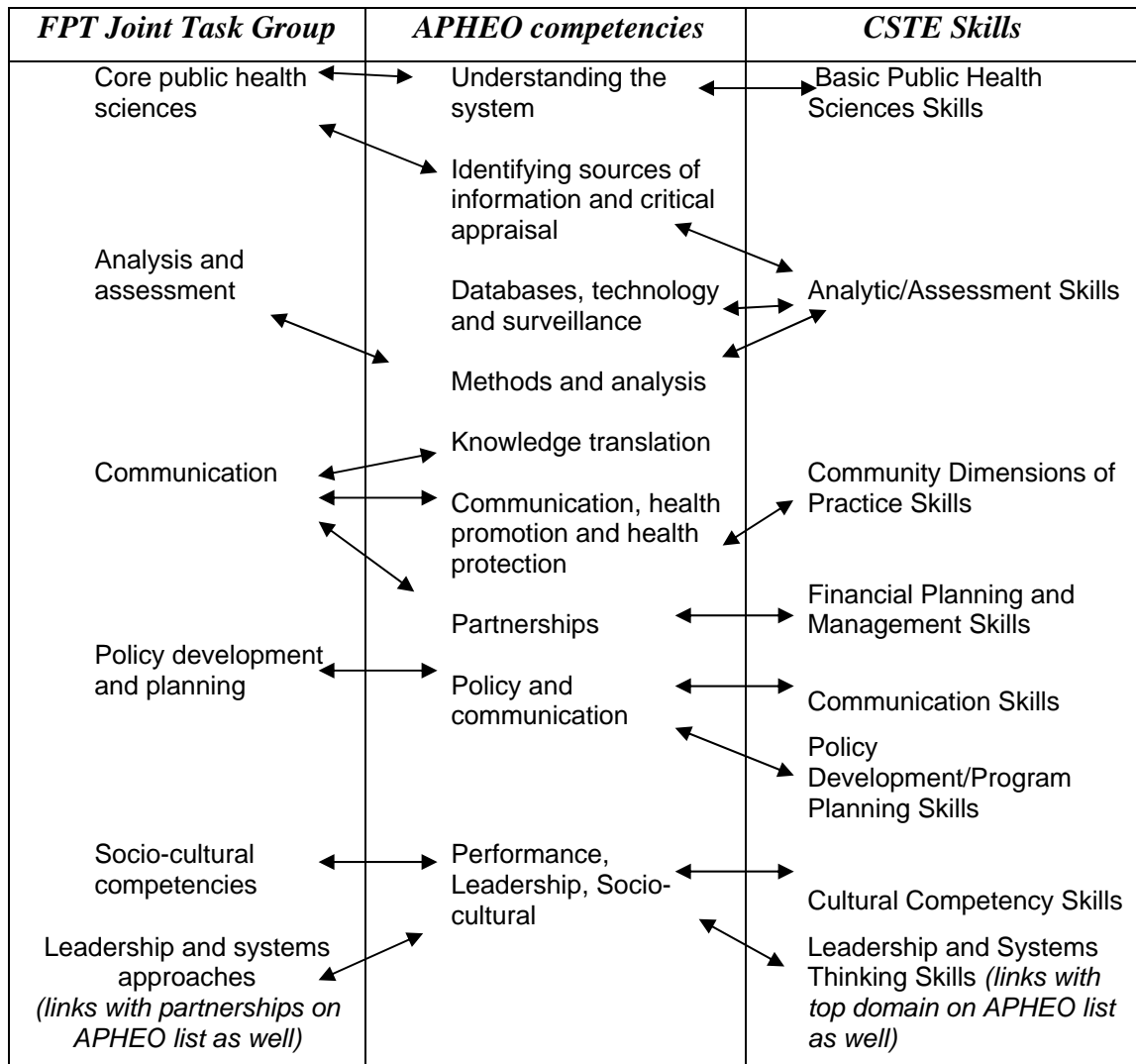
Overall, most respondents agreed that the stated competency items were the core (discipline-specific) competencies for public health epidemiologists. While the results are not identical, the results of the survey do show internal consistency with the interviews and analysis prepared by Berkovitz¹⁰.

The similarity between the core competencies defined by the OPHA and those derived by Moloughney for the Federal/Provincial/Territorial Joint Task Group^{1 2} are more

challenging and require more reflection. As would be anticipated, competencies rated as highly important by public health epidemiologists included more specific and detailed competencies, relative to those listed as general core competencies by PHAC^{1 2}. This was particularly true in areas of quantitative methods and analysis, critical appraisal of scientific evidence and knowledge transfer of scientific data to other members of the Public Health team. The creation of health status reports, provision of evidence to local health unit staff, and critical appraisal are all seen as central competencies and there is uniform agreement about their inclusion.

It is also interesting to note that the results of this process have some striking similarities to those recently published by in the United States⁸. This set of US based competencies was published when this work was halfway to being completed. Their list of overall areas is shown in Figure 3 below.

Figure 3 Overall* mapping of competency domains across frameworks†



* Overall, as some items/competencies within each domain map differently than the majority in that domain

† FPT Task Group = Federal/Provincial/Territorial Task Group on Public Health Human Resources¹

APHEO = Association of Public Health Epidemiologists of Ontario

CSTE= United States Council of State and Territorial Epidemiologists⁸

Readers should note the blank sections represent where some categories are collapsed. The main message is that these two listings were developed independently and thus represent a fair degree of consistency across jurisdictions.

Other important findings include:

- Evidence from all phases of this work indicated that a general core public health epidemiologist may not necessarily be expected to take a direct leadership role (in determining or advocating for policy change or resources). The role of the epidemiologist in these activities (unless explicitly in a leadership role) was more specialized and focused on the provision, interpretation and ‘translation’ of evidence to inform decision-making, where the final decisions might be made in concert with a larger team of professionals.
- Evidence was also found that there exists considerable debate around some potential competency items, particularly in the areas of more advanced database, and data-analytic skills. While many respondents agreed strongly that some more advanced data analytic skills were important core competencies, others viewed these as being more relevant to a specialist role, and disagreed that these were important as core competencies for all public health epidemiologists. Other areas of discussion included the development of new tools such as geographical analyses and representation of data, and the role of the epidemiologist in emergency response protocols.
- Comments throughout this consultation process have identified that ‘competencies’, once defined, may pose challenges for some individuals who are already experienced in their jobs, but may not have training in every one of the competencies identified. This highlights the need for continuing education to support the core competencies..
- Potential areas for training prior to job entry, as well as continuing professional education were also identified. In addition to training and re-training in statistical competency (above), needs were identified in the areas of other disciplines related to public health and epidemiology of: health promotion; program evaluation and qualitative research methods.

There are some major limitations to this work. The main ones are listed below.

- While efforts were made to scan all the grey literature for publications, some publications may well have been missed, particularly those done by professional groups or individual health units.
- The researchers here spent a considerable amount of time working on the conceptual model for defining the competencies so as to give a more formal

structure to the process and the results. This remains a challenge and may need to be addressed at a more national level.

- The response rate of 58% is acceptable and certainly sufficient for the analysis. However, with 42% not responding, one has to worry about a selection bias being potentially present.
- The need to improve the language and clarify the terminology used in the creation of competencies is recognized. Some competency items may have not been adopted because of wording issues as opposed to content. This may have resulted in some gaps or missing items. However, we are reasonably certain that no major content areas have been missed. The major areas of activity for public health epidemiologists remained quite consistent throughout this multi-step process, where additional suggestions were sought at all phases. There is also consistency externally, or across different groups considering the same question, as shown in Figure 1.

Recommended next steps

The consultants and the APHEO working group on core competencies recommends that this report (edited or amended as appropriate) should be distributed by PHAC and APHEO for broader discussion toward reaching the objectives of this work established by the APHEO Strategic Planning process and supported by PHAC. It is our hope that this work, in and of itself, will help to highlight the importance of, and contribution made by, epidemiologists to the public health system. This recognition may also help to ensure that the skills of epidemiologists are used optimally to forward the goals of the public health system overall. Immediately, this material should also be considered in light of ongoing Provincial and National discussions of the competencies for all professionals working in the public health setting.

We believe the content in this report is germane to the following:

- In curriculum development at Canadian schools of Health Studies and Public Health and elsewhere. Relevant curriculum development should include consideration of undergraduate, graduate, certificate and continuing education programs.
- Discussion with PHAC, OPHA, ALPHA, the provincial Ministries responsible for health and APHEO regarding the development of continuing education programs for public health epidemiologists currently working in the field and ensuring support for these individuals participating in the subsequent opportunities
- Discussions toward establishment of national standards for training both in the fields of Epidemiology in name, and Masters of Public Health.

- Discussion toward standardization of practice across Public Health Units intra-provincially and across jurisdictions.
- Discussion of the potential for establishment of accreditation or certification processes for Epidemiologists as professionals, particularly in the public health setting.
- Developing / updating position descriptions, informing hiring processes, enhancing performance appraisal processes and supporting continuous learning plans for public health epidemiologists at the local level.
- Review the core competencies for public health epidemiologist in conjunction with the broader set of core competencies for public health professionals, to identify areas of redundancy.

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Appendix A Summary of responses to web-based survey of APHEO members, 2006.

**Degree of agreement that each item was a 'core' competency for epidemiologists in public health.
Percent of respondents indicating item may pertain to a specialist instead.**

Competencies under this heading	<i>"Rate the degree to which you agree that the competency described at the left is an important CORE COMPETENCY for all public health epidemiologists" (percent responding to levels of agreement[1])</i>						<i>"Check here if you feel this competency is primarily a SPECIALIST as opposed to CORE competency" (percent checked)</i>	Mean agreement score (2)	% agree or strongly agree (1)
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Don't know			
	1	2	3	4	5	9			
A1 Understand concepts of population health status, health determinants, disease (or injury) risk factors, and health care utilization	0	0	0	6.7	93.3	0	2.2	4.9	100.0
A2 Know about public health and public health systems	0	1.1	1.1	27.0	70.1		4.4	4.6	97.1
A3 Know about other health care systems	1.2	4.6	23	56.3	13.8	1.2	12.2	3.8	70.1
A4 Advocate for better data and information resources	3.5	0	8.1	31.4	54.7	2.3	9.1	4.4	86.1
B1 Identify gaps in needed data and know how to fill them	0	4.6	2.3	31.8	61.4	0	5.6	4.5	93.2
B2 Identify sources of health-related data, and know how to access them	0	1.1	2.3	10.1	86.5	0	4.5	4.8	96.6
B3 Discuss or debate the strengths and weaknesses of existing health-related data	0	3.4	2.3	25.8	68.5	0	5.6	4.6	94.3
B4 Identify and obtain relevant scientific literature	0		2.2	34.4	63.3	0	1.1	4.6	97.7
B5 Critically evaluate and synthesize relevant scientific literature	0		1.1	31.1	67.8	0	2.2	4.7	98.9

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B6 Constantly evaluate one's abilities, knowledge and skills, and know one's professional limitations, seeking advice and assistance where appropriate.	1.1	0	3.3	29.0	65.6	1.1	1.1	4.6	94.6
C1 Use computers, software, the internet and other information technology	0	0	0	10.0	90.0	0	1.1	4.9	100.0
C2 Design and implement surveillance systems e.g. for risk factors, injuries, illnesses (n=83)	1.2	3.6	3.6	45.8	45.8	0	23.3	4.3	91.6
C3 Set up and manage a database	0	2.3	11.4	46.6	38.6	1.1	18.9	4.2	85.2
C4 Use Geographic Information Systems (GIS) (n=81)	3.7	17.3	22.2	46.9	8.6	1.2	43.8	3.4	55.5
C5 Apply ethical principles to the collection, maintenance, use, and dissemination of data and information	1.1	1.1	1.1	22.2	71.1	3.3	3.3	4.7	93.3
D1 Define problems and clarify questions	0	0	1.1	22.5	76.4	0	2.2	4.8	98.9
D10 Create an application for funding to support a research /evaluation project.	2.3	9.2	27.6	40.2	18.4	2.3	20.0	3.6	58.6
D11 Develop publications suitable for peer-review (e.g., presentation or poster at scientific conference, article).	0	5.6	7.9	49.4	37.1	0	5.6	4.2	86.5
D12 Design and conduct an outbreak investigation (n=85)	1.2	5.9	7.1	37.7	47.1	1.2	22.7	4.3	84.8
D13 Design and conduct an investigation into a disease cluster (e.g. cancer cluster) (n=85)	1.2	5.9	10.6	40.0	42.4	0	26.7	4.2	82.4
D14 Design and conduct health risk assessments (n=85)	1.2	4.7	10.6	49.4	29.4	4.7	18.2	4.1	78.8

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D2 Use statistical software to calculate measures of precision, trends and association	0	0	1.1	22.2	76.7	0	2.2	4.8	98.9
D3 Understand basic sampling methods as well as the estimation of appropriate sample sizes	0	0	2.2	30.0	67.8	0	2.2	4.7	97.8
D4 Use statistical software to carry out multivariable hypothesis-testing analyses of an original observational or experimental research study	0	11.6	14	37.2	37.2	0	26.7	4.0	74.4
D5 Interpret measures of burden, association and effectiveness	0	0	5.6	38.9	55.4	<i>1.1</i>	3.3	4.5	94.3
D6 Design the protocol for a new observational or hypothesis-testing research study	0	8	12.5	45.5	33.0	<i>1.1</i>	15.6	4.0	78.5
D7 Design a complex or advanced analysis plan, sampling design or sample size estimation (n=79)	1.3	13.9	19	40.5	24.1	<i>1.3</i>	43.3	3.7	64.6
D8 Assist with design and implementation of qualitative research	1.2	2.3	18.4	47.1	29.9	<i>1.2</i>	14.6	4.0	77.0
D9 Recognize potential sources of bias and describe methods to reduce the impact of such bias through design and/or analysis.	0	0	0	31.1	65.6	<i>3.3</i>	3.3	4.7	96.7
E1 Translate epidemiologic data and scientific literature into something that public health practitioners can understand and use	0	0	1.1	16.7	82.2	0	5.6	4.8	98.9
E2 Translate epidemiologic data and scientific literature into something that the general public can understand and use	0	4.5	3.4	22.5	69.7	0	4.9	4.6	92.2

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F1 Convey information clearly in formats (reports, presentations) appropriate to the recipient	0	0	0	22.2	77.8	0	1.1	4.8	100.0
F2 Be aware of health promotion theories sufficient to discuss them with other public health staff	1.1	3.4	21.4	41.6	31.5	1.1	8.9	4.0	73.1
F3 Be aware of approaches to health protection sufficient to discuss them with other public health staff	1.1	3.4	16.9	48.9	30.7	0	5.6	4.1	79.6
F4 Contribute to emergency response (n=65)	1.5	7.7	56.9	33.9	0	0	9.1	3.2	33.9
G1 Establish and maintain linkages with community leaders and other key stakeholders	1.1	9.1	22.7	44.3	21.6	1.1	2.3	3.8	65.9
G2 Effectively communicate with members of an inter-disciplinary team for the purpose of information exchange, conflict resolution and the provision and receipt of feedback.	1.1	4.4	3.3	36.7	54.4	0	1.1	4.4	91.1
G3 Facilitate learning of clients, co-workers, a team, your organization, and other health professionals.	1.1	4.4	12.2	41.1	41.1	0	5.6	4.2	82.2
G4 Demonstrate coaching/mentoring skills (n=73)	1.4	4.1	19.2	45.2	30.1	0	6.7	4.0	75.3
H1 Help create a culture where prevention-strategies and programming are evidence-based	1.1	3.4	5.7	35.2	54.6	0	4.5	4.4	89.8
H2 Frame a public health issue and integrate the relevant data with a critical interpretive lens	0	0	5.6	37.1	55.2	1.1	6.7	4.5	92.3
H3 Support program and policy development with relevant data and literature	1.1	1.1	4.5	32.6	60.7	0	6.7	4.5	93.3

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H4 Make formal recommendations for further investigations or actions that should be taken	1.1	6.8	6.8	34.1	48.9	2.3	3.4		4.3	83.0
H5 Directly advocate for policies or priorities with policy-makers and stakeholders	2.3	16.1	27.6	37.9	14.9	1.2	11.2		3.5	52.8
H6 Provide expertise in program monitoring and evaluation (n=85)	0	7.1	9.4	41.2	40.0	2.3	28.1		4.2	81.2
I1 Be accurate, meticulous and organized in one's work	0	0	4.4	28.9	66.7	0	1.1		4.6	95.6
I2 Effective time managers able to prioritize and complete multiple tasks	1.1	0	5.6	31.1	62.2	0	2.2		4.5	93.3
I3 Interact/work sensitively and effectively with persons from diverse back-grounds, health status, and lifestyle preferences	1.1	3.3	6.7	27.8	61.1	0	1.1		4.4	88.9
I4 Constantly evaluate one's abilities, knowledge and skills, and know one's professional limitations	1.1	1.1	3.3	36.7	57.8	0	1.1		4.5	94.5

(1) Expressed as percent of all valid responses, including 'don't know'.

(2) Mean of agreement scale, calculated as 1 to 5, excluding 'don't know' responses.

Appendix B Synopsis of discussion on competency statements from APHEO membership workshop, December 7, 2006

Understanding the system	
Accepted without significant discussion	
	A1 Understand concepts of population health status, health determinants, disease (or injury) risk factors, and health care utilization
	A2 Know about public health and public health systems
Accepted with comments only	
	A4 Advocate for better data and information resources
	<i>Clarification recommended. Comments made that 'advocate' implied to working within the public health bureaucracy and not to the general public; not advocacy in the sense of direct political involvement.</i>
	A3 Know about other health care systems
	<i>Clarification recommended. PH Epis should know about other sectors of the Ontario health system, and current/proposed changes being made in Ontario, but not necessarily other health system models, say, outside Ontario or Canada.</i>
Identifying sources of information and critical appraisal	
Accepted without significant discussion	
	B5 Critically evaluate and synthesize relevant scientific literature
	B4 Identify and obtain relevant scientific literature
	B2 Identify sources of health-related data, and know how to access them
	B6 Constantly evaluate one's abilities, knowledge and skills, and know one's professional limitations, seeking advice and assistance where appropriate.
	B3 Discuss or debate the strengths and weaknesses of existing health-related data
	B1 Identify gaps in needed data and know how to fill them
Databases, technology and surveillance	
Accepted without significant discussion	
	C1 Use computers, software, the internet and other information technology
	C5 Apply ethical principles to the collection, maintenance, use, and dissemination of data and information
	C2 Design and implement surveillance systems e.g. for risk factors, injuries, illnesses
Accepted with comments only	
	C3 Set up and manage a database
	<i>Clarification recommended. There was a clear consensus that PH epidemiologists need to be able to define key constructs, definitions, categories and data rules used in a database, reflecting substantive knowledge. They would be able to specify a data request. However, the Epidemiologists would often work with technical staff for more advanced aspects of design and programming to build a database tool.</i>

Not accepted as core (mix of in favour and not in favour)	
	C4 Use Geographic Information Systems (GIS) <i>Clarification is required. There was considerable discussion regarding the depth and complexity of task implied by 'use' of GIS. Use and interpretation of maps and mapping software was considered core. However, advanced analytic (hypothesis testing) use of GIS was seen as non-core. This was identified as an area where there is interest for continuing education. Flagged as a potential 'emerging' area or future core competency.</i>
Methods and analysis	
Accepted without significant discussion	
	D2 Use statistical software to calculate measures of precision, trends and association
	D1 Define problems and clarify questions
	D3 Understand basic sampling methods as well as the estimation of appropriate sample sizes
	D9 Recognize potential sources of bias and describe methods to reduce the impact of such bias through design and/or analysis.
	D5 Interpret measures of burden, association and effectiveness
Accepted with comments only	
	D11 Develop publications suitable for peer-review (e.g., presentation or poster at scientific conference, article). <i>Clarification recommended. Noted that getting publications was not always a priority for the public health unit, and not all epidemiologists would be given the opportunity to seek publication. However, skills required to produce publishable work was core, as was the ability to share findings. Noted that reports of various sorts could be peer-reviewed and read well beyond local community, not just in first-tier medical journals.</i>
	D12 Design and conduct an outbreak investigation <i>Overlap with specialist function noted. "Any epidemiologist could be called upon to do this." Also noted, however, that other specialists would be involved, typically.</i>
	D13 Design and conduct an investigation into a disease cluster (e.g. cancer cluster) (n=85) <i>Overlap with specialist function noted. As above, "any epidemiologist could be called upon..." Again, noted that the role overlaps with other role groups.</i>
	D6 Design the protocol for a new observational or hypothesis-testing research study <i>Clarification recommended. Comments focused on difference between competencies versus roles or activities. P.H.Epis would rarely be encouraged to initiate research of their own design unless it was directly related to their applied work. However, it was felt that all should have the competencies to design and complete research which forwarded the mandate of the Unit.</i>
	D8 Assist with design and implementation of qualitative research <i>Clarification recommended. Comments made were that epidemiologists were primarily quantitative people but who are expected (almost universally) to understand, contribute to and support qualitative research as well. It was noted that qualitative research was a discipline in which epidemiologists typically were not formally trained and would benefit from additional formal training.</i>

Accepted as core (mix of in favour and not in favour)	
	D14 Design and conduct health risk assessments
	<i>Clarification is required for meaning of "risk assessment". When defined in terms of toxic exposures, the role of other experts was noted. Could also be defined more broadly in terms priority setting etc., in terms of assessment of public health impacts.</i>
	D4 Use statistical software to carry out multivariable hypothesis-testing analyses of an original observational or experimental research study
	<i>Clarification should be provided. There was strong endorsement of this item when taken to mean that PH Epis need to understand how to carry out a thoughtful and thorough statistical analysis, using software tools (as distinct from deriving own biostatistical methods), and be able to guide and direct this process. It was noted that competent PH Epis needn't necessarily keep up proficiency with specific software and syntax, but might direct statistical analyses through an analyst, work with a biostatistician, or be able to relearn software if necessary.</i>
Not accepted as core (mix of in favour and not in favour)	
	D7 Design a complex or advanced analysis plan, sampling design or sample size estimation
	<i>Clarification required. The group as a whole was unable to accept this item, as written, as a core competency. It is possible that the heading includes too broad a list of specific activities, some of which would be core and others would not. Examples of understanding and using complex samples (e.g., use of RRFSS data) would fall under this category and be considered as something all PH Epidemiologists should be able to carry out. The design of some complex sampling designs (e.g., local monitoring involving schools or clinics) would be core, while others (design something as complex as the CCHS) would not. A wording change to "Understand a complex..." was recommended, following which the item was recommended as a core competency.</i>
Not accepted as core	
	D10 Create an application for funding to support a research /evaluation project.
	<i>Discussion included statements that PH Epis would be called upon to contribute epidemiological expertise to such applications and must be competent to contribute methodological expertise. This was paired with apparent consensus that the epidemiologist per se would not be expected to lead the process or working alone. Other role groups, specifically managers, would be expected to take the lead, particularly in terms of priority-setting and political considerations around why, and from where, outside funding would be sought.</i>
Knowledge translation	
Accepted without significant discussion	
	E1 Translate epidemiologic data and scientific literature into something that <u>public health practitioners</u> can understand and use
	E2 Translate epidemiologic data and scientific literature into something that <u>the general public</u> can understand and use

Communication, health promotion and health protection	
Accepted without significant discussion	
	F1 Convey information clearly in formats (reports, presentations) appropriate to the recipient
	F3 Be aware of approaches to health protection sufficient to discuss them with other public health staff
Accepted with comments only	
	F2 Be aware of health promotion theories sufficient to discuss them with other public health staff
	<i>Clarification required. The word 'theories' caused problems here. When rephrased as 'approaches' this seemed acceptable.</i>
	F4 Contribute to emergency response (n=65)
	<i>Clarification recommended. Group present were all in favour when the emergency was defined as a threat to the population (e.g., outbreak, toxic spill). Poorer agreement with this item in the online survey may have reflected consideration that epidemiologists would not work alone, nor necessarily lead such efforts. Clarification: epidemiologists are not EMS personnel; would not do field work on most emergencies.</i>
Partnerships	
Accepted without significant discussion	
	G2 Effectively communicate with members of an inter-disciplinary team for the purpose of information exchange, conflict resolution and the provision and receipt of feedback.
Accepted with comments only	
	G3 Facilitate learning of clients, co-workers, a team, your organization, and other health professionals.
	<i>Overlap with core competency for all of Public Health.</i>
Accepted as core (mix of in favour and not in favour)	
	G4 Demonstrate coaching/mentoring skills (n=73)
	<i>Clarification required. There was general support of this in a general and informal sense; and in this it was viewed as overlapping with core competencies for all public health staff. Dissenting voices stated that a formal role in training is not required of all PH Epidemiologists.</i>
	G1 Establish and maintain linkages with community leaders and other key stakeholders
	<i>Clarification required. The term 'community leaders' was very problematic here. Some said to strike this and others recommended inserting 'appropriate' or 'as appropriate' into the phrase. As was noted elsewhere the group present saw the epidemiologist as having a role working with all public health professionals and role groups, but not a direct role in speaking with the public (i.e., not acting unilaterally to define messages going directly to the public or media; not to usurp the role of government in setting policy).</i>
Policy and communication	
Accepted without significant discussion	
	H3 Support program and policy development with relevant data and literature
	H2 Frame a public health issue and integrate the relevant data with a critical interpretive lens
	H1 Help create a culture where prevention-strategies and programming are evidence-based

Accepted with comments only	
H4	Make formal recommendations for further investigations or actions that should be taken
	<i>Clarification recommended. The audience should be specified here. As was noted elsewhere the group present saw the epidemiologist as having a role working with all public health professionals and role groups, and the Ministries of Health, but not a direct role in speaking with the public (i.e., not acting unilaterally to define messages going directly to the public or media; not to usurp the role of government in setting policy).</i>
H6	Provide expertise in program monitoring and evaluation (n=85)
	<i>Clarification required. Those present felt that the application of epidemiologic methods and principles to program monitoring and evaluation were core competencies. Some stated that designing a full evaluation plan may be a specialty function. It was uncertain whether or not 'program evaluation' referred to a distinct discipline or training that epidemiologists would not have completed. Formal training in the discipline of program evaluation was flagged as an area of need for continuing education.</i>
Not accepted as core	
H5	Directly advocate for policies or priorities with policy-makers and stakeholders
	<i>As stated in relation to other items, the audience was important here. It was proposed that Epis would form recommendations and present them to the MOH but that other role groups would do the direct advocacy at the political level.</i>
Performance, Leadership, Socio-cultural	
Accepted without significant discussion	
I1	Be accurate, meticulous and organized in one's work
I4	Constantly evaluate one's abilities, knowledge and skills, and know one's professional limitations
I2	Effective time managers able to prioritize and complete multiple tasks
Accepted with comments only	
I3	Interact/work sensitively and effectively with persons from diverse back-grounds, health status, and lifestyle preferences
	<i>This was seen to be a core competency for all PH role groups.</i>