

Identifying Core Competencies for Public Health Epidemiologists

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ABSTRACT

Background: Public health authorities have prioritized the identification of competencies, yet little empirical data exist to support decisions on competency selection among particular disciplines. We sought perspectives on important competencies among epidemiologists familiar with or practicing in public health settings (local to national).

Methods: Using a sequential, qualitative-quantitative mixed method design, we conducted key informant interviews with 12 public health practitioners familiar with front-line epidemiologists' practice, followed by a web-based survey of members of a provincial association of public health epidemiologists (90 respondents of 155 eligible) and a consensus workshop. Competency statements were drawn from existing core competency lists and those identified by key informants, and ranked by extent of agreement in importance for entry-level practitioners.

Results: Competencies in quantitative methods and analysis, critical appraisal of scientific evidence and knowledge transfer of scientific data to other members of the public health team were all regarded as very important for public health epidemiologists. Epidemiologist competencies focused on the provision, interpretation and 'translation' of evidence to inform decision-making by other public health professionals. Considerable tension existed around some potential competency items, particularly in the areas of more advanced database and data-analytic skills.

Interpretation: Empirical data can inform discussions of discipline-specific competencies as one input to decisions about competencies appropriate for epidemiologists in the public health workforce.

Key words: Human resources; professional competence; epidemiology; interview; survey; Canada

La traduction du résumé se trouve à la fin de l'article.

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In Canada, federal and provincial public health authorities have called for increased training and expansion of the public health workforce.^{1,2} To guide this development, a single set of core (cross-disciplinary) competencies for all public health personnel were developed, primarily through consensus processes of experts.³⁻⁷ These core competencies define the main knowledge and skills of public health workers, and form the building blocks for discipline-specific ones, e.g., of public health nurses⁸ and nutritionists.⁹ For epidemiologists, national associations have set some criteria for admission to 'colleges', but competencies for an epidemiologist working in public health have only been defined in the USA.¹⁰

Discipline-specific competencies help a discipline to define their role within public health and guide training needs assessment and educational curricula development. During their 2004 strategic planning process, the Association of Public Health Epidemiologists of Ontario (APHEO) identified discipline-specific competencies as a priority and commissioned a review.¹¹ APHEO chose to focus on entry-level epidemiologists who had become familiar with their role, akin to roughly two years experience, rather than management, specialist, or research roles.

This article describes collaboration between the authors and APHEO, using qualitative, quantitative and consensus-based research, to draft a set of core, discipline-specific competencies for epidemiologists in Ontario public health settings. We assumed that core competencies for public health epidemiologists would build upon, but *not* necessarily be identical to, core competencies for all public health practitioners.⁷ Our objective was to ascertain the views of public health epidemiologists in Ontario on their own core competencies. We could find no examples of competencies being defined by rigorous research methods and involving front-line staff.^{3-7,12} Hence, we started with key informants exploring what was unique about competencies of public health epidemiologists. Second, we surveyed front-line practitioners to get their input and validate potential competencies. Finally, we convened a consensus workshop to explore areas of disagreement and resolve conflicts.

METHODS

Key informant interviews

We sought key informants who had experience working as, or working closely with, epidemiologists within public health units in Ontario and Canada. For ethical reasons, APHEO provided or approved 20 names (>50% more than needed), from which one of us (KB) could obtain consent and arrange interviews with 12. In order to obtain varied perspectives, the purposive sample included a mix of individuals who did and did not have: academic appointments related to epidemiology, advanced research training, and formal management experience.¹³ Interviews consisted of standard, relatively open-ended questions on the perceived nature of the core competencies, centred on the consensus Canadian five public health functions (population health assessment, health surveillance, health promotion, disease and injury prevention, and health protection),⁵ e.g., “What competencies do public health epidemiologists use when carrying out population health assessment?” Through a

TABLE I

Broad Competencies that Arose from the Key Informant Interviews (n=12) Regarding Core Competencies for Public Health Epidemiologists

- familiarity with technology (databases and systems)
- 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
- knowledge of determinants of health

review of notes from all interviews, general themes were identified and key illustrative quotes extracted.¹³ Feedback from the APHEO Executive to a presentation of initial findings assisted the authors with interpretation.

Web-assisted survey

Using the results from the key informant phase, the first three authors iteratively developed a survey instrument. Consistent with approaches used for defining educational objectives,¹⁴ competencies were worded in the active voice and expressed in the positive, e.g., “Advocate for better data and information resources.” General head-

ings assisted survey respondents in contextualizing the meaning of the 49 competency items. On a five-point Likert-type scale (strongly disagree through strongly agree), respondents indicated their level of agreement that each item was a required competency for an entry-level public health epidemiologist. A tickbox allowed respondents to indicate items felt to be primarily related to the role of a specialist. Narrative comments were solicited for each section and overall.

The survey sampling frame included all members of APHEO for fiscal years 2005 and 2006 (as of March 2006). Full APHEO members (epidemiologists in

TABLE II

Characteristics of Respondents to Web-based Survey of APHEO Members

	Total Sample		Full Members of APHEO		Affiliate Members	
	n	%	n	%	n	%
Total sample	90	100	53	58.9	37	41.1
Gender (n=89)						
Male	23	25.8	13	25.0	10	27.0
Female	66	74.2	39	75.0	27	73.0
Which of the following best describes the main type of work that you do? (n=87)						
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
Have you completed a degree in epidemiology? (n=90)						
Yes	65	72.2	48	90.6	17	46.1
No	25	27.8	5	9.4	20	54.1
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)						
Yes	77	88.5	47	90.4	30	85.7
No	10	11.5	5	9.6	5	14.3
What is the most advanced degree that you possess? (n=90)						
Bachelor's degree	6	6.7				
Masters degree (included in progress)	73	81.1				
PhD or doctoral degree	11	12.2				
How long have you worked in a health unit doing epidemiology? (n=90)						
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 health unit as epidemiologist, or <2 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

TABLE III

Competency Statements Grouped by Domains, Subranked by Percentage of Agreement, with Indication of Specialist Role, and Recommendation in Consensus Workshop

Domain	Item as Asked on the Survey Instrument (n=90 valid responses unless otherwise specified)	% Agree or Strongly Agree*	Possible Specialist Role†	Recommendation‡
Understanding the system	A1 Understand concepts of population health status, health determinants, disease (or injury) risk factors, and health care utilization	100.0		Accepted
	A2 Know about public health and public health systems	97.1		Accepted
	A4 Advocate for better data and information resources	86.1		Accepted; clarification recommended
	A3 Know about other health care systems	70.1	Yes	Accepted; clarification recommended
Identifying sources of information and critical appraisal	B5 Critically evaluate and synthesize relevant scientific literature	98.9		Accepted
	B4 Identify and obtain relevant scientific literature	97.7		Accepted
	B2 Identify sources of health-related data, and know how to access them	96.6		Accepted
	B6 Constantly evaluate one's abilities, knowledge and skills, and know one's professional limitations, seeking advice and assistance where appropriate	94.6		Accepted
	B3 Discuss or debate the strengths and weaknesses of existing health-related data	94.3		Accepted
	B1 Identify gaps in needed data and know how to fill them	93.2		Accepted
Databases, technology and surveillance	C1 Use computers, software, the internet and other information technology	100.0		Accepted
	C5 Apply ethical principles to the collection, maintenance, use, and dissemination of data and information	93.3		Accepted
	C2 Design and implement surveillance systems, e.g., for risk factors, injuries, illnesses (n=83)	91.6	Yes	Accepted
	C3 Set up and manage a database	85.2	Yes	Accepted; clarification recommended
	C4 Use Geographic Information Systems (GIS) (n=81)	55.5	Yes	Item not accepted without further deliberation; clarification recommended
Methods and analysis	D2 Use statistical software to calculate measures of precision, trends and association	98.9		Accepted
	D1 Define problems and clarify questions	98.9		Accepted
	D3 Understand basic sampling methods as well as the estimation of appropriate sample sizes	97.8		Accepted
	D9 Recognize potential sources of bias and describe methods to reduce the impact of such bias through design and/or analysis	96.7		Accepted
	D5 Interpret measures of burden, association and effectiveness	94.3		Accepted
	D11 Develop publications suitable for peer review (e.g., presentation or poster at scientific conference, article)	86.5		Accepted
	D12 Design and conduct an outbreak investigation (n=85)	84.8	Yes	Accepted
	D13 Design and conduct an investigation into a disease cluster (e.g., cancer cluster) (n=85)	82.4	Yes	Accepted
	D14 Design and conduct health risk assessments (n=85)	78.8	Yes	Accepted; clarification recommended
	D6 Design the protocol for a new observational or hypothesis-testing research study	78.5	Yes	Accepted; clarification recommended
	D8 Assist with design and implementation of qualitative research	77.0	Yes	Accepted; clarification recommended
	D4 Use statistical software to carry out multivariable hypothesis-testing analyses of an original observational or experimental research study	74.4	Yes	Accepted; clarification recommended
	D7 Design a complex or advanced analysis plan, sampling design or sample size estimation (n=78)	64.6	Yes	Item not accepted as written. Accepted when "Design" changed to "Understand". Clarification recommended.
	Knowledge translation	D10 Create an application for funding to support a research /evaluation project	58.6	Yes
E1 Translate epidemiologic data and scientific literature into something that public health practitioners can understand and use		98.9		Accepted
E2 Translate epidemiologic data and scientific literature into something that the general public can understand and use		92.2		Accepted
Communication, health promotion and health protection	F1 Convey information clearly in formats (reports, presentations) appropriate to the recipient	100.0		Accepted
	F3 Be aware of approaches to health protection sufficiently to discuss them with other public health staff	79.6		Accepted
	F2 Be aware of health promotion theories sufficiently to discuss them with other public health staff	73.1		Accepted; clarification recommended
	F4 Contribute to emergency response (n=65)	33.9		Accepted; clarification recommended
Partnerships	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		Accepted
	G3 Facilitate learning of clients, co-workers, a team, your organization, and other health professionals	82.2		Accepted
	G4 Demonstrate coaching/mentoring skills (n=73)	75.3		Accepted; clarification recommended
	G1 Establish and maintain linkages with community leaders and other key stakeholders	65.9		Accepted; clarification recommended

...continues

TABLE III, continued

Domain	Item as Asked on the Survey Instrument (n=90 valid responses unless otherwise specified)	% Agree or Strongly Agree*	Possible Specialist Role†	Recommendation‡
Policy and communication	H3 Support program and policy development with relevant data and literature	93.3		Accepted
	H2 Frame a public health issue and integrate the relevant data with a critical interpretive lens	92.3		Accepted
	H1 Help create a culture where prevention strategies and programming are evidence-based	89.8		Accepted
	H4 Make formal recommendations for further investigations or actions that should be taken	83.0		Accepted; clarification recommended
	H6 Provide expertise in program monitoring and evaluation (n=85)	81.2	Yes	Accepted; clarification recommended
Performance leadership, socio-cultural	H5 Directly advocate for policies or priorities with policy-makers and stakeholders	52.8	Yes	Item not accepted
	I1 Be accurate, meticulous and organized in one's work	95.6		Accepted
	I4 Constantly evaluate one's abilities, knowledge and skills, and know one's professional limitations	94.5		Accepted
	I2 Be effective time managers, able to prioritize and complete multiple tasks	93.3		Accepted
	I3 Interact/work sensitively and effectively with persons from diverse backgrounds, health status, and lifestyle preferences	88.9		Accepted

* Findings from web survey. Percent of respondents answering 'agree' or 'strongly agree' that the item was a core competency, over all responses including 'don't know'.

† Findings from web survey. "Yes" indicates that 10% or more of respondents checked that, in their view, this item was primarily at the level of 'specialist' as opposed to core competency.

‡ Final disposition of item following consensus-seeking workshop, December 2006.

public health) and affiliate members (other interested public health colleagues) were included. The survey was advertised in a message from the APHEO president via the APHEO listserv, followed by a mail-merge message including letter of consent and individual login instructions. Four additional broadcast invitations/reminders were sent, over the next four weeks, to non-respondents. Among the 165 members sent e-mails, 10 were subsequently removed after confirmation that they had left a position without a forwarding address, or were on extended absence, leaving 155 potential respondents.

In descriptive analyses, "don't know" responses were treated as missing and "agree" or "agree strongly" responses were categorized as agreement. Limited bivariate analyses determined if level of agreement for each item differed by respondent characteristics.¹⁵ Chi-square tests for non-independence (exact tests as appropriate) were calculated with 5% alpha. The only *a priori* hypothesis was that affiliate members, who tend to have research or management experience, might more commonly agree with items relating to their experience than full members.

Consensus workshop

In December 2006, all APHEO members were invited to a workshop focused on survey results. In small groups, participants discussed all statements with less than 90% agreement on importance and decided if each item should be kept as "core".

Decisions, and reasons, were shared in plenary and documented in field notes.

RESULTS

Key informants

All 12 contacted key informants agreed to participate. Familiarity with technology as well as critical thinking and analysis were regarded as important for epidemiologists to be able to fulfill all of the five public health functions (see Table I). Two quotations best summarized key informants' views: a public health epidemiologist is "*a friendly cynic*" and is "*able to translate highly technical and statistical information into information that front-line people can understand and use.*" Key informants also emphasized partnership, collaboration and being a team player.

Survey

Ninety individuals completed the web-assisted questionnaire (90/155, 58.1% response rate). Overall 58% of respondents were 'Full Members' of APHEO (Table II); 61% currently worked as general public health epidemiologists; and roughly half had two or more years of experience as an epidemiologist in a local public health unit.

For over half the competency items, 90% or more of respondents strongly agreed or agreed that the item was important. Eighteen items had between 70-90% agreement and 5 items <70% agreement. Overwhelming agreement was apparent for

items in *identifying sources of information* and *critical appraisal* (column 3, Table III). For *methods and analysis*, a substantial number of competency items were endorsed highly but other items had much lower levels of agreement, with assignment of many items as important for specialists rather than entry-level public health epidemiologists (column 4, Table III). The two items under *knowledge translation* were highly endorsed. Among the other headings, greater heterogeneity in responses was observed. No statistically significant associations between agreement ratings and APHEO membership status were found nor for other comparisons, though we likely had insufficient power for comparisons involving smaller subgroups.¹⁵

Open-ended comments were made regarding the meaning of "core" competencies and the nature of "professionalization" in epidemiology. Recommended were greater reference to specific legislation, programs and guidelines in Ontario, inclusion of global/international health, and active participation in associations of epidemiologists. Some individuals felt threatened by defining competencies, raising concerns about inadequate training or being asked to do more than they felt capable of doing.

Consensus workshop

Twenty-six APHEO members attended. Several competency items were flagged as requiring further clarity (definitions and boundaries set as to what was expected).

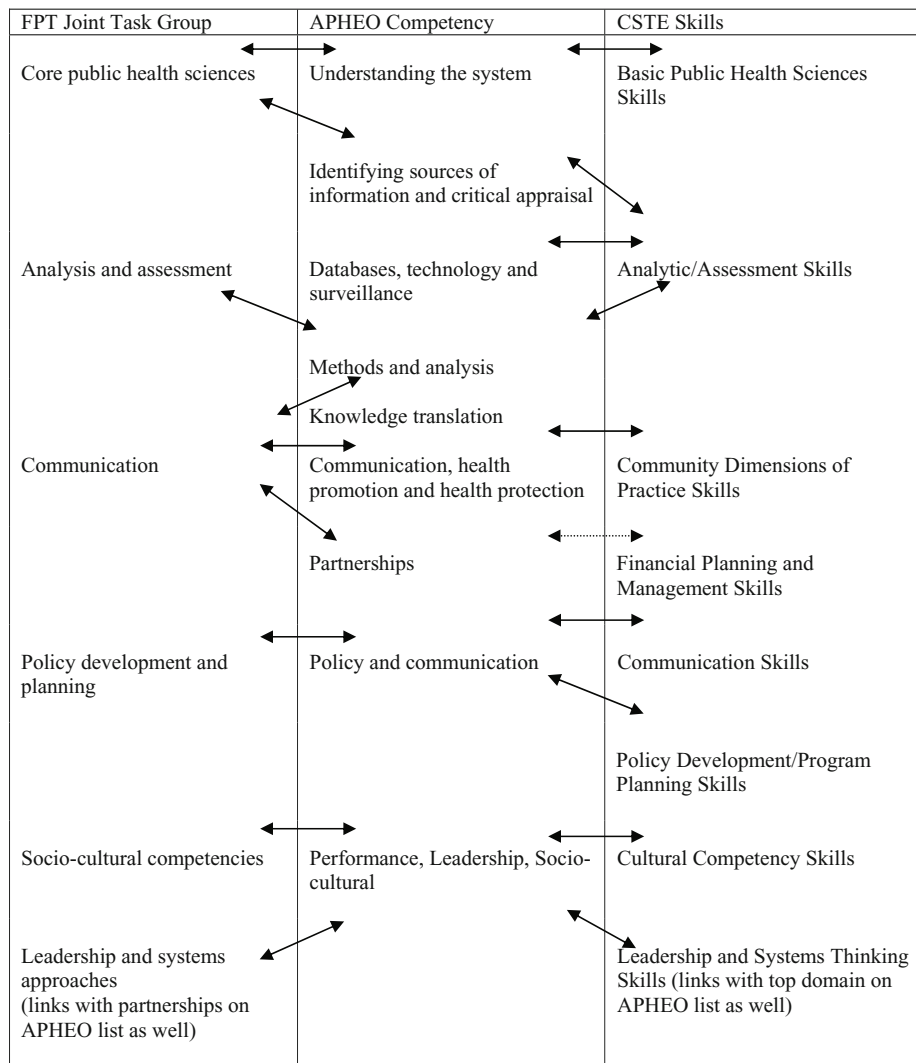


Figure 1. Overall* mapping of competency domains across frameworks†
 * Overall, as some items/competencies within each domain map differently than the majority in that domain
 † FPT Task Group = Federal/Provincial/Territorial Task Group on Public Health Human Resources^{3,4}
 APHEO = Association of Public Health Epidemiologists of Ontario (see Table II)
 CSTE= United States Council of State and Territorial Epidemiologists¹⁰

There was consensus that greater clarity was needed on some terms such as “*risk assessment*”, “*program evaluation*”, “*qualitative research*” and “*emergency response*”. In regard to detailed statistical and geographical analyses, many members felt that these were specialist competencies. Regarding peer-reviewed publication and research grants, the group commented that epidemiologists should be “able to do” but not “expected to do” these, as such activities may not be of interest to public health units. Participants challenged suggestions that epidemiologists would necessarily take a direct role in policy-making and management.

DISCUSSION

We used a qualitative-quantitative, mixed method approach to obtain empirical data from practicing epidemiologists on public health-relevant competencies for epidemiologists. This resulted in a set of competencies that was strongly endorsed by front-line staff. Most respondents agreed that the stated competency items encompassed the discipline-specific competencies for entry-level public health epidemiologists, though some items received sufficiently low endorsement to question their inclusion as core. These would preferentially be assigned to spe-

cialists, managers, or epidemiologists in other settings.

Our use of an explicit, empirical approach is innovative in this field. For recent Pan-Canadian overall core competencies for public health staff,⁷ an initial set was developed by a small group of experts (with no primary data collection) and revised through an iterative consultation process. Similar processes have been used by public health nurses⁸ and nutritionists.⁹ The US Council of State and Territorial Epidemiologists (CSTE¹⁰) also consulted the field through a volunteer sample (open) web-based survey with no formal sampling frame or follow-up included. We believe that our two-staged approach incorporated the advantages associated with both expert consultation and validation by a defined group of front-line staff.

However, the potential for selection and information biases exists. Key informants are “persons whose position or experience should give them some perspective on the magnitude and distribution of the problem,”¹⁶ but their identification by APHEO working group members may have limited the breadth and nature of perspectives tapped. Nevertheless, key informant interviews identified areas of disagreement that were echoed in the online survey and consensus meeting – showing cross-method convergence in findings. The sampling frame for the web survey was that of a professional association operated by and for public health epidemiologists. No alternative registry or governmental human resources list exists for epidemiologists working in public health.

Further, despite spending considerable time grouping competencies, we do not wish to overstate evidence of validity for our groupings. (See Figure 1 for a comparison of groupings.) We did not use techniques such as factor analysis to group competencies. Perceived importance of individual items was evaluated (rather than strength of association between items and an underlying construct). Groupings need not represent unidimensional constructs. Actual skills and knowledge needed to be competent in one area may overlap with others.

We see our competency statements as evolutionary. Specific language is likely to be shaped by later discussion involving APHEO and other provincial and national

organizations of members who will be affected when such competency statements are adopted. Additional work on logic models may be required.¹⁷

An advantage of our iterative mixed method approach was that we were able to explore areas of controversy and tension. For example, considerable tensions arose around the competency items related to advanced database and data-analytic skills and geographic information systems. While many respondents agreed strongly that more advanced data analytic skills were important, others deferred to specialists, and disagreed – often strongly – that these were necessary for entry-level epidemiologists in public health settings.

Further, the introduction of competencies into the practice of public health epidemiology, including their possible application to activities such as accreditation and performance evaluation, raised concerns among respondents. Though these concerns were reduced through discussion at the workshop, their presence speaks to the need for continuing education programs for current practitioners and career development guidance, as integral parts of competency implementation. We are encouraged that national work on public health competencies recognizes the interdependence of parallel processes of competency development, discussion, and utilization in the development of the public health workforce (e.g., <http://www.phac-aspc.gc.ca/ccph-cesp/next-prochaines-eng.html>).

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RÉSUMÉ

Contexte : Les autorités de santé publique accordent une haute priorité à la détermination des compétences, mais il existe très peu de données empiriques à l'appui des décisions sur l'éventail des compétences nécessaires dans telle ou telle discipline. Nous avons demandé à des épidémiologistes connaissant bien la santé publique ou exerçant dans un cadre de santé publique (local, provincial-territorial ou national) quelles compétences étaient importantes à leurs yeux.

Méthode : À l'aide d'une méthode séquentielle comportant à la fois des données qualitatives et quantitatives, nous avons interviewé 12 praticiens de la santé publique connaissant bien les pratiques des épidémiologistes de première ligne; ces entrevues ont été suivies par un sondage en ligne auprès des membres d'une association provinciale d'épidémiologistes en santé publique (90 répondants sur 155 personnes admissibles) et par un atelier de concertation. Des énoncés de compétences ont été extraits des listes de compétences de base existantes et des compétences désignées par nos informateurs, puis classés selon leur niveau de concordance quant à leur importance pour les praticiens au niveau d'entrée.

Résultats : Certaines compétences (méthodes et analyse quantitatives, évaluation critique des preuves scientifiques, transfert des connaissances scientifiques aux autres membres de l'équipe de la santé publique) revêtent une grande importance pour les épidémiologistes en santé publique. Ces compétences s'articulent autour de la prestation, de l'interprétation et de la « traduction » des données probantes pour étayer les processus décisionnels des autres professionnels de la santé publique. D'autres compétences envisagées, surtout les compétences spécialisées d'analyse de données et de bases de données, suscitent toutefois de vives controverses.

Interprétation : Les données empiriques peuvent alimenter le débat sur les compétences propres à certaines disciplines si l'on en tient compte dans les décisions sur les compétences exigées des épidémiologistes en santé publique.

Mots clés : ressources humaines; compétence professionnelle; épidémiologie; entrevue; sondage; Canada