2019 Epidemiology Capacity Assessment

Association of Public Health Epidemiologists in Ontario

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APHEO
Association of Public Health Epidemiologists in Ontario

Executive Summary

Background and purpose

This report summarizes the results of the 2019 Epidemiology Capacity Assessment project conducted by the Association of Public Health Epidemiologists in Ontario (APHEO). The project purpose was to enumerate the applied epidemiology workforce in the public health sector in Ontario, and to assess the extent to which current capacity meets public health mandates. The project was conducted in recognition of the value of such information for evidence-informed decision-making at a time of planned restructuring of the public health sector in the province.

It is important to note that the survey was conducted in late 2019, and therefore provides a snapshot of the state of public health epidemiology in Ontario prior to the COVID-19 outbreak, which was declared a global pandemic by the World Health Organization on March 11, 2020.

Methods

The assessment was conducted via an eleven-question online survey (**Appendix A**), distributed to organizations with a public health mandate from the Ontario government, including 35 public health units, one provincial public health agency (Public Health Ontario), and two First Nations health authorities. Organizations were provided inclusion criteria (**Appendix B**) to determine which staff to include in the enumeration; one response per organization was requested. The survey was open for a period of approximately three weeks in November and December 2019.

Results

Thirty-five of the 38 (92.1%) invited organizations responded to the enumeration survey, while two local organizations and Public Health Ontario did not respond. The summarized survey results are organized into seven parts in this report.

Part 1: Structure of workforce The majority of Ontario's local public health organizations (31 of 35, 88.6%) have a centralized epidemiology structure. Of those, two-thirds have epidemiology and analytical staff that support all program areas, while the remainder have staff with specific portfolios or support specific program areas. One other organization had a decentralized structure, with epidemiology and analytic staff in program areas. Two of the remaining three organizations had a hybrid, while the other noted that their structure includes formal service agreements for epidemiology consultancy services with neighbouring health units.

Part 2: Staff enumeration In total, there were 166.8 epidemiology and analytic staff full-time equivalents (FTEs) in 34 responding local public health organizations across Ontario (mean: 4.9, median: 3.8, range: 0.5-25.0 FTE per organization). There

were 33 unique job titles reported, with the most common being Epidemiologist (97.1% of organizations), Health or Data Analyst (41.2%), and Manager or Supervisor (41.2%).

Fourteen of the local public health organizations surveyed had only one Epidemiologist FTE. In addition, one organization had less than one Epidemiologist FTE, while another had no Epidemiologists. The number of Epidemiologist FTEs per organization differed by peer group, with 'mainly urban centres with moderate or high population density' tending to have more Epidemiologist FTEs compared to 'mainly rural' or 'sparsely populated urban-rural mix' areas.

Part 3: Local capacity to meet needs Insufficient capacity is a broad challenge affecting a variety of organizations serving populations of varying sizes. Two-thirds of organizations (23 of 35) reported being unable to meet their organizations' needs with their current capacity. This varied by peer group, from 42.9% of 'mainly urban' organizations to 78.6% of 'urban-rural mix' organizations indicating insufficient capacity to meet needs. Organizations with sufficient capacity reported having more Epidemiologists (median: 2.0 vs. 1.0 FTE per organization).

Reasons for insufficient capacity included: insufficient FTEs, large volume of requests for data and support, complex data needs, management duties, vacant positions, and funding and political uncertainty. Insufficient capacity led to problematic outcomes including: inability to fully meet public health mandate, core activities not prioritized, or limited time to keep up with emerging issues, knowledge translation work or professional development.

Suggestions to improve epidemiology capacity included: additional FTEs, training for, and support from, non-epidemiology and analytic staff, technological solutions, improvements in data quality and management, organizational strategies for population health assessment and surveillance activities, and centralization of certain population health assessment and surveillance activities.

Part 4: Impact of external requests on capacity to meet local needs Sixty percent of organizations indicated external requests affect their ability to meet their own epidemiology needs. Organizations provide epidemiological support to a wide range of external partners, including from the health system, academics, government and local community organizations. Reasons for the impact included increasing volume or resource-intensity of requests, external partners having insufficient capacity or expertise, or external requests being prioritized higher than routine work.

Despite some challenges, some organizations noted there are benefits to working with external partners, including building relationships, building capacity and knowledge exchange, and shared priorities and efficiencies.

Part 5: Impact of requests for non-traditional epidemiology work About half of organizations said work outside the scope of traditional population health assessment and surveillance functions had an impact on their ability to meet their

own epidemiological needs. Examples of such requests included organizational or operational initiatives, provincial Ministry of Health reporting requirements, data visualization and knowledge translation beyond the typical scope of population health assessment and surveillance, technical projects, committee and engagement work, or research projects. Organizations noted an increasing volume of requests or resource intensity of such requests, insufficient capacity in other domains, or a reliance on the epidemiology skill set.

Some organizations do not experience impact from such requests because they get few requests, there are other staff or teams to do this type of work, or they ensure epidemiology and analytic staff only support work that is within scope. Some benefits of responding to such requests include the short-term impacts that can be outweighed by long-term improvements, and acknowledgment that epidemiology and analytic staff can make valuable contributions to these projects.

Part 6: Future scope of epidemiological work Some organizations anticipate changes for the future scope of epidemiological work in Ontario, including: that the scope and mandate of public health is growing and evolving, an increased emphasis on collaboration and reducing duplication, a need to improve data quality and data systems, a need for linking data systems, and evolving technology which presents both opportunities and challenges for public health.

For the local role, organizations anticipate the scope will include: local data collection, analysis, interpretation and decision-making, supporting local partners, greater collaboration between public health organizations, and specialization of epidemiology and analytic staff portfolios.

For the provincial or central role, organizations anticipate the scope will include: indicator development and standardized reporting, provision of data, tools and resources to local organizations, the development of provincial surveillance systems, specialized or technical support for local public health organizations, and provision of standardized analytical software.

Organizations identified potential challenges and concerns with the prospect of centralizing some analytical functions in the province, including: loss of local data contributions in decision-making, needs of smaller organizations being outweighed by needs of larger ones, disruption of existing relationships, and the cost associated with any removal of public health units that are currently embedded into regional government structure if there were plans to amalgamate.

Part 7: Training needs Organizations noted future training needs for epidemiology and analytical staff to continue to adapt to the needs of their organizations. Key areas include knowledge translation and data visualization, spatial analysis, data science and artificial intelligence, advanced epidemiological methods, effective public health practice, ‘soft skills’, health economics, data governance, and project management.

Discussion and limitations

This report provides the first-ever snapshot of the epidemiology capacity in the public health system in the province of Ontario, and a picture of the state of public health epidemiology in Ontario prior to the COVID-19 pandemic. The results point to both the important role that Epidemiologists play in population health assessment and surveillance activities, but also the critical collaboration of a wide range of job positions that together conduct and contribute to this foundational body of work in public health practice. The survey results also highlight the broad issue of insufficient epidemiology capacity that impacts a majority of local public health organizations across a variety of regions and characteristics. Key themes also emerged around issues with provincial data infrastructure and the opportunities and challenges posed by rapidly advancing technology. This enumeration provides useful evidence at a time of planned structural change to the public health system, and more broadly, serves as a baseline assessment for the public health epidemiology capacity in Canada's largest province prior to the COVID-19 pandemic.

Some limitations of the survey include: a lack of inclusion of provincial level perspective, some varied interpretations of the enumeration inclusion criteria, or the meaning of some survey questions. Results also reflect the views and opinions of the individuals participating in the survey, and may not reflect the views of the whole organization. It is also important to reflect on the potential influence of the current public health system context when interpreting the results.

Recommendations and next steps

Based on the enumeration survey results, APHEO recommends:

1. Efforts should be made to ensure that local public health organizations have sufficient epidemiology and analytic staff and resources to ensure that organizations can meet the requirements for population health assessment and surveillance in their public health mandate.

2. Public Health Ontario (PHO) and the Ministry of Health should continue to strengthen efforts to engage local public health epidemiology and analytic staff in various population health assessment and surveillance initiatives.

3. Local public health organizations should adopt a formalized framework or business process to plan and prioritize population health assessment and surveillance activities.

4. Public health organizations need to ensure they have capacity in foundational areas that complement epidemiological work, including roles that may be new in the public health field (e.g. program evaluation, continuous quality improvement (CQI), knowledge translation, health informatics, data science).

5. APHEO and PHO should organize training opportunities in emerging and growing areas such as data visualization, spatial analysis, data science and artificial intelligence.

6. Organizations should ensure all staff have a foundational set of public health core competencies.

7. Epidemiology and analytic staff should have access to and training on modern analytic tools (e.g. GIS, data visualization and business intelligence software).

8. The province should proactively invest in efficient and effective provincial data infrastructure for the public health system.

9. PHO should create new and build upon existing opportunities for epidemiology and analytic staff to collaborate and share resources across the province.

10. PHO should continue and enhance efforts in centralized population health assessment and surveillance activities, including providing tools and resources to local public health organizations to build upon this work in a more efficient way (e.g. providing syntax for Snapshots).

11. PHO should enhance their support for projects requiring specialized technical expertise that is often outside of the capacity of local public health organizations (e.g. health economics, spatial analysis).

This 2019 enumeration survey provides a baseline measurement of the epidemiology capacity in the province of Ontario. It will be important to repeat the enumeration in the future in order to monitor how capacity may be impacted as the state of public health in Ontario continues to evolve. In particular, the APHEO Epidemiology Capacity Assessment Workgroup recommends conducting a capacity assessment following any restructuring of the public health system in Ontario, and after sufficient resolution of the emergency response to the COVID-19 pandemic has been reached.

This project will inform APHEO's on-going work to advocate for and support its members, and continue in its mission to advance and promote the discipline and professional practice of public health epidemiology in Ontario.

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Acknowledgements

This work was completed by the Epidemiology Workforce Capacity Working Group on behalf of the Association of Public Health Epidemiologists in Ontario (APHEO).

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About APHEO

The Association of Public Health Epidemiologists in Ontario (APHEO) is a not-for-profit association with a mission to advance and promote the discipline and professional practice of public health epidemiology in Ontario, Canada.

Introduction

Background

What is the Association of Public Health Epidemiologists in Ontario?

Since its inception in 1991, the Association of Public Health Epidemiologists in Ontario (APHEO) has supported excellence in professional practice and promoted the integration of epidemiology in public health decision-making. The mission of APHEO is to advance and promote the discipline and professional practice of public health epidemiology in Ontario.

What is applied public health epidemiology?

Broadly defined, applied public health epidemiology is the practice of collecting, measuring, analyzing and interpreting health-related data and information to monitor trends, identify issues, investigate public health problems, and facilitate effective decision-making and evaluation.

In the province of Ontario, this function is carried out by Epidemiologists, Analysts and other professionals at public health units, Public Health Ontario, First Nations Health Authorities, and other health agencies across the province. These public health professionals are also referred to as epidemiology and analytic staff throughout this document.

Key activities of applied public health epidemiology include population health assessment and surveillance. The Ministry of Health, Public Health Ontario, and local public health entities each contribute to population health assessment and surveillance. At a high level:

- The Ministry of Health established the mandate for local public health units to perform population health assessment and surveillance to inform public health program planning, delivery and management, as outlined in the Ontario Public Health Standards (OPHS; Ministry of Health and Long-Term Care, 2018a). The Ministry of Health is also responsible for defining reportable diseases and key accountability indicators, and providing access to a variety of data sources for public health Ontario and local public health units.
- Public Health Ontario provides analysis and reporting of key population health status indicators for the province as a whole and for individual health units. They also facilitate some data access for public health units.
- Local public health units conduct analysis and reporting of priorities determined at the community level, that are directly applied to program planning, resource allocation, and municipal policy development.

Organizations and agencies such as First Nations Health Authorities also perform population health assessment and surveillance activities for the populations that they serve, to inform and support public health in Ontario.

Context

In April, 2019, the Ontario Provincial government announced the intention to modernize and restructure the public health system in Ontario. In the context of the proposed changes to the public health sector, APHEO determined there would be value in enumerating the workforce and generating evidence about current epidemiology capacity in the province, similar to what has been done at the state level in the United States (Council of State and Territorial Epidemiologists, 2017).

To our knowledge, an epidemiology capacity assessment has not been conducted before anywhere in Canada. By comparison, the CSTE in the United States has regularly conducted such capacity assessments at the State and Territorial level since 2001 (CTSE, 2017) and on an international front, some efforts are being made to assess the global public health workforce capacity, including Field Epidemiologists (Williams, Fontaine, Turcios Ruiz, Walke, Ijaz, and Baggett, 2020).

The survey, analysis, results and recommendations provided in this report were all developed and completed prior to the COVID-19 pandemic. Therefore, while this report presents a useful snapshot of the state of public health and epidemiology capacity in Ontario prior to the pandemic, it does not necessarily reflect the current state in the province at the time of publication of this report.

Purpose

The purpose of this project is to enumerate the applied epidemiology workforce in the public health sector in Ontario and assess the extent to which current capacity meets public health mandates. At a time of planned restructuring of the public health sector in Ontario, an epidemiology capacity assessment will ensure sufficient evidence exists for stakeholders to make evidence-informed decisions about future capacity requirements of the applied epidemiology workforce in the public health sector.

Objectives

The objectives of this epidemiology capacity assessment were:

- To enumerate the current applied epidemiology workforce in the public health sector in Ontario
- To better understand how the applied epidemiology workforce is structured within various organizations
- To learn about the extent to which current capacity meets public health mandates

Methods

The 2019 Epidemiology Capacity Assessment was conducted via a survey distributed to select public health organizations in the province of Ontario (**Appendix A**). The 2017 Epidemiology Capacity Assessment conducted by the Council of Territorial and State Epidemiologists (CTSE) in the United States served as a foundation for this project (CTSE, 2017).

Inclusion criteria

The survey was distributed to organizations with a public health mandate from the Ontario government, including 35 public health units, one provincial public health agency (Public Health Ontario), and two First Nations health authorities. The Ministry of Health was excluded, as their role in applied public health epidemiology is limited.

For the enumeration portion of the survey, organizations were instructed to refer to the inclusion criteria described in the separate document '[Who to count in the 2019 Epidemiology Capacity Assessment survey]' (**Appendix B**). For the purposes for this enumeration, employees were to be included as part of the public health epidemiology workforce if they met all of the following criteria:

1. Work at the following organizations
    - Public Health Ontario
    - A board of health (i.e. public health unit)
    - An Indigenous community-serving organization with a specified public health mandate
    - Employed by another level of government or government agency and assigned to work at an organization specified above

2. Have the following job specifications
    - Full time, part time, or on contract at the time of enumeration
    - In union or non union positions
    - Staff or management positions
    - Not a Medical Officer of Health, Associate Medical Officer of Health or Public Health Physician
    - Not a (paid or unpaid) student on a practicum or work placement

3. Have a primary job responsibility to fulfil the epidemiology function, which was broadly defined as "*collecting, measuring, analyzing and interpreting health related data and information to monitor trends, identify issues, investigate public health problems, and facilitate effective decision making and evaluation*".

The 'Who to Count' document (see **Appendix B**) also provided a list of primary job functions for public health epidemiological practice in Ontario.

For the purposes of this project, a broad inclusion criteria based on function rather than title (i.e. Epidemiologist) was chosen in recognition that various positions can, and often do, contribute to the epidemiology capacity within public health organizations (e.g. health analyst, data analyst).

Survey methodology

Survey questions were adapted from the CTSE epidemiology capacity assessment survey (CTSE, 2017), and finalized by the APHEO Epidemiology Capacity Assessment Working Group. An online survey was formatted using Public Health Ontario's survey tool Surveys@PHO. The survey questions are provided in **Appendix A**.

The online survey and Microsoft Word copy were disseminated to the Council of Medical Officers of Health (COMOH), Public Health Ontario, and the two First Nations Health Authorities on November 25, 2019. One response was requested per organization. One epidemiologist or epidemiologist manager per organization was identified by the Epidemiology Capacity Assessment Working Group and contacted to request that they support their organization with survey completion. The online survey closed on December 20, 2019.

Analysis

Analyses were conducted by two members of the Epidemiology Capacity Assessment Working Group using Microsoft Word 365, Microsoft Excel 365, and Stata/MP v. 15.1.

Quantitative analysis

For each quantitative question, descriptive analyses were performed. The denominator was determined per question and excluded missing responses and responses that were not applicable.

Public health units were categorized by peer group according to Public Health Ontario's geographic metadata for Snapshots derived from Statistics Canada Peer Groups, 2018 (**Table 1**). Peer groups enable comparisons of health regions with similar socioeconomic characteristics such as basic demographics, living conditions, and working conditions. The Sioux Lookout First Nations Health Authority was grouped in the 'mainly rural' category and the Weeneebayko Area Health Authority was included in the 'sparsely populated urban-rural mix' category. The 2019 projections for population served by public health unit were obtained from the Ontario Ministry of Finance via IntelliHealth Ontario.

Qualitative analysis

Responses to open text questions were reviewed by two analysts for themes. Codes were agreed upon by consensus. One analyst coded each response in Microsoft Word, which was reviewed by a second analyst; decisions were made by consensus.

Table 1: Peer groups for local public health organizations

Peer Group	Local Public Health Unit or First Nations Health Authority	Median and range of population served by public health organization, 2019
Mainly urban centres with moderate population density (n=7)	Durham Region Health Department Halton Region Public Health City of Hamilton Public Health Services Middlesex-London Health Unit Ottawa Public Health Region of Waterloo Public Health and Emergency Services Windsor-Essex County Health Unit	584,621 (421,283 to 1,036,868)
Sparsely populated urban-rural mix (n=16)	Algoma Public Health Brant County Health Unit Chatham-Kent Health Unit Eastern Ontario Health Unit Haliburton, Kawartha, Pine Ridge District Health Unit Hastings Prince Edward Public Health Kingston, Frontenac and Lennox and Addington Public Health Lambton Public Health Niagara Region Public Health North Bay Parry Sound District Health Unit Peterborough Public Health Porcupine Health Unit Public Health Sudbury & Districts Thunder Bay District Health Unit Timiskaming Health Unit Weeneebayko Area Health Authority	149,933 (32,872 to 468,461)
Mainly rural (n=11)	Grey Bruce Health Unit Haldimand-Norfolk Health Unit Huron County Health Unit* Leeds, Grenville & Lanark District Health Unit Northwestern Health Unit Perth District Health Unit* Renfrew County and District Health Unit Simcoe Muskoka District Health Unit Southwestern Public Health Wellington-Dufferin-Guelph Public Health Sioux Lookout First Nations Health Authority	141,270 (59,399 to 590,376)
Largest population centres with high population density (n=3)	Toronto Public Health Peel Public Health York Region Public Health	1,572,813 (1,205,623 to 3,065,953)

*In January 2020, Huron County Health Unit and Perth District Health Unit amalgamated to Huron Perth Public Health. The survey was conducted in December 2019, therefore, the two responses were analyzed separately.

Sources: Public Health Ontario. Geographic metadata for Snapshots: Public health units, peer groups and Local Health Integration Networks. Accessed Jan 7, 2020 at: https://ws1.publichealthontario.ca/appdata/Snapshots/Potentially%20Avoidable%20Mortality/Snapshots_Geography_Metadata.pdf; Ontario Ministry of Finance. Population projections (2019). Extracted on January 16, 2020 from IntelliHealth Ontario.

Results

Overall, 35 of 38 (92.1%) invited organizations responded to the survey, comprising 34 of 35 public health units and one of two First Nations health authorities.

Public Health Ontario declined to participate in the survey, noting that "based on the survey questions, which are focused at the local level, we believe other public health stakeholders will be able to provide the most relevant responses". Based on the publicly available staff directory, at the time of publication of this report, Public Health Ontario's staff complement included approximately 30 positions with 'Epidemiologist' in the title, and approximately 10 additional Analyst or Specialist positions that likely would have met the survey inclusion criteria (Public Health Ontario, 2020). As Public Health Ontario did not participate in the survey, the following results only reflect responses from sub-provincial public health agencies and health authorities.

Part 1: Structure of the local public health epidemiology workforce

The majority of Ontario's local public health organizations (31 of 35, 88.6%) reported having a centralized epidemiology structure. One organization had a decentralized structure, and the three had a hybrid or other type of structure. **Tables 2** and **3** show how the epidemiology workforce is structured within organizations by the number of total epidemiology function full-time equivalents (FTE), and peer group, respectively.

Table 2: Number of local public health agencies, by structure of epidemiology workforce and by number of epidemiology function FTEs, December 2019 (n=35 organizations)

Total Epidemiology Function FTEs	Centralized epidemiology workforce, providing support to all program areas	Centralized epidemiology workforce, assigned specific portfolios	Decentralized epidemiology workforce or situated within specific program areas	Other structure	Total
1	9	0	0	1	10
2	3	0	0	0	3
3	3	0	0	0	3
4 or more	5	10	1	2	18
Missing	0	1	0	0	1
Total (Percent)	**20 (57.1%)**	**11 (31.4%)**	**1 (2.9%)**	**3 (8.8%)**	**35**

Note: Epidemiology function FTEs provided in survey responses were rounded up to the next whole number.

Table 3: Number of local public health agencies, by structure of epidemiology workforce by peer group, December 2019 (n=35 organizations)

Peer group	Centralized epidemiology workforce, providing support to all program areas	Centralized epidemiology workforce, assigned specific portfolios	Decentralized epidemiology workforce or situated within specific program areas	Other structure	Total
Mainly rural	7	3	0	1	11
Urban-rural mix	12	2	0	0	14
Mainly urban centres with moderate population density	1	5	0	1	7
Largest population centres with high population density	0	1	1	1	3
Total	**20 (57.1%)**	**11 (31.4%)**	**1 (2.9%)**	**3 (8.6%)**	**35**

Centralized epidemiology function

The majority of local public health organizations (31 of 35, 88.6%) reported having a centralized epidemiology structure, with 20 specifying that epidemiology FTEs provide support to all program areas, and 11 indicating that epidemiology FTEs are assigned specific portfolios or support specific program areas.

Several organizations identified the specific teams where the epidemiology capacity is situated (e.g. Foundational Standards, Health Analytics, Public Health Surveillance and Evaluation, Population Health Assessment, Surveillance and Evaluation, Data and Analytics), while one noted that their epidemiology and analytic staff are located on two different but centralized teams. Several organizations also mentioned that their epidemiology and analytic staff are situated within the Office of the Medical Officer of Health, a Foundational Standards division, or similar centralized division or department.

Decentralized epidemiology function

One public health unit has a decentralized structure whereby epidemiology FTEs are situated within specific program areas. They noted that each division in the public health unit has an analytic support team with each team having a slightly different structure.

Other structures

Two other organizations indicated they had a hybrid of centralized and decentralized epidemiology FTEs. One noted that their organization has a centralized team with epidemiology and analytic staff, as well as decentralized teams within each division with functions related to population health assessment and surveillance, such as planning, research and evaluation, as well as a team

focused on continuous quality improvement. The other organization noted that their epidemiology and analytic staff are situated within two separate directorates, one focusing on communicable disease surveillance, and the other on non-communicable disease epidemiology and population health assessment. In addition, an organization noted that their structure includes formal service agreements for epidemiology consultancy services with neighbouring health units.

Benefits and challenges of different structures

Two organizations noted that they had experience with having a centralized structure, as well as having a decentralized structure. Perceived benefits of having centralized epidemiology capacity included cross-coverage of staff, standardized approaches and efficiency, while perceived challenges included lack of program-specific support. Perceived benefits of a decentralized structure included better meeting divisional needs, while challenges included 'scope-creep', lack of standardization and difficulty with cross-coverage.

Reporting relationships

Some organizations described reporting structures in their response. Several mentioned that the Epidemiologist or Senior Epidemiologists manage a team or have staff reporting to them. A small number noted that the Epidemiologists report directly to the Medical Officer of Health or Associate Medical Officer of Health, while others report to an Epidemiology Manager.

Part 2: Enumeration of staff contributing to epidemiology capacity

When asked to provide a list of the positions that contribute to the public health epidemiology function in their organizations, 34 of 35 organizations responded. There were 33 unique job titles identified, which are classified into categories in **Table 4**. Since the survey's inclusion criteria for enumerating epidemiology and analytic staff were broad and open to each organization's interpretation, some organizations may have chosen to include certain roles such as researchers and program evaluators in this assessment, while other agencies may not have chosen to include them.

Table 4: Positions that contribute to the epidemiology function in local public health agencies in Ontario, December 2019 (n=34 organizations)

Job title	Number of organizations with job title contributing to epidemiology function (% of total organizations)	Total FTEs (% of total FTEs)
Epidemiologist (Any)	**33 (97.1%)**	**84.4 (50.6%)**
Epidemiologist	32	81.4
Senior Epidemiologist*	2	2.0
Spatial Epidemiologist	1	1.0
Health Data Analyst (Any)	**14 (41.2%)**	**32.5 (19.5%)**
Data Analyst	5	7.5
Geospatial Health Specialist	1	1.0
Health Analyst	1	1.0
Health Analytics Specialist	1	1.0
Health Data Analyst	3	6.0
Health Data Analyst II	1	2.0
Health Information Analyst	4	9.0
Research & Data Analyst	1	1.0
Senior Health Information Analyst	1	2.0
Statistical Data Analyst	1	2.0
Management (Any)	**14 (41.2%)**	**16.5 (9.9%)**
Manager	14	14.5
Supervisor	1	2.0
Research or Policy Analyst (Any)	**4 (11.8%)**	**13.6 (8.2%)**
Health Research Specialist	1	2.0
Policy Development Officer	1	1.0
Research Analyst	1	3.8
Research, Policy Planning Analyst	1	3.8
Epi Research Associate (MPH)	1	2.0
Epi Research Associate (PhD)	1	1.0
Health Promoter (Any)	**2 (5.9%)**	**9.4 (5.6%)**
Community Outreach/Public Relations Officer	1	1
Health Educator	1	1
Health Promotion Specialist	1	7.4
Coordinator, Program Planning & Evaluation	1	0.5
Evaluation Specialist	1	1.0
Planning & Evaluation Specialist	1	1.0
Program Evaluator	3	3.5
Data Scientist or Statistician (Any)	**2 (5.9%)**	**3.0 (1.8%)**
Data Scientist	1	1.0
Statistician	1	1.0
Applications Analyst	1	1.0
Public Health or Nurse (Any)	**2 (5.9%)**	**1.4 (0.8%)**
Public Health Inspector	1	0.15
Public Health Nurse	1	1.2
Total	**--**	**166.8 (100.0%)**

*1.0 FTE with job title Manager & Senior Epidemiologist was classified under Manager.

Job titles that were commonly reported as contributing to an organization's epidemiology function included: Epidemiologist (97.1% of organizations), Health or Data Analyst (41.2%), and Manager or Supervisor (41.2%). Program Evaluators (17.6% of organizations), Research or Policy Analysts (11.8%) were also listed by some organizations, while fewer organizations listed Health Promoters, Statisticians, Data Scientists, or Public Health Inspectors or Nurses as contributing roles to their organizations' epidemiology function (5.9% each).

In total, 166.8 FTEs were counted as contributing to the local public health epidemiology function in the 34 responding organizations (mean: 4.9, median: 3.8, range: 0.5 to 25 FTEs per organization).

Staff that contribute indirectly to epidemiology capacity

In the open text responses, several organizations also listed or described other positions that support, complement, or contribute indirectly to epidemiology capacity, but did not necessarily meet the criteria outlined in the 'Who to Count' document. This included positions such as Associate Medical Officer of Health, Foundational Standards Specialist, Public Health Nurse, Health Promoter, as well as other positions related to research, program planning, evaluation, continuous quality improvement and health informatics.

Staff portfolios

As shown in **Table 2**, some organizations have epidemiology and analytic staff who are considered 'generalists' and provide support to all program areas within the organization. Other organizations noted that their epidemiology and analytic staff have specific portfolios, with several indicating that work is divided up by team, department, division, or program area (e.g. communicable disease, chronic disease prevention). Other identified portfolios included GIS/mapping, data quality and reporting, performance monitoring, health equity, research and evaluation. One organization also noted that their epidemiology and analytic staff were assigned to specific geographic communities. In addition, two organizations noted that while their epidemiologists have specific portfolios, the analysts do not.

Backup and surge capacity

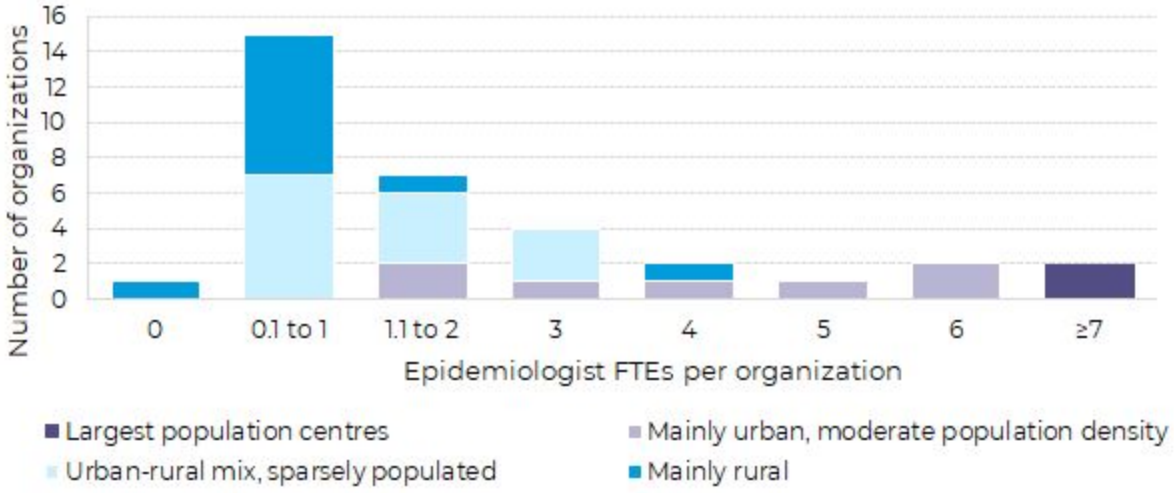
Some organizations also discussed backup coverage and surge capacity. Several noted that while their epidemiologists have specific portfolios, they are cross-trained to provide backup/coverage for one another as needed. Others noted that there are other staff at their organization (e.g. Associate Medical Officer of Health, planning and evaluation staff, public health nurse) with epidemiology competencies who can provide surge capacity, coverage and support when needed.

Enumeration of epidemiologists

Thirty-three of 34 (97.1%) of sub-provincial public health organizations who responded to the enumeration question in the survey specified having an Epidemiologist job title. Among these 33 organizations, the number of

Epidemiologist FTEs ranged from 0.5 to 12.0 per agency (**Figure 1**). Most commonly, organizations had 1.0 FTE Epidemiologist (14 of 34, 41.2%).

Figure 1: Number of organizations by Epidemiologist FTEs and peer group (n=34 organizations)



Note: Includes only FTEs with an Epidemiologist title.

The mean and median number of Epidemiologist FTEs per organization generally differed by peer group, with the 'mainly urban centres with moderate or high population density' having more Epidemiologist FTEs compared to 'mainly rural' or 'sparsely populated urban-rural mix' geographies (**Table 5**).

Table 5: Summary of Epidemiologist FTEs and salaries by peer group

Peer group (number of organizations who responded)	Mean Epidemiologist FTEs per organization	Median Epidemiologist FTEs per organization	Range of Epidemiologist FTEs per organization	Range of Epidemiologist salaries per organization
Mainly rural (11)	1.3	1.0	0 to 4.0	$70,452 to $98,459
Sparsely populated urban-rural mix (14)	1.6	1.2	0.5 to 3.0	$67,000 to $111,617
Mainly urban centres with moderate population density (7)	4.0	4.0	2.0 to 6.0	$73,746 to $115,142
Largest population centres with high population density (2)	9.8	9.8	7.5 to 12.0	$82,755 to $103,448
Total (34)	**2.5**	**1.7**	**0 to 12**	**$67,000 to $115,142**

Note: Includes only FTEs with an Epidemiologist title.

Epidemiologists with management roles

Eight of 34 organizations who provided epidemiology job information had senior Epidemiologists or Epidemiologists with management duties:

- Three public health organizations had a Senior Epidemiologist or Senior Epidemiologist and Manager role, and
- Five other public health organizations had Epidemiologist staff who had management duties.

Unionized epidemiologists

Among 30 organizations who had an Epidemiologist role and specified whether Epidemiologists were unionized or not, 13 of 30 (43.3%) indicated that their Epidemiologists were unionized:

- Mainly rural peer group: 3 of 9 organizations had unionized Epidemiologists
- Urban rural mix peer group: 7 of 14
- Mainly urban peer group: 3 of 7
- Largest population centre peer group: 2 of 2

Epidemiology function FTEs per population served

Accounting for 33 of 35 Ontario public health units, overall there were 0.6 Epidemiologist FTEs per 100,000 population served, however this ranged from 0.0 to 3.0 by public health unit (**Table 6**). There were 1.3 total epidemiology function FTEs per 100,000 population (range per public health unit: 0.5 to 15.7 FTE). The First Nations Health Authority was not included in this analysis due to overlapping geography and population served with the public health units in the area.

Note that the population estimates for the two public health units that did not respond to the survey were excluded from the denominator when computing the total number of FTEs per 100,000 population served in Ontario.

Table 6: Range and median Epidemiologist and epidemiology function FTEs per 100,000 population served in 33 Ontario public health units, by peer group

Peer group (number of public health units)	Epidemiologist FTEs per 100,000 population served		Epidemiology function FTEs per 100,000 population served	
	Range per public health unit	Median	Range per public health unit	Median
Mainly rural (10)	0.0 to 1.7	0.8	0.5 to 4.7	1.7
Urban-rural mix (14)	0.6 to 3.0	1.0	0.6 to 15.7*	1.4
Mainly urban (7)	0.4 to 0.9	0.6	0.8 to 1.3	1.0
Largest population centres (2)	0.4 to 0.6	0.5	0.8 to 1.1	1.0
Total (33)	**0.0 to 3.0**	**0.8**	**0.5 to 15.7**	**1.1**

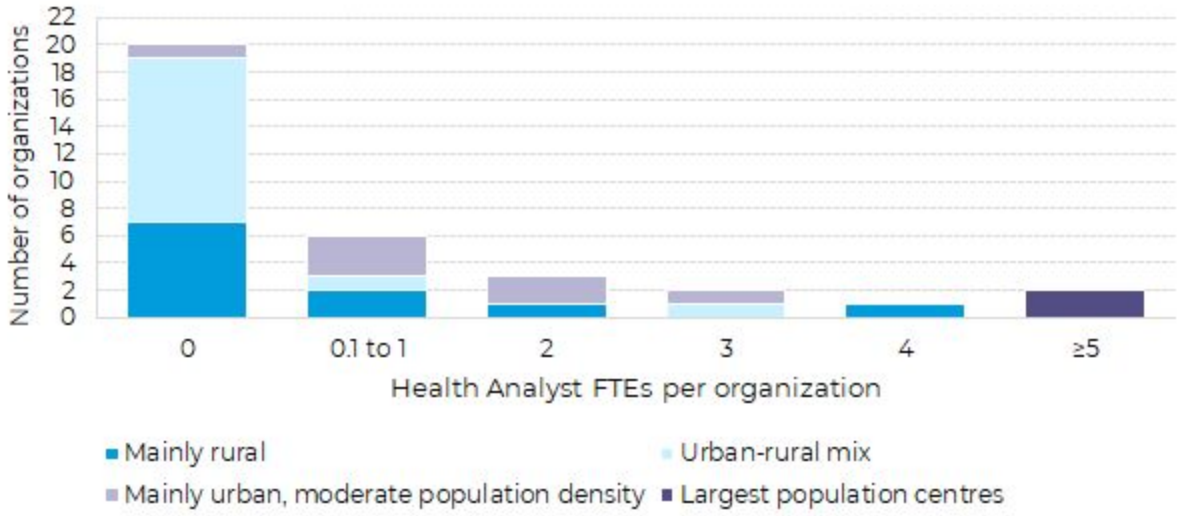
*Outlier reflective of a health unit serving a very small population.

Note: Represents 33 of 35 Ontario public health units who responded to the enumeration question. The First Nations Health Authority is not included.

Enumeration of Health Data Analysts

Fourteen of 34 participating organizations listed at least one type of health data analytical role in the enumeration survey. Information for roles listed under the 'Health Data Analyst' category in **Table 4** were summed. However, it is important to note that different positions might have different responsibilities or seniority (e.g. Health Analyst I vs. Health Analyst II, or Health Information Analyst vs. Senior Health Information Analyst), but for simplicity, all have been pooled together for this analysis.

Figure 2: Number of organizations by total Health Data Analyst* FTEs and peer group (n=34 organizations)



*Includes the following job titles: Data Analyst, Geospatial Health Specialist, Health Analyst; Health Analytics Specialist; Health Data Analyst; Health Data Analyst II; Health Information Analyst; Research & Data Analyst; Senior Health Information Analyst; Statistical Data Analyst.

Among the 14 organizations with at least one Health Data Analyst, six had 1.0 or fewer FTEs (42.9%). There were 0.3 Health Data Analyst FTEs per 100,000 population (range per public health unit: 0.0 to 6.0 FTE).

Table 7: Summary of Health Data Analyst* FTEs and salaries by peer group (n=34 organizations)

Peer group (number of organizations who responded)	Number of organizations with a Health Data Analyst role	Mean FTEs per organization	Median FTEs per organization	Range of FTEs per organization	Range of Health Data Analyst salaries per organization
Mainly rural (11)	4	1.9	1.5	0.5 to 4.0	$50,000 to $88,361
Sparsely populated urban-rural mix (14)	2	2.0	2.0	1.0 to 3.0	$67,290 to $87,800
Mainly urban centres with moderate population density (7)	6	1.7	1.5	1.0 to 3.0	$49,595 to $95,331
Largest population centres with high population density (2)	2	5.5	5.5	5.0 to 6.0	$66,286 to $80,462
Total (34)	**14**	**2.3**	**2.0**	**0.5 to 6.0**	**$49,595 to $95,331**

Table 8: Range and median Health Data Analyst* FTEs per 100,000 population served in 33 Ontario public health units, by peer group

Peer group (number of public health units)	Health Data Analyst FTEs per 100,000 population served	
	Range per public health unit	Median
Mainly rural (10)	0.0 to 1.3	0.0
Urban-rural mix (14)	0.0 to 0.6	0.0
Mainly urban (7)	0.0 to 0.5	0.2
Largest population centres (2)	0.2 to 0.4	0.3
Total (33)	**0.0 to 1.3**	**0.0**

Note: Represents 33 of 35 Ontario public health units who responded to the enumeration question. The First Nations Health Authority is not included.

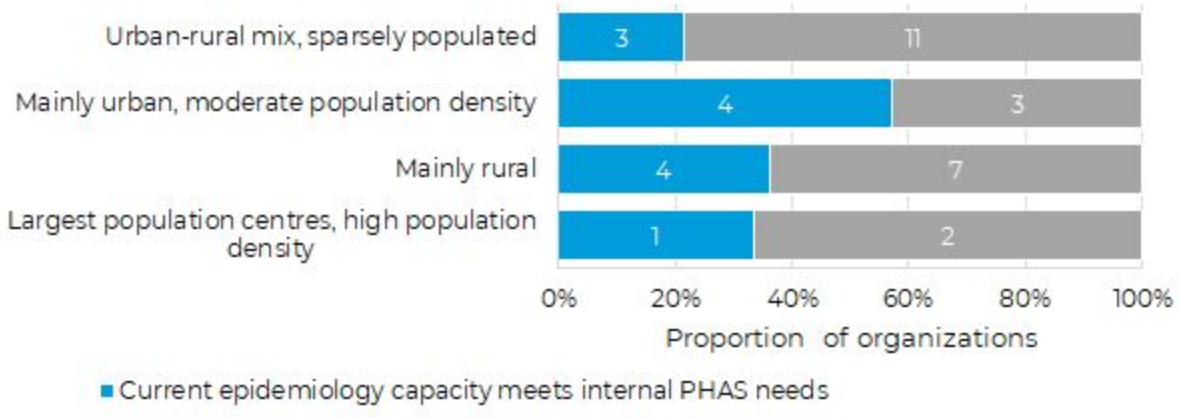
Enumeration of other epidemiology and analytic staff

Due to the broad variety of different positions included in the enumeration by various organizations, and the small number of positions under certain categories (described in **Table 4**), additional information on salary and FTEs per organization are not reported here.

Part 3: Local epidemiology capacity to meet population health assessment and surveillance needs

When asked if their current epidemiology capacity met the population health assessment and surveillance needs of their organization, including emerging public health issues, two thirds of respondents (23 of 35, 65.7%) indicated that they were unable to meet their organizations' needs with their current capacity. This proportion differed by peer group, ranging from 42.9% of organizations in the mainly urban peer group to 78.6% of organizations in the 'urban-rural mix' peer group (**Figure 3**).

Figure 3: Number of organizations who indicated that their current epidemiology capacity meets their internal population health assessment and surveillance (PHAS) needs, by peer group



To determine if there were certain characteristics associated with organizations' epidemiology capacity, other quantitative survey answers were compared between those who had enough capacity with those who did not have enough capacity (**Table 9**). Insufficient capacity appears to be a challenge across organizations serving populations of different sizes and characteristics. With the exception of the number of epidemiologists per organization and peer group, there were no major differences in the characteristics of organizations who indicated that they do and do not have sufficient capacity.

In general, organizations with sufficient epidemiology capacity had more epidemiologists (median: 2.0 FTE per organization) compared to organizations who stated they did not have enough capacity (median: 1.0 FTE). Organizations with insufficient capacity reported a higher proportion of 1.0 or fewer epidemiologist

FTEs (52.2% of organizations) compared to organizations with sufficient capacity (36.4%). In addition, organizations in the 'mainly urban' peer group were more likely than those from other peer groups to indicate they had sufficient capacity (57.1%, compared to 21.4-36.3% in the other peer groups).

Table 9: Comparison of characteristics of organizations with sufficient and insufficient epidemiology capacity

Characteristic	Organizations with sufficient epidemiology capacity (n=12)	Organizations with insufficient epidemiology capacity (n=23)
Peer group	In general, a similar proportion of organizations in each peer group (21.4% to 36.3%) said they had enough epidemiology capacity, except for the 'mainly urban' peer group, where 57.1% of organizations indicated that they had sufficient capacity	
Size of population served (public health units only)	Median: 258,951	Median: 148,331
Organizational model	The distribution of structure types did not differ between those organizations with or without sufficient capacity.	
Epidemiologist FTEs per organization	Median: 2.0 4 had 1.0 or fewer Epidemiologist FTE (36.4%)	Median: 1.0 12 had 1.0 or fewer Epidemiologist FTE (52.2%)
Epidemiologist FTE to population ratio (per 100,000 population)	Median: 0.8	Median: 0.8
Health analyst FTE to population ratio (per 100,000 population)	Median: 0.5	Median: 0.4
Total epidemiology function FTE to population ratio (per 100,000 population)	Median: 1.2	Median: 1.1
Requests for support from external organizations impact internal epidemiological needs	6 of 12 (50.0%) answered yes	15 of 23 (65.2%) answered yes
Requests for support outside of traditional epidemiology functions impact internal epidemiological needs	6 of 12 (50.0%) answered yes	11 of 23 (47.8%) answered yes

Note: range of population size served was not reported, in order to maintain response confidentiality. Number of FTEs per organization includes the 34 organizations that responded to the enumeration question. Number of FTEs per 100,000 population includes the 33 health units that responded to the enumeration question, the First Nations Health Authority was excluded from these estimates.

Organizations described the reasons why capacity is insufficient at their organization, the outcomes and impacts of insufficient capacity, opportunities and

ways to improve capacity, and the specific benefits of or activities that could take place if capacity were to increase (**Box 1**).

Box 1: Insufficient epidemiology capacity: drivers, outcomes, and opportunities for improvement

Several local public health organizations noted having insufficient epidemiology capacity. Reasons included:

- Insufficient epidemiology FTEs
- Large volume of requests for data and support
- Complex data needs
- Management duties
- Vacant positions
- Funding and political uncertainty

Outcomes of insufficient epidemiology capacity included:

- Inability to meet Ontario Public Health Standards
- Core population health assessment and surveillance activities not prioritized
- Difficulty keeping up with emerging issues
- Limited ability to do knowledge translation work
- Limited time for professional development

Suggestions for opportunities to improve epidemiology capacity included:

- Additional FTEs
- Training for and support from non-epidemiology and analytic staff
- Technological solutions
- Improvements in data quality and management
- Strategy for population health assessment and surveillance
- Amalgamation and centralization of certain population health assessment and surveillance activities

Why capacity is insufficient

Organizations provided a number of reasons as to why their population health assessment and surveillance needs are not being met with their current epidemiology capacity.

Insufficient epidemiology FTEs: Organizations noted that an insufficient number of epidemiology FTEs contributed to their organization's population health assessment and surveillance needs not being met, with some emphasizing the challenges of only having one Epidemiologist, or not having any FTEs specifically dedicated to epidemiology. A few organizations noted that due to insufficient capacity, they relied on contractual agreements from other organizations for support on certain projects and activities. Others mentioned that they did not have the budget to hire additional or permanent staff necessary to meet their organization's needs.

Volume of requests for data and support: Organizations discussed how a large volume of requests from both external partners (e.g. community groups, Indigenous partners, health system partners, multi-sectoral collaboratives) and internal staff (including support for operational or organizational initiatives, data support for program areas, responding to media requests and Council or political queries) impacted their ability to meet their population health assessment and surveillance needs. Several organizations mentioned that these demands appear to be increasing, with some indicating that the increase is related to the new updated public health mandate (OPHS), the introduction of the Ministry of Health's annual service planning and reporting requirements, and the increasing mandate to support health system planning.

Specific functions or program areas identified as requiring additional support included:

- Emerging issues (e.g. cannabis, opioids, climate change, vaping)
- Knowledge exchange
- Research
- Program planning
- Continuous quality improvement
- Health equity
- Health promotion
- Infant feeding surveillance
- Infectious disease surveillance

Complex data needs: Several organizations noted that complex data needs impact their ability to meet their population health assessment and surveillance needs. This includes increasing requests and need for advanced epidemiological or statistical skills and modern analytic tools to address complex issues (e.g. spatial analysis, health economics). Some organizations also mentioned challenges related to data quality and the time and resources necessary to convert data into a usable format.

Management function: One organization noted that their Epidemiologist also has a management role, which can make it difficult to have the time needed to adequately address the organization's population health assessment and surveillance needs.

Vacant positions: Three organizations noted that vacancies contribute to challenges in capacity at their organization, particularly related to backfilling parental leaves. Three other organizations noted that vacancies were not an issue. In addition, one organization noted that capacity would be impacted if the sole Epidemiologist were to leave, as it would be difficult to find a replacement with the same skill set.

Funding and political uncertainty: Funding and political uncertainty was also mentioned as a challenge, with one public health unit noting that "funding and the uncertainty of public health's structure and role within the health care system threatens the health unit's ability to meet the requirements outlined in the Ontario

Public Health Standards Foundational Standards and Population Health Assessment and Surveillance Protocol, 2018."

Outcomes of insufficient capacity

The responses also included descriptions of the specific outcomes or impacts that insufficient epidemiology capacity has on an organization.

Inability to fully meet mandate: Some organizations noted that with their current capacity, they are unable to fully meet their mandated requirements of the OPHS, particularly those outlined in the Population Health Assessment and Surveillance Protocol (Ministry of Health and Long-Term Care, 2018b).

Core population health assessment and surveillance activities not prioritized: Several organizations noted that as emerging issues, outbreaks, or ad-hoc requests arise, routine population health assessment and surveillance activities are given lower priority and/or delayed, which can result in data gaps or impact public health programming activities. Similarly, organizations also described not having the time and resources to conduct more complex epidemiological analyses, such as multivariate modeling or geo-spatial analysis.

Difficulty keeping up with emerging issues: Organizations described challenges keeping up-to-date with emerging issues, including limited ability to implement and maintain enhanced surveillance initiatives to gather information on potential or actual new emerging health issues.

Limited ability to do knowledge translation work: Organizations discussed having limited capacity for knowledge translation work both internally and with partners in order to ensure that data are available and used effectively to inform planning and service delivery.

Limited time for professional development: Organizations also noted that due to a lack of capacity at their organization, epidemiology and analytic staff struggled with finding time to engage in professional development opportunities that would further strengthen skills and knowledge.

Opportunities to improve epidemiology capacity

Organizations described various approaches and potential opportunities that they are currently taking or could take to improve epidemiology capacity.

Additional FTEs: Fourteen organizations described the need for additional Epidemiologist or Analyst positions in order to meet their population health assessment and surveillance needs. Estimates of the number of additional positions required ranged from one to three additional FTEs.

In addition, six organizations described a need for other roles that support the population health assessment and surveillance activities, work that is currently being done by epidemiology and analytic staff but outside the scope of population health assessment and surveillance (e.g. continuous quality improvement, data

science), or work requiring specialized expertise. Examples included Foundational Standards Specialists, Program Evaluators, Data Scientists, Data Architects, Data Stewards, Health Informaticians, Health Economists and GIS Specialists.

Training for and support from non-epidemiology and analytic staff: It was suggested that increasing capacity among non-epidemiology and analytic staff (frontline and management) related to assessment and analysis could help improve staff's ability to request and utilize data more effectively. It was also suggested that other staff (e.g. Program Evaluators, Research Coordinators, Knowledge Mobilizers, Health Promoters) could take on tasks currently being undertaken by epidemiology and analytic staff in order to keep their work more focused.

Technological solutions: Several organizations described technological solutions that could help improve epidemiology capacity, including access to and training on modern analytic and visualization tools (e.g. ArcGIS, R, Instant Atlas, Tableau, PowerBI) in order to analyze and present data more effectively and efficiently.

Improvements in data quality and management: It was noted that improvements in data quality and management of data systems across the public health sector could free up epidemiology and analytic staff time and allow for population health assessment and surveillance activities to be completed more quickly.

Population health assessment and surveillance strategy: One organization also noted that they had developed and were implementing a population health assessment and surveillance strategy in order to better meet the organization's population health assessment and surveillance needs.

Central support and amalgamation: It was also suggested that central (provincial level) support and resources for certain population health assessment and surveillance activities could help to free up capacity at the local level. In addition, it was noted that the amalgamation of two public health units into one, Huron Perth Public Health, would likely help to improve epidemiology capacity for this region.

Benefits of additional capacity

Some organizations mentioned specific benefits or activities that could take place if their epidemiology capacity were to increase, including:

- Ability to take on an Indigenous portfolio
- Increased ability to be proactive rather than reactive in planning and conducting population health assessment
- More comprehensive and timely reporting
- Producing more data products and types of products (e.g. dashboards)
- More opportunities for skill development
- More opportunity to provide support and education to other staff within the organization.

Part 4: Impact of external requests on ability to meet internal epidemiological needs

Among 35 survey respondents, 60.0% indicated that external requests had an impact on their organization's ability to meet their own epidemiology needs (**Table 10**).

Table 10: Impact of external epidemiology requests by peer group

Peer Group (number of organizations)	Number of organizations that indicated external requests have an impact on meeting internal epidemiological needs	Percent of organizations
Mainly rural (n=11)	7	63.6%
Urban-rural mix, sparsely populated (n=14)	7	50.0%
Mainly urban, moderate population density (n=7)	5	71.4%
Largest population centres, high population density (n=3)	2	66.7%
Total (n=35)	**21**	**60.0%**

In their responses, organizations presented examples of the types of external requests that they receive, explained why external requests do or do not have an impact on meeting the epidemiological needs of their organization, and discussed some of the benefits of supporting external requests (**Box 2**).

Box 2: Impacts of external requests on local public health organizations

Local public health organizations in Ontario provide epidemiological support to a wide range of external partners, including:

- Health system partners
- Academic partners
- Municipal partners
- Community organizations and agencies
- Networks and committees
- Drug strategies and safe consumption sites
- The provincial government
- Media and the public
- Other public health units

Benefits of working with external partners were noted by respondents, including:

- Relationship building and partnership
- Knowledge exchange and capacity building
- Shared priorities and efficiencies

For some local public health organizations, external requests impact their ability to meet their own internal needs. Reasons include:

- Increasing volume of requests
- External partners had insufficient epidemiological capacity or expertise
- Requests are often time and resource intensive
- External requests often given higher priority over routine work

For some local public health organizations, external requests do not impact their ability to meet their own internal needs. include:

- Having enough capacity
- Having no capacity, so not able to assist external partners
- Having no or few requests received from external partners
- Only responding to external requests that align with existing priorities

Many organizations provided examples of the types of requests they receive, as well as the specific partners who they receive the requests from. Examples included:

- **Health system partners** such as Ontario Health Teams, Local Health Integration Networks, hospitals, community health centres and mental health services.
- **Academic partners** such as post-secondary institutions for research projects, or for student placements or mentoring.
- **Municipal partners** including local municipalities, EMS, police, politicians/council, and school boards. Several organizations indicated that they were involved in regional strategic planning and community safety and well-being planning.
- **Community organizations and agencies** including Indigenous agencies. Examples of the type of work generated from these agencies include data requests, support for funding applications, and drafting or managing data sharing agreements.
- **Networks and committees** including child and youth networks, collective impact groups, social research and planning councils, data consortiums and action tables.
- **Drug strategies and safe consumption sites** including participating in local drug strategies and developing applications for safe consumption sites.
- **Province** including standard ministry reporting and the development of the Annual Service Plan.
- **Media and the public**, particularly around requests related to opioids and immunization.
- **Other public health organizations**, including collaborative projects, as well as contracting services to other public health units with less capacity.

Reasons why external requests impact organizations' ability to meet epidemiological needs

Organizations described how and why requests from external agencies impact their ability to meet the epidemiological needs of their own organization. Reasons included:

Increasing demands: Several organizations noted that they felt that there has been an increase in requests from external partners for local data, or that they anticipate demands will increase. In particular, organizations noted an increase in requests related to provincial direction for the public health sector to provide data to support health system planning.

Insufficient capacity or expertise elsewhere: Several organizations noted that a contributing factor to the volume of requests for support from local agencies was a lack of capacity or data expertise within their broader organization (i.e. municipality) or in the community. As a result, epidemiology and analytic staff are viewed as the expert in the community for information related to data analysis, data access, data interpretation and research.

Time consuming and resource intensive: Many organizations noted that requests for support from external partners tend to be time consuming, resource intensive, and may involve a large number of staff at times. It was also noted that requests can at times be complex, and that expectations from partners can be high and come with tight timelines.

External requests often given higher priority over routine work: Several organizations noted that prioritization of these external requests can interfere with their ability to conduct core population health assessment and surveillance work or other planned or ongoing projects. One organization referred to these requests as having a 'domino effect' on work being completed, while another noted that these types of requests also impact their organization's ability to spend time doing more complex epidemiological analyses (e.g. geospatial and multivariate analyses). It was also noted that balancing external requests with core work can result in added stress.

Several organizations indicated they do have sufficient capacity to meet the epidemiological needs of their organizations, and therefore did not respond to this question, expressed similar concerns in their response to the final open text question. These organizations noted that while they do have sufficient capacity to meet their organization's needs or the requirements of the Ontario Public Health Standards, at times capacity is stretched thin which impacts the ability to do more complex analyses, analyze certain data sources, or be more proactive in their approaches to population health assessment and surveillance.

Reasons why external requests do not impact ability to meet epidemiological needs

Several organizations noted that external requests did not impact their ability to meet the epidemiological needs of their organizations. Reasons for this included:

Enough capacity to support: Several organizations noted that they currently have enough capacity to support the volume of requests received from external organizations.

No capacity: One organization noted that they have no capacity to support external requests, so they are unable to assist.

No or few requests received: Several organizations noted that they receive no requests or very few requests to support external agencies, therefore it does not have an impact on their ability to meet their own epidemiological needs.

Ensure external requests align with existing priorities: A number of organizations noted that they ensure that all external requests that they respond to align with existing priorities and work of their organization.

Not currently working with external partners but would like to: Two organizations also indicated that while they do not currently work on many requests from external organizations, they would like to improve their capacity to do so.

Benefits of responding to external requests

Many organizations also noted that responding to external requests for data and support can have benefits for their organization and staff. Such benefits included:

Relationship building and partnership: Several organizations emphasized the importance and value of fostering positive relationships and strong partnerships within the community through responding to external requests for support.

Knowledge exchange and capacity building: Organizations also noted that collaboration with external partners presents opportunities for knowledge exchange and data sharing, and can improve the capacity of community organizations to use data to inform policies, planning and decision-making.

Shared priorities and efficiencies: Organizations noted that external requests often reflect shared goals or work that is already ongoing and may tie in to the organization's own population health assessment and surveillance needs. It was also noted that collaboration can result in efficiencies.

Part 5: Impact of requests to support other work

About half of organizations (17 of 35, 48.6%) said that requests related to work outside the scope of traditional population health assessment and surveillance functions had an impact on their ability to meet their epidemiological needs (**Table 11**).

Table 11: Impact of requests to support work outside the scope of the 'Who to Count' document on organizations' ability to meet their epidemiology needs, by peer group

Peer Group (number of organizations)	Number of organizations who indicated that requests for functions other than for population health assessment and surveillance have an impact on meeting their internal epidemiological needs	Percent of organizations
Mainly rural (n=11)	6	54.4%
Urban-rural mix, sparsely populated (n=14)	5	35.7%
Mainly urban, moderate population density (n=7)	4	57.1%
Largest population centres, high population density (n=3)	2	66.7%
Total (n=35)	**17**	**48.6%**

In their responses, organizations presented examples of the types of requests that epidemiology and analytic staff receive for work beyond the scope of the 'Who to Count' document, explained why these requests do or do not have an impact on meeting the epidemiological needs of their organization, and discussed some of the benefits of supporting these types of requests (**Box 3**).

Box 3: Impacts of requests to support work beyond the scope of the 'Who to Count' document on local public health organizations

Epidemiology and analytic staff at some local public health organizations in Ontario receive requests to support work outside of the scope of the 'Who to Count' document, including support for:

- Organizational or operational initiatives
- Ministry reporting requirements
- Data visualization and knowledge translation projects
- Technical projects
- Committee and engagement work
- Research projects
- Other project work

For some local public health organizations, these types of requests impact their ability to meet their own epidemiological needs. Reasons include:

- Increasing volume of requests
- Insufficient capacity in other domains/reliance on epidemiology skillset
- Requests are often time and resource intensive

For some local public health organizations, requests to support work beyond the scope of the 'Who to Count' document do not impact their ability to meet their own epidemiological needs. Reasons include:

- Having other staff or teams to do this type of work
- Ensuring that epidemiology and analytic staff only support work that is within scope
- Having limited or infrequent requests to support this type of work

Some local public health organizations noted that responding to these types of requests can be beneficial. For example:

- Short-term impacts can be outweighed by long-term improvements
- Epidemiology and analytic staff can make valuable contributions to these projects

Examples of requests

Many organizations provided examples of the types of requests that they receive for work beyond the scope of the 'Who to Count' document. These include support for:

- **Organizational or operational initiatives** such as business intelligence, performance monitoring, administrative work, planning and evaluation
- **Ministry requirements** such as supporting the development of the Annual Service Plan.
- **Data visualization and knowledge translation** such as dashboard creation (e.g. in Excel, PowerBI), compliance with the Accessibility for Ontarians with Disabilities Act and other knowledge translation work beyond the typical scope of public health epidemiology
- **Technical projects** such as improving data systems, informatics, automating analytical functions, website and IT work
- **Committee and engagement** work
- **Research projects** including Locally Driven Collaborative Projects
- **Other project work** including emergency management and climate change vulnerability assessments.

Reasons why requests impact ability to meet epidemiological needs

Many organizations discussed how and why requests to support work outside of the 'Who to Count' document have an impact on meeting their epidemiological needs. Many of the responses mirrored the reasons why requests to support external projects impacted the organization's ability to meet their own epidemiological needs. These include:

Increasing demands: Several organizations noted that they felt that requests to support work outside of the scope of the 'Who to Count' document were on the rise. In particular, organizations noted rising demands for continuous quality improvement, operational planning and data visualization initiatives.

Insufficient capacity elsewhere/reliance on epidemiology skillset: One organization noted that vacancies in other key, related positions resulted in more work for epidemiology and analytic staff, while others indicated that projects required a skillset (e.g. data and analytics, information management, flexibility) possessed by epidemiology and analytic staff.

Time consuming and resource intensive: A number of organizations emphasized that these types of projects can be time consuming and resource intensive, and may make up a large portion of the epidemiology and analytic staff workload. Several specifically noted the time commitment needed for business intelligence and dashboard development projects.

Reasons why requests do not impact ability to meet epidemiological needs

Some organizations also described reasons why they felt that requests to support work outside of the scope of the 'Who to Count' document did not impact their capacity to meet their own epidemiology needs. These reasons included:

Other staff do this work: Several organizations mentioned that they had other staff or teams within their organization dedicated to program planning and evaluation, continuous quality improvement, data management and business analytics.

In addition, one organization noted that while epidemiology and analytic staff may help support work outside of the scope of the 'Who to Count' document, other staff at their organization (e.g. health promoters) also assist with meeting the epidemiological needs of their organization.

Scope of work: One organization mentioned that they had an intake process that ensures that the work completed by their epidemiology and analytic staff are within the scope of the Population Health Assessment & Surveillance protocol. One organization also noted that the definition of the epidemiology function as outlined in the 'Who to Count' document was broad, and therefore felt that the work they do all falls within the scope of the document.

Infrequent or limited requests: Other organizations noted that requests for this type of work are infrequent or limited in scope at their organization, and therefore does not impact their ability to meet their epidemiological needs.

Benefits of responding to requests

A few organizations also identified benefits of contributing to work outside the scope of the 'Who to Count' document, including that short-term impacts can be outweighed by long-term improvements and efficiencies, and that epidemiology and analytic staff can make important contributions. One organization also noted that "the interplay between health informatics, quality improvement, information and technology, and epidemiology is key to the success of epidemiology programs".

FTE allocation

Several organizations provided estimates as to the amount of time or FTE resources dedicated to work outside of the scope of the 'Who to Count' document included:

- 1.0-1.5 FTE per year (out of 3.0)
- 10% of time
- 0.05 FTE
- 0.25 FTE for short periods
- 350 hours in 2019 for performance management/continuous quality improvement
- 0.5 FTE for data visualization & business intelligence
- Up to half of Epidemiologist's time (at times)
- .25 FTE for short (weeks to ~1 month) periods

However, most organizations noted that these were estimates and vary over time.

Part 6: Changes anticipated for the future scope of epidemiological work in public health in Ontario

In their responses, organizations spoke about the roles that they anticipated or envisioned for public health epidemiology generally, and at the local and central or provincial levels. Organizations also described the types of training, skills and new

roles that may be needed for public health epidemiology work in the future (**Box 4**). Several respondents noted that the future of public health epidemiology in Ontario will require new training, roles and skills.

Box 4: Changes anticipated for the future scope of epidemiological work in Ontario

When asked about anticipated changes for the future scope of epidemiological work in Ontario, local public health organizations noted that:

- The scope and mandate of public health is growing and evolving
- There will be an increased emphasis on collaboration and reducing duplication of work
- There is a need for improvements to data quality and data systems, including better linkages between data systems
- Evolving technology presents both opportunities and challenges for public health

Local public health organizations anticipate the future scope of public health epidemiology at the local level will include:

- Local data collection, analysis, interpretation and decision-making
- Supporting local partners
- Greater collaboration between public health organizations
- Specialization of epidemiology and analytic staff portfolios

Local public health organizations anticipate the future scope of public health epidemiology at the provincial or central level will include:

- Indicator development and standardized reporting
- Provision of data, tools and resources to local organizations
- The development of provincial surveillance systems
- Specialized or technical support for local public health organizations
- Provision of standardized analytical software

Some organizations identified potential challenges or concerns with the possibility of centralizing analytical functions, including:

- Loss of the contribution of local data to decision-making
- Needs of smaller organizations being outweighed by the needs of larger organizations
- Disruption of existing relationships
- Cost associated with removing PHUs currently embedded in a regional structure

General scope

Organizations described their general perceptions of the future scope of public health and epidemiology in Ontario.

Evolving public health mandate: Several organizations noted that the mandate of public health (e.g. through the Ontario Public Health Standards) has evolved and expanded, and that they anticipate that the future scope of public health and

public health epidemiology may continue to expand. Several organizations specifically identified the increasing mandate to support health system planning and to collaborate with other sectors (e.g. social services).

Collaboration and reduced duplication: It was also noted that broadly there appears to be a greater push for collaboration, consistency, and reduced duplication of work across the province.

Data improvements and linkages: Many organizations identified needs, opportunities and challenges related to data in public health.

Some organizations discussed a need and opportunity for new, timely, and integrated data sources across the health system, such as linkages between population health and administrative data sets, and integrated standardized electronic medical record systems. Organizations also identified opportunities for applying new types of data to public health problems, including digital data sources like Google Analytics, geospatial data and electronic medical records.

Others mentioned that there appears to be a general trend in society towards more transparent, accessible and timely data (e.g. interactive dashboards), however, these expectations can conflict with requirements such as AODA compliance and small-cell suppression and release guidelines.

Some organizations also noted that with emerging technologies and increased data sharing, there is a need for enhanced infrastructure, data architecture and security, as well as standardization of data management practices and changes to data privacy legislation.

Evolving technology: Several organizations also noted that evolving technology, such as artificial intelligence and machine learning are already driving change in other sectors, and present both challenges as well as opportunities for new and innovative ways to approach public health problems.

One organization also included a quote, which stated: “Although information technology specialists and public health programmatic or scientific staff might be comfortable within their respective domains of expertise, the new challenges will require increased attention in the analytic data management gap that exists between these two domains’ Rolka et al. Analytical Challenges for Emerging Public Health Surveillance MMWR July 27, 2012 / 61(03);35-39.”

Local role

Organizations described the role that they anticipated or envisioned for public health epidemiology at the local level.

Local data collection and analysis: Many organizations emphasized the value that epidemiology and analytic staff can contribute to local data collection, analysis, interpretation and decision-making:

- Organizations discussed how locally situated epidemiology and analytic staff could ensure the collection and analysis of locally relevant data, including: primary data collection, monitoring and tracking emerging public, subgroup analyses (e.g. neighbourhood level analysis, priority populations), and other customized analyses tailored to the unique needs of individual communities and reflective of local priorities.
- Similarly, organizations emphasized the importance and need for epidemiology and analytic staff to be situated locally in order to provide support for program planning, evaluation, continuous quality improvement, outbreak and infection prevention and control (IPAC) lapse investigations, emergencies, and ensure evidence-informed decision-making at the program level.
- Organizations also stressed the importance of interpreting data with a strong understanding of the local context, and ensuring that this information is communicated effectively to staff and community partners to support decision-making. Several organizations noted that they anticipated or recommended that the Epidemiologist's role related to interpretation and knowledge translation at the local level should increase.
- Some organizations mentioned that centralization of basic reporting functions would allow epidemiology and analytic staff at a local level more time to do locally relevant data collection, analysis and interpretation.

Supporting local partners: Respondents also identified a need for public health epidemiology and analytic staff to collaborate with and provide data to support the needs of various local community partners, in response to increasing requests and a growing provincial mandate to support health system planning. In particular, organizations anticipated working more closely with Indigenous organizations, Ontario Health Teams and other healthcare partners, and municipalities. One organization noted that they anticipated becoming more involved in municipal initiatives and planning efforts if municipalities are to take on a greater role in funding public health.

It was also noted that collaboration with external partners presents important opportunities for knowledge exchange, data sharing, and building partnerships and capacity. Such collaborations are also important in order to collectively address complex issues related to health and well-being in the population.

Collaboration between public health organizations: Several organizations noted that the future could offer more opportunities for epidemiology and analytic staff at other organizations to collaborate with one another. For instance, organizations with greater capacity could provide analytic support to smaller organizations with less capacity through formal agreements. The APHEO Core Indicator Project (add reference) was highlighted as an example of successful collaboration across public health units, noting that such work should be strengthened and supported.

Specialization: It was also noted that if public health units become larger, there may be more specialization of portfolios.

Central or regional roles

Organizations described the role that they anticipated or envisioned for public health epidemiology at a central or regional level. Central refers to work done at a provincial level by an entity such as the Ministry of Health or Public Health Ontario, while regional refers to work done to cover larger geographical regions in the event of amalgamated public health services.

Indicators and standard reporting: Many organizations identified an opportunity for centralizing or automating common, routine, basic analyses. For example, organizations suggested centralized:

- Analysis of core population health indicators and data sources (e.g. CCHS), as well as expanding PHO's Snapshots
- Coordination of the APHEO Core Indicator project in collaboration with local public health Epidemiologists
- Development and analysis of key performance or accountability indicators
- Development of standard reports (e.g. for iPHIS, Panorama)
- Other data management and data quality activities

It was noted that centralization of such analytic functions could reduce duplication, improve standardization, enhance capacity and allow local epidemiology and analytic staff more time to focus on more specific analyses and local priorities.

Provincial data and resources: Organizations suggested that the province or other centralized agency (e.g. PHO) could provide tools and resources to support the work of local public health epidemiology and analytic staff, such as literature reviews, policy analysis, metadata and documentation for public health datasets and provincial indicators.

Provincial surveillance systems: It was also suggested that the province or a centralized agency could implement provincial surveillance systems to ensure equitable access to timely, local data.

Specialized support: Some organizations noted that centralized support could be provided for complex or sophisticated analyses and research questions, including those related to small area analysis and health economics.

Standardized software: Several organizations recommended standardizing analytical software province-wide as a cost-saving measure, and to improve opportunities for training and sharing of work (e.g. syntax files) between organizations.

Challenges and concerns

Several organizations identified challenges, concerns and considerations with the centralization or regionalization of epidemiology capacity in the province, including concerns that:

- Centralization or regionalization could result in the loss of valuable contributions of local data and local epidemiology expertise to decision-making
- The move to large regional public health entities could result in the needs of larger public health units outweighing those of smaller or rural public health units
- Centralization or regionalization could disrupt important relationships that have been built with municipal partners and organizations within the community
- For organizations currently embedded in a regional government structure, there was concern about the loss of support from other departments (e.g. GIS, IT) if this structure were to change, and the cost associated with hiring new staff, new software and infrastructure
- The potential for 'pay for performance indicators' would oversimplify the complex nature of population health

New training, roles and skills

Many organizations described the anticipated need for expanded roles, new or strengthened skills and training for the epidemiology and analytic workforce. Examples included:

- Knowledge exchange including new ways to communicate information to various audiences
- Technical skills, including training on data visualization software, data science and computer programming skills, automation and advanced statistical analyses
- Learning how to work with the diversity and volume of data that are now available to support decision-making
- Learning about new data sources to inform emerging issues (e.g. climate change)
- Mapping, small area analysis and geographic information systems
- Program planning and performance monitoring
- Cultural competency

Several organizations also identified other roles that would complement or support the applied epidemiological workforce, such as web and graphics design, knowledge translation, IT, program evaluation, and performance monitoring. It was also noted that there is a need to increase data literacy among non-epidemiology and analytic staff and decision-makers.

Part 7: Additional training needs to meet the future changes in scope of public health epidemiology

Respondents identified various training opportunities for the public health epidemiology workforce (**Box 5**).

Box 5: Additional training needs to meet the future changes in scope of public health epidemiology

Local public health organizations identified the following areas for additional training in order to meet anticipated changes in the future scope of public health epidemiology:

- Knowledge translation and data visualization
- Spatial analysis
- Data science and artificial intelligence
- Advanced epidemiological methods
- Effective public health practice
- 'Soft skills'
- Health economics
- Data governance
- Project management
- Data literacy non-epi staff

The number of responses that mentioned each type of training need are listed in brackets after each description. Note that 31 organizations provided a response to this question.

- **Knowledge translation and data visualization** including best practices related to knowledge translation; clear and effective communication for various audiences; development of knowledge translation plans; data visualization and dashboard creation (including training on data visualization platforms like PowerBI). (n=21)
- **Spatial analysis** including GIS programs, mapping, small area analysis, spatial regression and isopleth mapping. (n=13)
- **Data science and artificial intelligence** such as the application of artificial intelligence and machine learning to public health, database design and management, working with 'big data', data mining, predictive modelling, and computer programming (including training in R, Python and SQL). (n=13)
- **Epidemiological methods** including advanced training in epidemiology, statistics, biostatistics (e.g. regression, trend analysis); outbreak and IPAC lapse investigations, surveillance techniques; and training on common statistical software (n=12)
- **Effective public health practice** including business intelligence, continuous quality improvement, LEAN, program planning, evaluation, performance measurement, evidence informed decision-making and priority setting (n=11)

- **'Soft skills'** such as communication, change management, conflict resolution, facilitation, consultation, negotiation; working in a unionized or non-unionized environment; and cultural sensitivity and diversity training (including working with Indigenous partners) (n=6)
- **Health economics** including calculating program utilization projections, cost-benefit analyses and return on investment (n=5)
- **Data governance** including data privacy, developing data standards and training related to the First Nations Principles of OCAP (Ownership, Control, Access and Possession) (n=5)
- **Project management** including Project Management Professional (PMP) training (n=3)
- **Data literacy non-epi staff** including basic assessment/analysis competencies (n=3)
- **Other** training suggestions included public health policy, working with electronic medical records (EMRs), communications platforms between public health and primary care, and training for IT staff related to infrastructure for the analysis of big data.

Organizations also mentioned that in addition to training epidemiology and analytic staff, there may be a need for new types of roles to support public health work, including roles related to GIS, health economics, predictive modelling and behavioural analysis.

Limitations

It is important to note several limitations of the project when interpreting the results. It is worth noting that these results cannot be directly compared to similar capacity assessments done internationally, due to differences in inclusion criteria and methods. The findings reflect the view of most (34 out of 35) local public health units and one out of two First Nations Health Authorities, but it does not capture a perspective from Public Health Ontario, which plays an important central role in public health epidemiology in the province. While a snapshot of provincial level public health epidemiology capacity is therefore missing, the publicly-accessible PHO staff directory gives an approximation of the FTEs from that organization.

There may have been some challenges with how responding organizations interpreted the inclusion criteria for which staff to include in the enumeration. The inclusion criteria were quite broad, though they were validated by an expert review by a group of experienced epidemiology managers in the field. Even so, it may still have been difficult for respondents to accurately estimate the extent to which some staff, such as Public Health Nurses or Inspectors, or Health Promoters, ought to be counted in an enumeration of population health assessment and surveillance capacity. Some organizations may have enumerated some of these FTEs either fully or partially while others may have excluded them altogether.

In addition, some of the survey questions may also have been interpreted differently by various respondents. For example, when reflecting on their experiences with external requests, some organizations appeared to focus more on shorter-term 'transactional requests' for data such as media requests, while others focused more on longer-term, mutually beneficial, collaborative partnerships with external agencies. Similarly, when asked about the future scope of public health epidemiology, some organizations described their ideal vision for the future, while others described what they anticipated would actually happen in the future. It is also important to note that results reflect the views and opinions of the individuals participating in the survey, and may not reflect the views of the whole organization.

The intention for this enumeration survey was to have a single response per organization, with collective insight from Medical Officers of Health, management and epidemiology and analytic staff. It is unclear the extent to which the insights collected were always collaborative and represented all perspectives within an organization, or when perspectives varied, which one was ultimately included in the response. In addition, it is important to consider the broader context in which the survey was conducted. The Epidemiology Capacity Assessment survey was completed at a time of anticipated changes in and some uncertainty in the future direction and structure of the public health system in Ontario. This context could have some influence on how organizations responded and perhaps affecting some organizations more than others for a variety of reasons. It is important to consider the impact of such context and the other considerations described here, when interpreting the enumeration survey results.

Discussion

This report provides the first-ever snapshot of the epidemiology capacity in the public health system in Ontario. This enumeration provides useful evidence at a time of planned structural change to the public health system, and it serves as a baseline assessment for the public health epidemiology capacity in Canada's largest province, prior to the COVID-19 pandemic.

In total there were 166.8 epidemiology and analytic staff FTEs in the public health system enumerated in this survey, for a rate of 1.3 total epidemiology FTEs per 100,000 population. Perhaps not surprisingly, Epidemiologists play a significant role in the population health assessment and surveillance activities that are conducted across the province, with virtually every organization reporting having at least one Epidemiologist and just over half, 84.4, of the enumerated FTEs being Epidemiologists (rate: 0.6 Epidemiologist FTEs per 100,000 population).

These results clearly indicate the collaborative nature of population health assessment and surveillance work in Ontario, with 33 unique job titles enumerated including Epidemiologist, and commonly analysts, managers and supervisors, as well as a variety of other positions.

Importantly, the results point to a broad issue of insufficient epidemiology capacity in the majority of organizations, with varying organization and population characteristics. There were different reasons provided for the capacity issues, from lack of staff, to increasing volume, complexity and resource-intensity of work demands, to an increasing scope of the nature of public health epidemiology work. Several recommendations are made in the next section to begin to address some of the underlying reasons for the insufficient epidemiology capacity in Ontario.

The primary local public health mandate in Ontario, the Ontario Public Health Standards, (Ontario Ministry of Health and Long-Term Care, 2018) recognizes epidemiology as a foundational science that is critical to effective public health practice. The capacity issues revealed in this Epidemiology Capacity Assessment survey point to the need for sufficient and equitable distribution of epidemiological and analytic resources across the province.

In addition, an important theme arose in the results related to challenges with data availability, data quality, and linkages between existing data sources. Many of these issues and their potential solutions are beyond the scope of local public health organizations, reinforcing the importance of provincial-level efforts to coordinate and begin to address data availability and quality issues in Ontario.

Another theme from the results emerged with organizations acknowledging the implications of rapidly evolving technology, including advancements in machine learning and artificial intelligence, which present both challenges and opportunities for Ontario's public health system. Such advancements may offer new and innovative ways to approach public health challenges. However, technology

changes also pose challenges, with increasing need for new skills and increasing importance of building connections between epidemiology and information technology, infrastructure limitations, new privacy and data sharing challenges. There is a need to continue to explore these challenges and opportunities further, in order to effectively contextualize and inform efforts to change and improve the entire public health system.

Recommendations

Sufficient local capacity

1. **Efforts should be made to ensure that local public health organizations have sufficient epidemiology and analytic staff and resources, to ensure that the organization can meet the requirements for population health assessment and surveillance in their public health mandate**, including but not limited to the Ontario Public Health Standards for public health units. Examples of such efforts could include ensuring sufficient base funding for local epidemiology and analytic staff, or for smaller public health organizations with less epidemiology and analytic capacity, consider formal service arrangements with other public health organizations to provide support and surge capacity.

Engagement

2. **Public Health Ontario (PHO) and the Ministry of Health should continue to engage local public health epidemiology and analytic staff in various population health assessment and surveillance initiatives**, and strengthen such efforts, to ensure that any initiatives are collaborative in nature and reflect the needs of local public health organizations.

Local organizational structure and processes

3. **Local public health organizations should adopt a formalized framework or business process to plan and prioritize population health assessment and surveillance activities.** This will ensure a more proactive approach and greater relevance of the work that epidemiology and analytic staff perform, while also enabling these organizations to better meet requirements for population health assessment and surveillance. (e.g. create detailed population health assessment and surveillance strategies/plans, project scoping to prioritize work and align with organizational priorities)

Professional development and training

4. **Public health organizations need to ensure they have capacity in foundational areas that complement epidemiological work, including roles that may be new in the public health field** (e.g. program evaluation, continuous quality improvement (CQI), knowledge translation, health informatics, data science). Having dedicated capacity in these other areas will enhance local epidemiology and analytic capacity, as well as provide a strong foundation for effective public health practice.

5. **APHEO and PHO should organize training opportunities** in the topic areas identified and described in part 7 of the ECA survey (e.g. data visualization, spatial analysis, data science and artificial intelligence). Such professional development opportunities will help ensure that the current workforce maintains and builds the skills and knowledge as emerging issues arise and the profession evolves over time.

6. **Organizations should ensure all staff have a foundational set of public health core competencies**, such as the Public Health Agency of Canada's Core Competencies (PHAC, 2019), which include interpreting and utilizing data for evidence informed decision-making and maximizing the use of epidemiological information to improve the health of the population.

7. **Epidemiology and analytic staff should have access to and training on modern analytic tools** (e.g. GIS, data visualization and business intelligence software) in order to effectively and efficiently present epidemiological information. For example,

    a. The Ministry of Health could provide standard software or tools to all local public health organizations to ensure equitable access, to facilitate shared training opportunities, and to better enable the sharing of resources (e.g. standard reports, syntax files).

    b. Organizations should consider providing an enhanced budget for the software, Information Technology and training needs necessary for effective population health assessment and surveillance work.

Data improvements

8. **The province should proactively invest in efficient and effective provincial data infrastructure for the public health system.** This would include improving data quality and management of existing databases, timely access to current and new sources of data, and linkages between data sources (e.g. through EMRs). These improvements would allow public health organizations to more efficiently and effectively perform epidemiological work. The province should engage APHEO in these efforts, for example, through collaborative groups such as the COMOH Digital Health work group.

Resources and support

9. **PHO should create new and build upon existing opportunities for epidemiology and analytic staff to collaborate and share resources across the province**. This would include providing enhanced support to APHEO's Core Indicator project, creating a centralized repository for resources like evidence reviews and standardized analytic syntax files, and resources for collaborating with external partners like Ontario Health Teams.

10. **PHO should continue efforts in centralized population health assessment and surveillance activities** including Snapshots, and enhance such initiatives by enabling local public health organizations to build upon this work in a more efficient way, for example by sharing statistical syntax and standard reports (e.g. IntelliHealth), and aligning indicator definitions with APHEO's Core Indicators project. This would enable local organizations to focus on more customized or locally-specific analyses.

11. **PHO could enhance their support for projects requiring specialized technical expertise that is often outside of the capacity of local public health organizations.** In particular, health economics and complex spatial analysis were two areas identified as areas requiring enhanced support.

Next steps

This 2019 Epidemiology Capacity Assessment provided a baseline measurement of the epidemiology capacity in the province of Ontario. This project will inform how APHEO can continue to advocate for and support its members, and continue in its mission to advance and promote the discipline and professional practice of public health epidemiology in Ontario.

It will be important to repeat the enumeration again in the future, to better understand the impact of any changes to the public health sector that might occur, and to monitor how capacity changes in the context of evolving technology, public health mandates, and emerging issues. In particular, the Epidemiology Capacity Assessment Workgroup recommends repeating an assessment of epidemiology capacity following any near-future restructuring of the public health system in Ontario, and after sufficient resolution of the emergency response to the COVID-19 pandemic has been reached, at a time that the work will not draw from resources required for the pandemic response.

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Appendix A: Enumeration Survey Questions

The applied epidemiology workforce (including the health analytic workforce) in the public health sector in Ontario has not been formally enumerated, and the extent to which the current capacity meets public health mandates has not been quantified. At a time of restructuring of the public health sector in Ontario, an epidemiology capacity assessment will ensure sufficient evidence exists for numerous stakeholders to make evidence-informed decisions about future capacity requirements of the applied epidemiology workforce in the public health sector.

The objective of this survey, as a first step, is to:

- enumerate the current applied epidemiology workforce in the public health sector in Ontario,
- better understand how the applied epidemiology workforce is structured within various organizations,
- learn about the extent to which current capacity meets public health mandates.

Where did this survey come from? This survey has been prepared by the Epidemiology Capacity Assessment Working Group of the Association of Public Health Epidemiologists in Ontario (APHEO).

Who completes the assessment? Please assign one staff person in your organization to submit the online survey. However, the survey might need input from a variety of individuals. We strongly recommend using this Word version of the survey to compile responses before submitting the online form (as the online survey will time out after 30 minutes of inactivity). It may be helpful to consult staff, organizational charts, or other reference documents to complete portions of this survey.

Who should be counted in the assessment? Please refer to the 'Who to Count' document for guidance about who to count in your organization in this assessment.

Deadline: Please submit a completed online survey for your organization by December 13, 2019, 11:59pm EST.

Contact: If you have any questions, please contact Megan Hempel Brunner (megan.brunner@halton.ca) or Jessica Deming (jdeming@regionofwaterloo.ca).

Consent & disclosure information: Your organization's participation in this survey is voluntary and by completing the questionnaire you consent to the collection of information. Information in connection with your response to the survey will be stored on Public Health Ontario (PHO) servers throughout the data lifecycle (e.g., collection process, use for analysis, retention), and is governed by PHO Terms of Use. Access to data stored on PHO servers will be limited to the online survey

administrator and to the APHEO Working Group leading this project. Your information will only be disclosed as permitted or required by law. For questions regarding the collection and use of your data, please contact Elaina MacIntyre (elaina.macintyre@oahpp.ca).

Do you consent to participate in this survey?

- ❑ Yes
- ❑ No

Respondent information

On behalf of which organization are you submitting this assessment?

- ❑ An Ontario Board of Health → Go to 2
- ❑ Public Health Ontario → Skip to 3
- ❑ An Indigenous-serving organization with a public health mandate → Go to 2

What is your organization?

- ❑ Algoma Public Health Unit
- ❑ Brant County Health Unit
- ❑ Chatham-Kent Health Unit
- ❑ Durham Region Health Department
- ❑ Eastern Ontario Health Unit
- ❑ Grey Bruce Health Unit
- ❑ Haldimand-Norfolk Health Unit
- ❑ Haliburton, Kawartha, Pine Ridge District Health Unit
- ❑ Halton Region Health Department
- ❑ Hamilton Public Health Services
- ❑ Hastings and Prince Edward Counties Health Unit
- ❑ Huron County Health Unit
- ❑ Kingston, Frontenac and Lennox & Addington Health Unit
- ❑ Lambton Health Unit
- ❑ Leeds, Grenville and Lanark District Health Unit
- ❑ Middlesex-London Health Unit
- ❑ Niagara Region Public Health Department
- ❑ North Bay Parry Sound District Health Unit
- ❑ Northwestern Health Unit
- ❑ Ottawa Public Health
- ❑ Peel Public Health
- ❑ Perth District Health Unit
- ❑ Peterborough Public Health
- ❑ Porcupine Health Unit
- ❑ Region of Waterloo, Public Health
- ❑ Renfrew County and District Health Unit
- ❑ Simcoe Muskoka District Health Unit

- ❏ Sioux Lookout First Nations Health Authority
- ❏ Southwestern Public Health
- ❏ Sudbury and District Health Unit
- ❏ Thunder Bay District Health Unit
- ❏ Timiskaming Health Unit
- ❏ Toronto Public Health
- ❏ Weeneebayko Area Health Authority
- ❏ Wellington-Dufferin-Guelph Health Unit
- ❏ Windsor-Essex County Health Unit
- ❏ York Region Public Health Services

Please provide contact information for an individual from your organization who we could contact for follow-up if needed:

Name: _____

Phone: _____

Email: _____

Enumeration questions

Q1. Which of the following best describes how epidemiology FTEs are situated within your organization?

- ❏ Epidemiology FTEs are centralized, and provide support to all program areas
- ❏ Epidemiology FTEs are centralized, but are assigned specific portfolios and/or support specific program areas
- ❏ Epidemiology FTEs are decentralized/situated within specific program areas
- ❏ Other, specify:
  _____

Q2. Please provide any comments or additional context needed to explain how epidemiology capacity is structured within your organization.

Q3. Please provide the approximate annual salary range for job positions that contribute to the epidemiology function in your organization, FTEs, and indicate whether or not the position is unionized (e.g., Epidemiologist, Health Analyst, Manager of Epidemiology team, Epidemiology lead, Field Epidemiologist, etc.)

Please note that we are asking for the salary ranges of the position (i.e. the pay band minimum and maximum), not for the salaries of individual employees.

Position title	Management or supervisory position (Yes/No)	Unionized ? (Yes/No)	# of FTEs	Salary Minimum	Salary Maximum

Q4. Please indicate whether your current epidemiology capacity meets the population health assessment and surveillance needs of your organization, including emerging issues (e.g., opioid overdose, climate change, cannabis)?

For clarity, capacity here refers to all currently filled positions. Recurring or longer-term vacancies could be a contributing factor to an organization's needs not being met.

- ❑ Yes, our organization's needs are met with our current capacity → Proceed to Q5
- ❑ No, our organization's needs are not met with our current capacity

Please describe how your organization's population health assessment and surveillance needs are not being met with your current epidemiology capacity. If possible, please estimate how much more capacity would be needed (e.g., number of Epidemiologists or FTEs) as well as the needed functions or program areas that require more capacity.

In your response, please clarify whether vacant positions are a contributing factor to your organization's needs not being met.

Q5. Do requests for support from health service organizations (e.g., Ontario Health Teams, SDOH tables, Ontario Health/LHINs) or other external agencies (e.g., community groups, local municipalities) have an impact on meeting the epidemiological needs at your organization?

- ❑ Yes
- ❑ No
- ❑ Not applicable

Q6. Please provide any comments or additional context needed to explain your answer to the previous question.

Q7. Do requests to support functions beyond those outlined in the 'who to count' definition (e.g. continuous quality improvement, performance management, business intelligence administration) have an impact on meeting the epidemiological needs at your organization?

- ❑ Yes
- ❑ No
- ❑ Not applicable

Q8. Please provide any comments or additional context needed to explain your answer to the previous question. If possible, provide an estimate of staff time (in FTEs) that your epidemiology workforce allocates to work outside of the functions outlined in the 'Who to Count' document.

Q9. What changes do individuals at your organization anticipate for the future scope of epidemiological work in public health, locally and regionally in Ontario?

Q10. What additional training needs may be required to meet those changes in scope for public health epidemiological work in the future?

Q11. Please provide any additional comments or concerns you might have related to the current epidemiology workforce capacity at your organization.

Submit Assessment

After you have completed a review of the responses to the 2019 Epidemiology Capacity Assessment Survey and confirm that the survey has been completed accurately to the best of your knowledge, please click the 'submit' button below to submit your responses. Your responses cannot be reviewed after submission. Thank you for completing this survey.

Appendix B: 'Who to Count' - Survey Inclusion Criteria

Primary job functions for public health epidemiological practice in Ontario

Please include employees whose role involves **all or most** of the job functions outlined below in the Epidemiology Capacity Assessment survey.

Employees in non-management roles

Assessment and analysis

- ☐ Recognize public health problems pertinent to the population, articulate/evaluate need for further investigation/public health action based on population health assessment and surveillance data
- ☐ Conduct and organize surveillance activities (e.g., identify data needs; implement and design new, or revise existing, surveillance systems; report key findings; support evaluation of surveillance system)
- ☐ Identify acute and chronic conditions or other adverse outcomes in the population (e.g., assist in community health assessments; design and conduct investigations; hypothesis generation and verification of hypotheses; recommend priorities of potential public health problems to be addressed)
- ☐ Apply principles of good ethical/legal practice as they relate to study design and data collection, dissemination, and use (e.g., privacy laws, research ethics)
- ☐ Organize, analyze, summarize and report on data and information from surveillance, investigations, or other sources (e.g., define and manage databases; create analysis plans; analyze data; identify bias and limitations; identify and synthesize key findings)
- ☐ Support the development of evidence-based interventions and control measures in response to epidemiological findings and scientific evidence
- ☐ Assist in evaluation of programs (e.g., develop measurable and program-relevant goals and objectives; develop program logic models and theories of action; collect data for use in tracking program objectives and outcomes; evaluate progress towards program objectives and outcomes)

Basic public health sciences

- ☐ Apply principles of informatics, including data collection, process, and analysis, in support of epidemiological practice
- ☐ Use identified informatics tools in support of epidemiological practice

Communication

- ☐ Prepare and communicate epidemiological information through written and oral reports and presentations to a variety of audiences (e.g., professional audiences, policy makers, and the public)

Community dimensions of practice

- ☐ Provide epidemiological input into epidemiological studies, public health programs, and community public health planning processes in the community, local, provincial/territorial, federal level

Cultural competency

- ☐ Describe population by sociodemographic characteristics (e.g. race/ethnicity, gender, sexual orientation) using appropriate methods and analyses
- ☐ Use knowledge of specific sociocultural factors in the population to interpret findings

Financial and operational planning and management

- ☐ Use skills that foster collaborations, strong partnerships, and team building to accomplish epidemiology program objectives

Leadership and systems thinking

- ☐ Support the epidemiological perspective in the agency strategic planning process
- ☐ Use performance measures to evaluate and improve epidemiology program effectiveness

Policy development

- ☐ Support the application of epidemiological knowledge to the development and analysis of public health policy

Employees in management roles

- ☐ Staff in management roles not only ensure that staff in non-management roles are carrying out the epidemiological functions described above, but are able to provide technical and functional support and guidance. Thus, these individuals should have training in epidemiology.

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