International Environmental Scan of Public Health Surveillance Functions

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National Collaborating Centre for Methods and Tools
Centre de collaboration nationale des méthodes et outils

Centre de collaboration nationale sur les politiques publiques et la santé
National Collaborating Centre for Healthy Public Policy

Acknowledgement

AUTHORS
Susan Snelling, National Collaborating Centre for Methods and Tools
Caitlin Ford, National Collaborating Centre for Methods and Tools
Caroline Cambourieu, National Collaborating Centre for Healthy Public Policy
Willy Dunbar, National Collaborating Centre for Healthy Public Policy

UNDER THE COORDINATION OF
Maureen Dobbins, National Collaborating Centre for Methods and Tools
Olivier Bellefleur, National Collaborating Centre for Healthy Public Policy

WITH THE COLLABORATION OF
Emily Patterson (National Collaborating Centre for Methods and Tools) who conducted the preliminary data collection.

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LAYOUT
Nayab Choudhry, National Collaborating Centre for Methods and Tools.

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About

ABOUT THE NATIONAL COLLABORATING CENTRE FOR METHODS AND TOOLS

The National Collaborating Centre for Methods and Tools (NCCMT) facilitates and scales evidence informed decision-making in public health organizations in Canada. This is achieved by providing high-quality resources, real-world training and practical mentorship that evolves with, and responds to, the ever-changing needs of public health. The NCCMT is part of a network of six National Collaborating Centres for Public Health financed by the Public Health Agency of Canada. It is hosted by McMaster University, a leader in research and innovation in Canada.

ABOUT THE NATIONAL COLLABORATING CENTRE FOR HEALTHY PUBLIC POLICY

The National Collaborating Centre for Healthy Public Policy (NCCHPP) seeks to increase the expertise of public health actors across Canada in healthy public policy through the development, sharing and use of knowledge. The NCCHPP is one of six centres financed by the Public Health Agency of Canada. The six centres form a network across Canada, each hosted by a different institution and each focusing on a specific topic linked to public health. The National Collaborating Centre for Healthy Public Policy is hosted by the Institut national de santé publique du Québec (INSPQ), a leading centre in public health in Canada.

National Collaborating Centre for Methods and Tools

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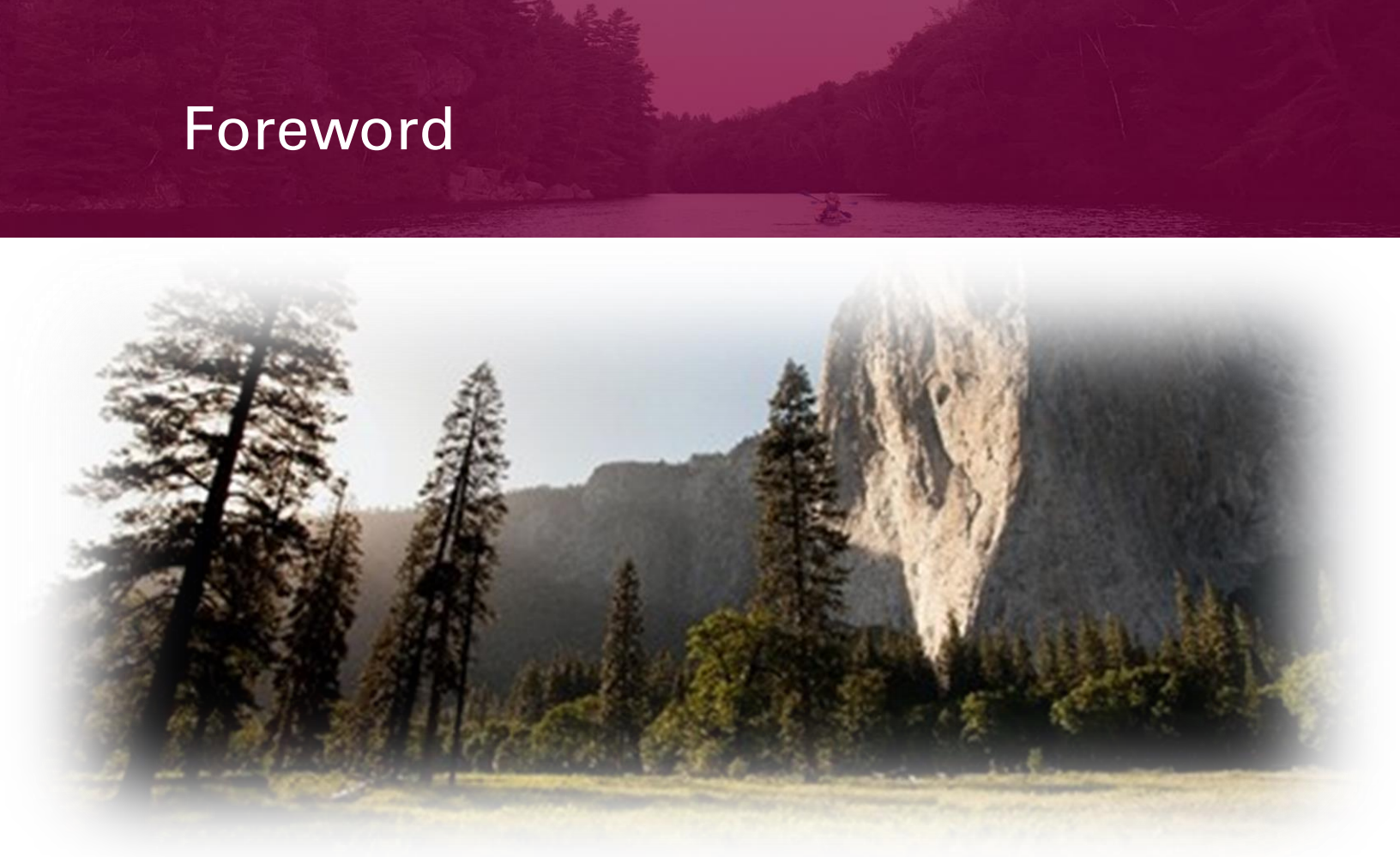
National Collaborating Centre for Healthy Public Policy

Foreword



The National Collaborating Centre for Methods and Tools (NCCMT), in collaboration with the National Collaborating Centre for Healthy Public Policy (NCCHPP), undertook an international environmental scan of public health surveillance functions for the Public Health Agency of Canada (PHAC). This environmental scan aims to describe characteristics of national public health surveillance functions from countries with comparable contexts to Canada to provide a global perspective on corporate surveillance system coordination functions at a national level.

PHAC conceptualized the original idea by outlining 6 key domains, with key questions for each. PHAC also identified 7 countries (Australia, Denmark, Israel, New Zealand, Norway, the United Kingdom, the United States) and the European Centre for Disease Prevention and Control (ECDC) for which to scan surveillance functions.

The results of this international environmental scan of public health surveillance functions are presented in this synthesis of information extracted from public documents, published literature, and key informants. The report is organized according to the set of questions related to each of the 6 key domains.

An appendix presents the information collected from grey and peer-reviewed literatures for each of the 7 countries under study and for the ECDC. The appendix may be of interest for readers who wish to know more about public health surveillance in a specific country, according to public documents.

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List of Key Structures and Acronyms

AHPPC: Australian Health Protection Principal Committee
CDC: Centers for Disease Control and Prevention (USA)
CDNA: Communicable Diseases Network Australia
CoP: Community of Practice
CTSE: Council of State and Territorial Epidemiologists (USA)
ECDC: European Centre for Disease Prevention and Control
EMR: Electronic Medical Records
EnHealth: Environmental Health Committee (Australia)
ESR: Institute of Environmental Science and Research (New Zealand)
EU: European Union
ICDC: Israel Center for Disease Control
MOH: Ministry of Health
MOHCS: Ministry of Health and Care Services (Norway)
MSIS: Norwegian Surveillance System for Communicable Diseases
NCHS: National Center for Health Statistics (USA)
NHEMS: National Health Emergency Management Subcommittee
NIPH: Norwegian Institute of Public Health
NNDSS: National Notifiable Disease Surveillance System (USA)
NSSP: National Syndromic Surveillance Program (USA)
SAMSS: South Australian Monitoring and Surveillance System
SSI: Statens Serum Institut (Denmark)
UK: United Kingdom
UKHSA: United Kingdom Health Security Agency
US or USA: United States of America
WHO: World Health Organization

Executive Summary

I. Introduction

The National Collaborating Centre for Methods and Tools (NCCMT), in collaboration with the National Collaborating Centre for Healthy Public Policy (NCCHPP), undertook this international environmental scan of public health surveillance functions at the request of the Public Health Agency of Canada (PHAC). The purpose of the scan was to describe characteristics of public health surveillance functions from countries and organizations with comparable contexts to Canada, to provide a global perspective on corporate surveillance system coordination functions at a national level. Seven countries (Australia, Denmark, Israel, New Zealand, Norway, the United Kingdom, and the United States) and one organization (the European Centre for Disease Prevention and Control (ECDC)), were included in the scan. Describing current public health surveillance functions for Canada was out of scope for this scan.

II. Methods

The search for relevant information was conducted in August-October 2022, based on Google, Google Scholar and PubMed searches. For each country/organization, findings from the relevant identified English and French documents related to each of 6 domains of interest were extracted. These findings, organized by countries/organization, are presented in an appendix. Key informant interviews were conducted with a person holding the position of director of surveillance, or a similar role, from each country and ECDC. Condensed working tables were created based on the findings of the literature and web scan, and the interview data. Key points to describe public health surveillance characteristics for the domains of interest were extracted from the condensed working tables and synthesized across countries/organization, by domain, and are presented in this report.

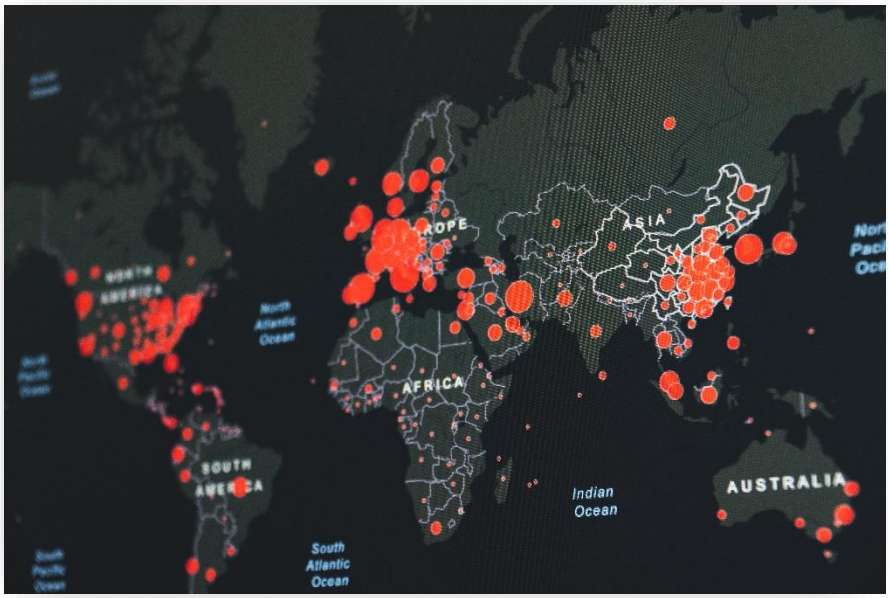
III. Limitations

The highly synthesized findings of the major similarities and differences across domains presented in this report may omit certain nuances of each system. From the available information, we are not able to compare systems to determine which produce preferred outcomes, or to make comparisons with Canada's current surveillance functions.

Findings

i. General Description of Public Health Surveillance

The structure and function of public health surveillance varies by country/organization size. Larger countries—geographically and by population—share public health surveillance responsibility across states, territories, and nations. Similarly, EU member countries conduct their own disease surveillance initiatives and share data with ECDC. Smaller countries conduct public health surveillance through branches under the national government. In some countries, there are closer connections to universities and research institutes that support this function; in other settings, capacity for surveillance is largely in-house within the agencies.



Across these 7 countries and ECDC, surveillance data are collected for a variety of infectious and non-communicable diseases based on indicators drawn from active surveillance and from sources such as hospitalization databases, laboratory data and wastewater testing. The number and types of surveillance systems in place varies across countries/organization.

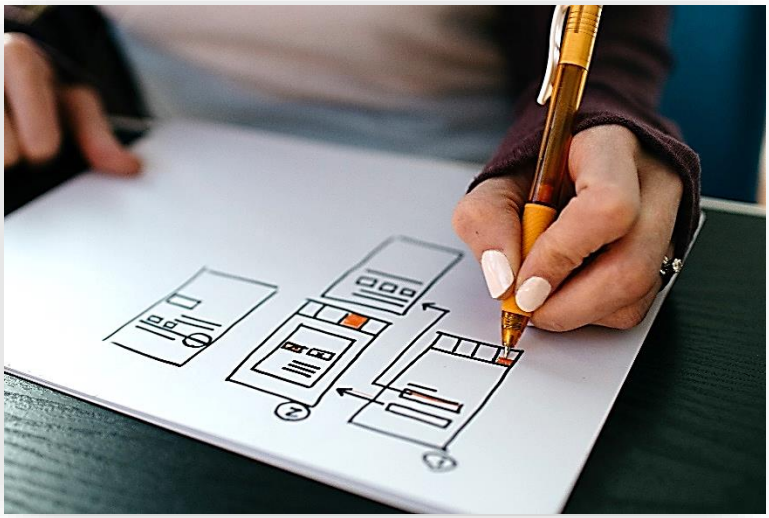
ii. Policies and Strategic Plans

High-level legislation governs public health functions (including surveillance) for each country or organization. In all countries/organization, legislation establishes and funds a public health centre or agency with a mandate that may include surveillance. Some notifiable disease legislation is national for some countries, while for others notifiable disease reporting occurs at the state/territory level.

Most countries have strategic plans or objectives for surveillance of COVID-19, or more broadly for communicable diseases. No countries identified a strategic plan for surveillance of non-communicable diseases. Several countries are developing new strategic plans for public health surveillance.

iii. Governance Structures and Processes

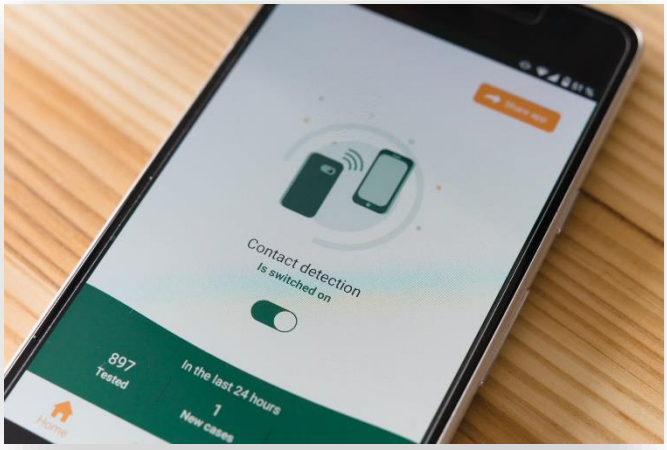
Across these countries, the national Ministry of Health or equivalent provides policy leadership and oversight for public health surveillance. Surveillance policy decisions are largely the responsibility of the national-level structures. Within, or at arm's length from, the national Ministry of Health are centres or agencies that hold responsibility for certain operations and coordination of public health surveillance functions. Within these structures are divisions that undertake and report on specific portfolios.



In decentralized models, in which surveillance happens primarily at the state/territory or member nation level, such as Australia and ECDC, legislation governs data sharing with national or European Union bodies. In the UK, each country conducts surveillance separately; they may share with other UK nations depending on the national interests. In the US, states are not required to share data nationally, but sharing is encouraged through collaborations and enabled through funding.

iv. Surveillance Performance Monitoring and Evaluation

Some countries have defined (or are developing) minimum standards for public health surveillance systems. There are established and accepted approaches, methods and standards for public health surveillance monitoring and evaluation, such as those from the US CDC and ECDC. Most surveillance evaluation is ad-hoc, with some evaluation or monitoring performed on a routine basis according to a schedule. Evaluations are done internally and/or by external bodies.



v. Internal Engagement Structures and Processes

Surveillance systems benefit from structures and processes that facilitate linkages between staff working on national surveillance. Some jurisdictions connect by virtue of being small teams. In larger countries/organization, there are national working groups that allow discussions across systems or diseases. ECDC has implemented a new structure (starting in 2020), in part to address a need for greater horizontal integration, including between laboratory-based surveillance and disease programs.

vi. Knowledge Synthesis

Knowledge synthesis involves processes or structures that facilitate the synthesis of knowledge drawn from individual surveillance systems, to be used in integrated and contextualized reporting, and as a support for informed decision-making. In order to bring surveillance knowledge to users, countries/organization establish networks that include government representatives, decision-makers, etc. Many countries use dashboards for real-time data, accessible to government and the public. Knowledge synthesis also happens through integrated reporting across subject matter expertise.

Synthesizing knowledge from individual surveillance systems is not without challenges. Not all data are available in integrated systems, and some data sources are incomplete. Some data are de-identified or pre-analyzed at a local or regional level, limiting the analyses that can be done at other levels. Nonetheless, there are expectations by partners and the public that timely surveillance outputs will be available, and data sharing legislation enables this kind of access.

Cross-cutting Themes

Themes noted across the domains are described, to contribute to the understanding of national structural components.

i. Surveillance as an Established Public Health Function

Public health surveillance is well-established across all countries/organization included in this environmental scan. Enabling legislation exists for public health functions, including surveillance, in all countries and for ECDC. Arm's-length structures, such as agencies or institutes, are generally charged with implementation of surveillance and other functions.

In some countries, there are connections to university institutes that support surveillance; in other settings, capacity for surveillance is in-house.

ii. Centralization

Models vary in terms of centralization of surveillance functions; degree of centralization is largely related to the size and complexity of the country or organizational jurisdictional structure. Countries in which public health is partly governed at the state, territory or member nation level are more decentralized in the way public health surveillance is carried out. As a result, these countries (and ECDC) have implemented more formal structures to enable communication and knowledge sharing – networks, national working groups, and similar structures.

iii. Refresh and Renewal of Public Health Surveillance Functions

Every country/organization identified challenges associated with their surveillance system that had been affected by, or heightened by, their response to the COVID-19 pandemic. Systems that draw from existing and real-time data, increased digitalization, and increased opportunities for knowledge exchange are generally of interest. An emerging priority is moving surveillance information into knowledge that can be accessed and used by decision-makers, media, and members of the public.

iv. Monitoring and Evaluation

Evaluations of public health surveillance systems overall are less common than disease- or system-specific evaluations. As a result, little can be concluded at a high level about how effectively public health surveillance systems are working.

v. Non-Communicable Diseases and Determinants of Health

This scan is less revealing about non-communicable disease surveillance, environmental surveillance, and about how determinants of health and health equity factor into countries' plans for public health surveillance. Perhaps because of the recent and ongoing focus on COVID-19, public health surveillance strategy continues to emphasize infectious diseases; nonetheless, other public health concerns are also present and may become more evident in forthcoming surveillance strategies.

Introduction

The National Collaborating Centre for Methods and Tools (NCCMT), in collaboration with the National Collaborating Centre for Healthy Public Policy (NCCHPP), undertook this international environmental scan of public health surveillance functions at the request of the Public Health Agency of Canada (PHAC).

The purpose of this environmental scan was to describe characteristics of public health surveillance functions from countries and organizations with comparable contexts to Canada, to provide a global perspective on corporate surveillance system coordination functions at a national level. PHAC provided a list of countries/organization of interest: Australia, Denmark, Israel, New Zealand, Norway, the United Kingdom, the United States, and the European Centre for Disease Prevention and Control (ECDC) were included in the scan. Although ECDC is an organization composed of 27 member nations (including Denmark, which is also independently included in this scan), and thus, is different in some respects from the countries included in the scan, all entities we included perform public health surveillance, and it is these functions that the present scan seeks to describe. Describing current public health surveillance functions for Canada was out of scope for this scan.

PHAC identified six domains of interest to describe characteristics of national or corporate level public health surveillance functions:

1. General description of public health surveillance systems
2. Policies and strategic plans
3. Governance organizational structures and processes
4. Surveillance performance monitoring and evaluation
5. Internal engagement structures and processes
6. Knowledge synthesis

See Appendix A for the specific questions explored in the scan.

Methods

a) Document Search

i. Grey literature search

In August-September 2022, we conducted a Google search based on the name of the included countries and ECDC, along with key terms such as public health surveillance, health surveillance, disease surveillance, health monitoring, or health protection. Content from the first two pages of results were reviewed for relevance. Any relevant links on the web pages were followed, and the content in English or French of those web pages was scanned for relevant documents. The link for each relevant document or web page was captured in a spreadsheet, and the source document was downloaded when available.

ii. Peer-reviewed article search

In October 2022, after a preliminary review and content collection from the relevant documents, links and webpages, we performed an additional search for peer-reviewed journal articles related to surveillance functions and system evaluations on PubMed and Google Scholar for the years 2017 – 2022. Relevant search terms such as governance, policies, strategic plans, performance monitoring and evaluation of public health surveillance systems were used to search for published literature in English or French related to public health surveillance functions for the seven included countries and ECDC. We also performed a limited ancestry search from the relevant references of the included papers.

iii. Key Informant document request

Key informants from each country/organization were asked to provide any additional documents that would not have been found through a web search, such as internal or unpublished documents. No relevant documents were shared by key informants that were not already available on websites or other public sites.

b) Key Informant Interviews

A key informant from each country and ECDC was approached by emailed invitation to participate in an interview lasting up to one hour, related to public health surveillance functions in their jurisdiction or organization. In general, the person holding the position of director of surveillance, or a similar role, was invited to participate. See Appendix B for the guiding questions for the interview – questions were posed based on available time, prioritizing gaps in knowledge from the document search. Eight interviews were completed in total, between November 2022 and February 2023, with at least one representative from each country/organization. One country had four people participate, to represent different aspects of their system. Anonymized notes were prepared from these interviews.

c) Data Extraction

Each included document, website, and article was reviewed to identify content related to the six PHAC-identified domains of: surveillance system description, policies and strategic plans, governance and organizational structures and processes, surveillance performance monitoring and evaluation approaches, internal engagement processes, and knowledge synthesis. For each country/organization, the findings from the relevant sources related to each domain were extracted into a spreadsheet, along with the reference source. Generally, relevant text was captured verbatim from the source.

d) Data Summarization

Based on the data extraction table content for each country/organization, a preliminary summary was prepared related to each of the six domains, drawing on the grey literature found on websites or government documents, and relevant peer-reviewed publications – see **Appendix C**.

A more condensed summary of key findings from each country/organization, along with the salient points from the interviews, was prepared as a working document to describe key characteristics for the six domains and reported here.

e) Data Synthesis

Key points to address each domain were extracted from the condensed summaries and are included here under Findings, to describe the variety of characteristics of public health surveillance systems identified in this project.

f) Identification of Cross-cutting Themes

By considering all content in the scan, cross-cutting themes emerged and are presented in a final section.

Findings

For each domain an overall summary of findings is presented, followed by a table presenting an 'at-a-glance' summary of information across each country and ECDC. Links to reference sources are provided throughout the text; a '‡' indicates information from key informant interviews.

General Description of Public Health Surveillance Systems

i. Public health surveillance structure

The structure and function of public health surveillance generally varies by country/organization size. Larger countries—geographically and by population—including Australia,[‡,1] UK,[‡,2] and US,[‡,3] share public health surveillance responsibility across states, territories, and nations. In these countries, each region is responsible for operating their own surveillance systems and sharing their findings with the national government. Similarly, EU member countries conduct their own disease surveillance initiatives and share data with ECDC.[‡,4] Smaller countries like Denmark,[‡,5] Israel,[‡,6] New Zealand[‡] and Norway[‡] conduct public health surveillance on a national scale. In these countries, it is the responsibility of branches under the national government to conduct disease surveillance (sometimes in partnership with academic institutions), synthesize the data and report to decision makers within government.

ii. Public health surveillance systems

Across all countries/organization, surveillance data are collected for a variety of infectious and non-communicable diseases based on indicators drawn from active surveillance and from hospitalization databases, laboratory data and wastewater testing. However, the number and types of surveillance systems in place vary across countries/organization.

Australia,[‡,7] Israel,[‡,8] US[‡,9] and ECDC[‡,10] separate surveillance functions by disease type and project area. Under this model, smaller teams of experts monitor trends for a specific disease, or group of diseases. For example, ECDC has several Disease Programmes[‡,11] which manage surveillance categories including antimicrobial resistance and healthcare-associated infections; emerging and vector-borne diseases; food- and waterborne diseases, zoonoses; HIV, STI and blood-borne viruses; respiratory tract infections; and vaccine-preventable diseases and invasive bacterial infections. Similarly, in Israel,[‡,12] individual units within the ICDC are responsible for conducting public health surveillance

and managing data on areas of concern such as infectious diseases, cancer, and other non-communicable diseases.

In Denmark,[‡,13,14] New Zealand,[‡] and Norway,[‡,15] surveillance functions are carried out by a central department/team/agency that consists of epidemiologists, microbiologists and public health experts who collaborate on a variety of disease surveillance projects. The UK[‡,16] has a similar central structure that complements the decentralized surveillance conducted by the UK member states.

Policies and Strategic Plans

i. Mandate or policies to conduct national public health surveillance

High-level legislation governs national or corporate public health functions (which may include surveillance) for each country/organization. For all countries and ECDC,[17] legislation establishes and funds a public health centre or agency, with a mandate that may include surveillance.[‡] Some notifiable disease legislation is national, such as in Denmark[18] and Norway;[‡,19] other countries establish notifiable disease reporting at the state/territory level, such as in the US.[20]

In decentralized models, in which surveillance happens primarily at state/territory or member nation level, such as Australia[‡] and ECDC,[‡,21] legislation governs data sharing with national or EU bodies. In the UK, each country conducts surveillance separately; they may share with other UK nations depending on the national interests[‡]. In the US, states are not required to share data nationally, but this is encouraged and enabled through funding[‡]. National legislation governs health and personal data privacy in Australia,[‡] Denmark,[22] Norway,[‡,23] and the US.[24]

ii. Surveillance strategic plans to guide national public health surveillance

Most countries[25,26,27] and ECDC,[28] have strategic plans or strategic objectives for surveillance of COVID-19, or more broadly for communicable/notifiable diseases.[29,30] In Australia, surveillance strategy normally happens at the state and territory level[‡,31] although for nationally significant outbreaks, the strategy would be developed at the national level.[‡,32]
No countries identified a strategic plan for surveillance of non-communicable diseases.
Several countries (and ECDC) are developing, or plan to develop, new strategic plans for national public health surveillance, in light of recent experiences with COVID-19.

For example:

- New Zealand is developing a new surveillance plan to scale down COVID-19 surveillance and scale up other disease surveillance.‡
- Norway will develop another broad surveillance plan once COVID-19 surveillance focus is reduced.‡
- US is re-evaluating its surveillance strategy to determine what is needed for quick response versus long-term needs.‡
- ECDC is preparing a new surveillance strategic plan. The EU has endorsed an extended mandate for ECDC related to disease prevention and control in light of COVID-19.‡

iii. Summary of Policies and Strategic Plans by Country/Organization

Australia	Surveillance function is carried out through the Department of Health and Aged Care and the Communicable Disease Network Australia, guided by a National Framework‡,33,34. Strategy occurs at the state and territory level.‡ National strategies exist for national outbreaks.‡,35
Denmark	The Statens Serum Institut (SSI) has a mandate to conduct surveillance, and reports to the Ministry of Health which has a statutory order for certain notifiable diseases.‡,36 SSI provides guidance to the National Health Authority to inform the national-level for strategies and plans.‡,37
Israel	Israel Center for Disease Control (ICDC) conducts routine and ad hoc surveillance and reports back to the Ministry of Health on a regular basis.‡ ICDC is responsible for providing policy makers with evidence to make decisions on public health issues and develop strategies for national outbreaks.‡
New Zealand	The Ministry of Health provides the legislative framework and strategic planning to conduct disease surveillance, in collaboration with the Public Health Agency (established in 2022) and the Institute of Environmental Science and Research (ESR).‡ The Public Health Agency published a COVID-19 surveillance strategy and is now working on a strategy for beyond the pandemic.‡
Norway	There are legislative acts that mandate surveillance of infectious diseases.‡ The Ministry of Health and Care Services determines the national policy and strategy for public health function.‡,38

	The Norwegian Institute of Public Health has strategic plans for surveillance. Currently the plan focuses on COVID-19; development of a broad strategy is underway.‡
UK	United Kingdom Health Security Agency carries out statutory functions for the Secretary of State for Health and Social Care. Several legislative frameworks exist for surveillance functions.[39] Each UK country is responsible for its own surveillance. A strategic meeting occurs to establish joint strategic plans.‡
USA	The Centers for Disease Control and Prevention (CDC) is a component of the US Department of Health and Human Services.[40] No federal mandate exists for states to share data with CDC, but CDC offers funding incentives and support to states to encourage sharing of data.‡ CDC is re-evaluating surveillance strategy to streamline approach to rapidly evolving issues.‡
ECDC	The ECDC has an extended mandate to perform surveillance. The ECDC founding regulation states that EU member states must provide timely and accurate data to ECDC to meet the centre's surveillance objectives.[41] ECDC has a long-term surveillance strategy (2021-2027) that is in the process of being updated.‡

Governance Structures and Processes

i. Governance

Across the seven countries, the national Ministry of Health or equivalent government ministry provides policy leadership and oversight for public health surveillance. Surveillance policy decisions are largely the responsibility of the national-level structures.

Within, or at arm's length from, the national Ministry of Health are Institutes (Denmark‡,[42]), Directorates[43] (Norway), Networks (Australia‡,[44]), Centres for Disease Control (US[45], Israel[46]) or Agencies (New Zealand[47], UK[48]), that hold responsibility for certain operations and coordination of public health surveillance functions. In New Zealand, surveillance data management and analysis are conducted by a crown research institute (Institute of Environmental Science and Research) under contract to the Ministry of Health.[49] Within these umbrella structures are Advisory Groups, Centres, Departments, or Divisions, that are designated to undertake and/or report on distinct diseases or specific health portfolios.

In some more de-centralized models, such as Australia[‡] and ECDC,[‡] surveillance is conducted at local or regional levels (regions, states and territories, member nations) and data are reported to or shared with the national or pan-national body.

ii. Summary of Governance by Country/Organization

Australia	The National Health Security Act allows the Communicable Diseases Network Australia to collect state-level surveillance data and act upon it nationally.[‡] Federal government provides funding and policy for public health.[50]
Denmark	Legislation makes Statens Serum Institut (SSI) responsible for infectious disease surveillance and for informing the Danish Health Data Authority on public health action plans.[‡,51,52] The SSI falls under the governance of the Danish Ministry of Health and Prevention.[53, 54]
Israel	The Israel Ministry of Health formulates public health policies and legislative direction for the Israel Center for Disease Control to conduct surveillance work.[55]
New Zealand	The Ministry of Health provides direction, funding and policy for health systems. The Public Health Agency and the Te Whatu Ora are directorates within the Ministry of Health.[‡,56] Te Aka Whai Ora - The Māori Health Authority has independent statutory authority and works alongside the Ministry of Health.[‡,57]
Norway	The Ministry of Health and Care Services (MOHCS) makes all legislative decisions for disease surveillance, which is conducted on a national level and reported to Norwegian Institute of Public Health (NIPH). The NIPH and the Directorate of Health are subordinates of the MOHCS.[58,59]
UK	The United Kingdom Health Security Agency falls under the Department of Health and consists of several committees and oversight groups that make joint decisions on health protection and policy.[60] Each of the four UK countries have their own public health agencies and report back to the group at regular meeting intervals.[‡]
USA	The Centers for Disease Control and Prevention (CDC) operate under the Department of Health and Human Services and are responsible for conducting surveillance through the National Notifiable Disease Surveillance System and the National Center for Health Statistics, which conducts activities under authority granted by the Public Health Service.[61] There is federal-level enabling legislation for CDC to conduct their work, however most authority lies at the state-level, with the CDC funding surveillance functions.[‡]

ECDC	ECDC oversees surveillance in all EU member states. ECDC coordinates the disease networks that compile surveillance data from each EU member state.[62,63]

Surveillance Performance Monitoring and Evaluation

i. Surveillance minimum standards

Some countries have defined minimum standards for public health surveillance systems. For example, in New Zealand, EpiSurv quality assurance criteria are agreed upon by the Ministry of Health, Institute for Environmental Science and Research, and local public health units.[64,65] At ECDC, standards are established by the disease and laboratory network members, and quality indicators are published in the surveillance reports.[66] ECDC is currently conducting a project on surveillance minimum standards needed to meet surveillance objectives – looking across the entire system from inputs to outputs.‡

ii. Monitoring and evaluation of public health surveillance systems

There are established and accepted approaches, methods and standards for public health surveillance monitoring and evaluation: ECDC has a handbook on data quality monitoring and surveillance system evaluation;[67] US CDC has a framework and updated guidelines for evaluating surveillance systems.[68, 69] These approaches are used by these and other countries when they undertake surveillance.

Most surveillance evaluation is ad-hoc, with some evaluation or monitoring performed on a routine basis according to a schedule. Different aspects of the surveillance system are evaluated on different schedules.

For example:

- Australia's Communicable Diseases Network has national guidelines for public health response to certain diseases which is reviewed every few years. States and territories in Australia also may perform their own monitoring and evaluation.‡,
- Denmark does frequent routine monitoring and data quality checks at the time of annual reports.‡
- Israel monitors and audits hospital and lab data for data quality.‡
- New Zealand does evaluation ad hoc, with the case reporting and data entry system (EpiSurv) checked on a weekly, monthly and annual basis for quality assurance standards.‡ The WHO did a one-time evaluation of New Zealand public health systems, including surveillance, in 2018.
- In Norway, monitoring is done per disease, with ad hoc evaluation of aspects of the system.‡ The Norwegian Patient Registry is monitored routinely for validity and completeness.

- UK surveillance is evaluated on an ad-hoc basis, per system.‡ For example, an external team recently completed an evaluation of the UK Public Health Rapid Support Team.
- In the USA, monitoring is generally done per system or program.‡ As one example, the National Syndromic Surveillance Program has formal user analysis and annual evaluation.
- ECDC completes and publishes evaluations on a routine basis.‡ ECDC evaluation of the overall surveillance system is at the country level.‡ A comprehensive external evaluation was completed in 2008 and another in 2019, with others to be repeated in future years.‡

Countries and organizations conduct internal and occasional external evaluations. Examples of external evaluations include Australia, where university-led and other external surveillance is currently being evaluated by an external consultant‡; New Zealand, where an evaluation of public health systems including surveillance was completed by the World Health Organization[70]; Norway, where the Auditor General evaluated the Health Registry and Quality Registry;[71] and ECDC; where an external evaluation is outsourced every few years.‡

Monitoring of surveillance performance is generally conducted for quality assurance purposes, with many countries following the attributes and indicators set out by the ECDC:[72]

(1) Completeness and validity
    (a) Completeness
        (i) Internal completeness
        (ii) External completeness
    (b) Validity
        (i) Internal validity
        (ii) External validity
(2) Sensitivity, specificity, positive predictive value and negative predictive value
(3) Timeliness
(4) Usefulness
(5) Representativeness
(6) Simplicity
(7) Flexibility
(8) Acceptability
(9) Stability, reliability and adequacy

Examples of these attributes as used in evaluations include:

- Australia: the Victoria COVID-19 surveillance system evaluation, and the South Australian Monitoring and Surveillance System were both evaluated using CDC indicators.
- Norway: Used ECDC attributes in recent evaluation of the Norwegian Surveillance System for Communicable Diseases; they often collaborate with ECDC on evaluations.[‡]

Along with other evaluation and monitoring indicators, ECDC monitors outputs from their surveillance activities, such as ECDC data being used or cited in publications.[‡]

iii. Key challenges and opportunities in measuring surveillance performance

Challenges and opportunities are apparent in approaches to performance monitoring. For example, New Zealand noted that monitoring and evaluation of public health surveillance needs more development,[‡] and the USA is currently looking to identify and address data gaps. ECDC noted that evaluation is complicated across countries, because there are many users in the network and their surveillance systems are not uniform.[‡]

iv. Innovative approaches used to monitor surveillance performance

Key informants identified innovations or attempts to address specific surveillance system needs, many of which had come to increased attention in responding to the COVID-19 pandemic.

For example:

- Denmark is aiming to improve and automate/digitize its surveillance process, moving increasingly to capture data from existing sources and only relying on clinicians when there is a system gap.[‡]
- Israel has some built-in redundancy in platforms, so that each platform is a control for others.[‡]
- Norway collaborates with ECDC on quality, case definitions, and discussions with other countries to strengthen surveillance approaches.[‡]
- UK has recently formed a Data and Surveillance Group, with the goal to centralize data from multiple systems. Subject matter or disease-specific teams will still exist, but surveillance will move to be managed centrally.[‡]
- USA has a community of practice, the National Syndromic Surveillance Program: a collaboration among CDC, federal partners, local and state health departments, and academic and private sector partners. The community of practice connects epidemiologists in the Council of State and Territorial Epidemiologists and others, and serves as a feedback loop to get real-time feedback from partners and surveillance users.[‡]

v. Summary of Surveillance Performance Monitoring and Evaluation by Country/Organization

Australia	General performance evaluation is done by Communicable Diseases Network Australia on an ad hoc and routine basis.‡ The CDC guidelines for evaluating surveillance systems have been used to evaluate. The states monitor and evaluate their own systems, which include funding external bodies such as university-based institutes; these are currently being reviewed by an external consultant.‡
Denmark	Legislation has defined what data should be collected through surveillance.[73] Disease reports are published annually, and data are quality checked.‡
Israel	Regular monitoring and auditing of the national disease registry data. Data are also cross-validated on several platforms so the Israel Center for Disease Control can monitor the accuracy of the reported data.‡
New Zealand	The overall surveillance system is monitored at routine time points, and also on an ad hoc basis.‡ The World Health Organization conducted an external evaluation and identified strengths and areas to improve on New Zealand surveillance.[74] The four recommendations were: 1. Sustain and continue strengthening existing multisectoral, multidisciplinary coordination and collaboration around International Health Regulations (IHR)-related activities at all levels, including through formalizing current arrangements where appropriate. 2. Build on the momentum of the Joint External Evaluation process in New Zealand to strengthen implementation of the IHR (2005) and coordinate monitoring and evaluation across agencies through the IHR National Focal Point (NFP). 3. Allocate increased, sustained funding and resources for advancing implementation of the IHR (2005) through the Asia Pacific Strategy for Emerging Diseases and Public Health Emergencies III, with a focus on strengthening national action around antimicrobial resistance, enhancing surveillance and risk assessment, addressing critical human resource needs and building risk communication capacity. 4. Given New Zealand's strong capability, consider formalizing existing arrangements and devising new ones where relevant, to support sustainable IHR implementation in Pacific Island countries and territories.
Norway	Registry data are routinely analyzed for validity and completeness.[75] CDC guidelines for surveillance system evaluation are followed.‡ Registry data were audited in 2017.[76] Norwegian Institute of Public Health (NIPH) works closely with ECDC and conducts regular quality checks. However, evaluation does not have a routine evaluation schedule.‡

	NIPH recently evaluated their COVID-19 system in Norwegian Surveillance System for Communicable Diseases, using the standard attributes defined by ECDC.[77]
UK	Monitoring and evaluation are on an ad hoc, system-by-system basis. Work is underway to create a centralized platform for surveillance data that will make it easier to monitor data quality and system performance‡
USA	Performance monitoring is on a system-by-system basis. There are various evaluations that happen on an annual basis and they are continuously getting real-time feedback from the NSSP community of practice.‡ CDC has published several surveillance evaluation frameworks.[78] CDC has also outlined several attributes that should be measured during surveillance system evaluation.[79]
ECDC	Data quality is evaluated on a routine basis by ECDC; surveillance system evaluation is conducted by EU member countries and by ECDC.‡ Currently working on a consolidated list of 20 surveillance system descriptors in 5 categories.‡ A handbook on data quality monitoring in surveillance system evaluation has been published with a set of standard attributes for the system and an evaluation framework for others to adopt.[80]

Internal Engagement Structures and Processes

i. Internal engagement

Surveillance systems benefit from structures and processes that facilitate internal connections among people: partnerships and linkages between staff working on surveillance. Some jurisdictions connect by virtue of being small teams: Key informants from Denmark‡, New Zealand‡, Norway‡, and Israel‡ each commented that connections happen in the course of doing business, because the teams are small and work in the same physical space.

In larger countries/organization, there are National Working Groups that allow discussions across systems or diseases:

- Australia's Communicable Diseases Network is a network of state/territory, federal and organizational partners who meet every two weeks to discuss disease surveillance. They report to the Australian Health Protection Principal Committee. The Public Health Laboratories Network meets monthly[88]. There was a National Surveillance Committee for data managers, with representatives from each nationally funded program, but it has been dissolved as it was too difficult to run during the pandemic.‡
- New Zealand holds weekly meetings between the Public Health Agency, Institute of Environmental Science and Research and Public Health Service.‡

- The ECDC Disease Network is used to share information internally, via in-person and virtual meetings.‡
- The USA has a large network of stakeholders that are brought together through working groups or committees. Council of State and Territorial Epidemiologists (CSTE) is a convenor of state and local public health jurisdictions – representation from these levels is especially important for the syndromic surveillance program. The CSTE supports a community of practice, the National Syndromic Surveillance Program (NSSP). The NSSP shares a data system that is used by many jurisdictions, which facilitates collaboration[90].

Other scheduled meeting or network structures apart from National Working groups include:

- Denmark, where different disease groups (e.g., vaccine preventable diseases, respiratory diseases) have regular meetings.‡
- Norway holds regular meetings and collaborations between various infectious disease surveillance groups. They also participate in ECDC meetings on an annual basis to collaborate at the EU level.‡
- USA: States are not required to share data federally, so the CDC has to emphasize partnership and collaboration in order to incentivize data sharing, such as through the Council of State and Territorial Epidemiologists (CSTE)‡,[91].

There are established internal knowledge exchange processes related to surveillance, such as seminars, forums and educational events. For example, Norway holds infectious disease conferences.‡ Israel uses social media platforms, such as a WhatsApp group for all pediatric physicians.‡ ECDC organizes forums/events that discuss surveillance activities, and will organize internal training, e.g., to teach staff how to use new software, etc.‡

With respect to connections between laboratory and epidemiological surveillance staff, Australia's Public Health Laboratory Network (PHLN) has a network of laboratories and meets monthly. PHLN works with other Australian Health Protection Principal Committee standing committees such as the Communicable Diseases Network Australia, National Health Emergency Management Subcommittee and Environmental Health Committee, as needed.[81] In Denmark, epidemiologists and microbiologists all work in the same building, making connections easier to develop‡.

ii. Avoiding 'silos' of knowledge

Although some countries do not find siloing to be a challenge because the staff group is small and co-located,‡ as systems get larger and more dispersed, attention to information sharing across staff groups is warranted.

ECDC has implemented a new structure (starting in 2020), in part to address this need for greater horizontal integration. The ECDC reorganization rationale makes reference to Transversal Activities,[82] which are cross-organizational activities involving at least two

units. Attention is also paid to interaction between laboratory-based surveillance and the disease programs.

iii. New initiatives related to internal engagement in public health surveillance

Key informants identified recent and planned efforts to improve surveillance. Some examples include:

- Australia: Currently creating a data managers committee to help the Communicable Diseases Network Australia data managers meet with the state/territory members on a regular basis to make assessments of quality.‡
- Denmark: Working towards having an annual seminar where the working groups meet and discuss/exchange information on each of their projects.‡
- USA: The CDC Data Modernization Initiative‡,[83] aims to get better, faster, actionable insights for decision-making at all levels of public health. Within this initiative are some implications for internal engagement:

  - Aim for development of a series of cloud-based platforms to share information in real-time.
  - Extending partnerships: work across the federal government and with partners on policies that support the exchange and use of data between CDC, jurisdictions, partners, and data providers.
  - Improve access: increase access to data modernization plans and progress to increase participation and alignment.
  - Improve collaboration: work with research and academic partners on innovative projects that streamline information flow, reduce burden on data providers, and accelerate data from the local to the federal level.

- ECDC: A new organizational structure has been established.‡ According to the ECDC report on the new structure, "the structure increases staff engagement and empowerment by creating a constructive dialogue between all internal stakeholders and proactively supports the management of information and knowledge across ECDC."[84]

iv. Summary of Internal Engagement by Country/Organization

Australia	Communicable Diseases Network Australia (CDNA) is a network of state/ territory, federal and organizational partners who meet approx.. every two weeks to discuss disease surveillance.‡ The Public Health Laboratories Network (PHLN) has a network of laboratories that meet monthly.[85] Meetings between Australian Health Protection Principal Committee, CDNA and PHLN chairs also occur on a regular basis.‡

	Australia is currently creating a data managers committee to help the CDNA data managers meet with state members on a quarterly basis to assess data quality.‡
Denmark	The epidemiologists and microbiologists work in the same building, so there is regular knowledge exchange. There are also disease groups that have regular meetings. Work is underway to have an annual meeting to exchange information among all working groups.‡
Israel	The organization is small and it is easy to communicate with other staff members and teams.‡
New Zealand	The surveillance team is small and works locally, so they can connect on a daily basis.‡ Weekly communicable disease meetings occur between the Public Health Agency, Institute of Environmental Science and Research and Public Health Service to cover acute and long-term strategic topics.‡
Norway	The Norwegian Institute of Public Health is small, and infectious disease surveillance staff will regularly meet and collaborate.‡ The staff also attends ECDC meetings on an annual basis to collaborate with EU members.‡
UK	The heads of each country meet regularly to discuss surveillance initiatives and to ensure a consistent approach. A data and surveillance group is working on a centralized approach to data sharing to coordinate data analysis and surveillance.‡
USA	CDC collaborates with partners and stakeholders on surveillance functions. The Council of State and Territorial Epidemiologists hosts a community of practice where data is shared by jurisdictions and serves as a forum to learn the challenges and concerns of each jurisdiction.[86] CDC is working on a data modernization initiative to disseminate information quickly across all levels of public health. This initiative aims to create cloud-based exchange platforms and to improve collaboration to accelerate data sharing from local to federal levels.[87]
ECDC	Meetings between the ECDC disease networks are used to share information between teams working on various surveillance initiatives. These networks are coordinated by disease experts from EU countries. ECDC will also organize internal trainings to connect staff.‡

Knowledge Synthesis

Knowledge synthesis involves processes or structures that facilitate the synthesis of knowledge drawn from individual surveillance systems, to be used in integrated and contextualized reporting, as a support for informed decision-making.

i. Synthesizing surveillance knowledge within the organization

In general, internal or horizontal synthesis of surveillance knowledge happens via structured networks or groupings of personnel, such as the Australian Health Protection Principal Committee‡ and ECDC's Disease Programmes. New Zealand has weekly communicable disease meetings between the Public Health Agency, Institute of Environmental Science and Research and the Public Health Service; New Zealand's public health Director General has a monthly strategy meeting for future planning, with the Public Health Agency and Ministry of Health in attendance.‡ ECDC Member States belong to an Advisory Forum that meets at least 4 times a year.[88]

ii. Moving knowledge to other surveillance systems

Some jurisdictions have developed health data registers or databases that are intended to facilitate data access and integrated analyses. For example, the Danish Health Data Authority provides the Unified Data Portal, allowing researchers and analysts to access health data as needed, with an emphasis on high-quality data from electronic medical records and laboratories.‡,[89]

iii. Moving surveillance to decision makers

Surveillance information is intended to be used as knowledge that can be effectively used by decision makers. In order to bring surveillance to users, countries/organization establish networks that include government representatives, decision-makers, etc. In Australia, the Communicable Diseases Network (communicable disease surveillance [90]) and Australian Institute of Health and Welfare (chronic disease surveillance [91]) structures include decision-makers; Israel has several national committees‡; New Zealand holds strategy meetings focused on public health topics‡; Norway shares reports from public health with decision makers and the public, and will meet with the Ministry of Health in outbreak situations.‡

Some countries (e.g., Denmark‡, UK‡) use dashboards for real-time data, accessible to government and the public. In Israel, routine surveillance outputs from the Israel Center for Disease Control (ICDC) contain key points for public action to support the application of findings – these are translated into English and are made available on the website. The ICDC produces scheduled reports to Ministry of Health management and others in public health‡. The UK has an annual process in which

local public health and healthcare partners come together to develop a joint needs assessment and develop an action plan with a strategy to address the issue. Surveillance data are used to track the impact of the action plans.‡

iv. Challenges and opportunities in synthesis of knowledge from individual surveillance systems

Synthesizing knowledge from individual surveillance systems is not without challenges. Not all data are available in integrated systems (laboratories, electronic medical records are sometimes not accessible), and some data sources are incomplete. Some data are de-identified or pre-analyzed at a local or regional level, such as those available to ECDC,‡ limiting the analyses that can be done.

Nonetheless, there are expectations by partners and the public that timely surveillance outputs will be available, and data sharing legislation enables this kind of access. In Norway, data sharing legislation between public health and the public/media exists, although some data are not complete. In the USA, there are efforts to have the CDC host all data in a centralized place. Currently, some data shared with the CDC by states or territories may not be sharable with other partners.‡

v. Synthesizing knowledge across subject matter expertise

Knowledge synthesis also happens through integrated and contextualized reporting across different subject matter expertise. In some countries, there is one department that does integrated analysis and reporting across diseases (e.g., Communicable Diseases Network Australia;‡, [92] Denmark's Statens Serum Institut; [93] Israel's Center for Disease Control (ICDC)[94]). Scheduled broad health status reports are another method of bringing multiple data streams together in a contextualized way (e.g., Australian Institute of Health and Welfare;[95] the ICDC prepares a 5-year health status book‡).

vi. Facilitating contextualized evidence to support decision making

Informed decision-making is facilitated in many formal and informal ways:

- Australia has established links between state/territory and national-level epidemiologists, allowing the early identification of issues of interest at state/territory-level networks that can be shared at the national level‡. The Indo-Pacific Centre for Health Security plays a similar role in the pan-national region, sharing regional knowledge with national-level public health.
- Denmark involves academics in surveillance to support new research and collaboration.‡
- UK provides interpretation of the data through "Spotlight" documents that feature contextualized discussion‡
- The US CDC provides pictures, analytics, and tools that provide options for local-level stratification, communicating in ways that are meaningful for diverse end-users. In future, the CDC is interested in developing more analytic and data visualization tools for state and local partners to use.‡

vii. Knowledge Synthesis by Country/Organization

Australia	Data analysis is conducted by Communicable Diseases Network Australia who compile state-level data and collaborate with Public Health Laboratory Network.‡ Both groups fall under the Australian Health Protection Principal Committee which advises health ministers about public health decisions.‡ Several networks collaborate to provide guidance and direction on public health issues to the Chief Health Officers and Chief Medical Officer to make decisions.‡
Denmark	The Statens Serum Institut aggregates all digital data and provides information to the Ministry of Health for high-level decision making.‡ Currently aiming to capture most data through existing systems, with clinicians filling in only data not available through other means.‡ The Danish Health Data Authority's portal allows clinicians and researchers to access health data and compile data from across several registries and databases.‡,[96]
Israel	Israel Center for Disease Control provides weekly data to the Ministry of Health to inform policy decisions and synthesizes a larger report every five years. Several committees collaborate on policy and issues of interest.‡
New Zealand	Data analysis is conducted by the Public Health Agency, Institute of Environmental Science and Research, and university partners. The Agency is a small team that holds regular meetings to connect, and regular strategy meetings occur with decision makers.‡
Norway	Reports and data are shared often with decision makers at the ministry of health. In outbreak situations, meetings are conducted on a weekly basis. Legislation governs how information is to be shared with the public and media.‡
UK	United Kingdom Health Security Agency is piloting dashboards for disseminating surveillance data. They provide interpretation of the data and share these outputs at regular intervals.‡
USA	Data analysis occurs at all levels of public health and the CDC funds initiatives at each level. CDC is moving towards hosting all surveillance data in a centralized place to help decision makers and partners use it better.[97] CDC provides case surveillance, tools, support, guidance and resources to public health agencies to help with knowledge synthesis efforts.‡
ECDC	ECDC analyzes surveillance data and collaborates with internal networks to share information and produces routine outputs with key points of action for EU member to make decisions.‡ ECDC provides several online resources to promote knowledge synthesis, knowledge translation and data exchange for surveillance activities.[98]

Cross-cutting Themes

The purpose of this scan was to describe characteristics of national public health surveillance functions from countries with comparable contexts to Canada, building an understanding of corporate surveillance system coordination functions at a national level. Given this overview of key characteristics of public health surveillance functions, certain themes were identified that contribute to the understanding of national structural components.

Surveillance as an Establised Public Health Function

Enabling legislation exists for public health functions, including surveillance, in all countries and for ECDC. Arm's-length structures, such as agencies or institutes, are generally charged with implementation of surveillance and other functions. In some countries, there are closer connections to universities and research institutes that support this function; in other settings, capacity for surveillance is largely in-house within the agencies.

Centralization

Models vary in terms of centralization of surveillance functions; degree of centralization is largely related to the size and complexity of the country or organizational jurisdictional structure. Countries in which public health is partly governed at the state, territory or member nation level are more decentralized in the way public health surveillance is carried out. As a result, these countries (and ECDC) have implemented more formal structures to enable communication and knowledge sharing – networks, national working groups, and similar structures.

Refresh and Renewal of Public Health Surveillance Functions

Every country/organization identified challenges associated with their surveillance system that had been affected by, or heightened by, their response to the COVID-19 pandemic. The sheer demands on the surveillance system were one obvious aspect of their experience. However, key informants also identified the need for innovation and change based on what they had learned and experienced. Some of these initiatives were already underway before the COVID-19 pandemic – ECDC, for example, had initiated a new organizational structure that was developed in 2019, although changes are being proposed to this new structure based on the COVID-19 experience. Systems that draw from existing and real-time data, such as electronic medical records, and laboratory and hospitalization records, are taking prominence in the surveillance strategies being implemented. A move to increased digitalization is evident among the directions for change: the Danish Unified Data Portal

Databases are one such example. The US CDC Data Modernization Initiative has the ultimate goal of enabling actionable insights for decision-making at all levels of public health, and includes cloud-based and real-time data platforms, improved data access, and partnerships. Related trends include moving to dashboards for data sharing, and publishing shorter, topic-focused reports, rather than lengthy, all-encompassing surveillance reports.

Increased opportunities for collaboration, data sharing, and knowledge exchange across systems and structures are generally of interest. For example, the US connects epidemiologists in the Council of State and Territorial Epidemiologists and others, through the National Syndromic Surveillance Program (NSSP) Community of Practice. The NSSP Community of Practice is described as "the social framework for public health workers on the front lines of public health surveillance and emergency preparedness", which complements the technology component of the syndromic surveillance program. An emerging priority is increasingly moving surveillance information into knowledge that can be accessed and used by decision-makers, media, and members of the public.

Monitoring and Evaluation

The CDC surveillance evaluation framework and ECDC attributes are well-known and used across many countries. However, there is variety in the extent to which evaluation is conducted on a routine basis; the majority of evaluation appears to happen ad-hoc. Evaluations of public health surveillance systems overall are less common than disease- or system-specific evaluations. As a result, little can be concluded at a high level about how effectively public health surveillance systems are working. Similarly, although some minimum standards for data systems and data quality have been established, such standards are not widespread.

Non-Communicable Diseases and Determinants of Health

This scan is less revealing about non-communicable disease surveillance and environmental surveillance, and about how determinants of health and health equity, factor into countries' plans for public health surveillance. Perhaps because of the recent and ongoing focus on COVID-19, public health surveillance strategy continues to emphasize infectious diseases; nonetheless, other public health concerns are also present and may become more evident in forthcoming surveillance strategies. The COVID-19 pandemic highlighted the importance of surveillance systems being able to adequately and accurately capture race-based data, for example. While the experience from the COVID-19 pandemic suggests that race, and all SDOH indicators, should be an important component of surveillance moving forward, this was not addressed in the documents included in this scan and did not emerge strongly in the interviews conducted.

Limitations

- The intent of this report was to provide an overall perspective on the public health surveillance functions across seven countries and ECDC. The findings presented are, thus, highly synthesized and may omit certain nuances of each system.
- Although the document and website searches followed a methodology that allowed many relevant documents to be found, there may be other sources that were not identified.
- In order to complete the scan within a compressed time period, the search for source documents and the breadth of key informant interviews were limited.
- Recent changes in public health surveillance functions may not have been captured in the document search, if available documents had not been updated to reflect current policy or practice.
- From the available information, we are not able to compare systems to determine which produce preferred outcomes.
- For most countries and organizations, only one key informant was interviewed, and their knowledge may not have been complete across the entire public health surveillance system.
- Key informants have not reviewed or validated the content of this report or the supporting documentation.
- Most key informants had expertise in communicable diseases – there may be a gap in informant knowledge related to other aspects of public health surveillance.
- Description of Canada's surveillance system was out of scope of this scan, and thus it was not possible to compare the systems of the included entities to Canada's system.

Conclusion

This international environmental scan of public health surveillance functions from countries and organizations with comparable contexts to Canada allows a global perspective on corporate surveillance system coordination functions. National-level public health surveillance systems and functions are complex, and the differences between systems make comparisons challenging. The rapidly changing context of surveillance in the context of COVID-19 heightens the value of understanding different approaches to surveillance, although a scan such as this can only capture descriptions of systems at a moment in time. Nonetheless, consideration of what is known about different systems and functions may provide a valuable perspective on national public health surveillance options.

Appendix A: Scan Guiding Questions

The following set of questions was developed by PHAC to guide the focus of the scan across the six domains of interest.

1. General Description of Public Health Surveillance Systems
    a. How is public health surveillance defined at the national level?
        i. How is public health surveillance structured at the national level?
        ii. Where does surveillance fit into the organisational chart, if available?
        iii. How many different surveillance systems are there?
        iv. How are surveillance systems distributed across the organisation? (i.e., positioned within disease-specific prevention and control programs, stand-alone, or grouped by function (i.e., network of similar systems grouped together)
    b. Is there a good understanding of how surveillance systems are performing?
    c. Are innovative approaches for public health surveillance considered and tested?
    d. Who are the national public health surveillance stakeholders?
        i. Who provides information and who uses the information?
        ii. Are there legislative or formal information sharing mechanisms in place?
        iii. What are some of the challenges with collecting and sharing information?

2. Policies and strategic plans
    a. Is there a mandate to conduct national public health surveillance? For example: a specific public health policy, including legislation, regulations, authorities, protocols for national public health surveillance.
    b. Are there any surveillance strategic plans, surveillance frameworks, surveillance policies at the organisational level to guide national public health surveillance?

3. Governance structures and processes
    a. What does the national public health surveillance governance structure look like?
    b. Are there any committees within the governance structure that are specific to public health surveillance?
        I. If yes, what are their roles and responsibilities?
        II. Who reports to them and who do they report to?
        III. How is it represented? Are there participants from different surveillance systems/programs? What are the organisational levels represented?
    c. How are decisions being made about public health surveillance system function?

4. Surveillance Performance Monitoring and Evaluation methods, standards and tools – best practices and innovative approaches
    a. Are the surveillance systems monitored and evaluated at the national level?
        i. If yes, are there any standards, guiding principles or frameworks for measuring surveillance performance and evaluation?
        ii. How is a surveillance system's function assessed and monitored, and how frequently does this assessment occur?
        iii. For what purpose is monitoring surveillance performance conducted?
        iv. What attributes and indicators are being used to monitor performance?
        v. What are the key challenges and opportunities when it comes to measuring surveillance performance?
        vi. What best practices and/or innovative approaches are used to monitor surveillance performance?
        vii. Are there any mechanisms in place to ensure innovative developments are identified?

5. Internal engagement structures and processes

This refers to structures and processes that facilitate internal partnerships and linkages between staff working on national surveillance.

    a. How does the organization avoid 'silos' of knowledge, if applicable?
    b. Is there a community of practice for employees working on national public health surveillance or applied epidemiology?
        i. If yes, please provide details on this community of practice/network and their objective, membership, platforms used, success factors, promising practices, etc.
    c. Is there a forum/platform for government employees working on public health surveillance to collaborate and have surveillance related discussions?
        i. If yes, is this platform open to other levels of governments (state/provincial/local/other) or beyond? Who specifically?
        ii. Who maintains and facilitates the forum?
    d. Are there national working groups focussed on public health surveillance or applied epidemiology?
        i. If yes, what are they, what are their objectives, who is on these working groups? Any details on their operations would be useful.
    e. In the case where public health surveillance integrates laboratory testing and epidemiological data, how do these teams work together?

6. Knowledge Synthesis

This refers to processes or structures that facilitate the horizontal integration or synthesis of knowledge from individual surveillance systems (e.g., moving beyond silos of topic-specific surveillance knowledge, towards more integrated reporting, more holistic contextualization of surveillance knowledge, to support more informed decision-making)

    a. What processes are in place for synthesizing surveillance knowledge within the organization?

b. How does the organization move surveillance knowledge out of individual surveillance systems to the intended audiences (e.g., decision makers)?
    i. How does your organization move this knowledge to other surveillance systems?
c. What are the key challenges and opportunities when it comes to horizontal integration or synthesis of knowledge from individual surveillance systems?
d. What best practices are used for surveillance teams operating with different subject matter expertise to synthesize and share knowledge to contextualize the bigger picture of population health?
    i. If yes, please provide details.
e. Are there any processes in place that support integrated (wholistic) reporting on population health?
    i. If yes, please provide details.
f. What best practices or structures does your organization have that facilitate wholistic and contextualized evidence to support informed decision-making?

Appendix B: Key Informant Interview Guide

International Environmental Scan of National Public Health Surveillance Functions 2023

1) Introduction
   a) Purpose of Project

Thank you for taking the time to meet with us. We are conducting this international environmental scan of public health surveillance functions for the Public Health Agency of Canada (PHAC). The purpose is to describe characteristics of national public health surveillance functions from countries with comparable contexts to Canada.

Components include:

- Internet Document Search
- Additional Documents via Key Informants – if there are any additional documents that would be helpful, we would appreciate receiving those after this call.
- Key Informant Interviews

b) Question areas
   - Overall picture of how surveillance functions are organized,
   - How monitoring and evaluation are done, and what is known about the current functioning of surveillance at the national level,
   - how information is used and shared,
   - any significant changes made during the last two years or being contemplated now.

1. **To begin,**
   a. I am interested in the mandate to conduct national public health surveillance. Is there relevant legislation that governs the surveillance functions?
   b. Are there any surveillance strategic plans, surveillance frameworks, surveillance policies at the organisational level to guide national public health surveillance?

2. **With respect to Governance structures and processes,**
   a. What does the national public health surveillance governance structure look like? How is public health surveillance structured at the national level? Where does surveillance fit into the organisational chart, if available?
   b. How is *chronic disease surveillance* handled, related to health promotion, health behaviours (e.g., physical activity, tobacco use, etc.)?

c. How are surveillance systems distributed across the organisation? (i.e., positioned within disease-specific prevention and control programs, stand-alone, or grouped by function (i.e., network of similar systems grouped together)
d. Are there any committees within the governance structure that are specific to public health surveillance, or is surveillance blended with other disease-specific organizational groupings? Is there an org chart we could see?
    i. If yes, what are their roles and responsibilities?
    ii. Who reports to them and who do they report to?
    iii. How is it represented? Are there participants from different surveillance systems/programs? What are the organisational levels represented?
e. How are high-level decisions being made about public health surveillance system function? By the bodies we just talked about?
f. Do you have minimum standards or goals for surveillance systems?
    i. If yes, what are these minimum standards/goals?
    ii. How are these minimum standards being used/measured and how are decisions being made?
    iii. Do they have any lessons learned or best practices that they could share?
g. Who are the national public health surveillance stakeholders? Who provides information and who uses the information?
    i. What are some of the challenges with collecting and sharing information?
    ii. Are there legislative or formal information sharing mechanisms in place?

3. Surveillance Performance Monitoring and Evaluation methods, standards and tools – best practices and innovative approaches

a. Is there a good understanding of how surveillance systems are performing?
b. How is a surveillance system's function assessed and monitored, and how frequently does this assessment occur?
c. What best practices and/or innovative approaches are used to monitor surveillance performance?
d. Are innovative approaches for public health surveillance considered and tested?

4. Successful engagement structures and processes

This refers to structures and processes that facilitate internal partnerships and linkages between staff working on national surveillance:

a. Is there a community of practice for employees working on national public health surveillance or applied epidemiology?
    i. If yes, please provide details on this community of practice/network and their objective, membership, platforms used, success factors, promising practices, etc.

b. Is there a forum/platform for government employees working on public health surveillance to collaborate and have surveillance related discussions?
    ii. If yes, is this platform open to other levels of governments (state/provincial/local/other) or beyond? Who specifically?
    iii. Who maintains and facilitates the forum?
c. Are there national working groups focussed on public health surveillance or applied epidemiology?
    iv. If yes, what are they, what are their objectives, who is on these working groups? Any details on their operations would be useful.
d. In the case where public health surveillance integrates laboratory testing and epidemiological data, how do these teams work together?

5. **I am interested in how the surveillance information is used and shared.**
    a. What processes are in place for synthesizing surveillance knowledge within the organization?
    b. How does your organization move surveillance knowledge *to other surveillance systems?*
    c. How does the organization move surveillance knowledge out of individual surveillance systems *to decision makers?*
    d. How do *staff* working on national surveillance *connect across systems*? E.g., Communities of practice, collaboration platforms, working groups? – horizontal integration.
        i. Does public health surveillance integrate laboratory testing and epidemiological data? If so, how do these teams work together?
    e. What are the key challenges and opportunities when it comes to horizontal integration or synthesis of knowledge from individual surveillance systems?
    f. How does the organization avoid 'silos' of knowledge, if applicable?
    g. What best practices are used for surveillance teams operating with different subject matter expertise to synthesize and share knowledge to contextualize the bigger picture of population health?
        i. Are there any processes in place that support integrated reporting on population health? If yes, please provide details.
    h. What best practices or structures does your organization have that facilitate integrated and contextualized evidence to support informed decision-making?

6. **Are there any significant changes** made in the last two years, or being planned or implemented now?
    a. What is the nature of those changes? What led to the changes? What are the goals of the new approaches?
    b. Are there any innovative approaches being tried or implemented now?

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‡ designates content from key informant interviews

‡ Key Informant interview
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