JOINT EXTERNAL EVALUATION OF IHR CORE CAPACITIES

of

CANADA

Mission report:
11-20 June 2018

World Health Organization

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Pan American Health Organization
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REGIONAL OFFICE FOR THE Americas

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Acknowledgements

Abbreviations

AAFC	Agriculture and Agri-Food Canada
AMR	Antimicrobial resistance
AMU	Antimicrobial use
BSL	Biosafety level
CAEFISS	Canadian Adverse Events Following Immunization Surveillance System
CAF	Canadian Armed Forces (National Defence and the Canadian Armed Forces)
CAHSS	Canadian Animal Health Surveillance System
CANUTEC	Canadian Transport Emergency Centre
CARSS	Canadian Antimicrobial Resistance Surveillance System
CBRN	Chemical, biological, radiological and nuclear
CBSA	Canada Border Services Agency
CDC	US Centers for Disease Control and Prevention
CEPR	Centre for Emergency Preparedness and Response
CFEP	Canadian Field Epidemiologist Program
CFIA	Canadian Food Inspection Agency
CHT	Canada Health Transfer
CIC	Canadian Immunization Committee
CIHR	Canadian Institute for Health Research
CIPARS	Canadian Integrated Program for Antimicrobial Surveillance
CIRN	Canadian Immunization Research Network
CNISP	Canadian Nosocomial Infection Surveillance Program
CNPHI	Canadian Network for Public Health Intelligence
CNSC	Canadian Nuclear Safety Commission
CPHLN	Canadian Public Health Laboratory Network
CRMN	Canadian Radiological Monitoring Network
CSCHAH	Canadian Science Centre for Human and Animal Health
CSIS	Canadian Security Intelligence Service
CVMA	Canadian Veterinary Medical Association
CWHC	Canadian Wildlife Health Cooperative
CWS	Canadian Wildlife Service
DND	Department of National Defence (National Defence and the Canadian Armed Forces)
ECCC	Environment and Climate Change Canada
EIS	Event Information Site for National IHR Focal Points
EMAT	Ontario Emergency Medical Assistance Team
EOC	Emergency Operations Center
EPI	Expanded Programme on Immunization
EPREV	Emergency Preparedness Review
ERAP	Emergency Response Assistance Plans
EURO	WHO Regional Office for Europe
F/P/T	Federal, provincial and territorial
FAO	Food and Agriculture Organization
FBI	United States Federal Bureau of Investigation
FDA	United States Food and Drug Administration

GAC	Global Affairs Canada
GLASS	Global Antimicrobial Surveillance System
GPHIN	Global Public Health Information Network
HC	Health Canada
HP	Health Portfolio
HPOC	Health Portfolio Operations Centre
IAEA	International Atomic Energy Agency
IHR	International Health Regulations
IMS	Incident Management System
INFOSAN	International Network of Food Safety Authorities
IPC	Infection prevention and control
IRCC	Immigration, Refugees and Citizenship Canada
ITAC	Integrated Terrorism Assessment Centre
JEE	Joint External Evaluation
MCM	Medical countermeasures
MLISA	Multi-lateral Information Sharing Agreement
MoU	Memorandum of Understanding
NACI	National Advisory Committee on Immunization
NCFAD	National Centre for Foreign Animal Diseases
NEEC	National Environmental Emergency Centre
NESS	National Emergency Strategic Stockpile
NFP	National IHR Focal Point
NML	National Microbiology Laboratory
OIE	World Organisation for Animal Health
PAHO	Pan American Health Organization
PASB	Pan American Sanitary Bureau
PHAC	Public Health Agency of Canada
PHEIC	Public Health Emergency of International Concern
PHEOC	Public Health Emergency Operations Center
PHN	Pan-Canadian Public Health Network
PHN Council	Pan-Canadian Public Health Network Council
PMPRB	Patented Medicine Prices Review Board's
PoE	Points of Entry
PSC	Public Safety Canada
PSPC	Public Services and Procurement Canada
PVS	Evaluation of Performance of Veterinary Services
RCMP	Royal Canadian Mounted Police
Regulations	International Health Regulations
SARS	Severe Acute Respiratory Syndrome
SCC	Standards Council of Canada
SOP	Standard Operating Procedure
TC	Transport Canada
US	United States of America
WAHIS	World Health Information System
WHO	World Health Organization

Note: All hyperlinks presented in this document were accessed on 8 October 2018.

Executive summary

The Joint External Evaluation (JEE) mission of Canada was conducted on request of the Government of Canada to the Pan American Sanitary Bureau (PASB) of the Pan American Health Organization (PAHO) / Regional Office of the World Health Organization for the Americas (WHO), and in the context of the *PAHO Program Budget 2018-2019[1]*, adopted by the 29th Pan American Sanitary Conference in 2017, through Resolution CSP29.R6[2].

The JEE mission in Canada took place from 11 to 20 June 2018, in Ottawa and Toronto, Ontario, and Winnipeg, Manitoba; and was based on the first version of the *Joint External Evaluation Tool: International Health Regulations (2005)[3]*.

The JEE of Canada represents the outcome of an extensive, thorough, and inclusive self-assessment process – led by the Public Health Agency of Canada (PHAC) across Government sectors and jurisdictions – as well as of the preparatory work of Canadian authorities and PAHO inspired by the spirit of "jointness" and transparency, which endured throughout the mission.

The detailed JEE Self-Assessment Report provided by the Canadian authorities to the JEE mission team captures the degree to which the institutionalization and sustainability achieved by Canada in the area of public health preparedness drives innovation and a deep-rooted continuous quality improvement culture. The report was instrumental in familiarizing the JEE mission team with the federated context of Canada, the "collaborative federalism" approach, as well as with the intrinsic inter-jurisdictional complexities underpinning pan-Canadian legal, administrative and operational arrangements. It would be highly desirable if the Canadian authorities considered sharing the JEE Self-Assessment Report in the public domain, given its quality and scope.

It is worthwhile noting that both the quality improvement culture of Canada and its active and concrete commitment towards the international community are exemplified by the fact that the JEE is part of a cycle of cross-Government preparedness efforts undertaken by Canada. This cycle began in 2017 with the Evaluation of Performance of Veterinary Services (PVS) conducted under the auspices of the World Organisation for Animal Health (OIE) and will be concluded in 2019 with the Emergency Preparedness Review (EPREV) under the auspices of the International Atomic Energy Agency (IAEA).

Notwithstanding that, based on the documentation provided to the JEE mission team – extensive in the case of Canada – and face-to-face discussions with national authorities, a JEE only allows to gauge the conduciveness of institutional arrangements for public health actions to be taken and to be effective, the appraisal of Canada's level of capacities by the JEE mission team was fully consistent with the status of core capacities portrayed by the State Party Annual Report regularly submitted by Canada to the World Health Assembly, from 2011 to 2018, pursuant to Article 54 of the International Health Regulations (IHR or Regulations) and Resolution WHA61.2[4]. On that basis, at present, Canada can apply and comply with all IHR provisions.

This determination primarily rests on (i) an overall robust governance framework and adequate resource across all orders of government; (ii) the existence of well-oiled mechanisms and networks to implement, and, when needed, develop, policies and strategies; and (iii) exemplary practices surrounding stakeholder engagement, collaboration at the human-animal interface, the public health laboratory network, and active engagement in bilateral and multilateral high-level fora and operational initiatives that often results in the provision of financial and technical support to other States Parties.

1 Available at: https://www.paho.org/hq/index.php?option=com_docman&task=doc_download&gid=41770&Itemid=270&lang=en
2 Available at: https://www.paho.org/hq/index.php?option=com_docman&task=doc_download&gid=42307&Itemid=270&lang=en
3 World Health Organization. (2016). Joint external evaluation tool: International Health Regulations (2005). World Health Organization. http://www.who.int/iris/handle/10665/204368
4 Available at: http://apps.who.int/gb/ebwha/pdf_files/wha61-rec1/a61_rec1-en.pdf

Institutional strengths, resources, self-awareness and technical expertise have allowed Canada, over the past two decades, to explore innovative technological paths and modi operandi, some of which, such as the Global Public Health Information Network (GPHIN), have not only triggered changes of paradigms at global level, but have also shaped the current IHR.

Nevertheless, the present evolutionary stage of some of the components of the Canadian public health framework pertaining to the technical areas falling under the scope of the JEE — public health surveillance and preparedness arrangements in particular — reflects a higher level of elaboration and apparent process pluripotency than is necessarily warranted. Such a level of complexity might entail a sub-optimal use of resources, as well as negatively affect the ability to efficiently and effectively implement public health actions in response to an acute public health event. Therefore, while the Canadian authorities should periodically review and refine national IHR-related legislation and/or regulations, they should also consider, across sectors and jurisdictions, confidently shifting innovative potential toward the consolidation of a collective vision. In particular, this concerns: (i) the conceptual and IT rationalization of the public health surveillance framework; and (ii) the rationalization of the suite of policies, strategies, plans, and procedures underpinning the national public health preparedness framework, including the recovery component, and stimulating both institutional and individual adaptive approaches to response.

The JEE mission has made further patent the leading role of Canada in the global public health arena both as a pathfinder and as a partner that devotes efforts and resources to support other countries in their efforts to attain sustainability in essential public health functions as part of strengthening their health systems.

Canada scores

Technical areas	Indicators	Score
National legislation, policy and financing	p.1.1 Legislation, laws, regulations, administrative requirements, policies, or other government instruments in place are sufficient for implementation of IHR (2005)	5
	P.1.2 The State can demonstrate that it has adjusted and aligned its domestic legislation, policies, and administrative arrangements to enable compliance with IHR (2005)	5
IHR coordination, communication and advocacy	P.2.1 A functional mechanism is established for the coordination and integration of relevant sectors in the implementation of IHR	5
Antimicrobial resistance	P.3.1 Antimicrobial resistance detection	3
	P.3.2 Surveillance of infections caused by antimicrobial-resistant pathogens	4
	P.3.3 Health care-associated infection (HCAI) prevention and control programmes	5
	P.3.4 Antimicrobial stewardship activities	3
Zoonotic diseases	P.4.1 Surveillance systems in place for priority zoonotic diseases/pathogens	4
	P.4.2 Veterinary or animal health workforce	5
	P.4.3 Mechanisms for responding to infectious and potential zoonotic diseases are established and functional	5
Food safety	P.5.1 Mechanisms for multisectoral collaboration are established to ensure rapid response to food safety emergencies and outbreaks of foodborne diseases	5
Biosafety and biosecurity	P.6.1 Whole-of-government biosafety and biosecurity system is in place for human, animal and agriculture facilities	5
	P.6.2 Biosafety and biosecurity training and practices	4
Immunization	P.7.1 Vaccine coverage (measles) as part of national programme	3
	P.7.2 National vaccine access and delivery	5
National laboratory system	D.1.1 Laboratory testing for detection of priority diseases	5
	D.1.2 Specimen referral and transport system	5
	D.1.3 Effective modern point-of-care and laboratory-based diagnostics	5
	D.1.4 Laboratory quality system	5
Real-time surveillance	D.2.1 Indicator- and event-based surveillance systems	5
	D.2.2 Interoperable, interconnected, electronic real-time reporting system	3
	D.2.3 Integration and analysis of surveillance data	5
	D.2.4 Syndromic surveillance systems	5
Reporting	D.3.1 System for efficient reporting to FAO, OIE and WHO	5
	D.3.2 Reporting network and protocols in country	5
Workforce development	D.4.1 Human resources available to implement IHR core capacity requirements	5
	D.4.2 FETP[5] or other applied epidemiology training programme in place	5
	D.4.3 Workforce strategy	4

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5   FETP: Field epidemiology training programme

Technical areas	Indicators	Score
Preparedness	R.1.1 National multi-hazard public health emergency preparedness and response plan is developed and implemented	**5**
	R.1.2 Priority public health risks and resources are mapped and utilized	**4**
Emergency response operations	R.2.1 Capacity to activate emergency operations	**5**
	R.2.2 EOC operating procedures and plans	**5**
	R.2.3 Emergency operations programme	**4**
	R.2.4 Case management procedures implemented for IHR relevant hazards.	**5**
Linking public health and security authorities	R.3.1 Public health and security authorities (e.g. law enforcement, border control, customs) are linked during a suspect or confirmed biological event	**5**
Medical countermeasures and personnel deployment	R.4.1 System in place for sending and receiving medical countermeasures during a public health emergency	**5**
	R.4.2 System in place for sending and receiving health personnel during a public health emergency	**5**
Risk communication	R.5.1 Risk communication systems (plans, mechanisms, etc.)	**4**
	R.5.2 Internal and partner communication and coordination	**5**
	R.5.3 Public communication	**5**
	R.5.4 Communication engagement with affected communities	**4**
	R.5.5 Dynamic listening and rumor management	**3**
Points of entry	PoE.1 Routine capacities established at points of entry	**5**
	PoE.2 Effective public health response at points of entry	**5**
Chemical events	CE.1 Mechanisms established and functioning for detecting and responding to chemical events or emergencies	**4**
	CE.2 Enabling environment in place for management of chemical events	**4**
Radiation emergencies	RE.1 Mechanisms established and functioning for detecting and responding to radiological and nuclear emergencies	**5**
	RE.2 Enabling environment in place for management of radiation emergencies	**5**

Scores: 1=No capacity; 2=Limited capacity; 3=Developed capacity; 4=Demonstrated capacity; 5=Sustainable capacity.

PREVENT

National legislation, policy and financing

Introduction

The IHR provide obligations and rights for States Parties, which may need to enact or revise laws, policies, or financing strategies in order to meet those obligations. Even if changes or revisions are not required per se, states may determine the need to revise some regulations or other instruments to facilitate IHR implementation in a more effective manner. Implementing legislation could serve to institutionalize and strengthen health security operations within the State Party. It can also ensure coordination among the different entities involved in their implementation. See detailed guidance on IHR implementation in national legislation at http://www.who.int/ihr/legal_issues/legislation/en/index.html.

Target

Adequate legal framework for States Parties to support and enable the implementation of all their obligations, and rights to comply with and implement the IHR. New or modified legislation in some States Parties for implementation of the IHR. Where new or revised legislation may not be specifically required under the State Party's legal system, States may revise some legislation, regulations or other instruments in order to facilitate their implementation and maintenance in a more efficient, effective or beneficial manner. States Parties ensure provision of adequate funding for IHR implementation through the national budget or other mechanism.

Canada level of capacity

With a federal form of government, public health services and health care in Canada, including routine emergency preparedness and response, are primarily the responsibilities of the provincial and territorial governments. The federal government supports the functions of those health systems through the development of guidelines and provision of finances and other assistance when needed. Canada adopted the IHR through an Order in Council approved by the cabinet. Led by the National IHR Focal Point (NFP), Canada conducted an internal review of their legislative framework in 2010, concluding that no new, unique laws were needed.

Canada has in place several federal, provincial and territorial (F/P/T) agreements and collaborating mechanisms to ensure effective collaboration during emergencies. Notably, the Pan-Canadian Public Health Network (PHN) provides a national governance structure to support evidence-based decision-making, information sharing and dissemination, and coordination across jurisdictions. The network has proved instrumental in developing national plans and agreements supporting IHR implementation, such as the *Multi-lateral Information Sharing Agreement* (MLISA, 2014). There are also administrative arrangements that ensure resource sharing across jurisdictions during emergencies, such as the *Federal/Provincial/Territorial Memorandum of Understanding on the Provision of Mutual Aid in Relation to Health Resources During an Emergency Affecting the Health of the Public* (2012). Three standing Steering Committees, informed by a national roster of experts and technical task groups, provide analysis and policy recommendations to PHN, which also involves inputs from the Chief Medical Officers of Health and other senior health authorities from the provinces and territories.

The creation of the Public Health Agency of Canada (PHAC) in 2004, following the 2003 outbreak of severe acute respiratory syndrome (SARS), strengthened federal leadership and capacity in public health, both in preparedness and response to health emergencies. The agency also maintains the NFP, facilitating coordination and collaboration for IHR implementation among federal departments and agencies and across provinces and territories. PHAC is one component of Canada´s Health Portfolio (HP) under the Minister of Health, which also includes Health Canada (HC), the Canadian Food Inspection Agency (CFIA), the Canadian Institute for Health Research (CIHR), and the Patented Medicine Prices Review Board (PMPRB).

The Canada Health Transfer (CHT), the Canadian government's transfer payment programme in support of the health systems of provinces and territories, covers an average of 23% of the costs for public health and health care, public health emergency preparedness, and responses to local health events. Upon request, with or without a formal emergency declaration, provinces, territories and local governments may request additional assistance from the federal government, for emergencies that exceed provincial and territorial capacity.

Recommendations for priority actions

- Continue to periodically evaluate and use existing mechanisms to refine pan-Canadian policies and procedures for public health security.
- Continue to periodically review and refine as needed any legislation or regulations concerning the application, implementation, and compliance with the IHR.

Indicators and scores

P.1.1 Legislation, laws, regulations, administrative requirements, policies or other government instruments in place are sufficient for implementation of IHR – Score 5

Strengths and best practices

- Robust health and emergency management legislation at all levels, supplemented with policy and administrative instruments.
- F/P/T collaborative mechanisms are in place, allowing legal and policy framework alignment across different sectors and jurisdictions.
- The PHN supports a collaborative, multisectoral and multi-jurisdictional approach to public health within a federated system.

Challenges and areas that need strengthening

- Some variation in legislation, policy, and implementation among provinces and territories at times suggests the need for increased coordination.

P.1.2 The State can demonstrate that it has adjusted and aligned its domestic legislation, policies and administrative arrangements to enable compliance with the IHR – Score 5

Strengths and best practices

- Continuous improvement of government instruments and procedures, based on formal, internal evaluations, simulation exercises and after-action reviews.
- The existence of joint protocols among federal agencies facilitate reporting to WHO, the International Atomic Energy Agency (IAEA), the Secretariat of the International Network of Food Safety Authorities (INFOSAN), and others as needed.

Challenges and areas that need strengthening

- The *Quarantine Regulations* (2006) require further alignment with the *Quarantine Act* (2005) and selected IHR provisions (see section *Points of Entry*).

IHR coordination, communication and advocacy

Introduction

The IHR requires multi-sectoral and multidisciplinary, One Health approaches to public health surveillance, information sharing, and event response. Coordination of nationwide resources ensures that all public health hazards are identified quickly and communicated through successively higher levels of government to inform the designated centre responsible for the NFP of events that must be assessed and notified to the Regional Contact Point.

Target

Multisectoral/multidisciplinary approaches through national partnerships that promote efficient alert and responsive systems. Coordinated nationwide resources, including sustainable functioning of a national IHR focal point – a national center for IHR communications which is a key requisite for IHR implementation – that is accessible at all times. States Parties provide WHO with contact details for the NFP and update that information as needed, at least annually.

Canada level of capacity

Canada has a well-established and fully functional national focal point (NFP) maintained by PHAC. The Health Portfolio Operations Centre (HPOC) Watch Office supports the NFP, serving as the 24/7 communication hub for the WHO IHR Regional Contact Point as well as for all relevant national sectors and stakeholders. Specifically, the Watch Office coordinates urgent communications concerning the implementation of IHR Articles 6-12. An IHR technical advisor, generally a public health or health professional, is also available to assist the exercise of the NFP functions by the Watch Office with assessing and reporting events using the Annex 2 decision instrument and other technical activities.

The NFP maintains comprehensive Standard Operating Procedures (SOPs) for the Watch Office and coordination with other relevant sectors, including a detailed technical *Guidebook for IHR Assessment and Reporting at the Federal Level* (2018). Canada regularly validates national IHR implementation and the NFP capacities through informal internal monitoring and assessment activities facilitated by a Health Portfolio (HP) working group. Those activities are complemented by the biannual communication tests conducted by the WHO IHR Contact Point for the Region of the Americas and the submission of the State Party Annual Report to the World Health Assembly, pursuant to IHR provisions. The NFP also routinely reviews IHR coordination and communications following real-life events and exercises. For formal national policy considerations, the NFP addresses the Pan-Canadian Public Health Network Council (PHN Council), through either the Public Health Infrastructure or Communicable and Infectious Disease Steering Committees.

The implementation of the IHR is a shared responsibility in Canada, touching a range of F/P/T partners. The NFP is also the implementation hub for policy recommendations, advocacy, training, stakeholder outreach and coordination of IHR monitoring and evaluation activities. To ensure the functionality of those partnerships, the IHR Programme in PHAC coordinates a network of IHR champions, which are designated points of contact in relevant F/P/T government agencies. The IHR champions support IHR advocacy across the country, promoting training and sharing assessment results with other government stakeholders. The IHR champions act as a conduit and contact point for routine information exchange, though may not necessarily be involved in event assessments and official notifications, which occur through the established public health surveillance systems.

Recommendations for priority actions

- Continue the efforts to expand and better utilize the network of IHR champions, including linkages to existing F/P/T structures.

Indicators and scores

P.2.1 A functional mechanism established for the coordination and integration of relevant sectors in the implementation of IHR – Score 5

Strengths and best practices

- Canada has a well-established and fully functional NFP that enables multisectoral and multidisciplinary coordination, communication, and partnership.

- The HPOC Watch Office, at PHAC, serves as the IHR 24/7 communication hub to WHO IHR Contact Point for the Region of the Americas and with all relevant sectors and stakeholders.

- IHR champions support advocacy across the country, which promotes training and sharing assessment results with other government stakeholders.

Challenges and areas that need strengthening

- Maintaining awareness and awareness building activities across the federal family and provincial and territorial partners, including sharing the results of after-action reviews and the annual State Party Annual Report to the World Health Assembly.

Antimicrobial resistance

Introduction

Bacteria and other microbes evolve in response to their environment and inevitably develop mechanisms to resist the effects of antimicrobial agents. For many decades, the problem was manageable as the growth of resistance was slow and the pharmaceutical industry continued to create new antibiotics. Over the past decade, however, this problem has become a crisis. Antimicrobial resistance (AMR) is evolving at an alarming rate and is outpacing the development of new countermeasures capable of thwarting infections in humans. This situation threatens patient care, economic growth, public health, agriculture, economic security and national security.

Target

Support work coordinated by FAO, OIE, and WHO to develop an integrated global package of activities to combat antimicrobial resistance, spanning human, animal, agricultural, food and environmental aspects (i.e. a One Health approach). Each country has: (i) its own national comprehensive plan to combat antimicrobial resistance; (ii) strengthened surveillance and laboratory capacity at the national and international levels following international standards developed as per the framework of the Global Action Plan; and (iii) improved conservation of existing treatments and collaboration to support the sustainable development of new antibiotics, alternative treatments, preventive measures and rapid point-of-care diagnostics, including systems to preserve new antibiotics..

Canada level of capacity

In 2017, Canada released the document *Tackling Antimicrobial Resistance and Antimicrobial Use: A Pan-Canadian Framework for Action*, a framework for reducing emergence and spread of antimicrobial resistance (AMR), developed with the full involvement of F/P/T partners, including with inputs from experts from the health, public health, veterinary, agriculture, and agri-food sectors; and health professionals, academia, industry and professional organizations. The four components of the framework are surveillance, infection prevention and control (IPC), stewardship, and research and innovation. Governance to guide the development of the Pan-Canadian Framework has three tiers (F/P/T deputy minister champions; F/P/T AMR steering committees; multisectoral task groups), and this structure has links to national health sector decision-making groups, and agriculture sector committees. A federal interdepartmental committee representing eleven departments and agencies provides strategic direction and leadership for the Canadian response to AMR and for Canada's contribution to the global AMR agenda.

Canada determines its list of priority pathogens for AMR surveillance — many of which align with the priority pathogens for surveillance of AMR identified in the Global Antimicrobial Resistance Surveillance System (GLASS) Manual for Early Implementation — and implements nine surveillance programmes. The list of priority pathogens is reviewed regularly using updated data and considering changing AMR information needs identified after consulting stakeholders. The data collected from these programmes and other surveillance data sources are reported in the Canadian Antimicrobial Resistance Surveillance System (CARSS), a platform which provides a snapshot of AMR and antimicrobial use (AMU), with an annual report published since 2015. The *Canadian Antimicrobial Resistance Surveillance System – 2017 Report* describes the current limitations of Canada's AMR and AMU surveillance and provides an update on efforts planned or underway to address existing surveillance gaps.

The Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS) can be regarded as the global gold standard for AMR surveillance as it combines data from human, animal, and food sources. The programme is based on several representative and methodologically unified surveillance components which can be linked to examine the relationship between antimicrobials used in food-animals and humans and AMR in bacteria from animals and humans. However, animal and human AMR data along the food chain are restricted to specific bacterial organisms (Salmonella spp., Campylobacter spp., E.coli spp.). The livestock species covered include the major meat-producing animals but is limited to cattle, pigs, broiler chickens, and turkeys. Farm-level AMU data are currently limited to sentinel farms in swine and poultry.

Surveillance in hospitals is carried out under the Canadian Nosocomial Infection Surveillance Program (CNISP). While clear trends for certain AMR pathogens can be identified from this surveillance, there are limited data on antimicrobial-resistant organisms in the community. There are also limited data on AMR in smaller, non-academic hospitals, indigenous populations, long-term care facilities; and no or limited data for northern healthcare settings.

Diagnostic capacity for the detection of AMR pathogens is widely available through the Canadian Public Health Laboratory Network (CPHLN), with the National Microbiology Laboratory (NML) as the national reference laboratory. Canada has joined the WHO's Global Antimicrobial Surveillance System (GLASS), and contributes to OIE's global database for antimicrobial agents intended for use in animals. Work is currently underway by PHAC to harmonize human surveillance methods with the WHO's _Global Action Plan on Antimicrobial Resistance_ (2015).

Regarding the sale of antimicrobial drugs, Health Canada issues marketing authorization for all human and veterinary indications and monitors sales and prescriptions in humans (using data collected from community pharmacies and hospitals) while PHAC acquires and analyses data on the annual volume of veterinary antimicrobials distributed for sale. Antimicrobial stewardship programmes for human health focus on appropriate and prudent use of antimicrobials through a myriad of different activities such as outreach campaigns for patients, clinicians, and communities. Varying by location, there is limited data, however, on the appropriateness of antimicrobial prescriptions based on clinical impression.

Policies and regulations outlined by Health Canada related to the use of antimicrobials in animal feed are reflected in compliance and enforcement materials (for example Compendium of Medicating Ingredient Brochures) and surveillance measures administered by CFIA. From December 2018, all medically-important antimicrobials for veterinary use require a prescription. In the livestock sector, national biosecurity standards and protocols developed by CFIA in collaboration with producer organizations, provincial and territorial governments and academia. These complement various on-farm food safety, and animal health and welfare programmes from different livestock industries, which help to reduce the use of antimicrobials. _Veterinary Oversight of antimicrobial use: a Pan-Canadian Framework of Professional Standards for Veterinarians_ (2016), developed by Canadian Veterinary Medical Association (CVMA), provides a template for provincial and territorial veterinary regulatory (licensing) bodies when developing their own regulations, guidelines, or bylaws.

The federal government publishes guidelines on infection prevention and control (IPC) for use by different jurisdictions to develop their own policies and protocols. Most provinces have isolation units or rooms, and several have negative pressure isolation rooms, though full adherence to IPC standards remains a challenge at smaller hospitals and community health centres. IPC training is typically facility or programme-based. Dedicated IPC resources and programmes vary across jurisdictions and centres, with teaching hospitals generally having more infection control professionals and infectious disease specialists than community and long-term care settings.

Recommendations for priority actions

- Better integration of data between human and animal AMR in CARSS.

- Strengthen detection capacity for AMR and high priority pathogens, with an emphasis on human populations.

- Consider methods to collect data and analyse Canada-wide AMU (including public attitudes) to enhance AMU surveillance, public messages, clinical management guidelines, and infection prevention and control services.

- Develop national AMU guidelines for patients and health providers that cover stewardship issues of relevance to all PTs (for example drug labelling).

Indicators and scores

P.3.1 Antimicrobial resistance detection – Score 3

Strengths and best practices

- Pan-Canadian Framework for AMR approved by federal government, provinces and territories in 2017, grounded in a One Health approach and developed via an F/P/T governance model.

- Strong diagnostic capacity and reference capacity for human and animal health systems.

- Canadian-specific list of 10 priority pathogens for AMR surveillance, periodically revised to reflect data needs or changes in developments of AMR.

Challenges and areas that need strengthening

- Data incompatibility and incompleteness for AMU and AMR coming from different sources.

- Lack of data related to human factors, such as patient behaviours and physician prescribing practices.

- Lack of integration of data between human and animal AMR in CARSS.

- Strengthen detection capacity for AMR and high priority pathogens resulting in human infections.

P.3.2 Surveillance of infections caused by antimicrobial-resistant pathogens – Score 4

Strengths and best practices

- Data from Canada's surveillance systems, captured in CARSS, provide an annual surveillance overview on AMR and AMU and depict trends over time, supporting commitments for reporting to WHO and OIE.

- Well-established active and passive surveillance systems, including in food of animal origin.

Challenges and areas that need strengthening

- Limited access to susceptibility testing of specimens in small health centres and remote areas.

- Include additional livestock species into susceptibility testing and surveillance for AMU.

P.3.3 Health care-associated infection (HCAI) prevention and control programmes – Score 5

Strengths and best practices

- Many health workers trained in IPC accredited courses informed by federal guidelines, and aligned with provincial, territorial and facility guidelines, standards and protocols.

- IPC programmes run in all major hospitals.

Challenges and areas that need strengthening

- Variability of IPC implementation across provinces, territories, and different types of health facilities (such as small clinics and long-term care facilities).

P.3.4 Antimicrobial stewardship activities – Score 3

Strengths and best practices

- A multitude of stewardship programmes implemented at F/P/T levels, including strong controls in livestock industry and veterinary care.

- Strong collaborations between F/P/T governments and livestock industry for the development of standards.

Challenges and areas that need strengthening

- Variability of clinical standards for AMU across provinces and territories.

- Develop national guidelines for patients and health providers that cover stewardship issues of relevance to all levels of the health system (for example drug labelling).

- Address differences in regulatory roles and responsibilities for antimicrobials.

Zoonotic diseases

Introduction

Zoonotic diseases are communicable diseases that can spread between animals and humans. These diseases are caused by viruses, bacteria, parasites and fungi carried by animals, insects or inanimate vectors that aid in its transmission. Approximately 75% of recently emerging infectious diseases affecting humans is of animal origin; and approximately 60% of all human pathogens are zoonotic.

Target

Adopted measured behaviors, policies, and practices that minimize the transmission of zoonotic diseases from animals into human populations.

Canada level of capacity

Canada addresses this technical area with a One Health approach by involving the key federal institutions of PHAC, CFIA, Health Canada, Environment and Climate Change Canada (ECCC) and non-government organizations, as well as academic institutions. This approach is mirrored at the provincial and territorial level while at the federal level, zoonoses are programmatically divided into non-enteric and enteric. Non-enteric pathogens are primarily the responsibility of PHAC and CFIA, while enteric pathogens are the responsibility of CFIA, PHAC and Health Canada. Zoonotic disease events with potential or actual international public health implications are reported to the WHO IHR Contact Point for the Region of the Americas and, when animals are affected, to the OIE. Such events are reported to both organizations when both humans and animals are affected.

Responsibility for surveillance to detect wild and domestic animal diseases that might affect humans lies mainly with the CFIA, the Canadian Wildlife Service (CWS) of ECCC, equivalent provincial and territorial organizations, and non-government institutions. This information is shared with PHAC for trend analysis and comparison with human surveillance data (for example in the case of West Nile fever cases in horses). Health Canada, PHAC, and CFIA have a *Memorandum of Understanding for Common Issues Related to Human Health* (2008) and also a *Letter of Agreement regarding zoonotic surveillance and risk assessment process* (2008) which lay down the coordination and information sharing between the sectors in case of outbreaks. Examples of timely response to threats and outbreaks include influenza A(H3N2)v in Ontario (2016), influenza A(H5N2) low-pathogenic avian influenza A in Ontario (2016), salmonella in live chicks in several provinces (2015), and Eastern equine encephalitis in Ontario (2016).

For the eleven zoonotic diseases that are on both the human and animal nationally notifiable disease list for Canada, a risk-based prioritization exercise resulted in selecting four diseases for which Canada has established special, multisectoral surveillance programmes: West Nile virus, Lyme disease, rabies, and animal influenza. The surveillance strategy involves a collaborative approach with provinces and territories, although, for many locations, surveillance for zoonotic diseases of all types and emerging pathogens remains a challenge. For rabies, West Nile virus, and influenza, preparedness and response plans describe how the sectors collaborate during a response to an outbreak. Annual strategic and operational planning exercises are carried out to identify emerging risks and to develop action plans to address them, such as for Zika virus. Consistent with its responsibility for operational entomology, PHAC also contributes to some animal surveillance for Lyme disease.

The Canadian Animal Health Surveillance System (CAHSS) is an independent "network of networks" to which different stakeholders contribute voluntarily, including the livestock industry. Within CAHSS, unique and specific expertise on wildlife health is brought together on the virtual Canadian Wildlife Health Cooperative (CWHC) platform. Scientists in academic institutions and non-governmental organizations and other wildlife experts contribute to the CWHC platform, promoting timely information exchange, collaborations, and quick updates on emerging issues, such as the national platform for avian influenza surveillance in wild birds.

Canada has sufficient laboratory capacity to diagnose zoonoses and emerging disease agents, through both the animal health and human health laboratory networks and reference laboratories (the NCFAD and the NML, respectively). Data sharing on zoonotic diseases is actively pursued but patient and industry privacy issues can affect the sharing of reports and key data elements between public health and animal health laboratories and programme areas, including during outbreaks. Common platforms, such as the Canadian Network for Public Health Intelligence (CNPHI), support the integration of surveillance outcomes across human, animal, food, and environment domains.

During outbreaks of zoonotic diseases, HPOC and CFIA's National Emergency Operations Centre support the collaboration between sectors. However, as most outbreaks to date have been relatively small and quickly contained, the informal network of individual subject matter experts across the country lacks formal mechanisms to translate lessons learned (such as specialized surveillance activities and outbreak response methods) into systematic changes that institutionalize best practices and methodological refinements.

Canada has a well-trained veterinary and auxiliary workforce. Participation in a continuous professional education programme is mandatory and many of the courses are related to public health. Postgraduate training so that veterinarians can specialize in public health is available, including PHAC's Canadian Field Epidemiologist Program (CFEP). Although no formal assessment is available, the consensus is that too few graduate professionals complete specialized training to meet the need for veterinary public health specialists.

Recommendations for priority actions

- Maintain collaborative mechanisms to detect zoonotic agents alive through pan-Canadian exercises, involving provinces and territories, and formalize best practices drawn from after-action analysis.

- Formalize the networks required for joint efforts to detect zoonotic agents beyond the inter-personal links.

- Assess needs at all levels for public health veterinarians and consider ways to incentivize recruitment and retention.

Indicators and scores

P.4.1 Surveillance systems in place for priority zoonotic diseases/pathogens – Score 4

Strengths and best practices
- Risk-based prioritization of surveillance for zoonotic diseases, regularly reviewed by the PHN Council.
- CAHSS: an independent surveillance network to which all stakeholders can contribute, including the livestock industry.
- General and specific surveillance systems for human and animals.

Challenges and areas that need strengthening
- The need to strengthen mechanisms for after-action review among informal networks of experts with documentation of lessons learned.

P.4.2 Veterinary or animal health workforce – Score 5

Strengths and best practices

- Mandatory continuous education for veterinarians with options to specialize in public health.

- Veterinarians with a degree in public health and epidemiology are eligible for the CFEP.

Challenges and areas that need strengthening

- Assess the need for public health veterinarians among F/P/T levels and consider ways to incentivize recruitment and retention.

P.4.3 Mechanisms for responding to infectious and potential zoonotic diseases established and functional – Score 5

Strengths and best practices

- Capacity to deal with unpredictable, new and evolving zoonotic disease outbreaks leveraging One Health approaches and shared responsibilities among F/P/T authorities.

- CWHC, a virtual platform fed by many institutions (for example academia) and agencies (for example Parks Canada, ECCC) to provide information on wildlife health.

Challenges and areas that need strengthening

- Streamline and describe roles and responsibilities in the coordination, investigation and response to multidisciplinary, multi-jurisdictional zoonotic disease events.

PREVENT

Food safety

Introduction

Food- and water-borne diarrheal diseases are leading causes of illness and death, particularly in less developed countries. The rapid globalization of food production and trade has increased the potential likelihood of international incidents involving contaminated food. The identification of the source of an outbreak and its containment is critical for control. Risk management capacity with regard to control throughout the food chain continuum must be developed. If epidemiological analysis identifies food as the source of an event, based on a risk assessment, suitable risk management options that ensure the prevention of human cases (or further cases) need to be put in place.

Target

Surveillance and response capacity among States Parties for food- and waterborne disease risks or events by strengthening effective communication and collaboration among the sectors responsible for food safety, and safe water and sanitation.

Canada level of capacity

Canada has a strong food safety system along the farm-to-fork continuum. The regulatory framework is established in the *Food and Drugs Act* and *Regulations* and the *Safe Food for Canadians Act* (2012) and *Regulations*, which encompass the following Acts: *Fish inspection* (1985), *Meat inspection* (1985), *Agricultural Products* (1985) and *Consumer Packaging and Labelling* (1985). Canada applies One Health principles in its "collaborative federalism" across the different jurisdictions. Health Care's Food Directorate establishes national standards and policies and addresses issues with multi-jurisdictional, international, and trade implications. The food safety system is built on international standards and the inspections system applied to food-producing industries is risk-based.

Provincial and territorial public health authorities are responsible for enforcing food safety regulations within their regions. Food inspection is carried out by the regional inspection staff of CFIA, while the CFIA's Office of Food Safety and Recall coordinates investigations and decision-making on food recalls. It is recognized that most food producers voluntarily recall products in collaboration with food safety authorities. CFIA is the INFOSAN Emergency Contact Point (ECP) and single window for Canada, with PHAC and Health Canada serving as additional focal points. CFIA and is also responsible for compliance with food safety standards of imported food products, live animals and animal products. Canada Border Services Agency (CBSA) has the powers to enforce those standards.

Health Canada conducts health risk assessments for chemical and microbiological foodborne hazards, which may be supported by epidemiological evidence and assessment from PHAC's Infectious Disease Prevention and Control Branch and CFIA. Health Canada provides reference services for botulism (including clinical botulism), listeriosis, vibrioses, and viruses in food. Surveillance for enteric disease and zoonoses is the responsibility of provincial and territorial authorities, with assistance available from federal agencies as needed. Pulse-field gel electrophoresis data from laboratories across the country are shared through *PulseNet Canada*. NML provides additional diagnostic capacity and whole genome sequencing of enteric pathogens.

Responses to outbreaks of foodborne illnesses are similarly the responsibility of local authorities, with PHAC taking the lead in the coordination of multi-jurisdictional outbreak investigations, guided by the *Food-borne illness outbreak response protocol* (2017). Information sharing of foodborne illness information is regulated by several agreements and Memoranda of Understanding (MoU) between the agencies. Those MoUs outline the type of information that can be shared, with whom it might be shared, and which data need to be protected. Additionally, the public has access to information regarding food safety (for example on recent food recalls, advice on healthy food, and so on) through Health Canada's *Food and Nutrition* website.

However, challenges persist during multi-jurisdictional outbreaks caused by the wide distribution or multiple sources of many food ingredients, when roles and responsibilities may not be clearly defined. Other relative challenges include methods for continuous evaluation of food safety systems and modernization of epidemiological tools.

Specific surveillance programmes assist PHAC and the F/P/T collaboration mechanisms to identify subtle food safety events:

- The *National Enteric Surveillance Program* results in weekly analysis and reporting.

- *PulseNet Canada* provides high-resolution outbreak detection and strain characterization data on a daily and weekly basis. PHAC is in the process of transitioning all laboratory-based surveillance to use whole-genome sequencing.

- The *Enhanced National Listeriosis Surveillance Program* collects clinical, demographic and risk factor data from provinces and territories.

- *FoodNet Canada* collects the information from samples taken in three sites at local farms, grocery stores and water sources and linking this information with human illness.

International collaboration is well established, particularly with the Food and Drug Administration (FDA) of the neighbouring United States of America, as part of a Joint Action Plan to detect and respond in the case of a cross-border event. *PulseNet Canada* also shares data with *PulseNet International*, a cooperative arrangement among 86 countries. Canada is a member of various specialized international committees on food safety.

The agencies in Canada responsible for food safety have well-trained personnel specialized in epidemiology, microbiology, risk assessment, food inspection and public health, and there is a great number of continuous education programmes in this specialized sector.

Recommendations for priority actions

- Continue to develop whole genome sequencing capacity at other laboratories while also developing new detection methodologies.

- Continue to share data nationally and internationally for trend analysis.

- Continue to reinforce F/P/T coordination and *PulseNet* contribution.

Indicators and scores

P.5.1 Mechanisms for multisectoral collaboration established to ensure rapid response to food safety emergencies and outbreaks of foodborne diseases – Score 5

Strengths and best practices

- Wide network of laboratories contributing to *PulseNet Canada* as a supporting mechanism for diagnostic subtyping results and detection of distributed outbreaks.

- A foodborne illness outbreak response protocol lays down roles and responsibilities of F/P/T and communication channels in case of multi-jurisdictional outbreaks.

- Routine post-event review process under the foodborne illness outbreak response protocol allows for continuous adaptation of risk assessments and policy.

Challenges and areas that need strengthening

- Continue to reinforce federal coordination and support for provinces and territories in their outbreak detection and response capacities by conducting more clinical, food, and environmental testing, and isolate characterization.

Biosafety and biosecurity

Introduction

It is vital to work with a variety of pathogens in safe and secure laboratories to ensure development and validation of robust instruments and interventions to protect public health, such as drugs, diagnostics, and vaccines, which counter the ever-evolving threat of infectious diseases. At the same time, the expansion of infrastructure and resources dedicated to working with infectious agents raises questions regarding whether adequate oversight exists for biosafety (prevention of accidental release of harmful agents from the laboratory) and biosecurity (prevention of deliberate release).

Target

A whole-of-government national biosafety and biosecurity system with especially dangerous pathogens identified, held, secured and monitored in a minimal number of facilities according to best practices; biological risk management training and educational outreach conducted to promote a shared culture of responsibility, reduce dual-use risks, mitigate biological proliferation and deliberate use threats, and ensure safe transfer of biological agents; and country-specific biosafety and biosecurity legislation, laboratory licensing and pathogen control measures in place as appropriate.

Canada level of capacity

Canada's current biosafety and biosecurity legal oversight framework is comprehensive, risk-based and enforceable. It covers all sectors working with risk group 2, 3 and 4 pathogens and selected toxins, and the levels of control are commensurate with the risks. The country has a national biosafety and biosecurity programme for the oversight of activities with human and animal pathogens and toxins and regulated plant pests. The ultimate goal of the programme is to reduce public health risks and potential risks to Canadian plant and animal resources posed by activities involving these materials.

Biosafety and biosecurity oversight requirements are predominately a federal responsibility, although requirements regarding worker safety, hazardous waste, and accreditation for diagnostic laboratories are developed and enforced by governments at the F/P/T and municipal levels. Federal oversight has been developed to complement existing provincial and territorial regimes to reduce the overall burden to regulators and regulated parties. PHAC's Centre for Biosecurity, within the Health Security Infrastructure Branch, is the national authority on biosafety and biosecurity for human pathogens and toxins and is responsible for their regulation. This agency has been designated as a *WHO Collaborating Centre for Biosafety and Biosecurity* (WHO CC CAN-92).

As a laboratory that falls under the Canadian oversight framework for biosafety and biosecurity, the NML provides mandatory biosafety and biosecurity training or refresher training based on a common curriculum at all its sites. It maintains a database of staff training results and conducts annual emergency drills to test staff on procedures. Otherwise, specific training and oversight protocols are developed uniquely by each province or territory.

All the components of Canada's biosafety and biosecurity activity receive stable and adequate funding through the federal government's annual budgeting process. PHAC reviews its biosafety and biosecurity oversight programme every five years to assess value, effectiveness and reach.

Recommendations for priority actions

- Develop a regular national training needs assessment and address gaps as needed.

- Continue to explore options to integrate into a common management system for laboratory quality and biological risk management.

- Strengthen oversight framework to enhance awareness and mitigation of the risks of potential dual-use research of concern.

Indicators and scores

P.6.1 Whole-of-government biosafety and biosecurity system is in place for human, animal, and agriculture facilities – Score 5

Strengths and best practices

- Federal government maintains an inventory of dangerous pathogens and toxins held in licensed facilities.

- Legislation and biosecurity plans address physical security, personal suitability and reliability, pathogen and toxins accountability, information management and security.

P.6.2 Biosafety and biosecurity training and practices – Score 4

Strengths and best practices

- Stable funding for facilities and equipment maintenance, personal protective equipment available, immunization policies for laboratory workers, post-exposure prophylaxis guidelines, protocols and plans in place.

- Strong training programmes in biosafety and biosecurity programmes at all regulated facilities.

Challenges and areas that need strengthening

- Variability in training and oversight of biosafety and biosecurity programmes among F/P/T implementers.

Immunization

Introduction

Immunizations are estimated to prevent more than two million deaths a year globally. Immunization is one of the most successful global health interventions and cost-effective ways to save lives and prevent disease.

> **Target**
>
> *A national vaccine delivery system – with nationwide reach, effective distributions, access for marginalized populations, adequate cold chain and ongoing quality control – that is able to respond to new disease threats.*

Canada level of capacity

F/P/T governments share responsibility for the immunization programme. Vaccines and vaccination are not covered by the *Canada Health Act* (1985), but are provided as supplemental services from each province and territory. Provinces and territories select and fund vaccines for targeted populations, make decisions on immunization schedules, run immunization services, and monitor vaccination uptake. Variation in immunization schedules between jurisdictions is based on the local epidemiological situation and immunization delivery model. Immunization services are available in a variety of settings, including primary health care offices, school and occupational programmes, and pharmacies with an injection license. The network of sites can easily scale up immunization capacities to respond to public health emergencies. The Canadian Armed Forces (CAF) maintain an immunization standard based on existing national guidance.

At the federal level, Health Canada is responsible for vaccine marketing authorization through its Biologics and Genetics Therapies Directorate and Marketed Health Products Directorate. PHAC has the responsibility for pan-Canadian surveillance of vaccine-preventable diseases, manages the Canadian Adverse Events Following Immunization Surveillance System (CAEFISS), coordinates bulk vaccine procurement in collaboration with the Public Services and Procurement Canada (PSPC) and coordinates supply exchanges as needed between the provinces and territories. The Canadian Immunization Committee (CIC) provides operational and technical advice on immunization policies and programmes run by the provinces and territories.

PHAC acts as the secretariat to the National Advisory Committee on Immunization (NACI), an expert committee that provides advice to PHAC via the vice president, Infection Disease Prevention and Control Branch. NACI makes recommendations for the use of vaccines, immunization target groups and addresses other technical questions pertaining to the programme. Its recommendations, statements and updates are available online, and also published online as the *Canadian Immunization Guide*.

Coverage estimates for standard childhood immunizations and both adult and childhood influenza vaccination are based on surveys. The methods used by PHAC are intentionally conservative, which underestimate actual values, and stratified data vary significantly from region to region. An immunization coverage study conducted in 2013 indicated that 2.7% of children under 24 months had not received a single vaccine. In a 2015 study, 89% of children under 24 months across Canada had received at least one dose of measles-containing vaccine, with significantly lower coverage rates for some provinces. Among many ongoing studies, the Canadian Immunization Research Network (CIRN) has completed an evaluation and gap analysis of F/P/T systems and methodologies used to assess immunization coverage.

The *National Immunization Strategy*, developed in 2003, provides a framework for inter-jurisdictional collaboration. Its strategic objectives have been recently updated for the period 2016-2021 and aligned with the WHO's *Global Vaccine Action Plan 2011-2020* (2012). Goals for vaccination coverage and targets for the decrease of vaccine-preventable diseases have been endorsed by provinces and territories via the PHN Council, which continues working on the strategies together with NACI and the Vaccine Supply Working Group. The strategy update led to an investment of 25 million Canadian dollars over five years to improve programme performance and increase coverage rates. While some barriers to immunization are known (vaccine delivery, sociodemographic disparities, unfounded concerns over vaccine safety), studies on the determinants of non-immunization and under-immunization are underway.

Each province and territory maintains a system for tracking immunization coverage. Jurisdictions are using different methods for tracking immunization data, including electronic, paper-based, or both. Work is underway to develop a national network of immunization registries and to coordinate with provinces and territories to develop a consistent documentation standard.

The *National Vaccine Storage and Handling Guidelines for Immunization Providers* were updated in 2015. Provinces and territories maintain their respective policies and issue guidance on cold chain management for public health and health professionals involved in vaccine delivery. Health Canada licenses vaccine warehouses, which are required to have a Drug Establishment License and Good Manufacturing Practice certificate. Procurement contracts and vaccine suppliers under the national bulk procurement programme include provisions for cold chain maintenance.

Recommendations for priority actions

- Continue to act on findings of the study on vaccine uptake barriers as soon data become available.

- Based on existing targets, encourage provinces and territories to monitor implementation at lower administrative levels.

- Improve the monitoring of immunization in age cohorts outside of the Expanded Programme on Immunization (EPI) target population in order to set up strategies to close any immunization gaps.

Indicators and scores

P.7.1 Vaccine coverage (measles) as part of national program – Score 3

Strengths and best practices
- Maintaining publicly funded programmes, vaccination coverage goals and vaccine-preventable diseases reduction targets have been endorsed by F/P/T governments.

- Progress reports are completed every two years, using national coverage surveys and vaccine-preventable disease surveillance system data.

- Additional research funding has been directed to identify systemic barriers associated with lower immunization access and uptake in order to inform interventions.

Challenges and areas that need strengthening
- Incomplete understanding of social determinants of vaccine uptake with commensurate difficulty identifying and targeting under and unvaccinated subgroups at the community level.

- Lack of consistent and aligned immunization registries among provinces, territories and First Nations communities and their respective health services.

- The most recent statistical estimates of the national vaccination rate for measles in children are under the stated target; vaccination rates in some provinces and territories are significantly lower than the national average.

P.7.2 National vaccine access and delivery – Score 5

Strengths and best practices

- Publicly funded vaccination programmes for children, schoolchildren and adolescents, adults, and influenza vaccination in all high-risk groups.

- Bulk procurement programme enables effective price negotiation and management of supply disruption.

Challenges and areas that need strengthening

- Ensuring that vaccines and qualified vaccination staff are available in very remote parts of the country.

DETECT

National laboratory system

Introduction

Public health laboratories provide essential services including disease and outbreak detection, emergency response, environmental monitoring and disease surveillance. State and local public health laboratories can serve as a focal point for a national system, through their core functions for human, veterinary and food safety including disease prevention, control and surveillance; integrated data management; reference and specialized testing; laboratory oversight; emergency response; public health research; training and education; and partnerships and communication.

Target

Real-time biosurveillance with a national laboratory system and effective modern point-of-care and laboratory-based diagnostics.

Canada level of capacity

The laboratory system in Canada includes facilities at the national level, within each of the ten provinces and three territories, and at the local level. The National Microbiological Laboratory (NML) currently has four laboratory facilities. At the provincial level, most jurisdictions have an officially designated provincial public health laboratory that often operates with close linkages to post-secondary institutions to support education and the advancement of research. The territories work closely with nearby provincial laboratories for the testing of their samples. Some provinces have laboratories that are not officially designated as provincial public health laboratories.

Within each jurisdiction, the local level laboratory system is comprised of hospital acute care microbiology laboratories and community laboratories (for example private laboratory providers). Smaller jurisdictions that do not possess the laboratory infrastructure can access other provinces as reference laboratories, in addition to accessing the NML. A strategic plan for F/P/T public health laboratory capacity has been in place since 2002. It is updated every three to five years by the Canadian Public Health Laboratory Network (CPHLN) and the most recent is the _Canadian Public Health Laboratory Network Strategic Plan 2016-2020_ (revised in 2018).

Canada possesses a high level of competency to maintain access to and conduct laboratory testing for many communicable diseases. The NML has identified approximately 300 tests deemed necessary in Canada, which include those for the detection of the four pathogens subject to international notification (Annex 2 of the IHR). The entire population has access to laboratory services for testing priority diseases; however, ease of access can vary depending on the geographic location of the affected community.

Clinicians across the country routinely use the laboratory system. They can access services through community laboratories or through hospital acute care microbiology laboratories that will refer to provincial laboratories when required. Protocols and guidelines for communicable disease investigation exist at all levels of government for a variety of diseases.

DETECT

Most tertiary centres or public health laboratories have a web-accessed guide to services describing a menu of available tests and sample requirements which is available to clinicians. Laboratory reports are routinely provided to ordering clinicians by several different methods. Similarly, at the national level, results are provided back to the referring provincial health laboratory/hospital via the client's preferred method (such as mailed hard-copy, emailed or faxed). Canada is working to develop a system of electronic test requisitioning and reporting. Each test performed at the NML has a test-specific turnaround time.

At F/P/T levels, some laboratories follow specified turnaround times for their tests as part of quality system accreditation. These times will vary depending on the complexity of the test and the urgency of the request. Wherever possible, electronic methods are used to facilitate timely reports back to clinicians.

Recommendations for priority actions

- Consider mechanisms/methods to better understand the impact of variations in laboratory capacity and testing.

- Coordination within and among provinces to ensure that the adoption of point-of-care testing does not have negative impacts on public health surveillance system over time.

- Support further expanding and ensuring conformity to quality assurance standards across the entire country, in coordination with provinces and considering the Canada's federal system.

Indicators and scores

D.1.1 Laboratory testing for detection of priority diseases – Score 5

Strengths and best practices
- The national laboratory system provides sufficient capacity to test for a broad range of samples in safe and secure environments, including BSL-3 and BSL-4 facilities.

- Sustainable capacity for performing modern molecular and serological techniques as part of a national system of sample referral and confirmatory diagnostics is in place.

- Provincial public health laboratories all perform a range of reference tests as required by their region.

Challenges and areas that need strengthening
- Real-time data collection from laboratories with linkages to clinical information is difficult.

D.1.2 Specimen referral and transport system – Score 5

Strengths and best practices
- Demonstrated capacity for specimen referral and transport system to and from other laboratories in the region.

D.1.3 Effective modern point of care and laboratory-based diagnostics – Score 5

Strengths and best practices
- Federal-level laboratories are subject to guidelines and are responsible for the selection of the equipment, reagents and consumables that they require.

- Many jurisdictions have standards for point-of-care testing and have developed procedures and training for this type of testing.

DETECT

Challenges and areas that need strengthening

- Rapid development, validation and adoption of appropriate point-of-care clinical testing outside of formal laboratory surveillance systems and other stakeholders.

D.1.4 Laboratory Quality System – Score 5

Strengths and best practices

- Concerning biosafety, microbiology laboratories must be licensed by PHAC. Licensing and inspection of most laboratories is a function of provincial governments or provincial government agencies. Provincial laboratories are required by their respective governments to be accredited by an appropriate accreditation body.

- The Standards Council of Canada (SCC) is the national body responsible for laboratory certification and accreditation (ISO 17025 and ISO 15189); the Canadian General Standards Board (CGSB) administers ISO 9001 at the NML.

- Federal facilities voluntarily and consistently undergo assessments through certification and accreditation processes.

Challenges and areas that need strengthening

- While licensing of laboratories is mandatory, each province sets out its individual licensing and inspection expectations as there is no national oversight.

Real-time surveillance

Introduction

The purpose of public health surveillance is to ensure both, the early warning function across jurisdictional levels – so that risk assessment and management actions related to an acute public health event can be taken without unnecessary delays –, and the generation of information to drive the public health related decision-making process as an acute public health event evolve.

Target

The public health related early warning function, as well as the ability to generate information to drive the public health related decision-making for acute public health event management purposes, require seamless connections across multiple jurisdictions – potentially from the local to the international levels –, and, potentially, across multiple disciplines and sectors.

Canada level of capacity

National public health surveillance operates within an array of interconnected and interdependent mechanisms dedicated to specific diseases, as well as to potential or actual acute public health events, or public health risks, of significance to human and animal health. These mechanisms are set up along jurisdictional lines and are based on multiple and different platforms, interfaces, and means for data and information sharing, also mirroring the heterogeneous geographic and ethnic context of the country.

Given that Canada is a federated system, local provincial and territorial public health officials, clinicians (primary care providers and hospitals and emergency rooms), laboratories and school health authorities are the major contributors of health-related data for public health surveillance at the federal level. Information largely flows through provincial ministries of health or public health agencies, who respond within their jurisdictions, but pass vital information up to the federal level as required. PHAC constitutes the hub for public health surveillance at the federal level.

Public health surveillance activities are governed by legislation (for example provincial and territorial public health acts) that outlines the responsibilities of public health officials for monitoring and reporting on specific diseases within the province or territory. While existing legislation does not specify terms for inter-jurisdictional sharing – which remains voluntary between provinces and territories and the federal levels – informal collegial relationships with provincial and territorial health authorities have been essential for public health surveillance and response to acute public health events across Canada.

Similarly, Canada relies on strong collaboration among partners across the federal government to ensure that national public health surveillance meets the public health needs of Canadians and fulfils national and international requirements and agreements. Policy statements, intergovernmental agreements and MoUs have traditionally been used to formalize the terms of intergovernmental collaboration.

Therefore, in the absence of a cross-jurisdictional legislation, and despite multiple and diverse public health surveillance mechanisms in place, the public health early warning function of the pan-Canadian public health surveillance system, as a whole, culturally and historically relies heavily on interpersonal relationships, mutual trust, and the sense of responsibility of individual professionals, civil servants and the community. Provincial and territorial authorities act upon signals detected in their jurisdictions and escalate requests for support to equivalent or higher jurisdictions when needed. Reports from informal sources, including identified through the *Global Public Health Information Network* (GPHIN), account for

most signals related to potential or actual acute international public health events, or public health risks, originating from outside Canada's borders coming to the attention of PHAC at the federal level. Those signals are also rapidly acted upon as they trigger a cascade of actions, across jurisdictions and government sectors, ranging from assessment and monitoring to discrete or large-scale responses.

The institutional cornerstones of the national public health early warning function, and subsequent rapid response, include: GPHIN, which also constitutes the foundation of the public early warning function at the global level; the *Multi-lateral Information Sharing Agreement* (MLISA, 2014); and PHN. Additionally, the analysis of data and information conducted as part of public health surveillance allows for the leads to generate numerous outputs, most of which are publicly accessible (for example weekly surveillance reports related to influenza, measles and rubella, peer-reviewed monthly *Canadian Communicable Disease Report*, *travel advice and advisories*, and others).

Another information-sharing agreement among F/P/T public health authorities in Canada is the *Federal/ Provincial/Territorial Memorandum of Understanding on the Sharing of Information During a Public Health Emergency* (2009) which establishes a framework for the sharing of information among F/P/T governments during a public health emergency.

Over the years, Canada has formed a clear understanding of the very limited circumstances under which the implementation of real-time surveillance, as portrayed in the first version of the JEE tool, might have an actual value in informing public health actions. Canada has also shown the capacity to adapt and enhance its surveillance mechanisms to emerging and specific public health needs requiring a robust early warning public health function, as well as intensified monitoring (for example the syndromic surveillance of high visibility mass gathering events, communicable disease outbreaks, and so on) both nationally and internationally.

The current evolutionary stage of the public health surveillance system as a whole, primarily reflecting the introduction of innovative approaches driven by information technology, or determined by specific scientific interests, has resulted in the development and coexistence of multiple different platforms, interfaces, and means for data and information sharing. However, these are not necessarily conducive for a reliable national early warning public health surveillance function, timely and cohesive public health actions, or inter-jurisdictional mutual accountability, especially in a federal context. Therefore, taking the *Blueprint for a Federated System for Public Health Surveillance in Canada* (2016) as the basis, a long-term collegial vision for a more streamlined the pan-Canadian public health surveillance system as a whole, serving well-defined surveillance objectives, needs to be formed and resources for actions allocated accordingly.

Recommendations for priority actions

- Map and publish a description of the entire surveillance system and other mechanisms contributing to the public health-related early warning function – across sectors, disciplines, administrative levels.

- Conduct a review of public health sectors IT platforms currently available to support surveillance activities, and share the outcome of the review with stakeholders.

- Consider revisiting the *Blueprint for a Federated System for Public Health Surveillance in Canada: Vision and Action Plan:*
  - ❍ Embed the principles and values of the Blueprint Action Plan in the annexes of MLISA
  - ❍ Clear definition of the terms "integration", "real-time", "interoperability" and "interconnectedness"

Indicators and scores

D.2.1 Indicator- and event-based surveillance systems – Score 5

Strengths and best practices

- The cornerstone of the national public health early warning function is event-based surveillance and relies on the GPHIN platform, which also constitutes the foundation of the public early warning function at the global level.

- The recognition of Public Health Emergencies of International Concern (PHEIC), determined as per IHR provisions, in the Multilateral Information Sharing Agreement (MLISA) offers the opportunity for the rapid implementation of and compliance with Temporary Recommendations that might be issued related to surveillance.

Challenges and areas that need strengthening

- Gaps in the pan-Canadian legal foundation for public health surveillance infrastructure have the potential to undermine the capacity to detect public health events affecting multiple-jurisdictions. Therefore, consideration should be given to the development of technical annexes in the MLISA.

- The public health surveillance infrastructure is characterized by fragmentation, duplications and unnecessary redundancies at federal level across sectors and within the public health community. Therefore, consideration should be given to the development of technical annexes in the MLISA to crystallize the pan-Canadian streamlined principles and values of the Blueprint for a Federated System for Public Health Surveillance in Canada: Vision and Action Plan.

D.2.2 Interoperable, interconnected, electronic real-time reporting system – Score 3

Strengths and best practices

- The public health early warning function of the pan-Canadian public health surveillance system as a whole relies on mutual trust and the sense of responsibility of individual professionals, civil servants and the community.

- Selected laboratory-based platforms allow some unusual health events, including those with a multifocal nature, to be detected in near-real time.

Challenges and areas that need strengthening

- The surveillance paradigm underpinning the evolution of the pan-Canadian public health surveillance system leans toward data collection and information management rather than toward actions, as indicated by the lack of a registry or registries for event management purposes at the federal level. Additionally, the current use of IT might not necessarily ameliorate the sub-optimal balance of resources allocated to surveillance across administrative levels.

D.2.3 Integration and analysis of surveillance data – Score 5

Strengths and best practices

- The public health surveillance system of Canada is characterized by a very robust feedback loop. The advanced analytical capacity of Canada, as well as its transparency in information sharing, allows multiple surveillance outputs, including disease-specific weekly surveillance reports (on, for example, influenza, measles, and rubella), monthly peer-reviewed publications (for example Canadian Communicable Disease Report) and travel advice and advisories to be generated.

D.2.4 Syndromic surveillance systems – Score 5

Strengths and best practices

- Canada has formed a clear understanding of the circumstances under which a syndromic approach to surveillance might have an actual value in informing public health actions (for example the syndromic surveillance of high visibility mass gathering events, communicable disease outbreaks, and so on).

DETECT

Reporting

Introduction

Health threats at the human-animal-ecosystem interface have increased over the past decades, as pathogens continue to evolve and adapt to new hosts and environments, imposing a burden on human and animal health systems. Collaborative multidisciplinary reporting on the health of humans, animals and ecosystems reduces the risk of diseases at the interfaces between them.

Target

Timely and accurate disease reporting according to WHO requirements and consistent coordination with FAO and OIE.

Canada level of capacity

Canada is committed to transparent and open information sharing mandated under IHR. Canada's national focal point (NFP) reports on behalf of the Government of Canada, which includes PHAC, Health Canada, Agriculture and Agri-Food Canada (AAFC), ECCC, CFIA, CBSA, Transport Canada (TC), Department of National Defence (DND) and the Canadian Armed Forces (CAF); Immigration, Refugees and Citizenship Canada (IRCC); Global Affairs Canada (GAC); and Public Safety Canada (PSC), in collaboration with provincial and territorial Ministries of Health.

CFIA is appointed INFOSAN Emergency Contact Point for the Government of Canada. It is responsible for reporting urgent food safety events including feed-related reporting on behalf of AAFC, and for responding to verification requests by the INFOSAN Secretariat. CFIA serves as contact point for OIE, and regularly reports to OIE's World Health Information System (WAHIS). For reporting to IAEA and WHO, PHAC and Health Canada use a joint reporting protocol for real or potential nuclear emergencies.

Canada follows a selection of guidelines, procedures and tools including the IHR Annex 2 decision instrument for event assessment and reporting. Information pertinent to an event under consideration for reporting under IHR, is obtained, assessed and formulated in a collaborative manner between technical and operational levels of respective provinces and territories, and/or other partners. The key partners involved are: NFP; IHR technical advisor; Health Portfolio technical leads, decision makers and senior management; provincial and territorial partners; and, when applicable, an incident management system. Each of these partners has defined role in the preparation and approval process for notifications and reporting under IHR.

Considering the complexity of the federal system, the NFP sets and monitors timelines set by IHR for reporting and responding to verification requests. The NFP has a pivotal role in coordinating processes across jurisdictions pertinent to reporting or verification processes. The Health Portfolio Operations Centre (HPOC) Watch Office ensures the 24/7 contact capacity of the NFP. An IHR technical advisor supports event risk assessment, completeness and consistency of reporting.

Between 1 January 2011 and 15 May 2017, Canada made 14 reports under Article 6 of the IHR, two under Article 7, one under Article 9, in addition to responding to 10 verification requests.

To ensure a common understanding of obligations under the IHR, a variety of formal and informal training opportunities are available to key reporting contact points of all stakeholders. The IHR points of contact, appointed at F/P/T levels, have an active role in raising awareness of reporting obligations. Information on acute public health events, published by the WHO Secretariat on the secure Event Information Site for

National IHR Focal Points (EIS) is shared regularly with provinces and territories, and other federal IHR points of contact and stakeholders.

Apart from IHR reporting mechanisms, Canada uses a variety of other reporting and information exchange based on bilateral and multilateral agreements, as well as multitude of platforms and networks for technical exchange.

Canada's reporting capacity has been tested during domestic simulation exercises.

Situation awareness and risk assessments are based on established surveillance systems including event-based monitoring. Reporting in relation to a declared PHEIC without Canada being directly affected at a certain point in time was identified to pose problems (for example the Zika virus outbreak). "Unplanned" information sharing and reporting required ad hoc negotiation, thus possibly delaying Canada's reporting ability within the scope of a PHEIC outside Canada.

Recommendations for priority actions

- Use real or simulated events to test barriers to reporting between provinces and territories and the federal level for events that either meet criteria of IHR Annex 2 (Article 6 or Article 7) or for the purposes of medical intelligence.

- Continue raising stakeholders' awareness of the potential international dimension of local events, risk assessment and the value of bilateral or multilateral communication.

- Continue to provide learning opportunities and regular updates on IHR implementation (internal and global), starting with the outcomes of the JEE.

Indicators and scores

D.3.1 System for efficient reporting to FAO, OIE and WHO – Score 5

Strengths and best practices
- Various protocols/agreements and intersectoral collaboration between the public and animal health sectors as well as the security sector underpins reporting capacity through various channels.

- Canada's federal Health Portfolio uses a joint protocol for the international reporting of food safety/foodborne illness events to WHO through INFOSAN and IHR channels, to OIE through the WAHIS portal, and to WHO through channels established according to IHR provisions. A similar protocol is in place to harmonize the reporting of radiation-related emergencies to IAEA and WHO.

- Key contact points, especially those at the federal level, receive training through formal and informal learning opportunities (such as awareness-raising sessions, workshops, and international meetings) on reporting requirements.

Challenges and areas that need strengthening
- Promote awareness of the IHR among broader stakeholders at all levels of government to enhance reporting further.

- Currently, there is no formal protocol in place between PHAC and CFIA for the international reporting of zoonosis-related events to WHO, OIE and FAO.

- As a federal state, barriers to information sharing across jurisdictions can impact the timeliness, flexibility, and quality of international reporting under the IHR.

D.3.2 Reporting network and protocols in country – Score 5

Strengths and best practices

- The NFP reports on behalf of the Government of Canada. Coordination and information flow between the NFP and other stakeholders within the Government are well defined. The HPOC Watch Office ensures 24/7 contact capacity of the NFP. The NFP sets and monitors timeliness and coordinates reporting under IHR.

- An IHR technical advisor supports event assessment using the IHR Annex 2 decision instrument and assists with the completeness and consistency of reporting.

- Canada has exercised IHR-related assessment and reporting on many occasions based both on real-life scenarios and during domestic simulation exercises.

Challenges and areas that need strengthening

- Recognized need to further streamline and facilitate information sharing across F/P/T jurisdictions to ensure effective and efficient reporting under IHR.

- Some provinces and territories have noted difficulty finding the appropriate authority at the national level to report cases to during and after the declaration of a PHEIC by WHO.

Relevant documentation

- *International Health Regulations National Focal Point (NFP) Office of Canada - Privacy Impact Assessment* (2016)

- *Guideline for internal/external communication of an International Health Regulations (IHR) - Notification to PAHO/WHO* (2017)

- *Federal Health Portfolio protocol for information sharing with international partners and under the International Health Regulations (IHR) for food safety or foodborne illness events* (updated: 2017)

Workforce development

Introduction

Workforce development is important in order to develop a sustainable public health system over time by developing and maintaining a highly qualified public health workforce with appropriate technical training, scientific skills and subject-matter expertise.

Target

States Parties Should have skilled and competent health personnel for sustainable and functional public health surveillance and response at all levels of the health system and the effective implementation of the IHR. A workforce includes physicians, animal health or veterinarians, biostatisticians, laboratory scientists, farming/livestock professionals, with an optimal target of one trained epidemiologist (or equivalent) per 200,000 population, who can systematically cooperate to meet relevant IHR and PVS core competencies.

Canada level of capacity

At all levels of government, Canada has a skilled and competent multidisciplinary public health workforce to carry out surveillance and response as required under the IHR. The diversified workforce includes epidemiologists and public health specialists, physicians and veterinarians with specialized training in preventive medicine, infectious diseases specialists, and other specialties, nurses, laboratory specialists and technicians, environmental health officers and health inspectors, information systems and technology specialists, and public health communication specialists. Canada mobilizes this multidisciplinary public health staff to augment provincial and territorial public health response efforts when needed through both formal and informal arrangements.

There is a comprehensive offering in public health training on core disciplines and specializations through public and private institutions and government-sponsored programmes at undergraduate and graduate levels. Several universities across Canada offer Master's or Doctoral degree programmes in epidemiology and public health. The *Canadian Field Epidemiology Program* (CFEP), established in 1975, provides advanced, post-graduate training in field epidemiology. This programme trains approximately five people a year, with a total of 187 graduates since its inception. While there are ample opportunities for training, experts in Canada agree that recruitment and retention of public health professionals, especially those who might serve in less-populated, isolated regions of the country, remains a challenge. There is a national public health force workforce strategy (*Building the public health workforce for the 21st century: a pan-Canadian framework for public health human resources planning*), but it has not been updated since 2005, and some of the strategic objectives in that strategy have yet to be realized. In 2007 a national initiative was undertaken to develop the *Core Competencies for Public Health in Canada* as a framework for defining and assessing workforce capacity across disciplines and jurisdictions. To date, however, the core competency model has not been widely adopted as a mechanism for human resource investment and management, and the framework has not been updated to reflect the changing public health landscape.

DETECT

Recommendations for priority actions

- Review and consider updating the national public health workforce strategy and explicitly promote the use of the Core Competencies for Public Health in Canada.

- Continue to improve a national approach to defining and mobilizing capacity to underserved areas (ongoing and during emergencies).

- Assess and tackle barriers for professionals, and particularly physicians, to reach public health and field epidemiology training.

- Continue to create linkages with academia in improving tracking of public health graduates.

Indicators and scores

D.4.1 Human resources available to implement IHR core capacity requirements – Score 5

Strengths and best practices
- Skilled and competent health personnel for sustainable practice of public health and effective implementation of the IHR.

- Multidisciplinary human resources capacity at all levels, with the ability to provide technical assistance and/or mobilize resources within the country during an emergency.

Challenges and areas that need strengthening
- Human resources distribution in all disciplines in parts of the country that have smaller populations or are very remote.

D.4.2 FETP or other applied epidemiology-training programme in place – Score 5

Strengths and best practices
- CFEP has been accredited and recognized for excellence in advance training in field epidemiology.

Challenges and areas that need strengthening
- Despite the well-established and successful field epidemiology programme, there are challenges in recruiting and retention of physicians and veterinarians, as well as recruiting sufficient numbers of epidemiologists that are bilingual in English and French, or in English and French and indigenous languages.

D.4.3 Workforce strategy – Score 4

Strengths and best practices
- Significant past work provided a foundation for growth and strengthening following the SARS crisis, including a national workforce strategy and the development of a core competency model.

Challenges and areas that need strengthening
- The workforce development tools – *Building the public health workforce for the 21st century: a pan-Canadian framework for public health human resources planning* (2005) and *Core Competencies for Public Health in Canada* (2007) – have not been updated, and data on composition, numbers, and capacities of the public health workforce across the country are incomplete.

- Harmonization and alignment of provincial and territorial workforce strategies to ensure the availability of appropriate technicians and expert advice when needed.

RESPOND

Preparedness

Introduction

Emergency public health preparedness constitutes a continuous process for making arrangements and building mechanisms, at institutional, community, and individual levels, to reduce the risk, anticipate, respond to, and recover from the impacts of likely, imminent, emerging, or current acute events, irrespective of their origin, including unknown.

> **Target**
>
> *Emergency public health preparedness requires the establishment and maintenance of constantly revised and exercised institutional arrangements, mechanisms, and tools that allow a dynamic approach to risk assessment, a flexible approach to decision making and operations during a response, and the implementation of rapid recovery actions, all the while strengthening the national health system.*

Canada level of capacity

Because of the federated status of Canada, emergency management is a responsibility shared across several stakeholders at municipal, provincial, territorial and federal levels. Jurisdictional legislations require that all jurisdictions have in place the emergency management structure and tools to reduce the risk of, anticipate, respond to, and recovery from emergencies, including public health ones, or disasters.

Public Safety Canada (PSC) is the overall national custodian of emergency management, and activities falling under the health and public health risk reduction, anticipation, response, and recovery cycle are rooted in a series of laws (*Emergency Management Act* (2007)), formal frameworks (*Emergency Management Framework for Canada* (2017), *Federal Policy for Emergency Management* (2009), *National Framework for Health Emergency Management* (2004)), and plans (for example the *Federal Emergency Response Plan* (2011)) articulating the different jurisdictional levels, and the different governmental sectors at federal level, as well as Canada with the international community, either bilaterally or multilaterally. It is worth noting the key partnership between federal institutions and the Canadian Red Cross.

It should be noted that the definition and use of the term "emergency" varies across jurisdictions and government sectors; that the declaration of an "emergency" by the federal level can only be done pursuant to the Emergency Management Act; that the declaration of such an "emergency" does not constitute either the trigger or the prerogative for making federal resources to respond available (financial, human, assets, supplies); and that, while funding to sustain the risk reduction, anticipation, response, and recovery cycle is generally regarded as adequate, across jurisdictions and government sectors vis-à-vis the risk profiles determined, access to federal funds to support response and recovery efforts, in any part of Canada constitutes a relatively straightforward process.

As outlined in the *Emergency Management Framework for Canada,* the components of the health and public health risk reduction, anticipation, response, and recovery cycle, which, with a certain degree of heterogeneity, are being operationalized across jurisdictions and government sectors, including the following:

i. Jurisdiction- and sector-specific risk assessment and risk-mapping exercises to inform emergency management-related planning (for example the development of response plans, National Emergency Strategic Stockpile (NESS) and so on). PSC is currently leading the efforts to establish a pan-Canadian risk registry based on a shared methodological approach across sectors and jurisdictions, also with a focus on specific populations.

ii. Development and continuous revision of response plans that can be used as standalone tools, while being articulated among each other to ensure efficient communication and coordinated response efforts, when/if needed (see section *Emergency response operations*).

iii. After-action reviews and exercises, with multiple national, regional, provincial and locally run exercises take place each year and range from small workshops and tabletop exercises to large, complex, multi-jurisdictional exercises. The degree of institutionalization of this component demonstrates Canada's deeply ingrained continuous quality improvement culture, which, for instance, is exemplified by the existence of a dedicated after-action reviews and exercises unit within PHAC, as well as by formal evaluations such as the PHAC's *Evaluation of Emergency Preparedness and Response Activities 2012-13 to 2016-17* (2018).

iv. Establishment and maintenance of stockpiles of supplies, including medical countermeasures, for rapid deployment (see section *Medical countermeasures and personnel deployment*).

v. Maintenance of trained professionals for rapid mobilization (for example *Federal/Provincial/Territorial Memorandum of Understanding on the Provision of Mutual Aid in Relation to Health Resources During an Emergency Affecting the Health of the Public* (2012); *Operational Framework for Mutual Aid Requests for Health Care Professionals* (OFMAR, 2018); see section *Medical countermeasures and personnel deployment*).

vi. Development of recovery plans. Possibly due to successful risk reduction strategies historically implemented by Canadian authorities, pan-Canadian governance and operational arrangements related to the recovery component are not as extensive, sophisticated, and documented as those related to the components mentioned above.

The institutional risk reduction, anticipation, response, and recovery cycle established, and currently maintained, in Canada, across jurisdictions, government sectors at federal level, and encompassing the international dimension, embodies the conceptual model of resilience-building, multi-hazard, whole-government, intersectoral, whole-societal preparedness that, during the last decade, the international public health community has been promoting as the one deemed to be most conducive for effective and efficient responses.

Recommendations for priority actions

- Develop and maintain a map/visualization of preparedness related instruments to facilitate a common understanding of their various objectives and the interrelationships of the instruments across sectors and levels of government.

- Consider streamlining the set of instruments:

  ○ Users survey regarding suite of plans (for example *Health Portfolio Strategic Emergency Management Plan* (2016).

  ○ Improve the repository of corrective actions derived from after-action reviews and simulation exercises across government sectors and administrative levels.

- Focus simulation exercises on enhancing adaptive behaviour of responders (in other words not on testing plans).

- Assess current gaps in all instruments of the national response framework to ensure that recovery phase is addressed.

Indicators and scores

R.1.1 National multi-hazard public health emergency preparedness and response plan developed and implemented – Score 5

Strengths and best practices

- Existence of an extensive and comprehensive set of laws, regulations, agreements, plans, operational tools, and consultative mechanisms encompassing Government sectors and administrative levels.

- Institutionalized culture of transparent continuous quality improvement (review of plans embedded in plans themselves, after-action reviews, simulation exercises, formal evaluations) across Government sectors and administrative levels.

Challenges and areas that need strengthening

- The ability to develop instruments of a different nature (laws, plans, and so on) may have resulted in their excessive production with actual and potential undesired consequences (see below) and that requires considering taking streamlining actions:

  ○ Increasingly limited role of risk assessment in driving and justifying planning initiatives and resource allocation.

  ○ Significant needs for human resources specifically dedicated to coordinating response efforts in a sophisticated context.

  ○ Suboptimal knowledge of existing operational plans and procedures, develop to support emergency response efforts, across Government sectors and administrative levels.

  ○ Capacity to "improvise", based on information and resources actually available during a response, might be undermined.

- The recovery component needs to be further emphasized, institutionalized, documented and exercised.

R.1.2 Priority public health risks and resources mapped and utilized – Score 4

Strengths and best practices

- Existence of arrangements, across Government sectors and administrative levels, ensuring both, availability and access to financial and human resource, as well as to assets and supplies needed for response.

Challenges and areas that need strengthening

- The PSC-led pan-Canadian process to establish a national risk registry, based on a shared methodological approach across sectors and jurisdictions, needs finalizing to ensure that further actions to be taken in the context of the preparedness cycle are commensurate to the risk (see section *Chemical events*).

RESPOND

Emergency response operations

Introduction

A public health emergency operations center (PHEOC) is a central location for coordinating operational information and resources for strategic management of public health emergencies and emergency exercises. Emergency operations centers provide communication and information tools and services, and a management system during a response to an emergency or emergency exercise. They also provide other essential functions to support decision-making and implementation, coordination and collaboration.

> ### Target
> *Country with public health emergency operations center (PHEOC) functioning according to minimum common standards; maintaining trained, functioning, multisectoral rapid response teams and "real-time" biosurveillance laboratory networks and information systems; as well as trained EOC staff capable of activating a coordinated emergency response within 120 minutes of the identification of a public health emergency.*

Canada level of capacity

F/P/T and municipal governments share responsibilities in preparing for and responding to public health emergencies. In accordance with the *Emergency Management Act* (2007) and the *Federal Policy for Emergency Management* (2009), the Health Security and Infrastructure Branch in PHAC maintains the (HPOC and the Centre for Emergency Preparedness and Response (CEPR). CEPR is the single, national platform for planning and coordinating emergency management, utilizing the HPOC and other programmes to connect with the six Regional Emergency Coordination Centers throughout Canada (covering all 13 provinces and territories) and the NML Emergency Operation Center in Winnipeg, Manitoba. The NML Emergency Operation Center provides coordination of specialized resources for local, regional, national and international infectious disease outbreaks. All emergency management operations throughout the country use the Incident Management System (IMS).

Triggers for activation for all operation/coordination centres are well-described, which function semi-independently within their respective scopes of practice or geographic ranges. For multi-jurisdictional emergencies or emergencies that exceed the local management capacity, the HPOC, hosted in PHAC premises, provides direct support to the F/P/T health sector emergency management functions. Subnational emergency management functions may be contained within a dedicated Health Portfolio emergency operation centre (such as in densely populated Ontario) or as a sub-activity within the F/P/T multisectoral emergency operation centre maintained by a public safety or law enforcement agency. Provinces and territories may request assistance from the federal government with or without a specific public health emergency declaration. The *Federal/Provincial/Territorial Memorandum of Understanding on the Provision of Mutual Aid in Relation to Health Resources During an Emergency Affecting the Health of the Public* (2012) and the *Operational Framework for Mutual Aid Requests for Health Care Professionals* (OFMAR, 2018) ensure that F/P/T governments have ability to request specific assistance from one another, including provisions to address health care professional licensing and liability.

CEPR maintains a training programme for public health emergency management that aims to ensure that there are sufficient numbers of trained personnel at the federal level who are available for emergency responses. When the federal HPOC requires a high level of activation, and after core CEPR staff members are already activated, staff members from other programmes throughout the Health Portfolio who are trained in emergency management tasks can be released from their normal duties to support the operation.

Despite the successes of that staffing model in past responses, a review of the CEPR programme indicates that not enough staff are trained to an expert level, with many lacking the practical experience needed to slip into an emergency management role easily. Additionally, experienced personnel can be required to work for exceptionally long periods without relief because there are no replacement staff members available. Across Canada, each province and territory maintains its own training and staffing models for the health sector emergency management functions. Published in March 2018, the *Evaluation of Emergency Preparedness and Response Activities* 2012-13 to 2016-17 provides a detailed review of existing emergency management capacities at the federal level and examines lessons learned from past responses.

The management and transportation of potentially infectious patients is the responsibility of the provinces and territories and local paramedic services. Each province and territory has standard operating procedures related to the transportation and management of infectious patients. These procedures follow principles of good patient care and use "routine practices" provided by PHAC. PHAC provides guidance on routine practices and additional precautions for preventing the transmission of infection in healthcare settings (*Routine practices and additional precautions for preventing the transmission of infection in healthcare settings* (2012)). Transport Canada has coordinated development of the *Civil aviation contingency plan for pandemics and communicable disease events* (2010) to ensure that the civil aviation response to a pandemic or communicable disease event is appropriate and adequately addresses the declared phase and subsequent issues.

Recommendations for priority actions

- Increase the depth of existing federal HPOC emergency management training to strengthen and expand the expertise among Health Portfolio and related staff.

- Consider mechanisms to centralize and strengthen alignment of emergency management training among F/P/T governments.

- Consider development of academic and private sector partnerships as the foundation for a national training programme in emergency management.

- Consider ways to involve intermittent or auxiliary staff members in real-world events or exercises to reinforce training.

Indicators and scores

R.2.1 Capacity to activate emergency operations – Score 5

Strengths and best practices
- HPOC and other emergency operations centres (EOCs) across the country maintain low-level activation 24/7 for situational awareness and rapid notifications of emerging events.

- Well-defined triggers and threat assessment processes are in place to increase and deescalate the level of activation as needed.

- HPOC and other operations centres maintain rosters of trained personnel who can be activated for a response as needed.

- EOCs are well-designed and utilize an appropriate combination of analogue and digital methods to maintain situational awareness, conduct coordination activities, and communicate with stakeholders promptly.

Challenges and areas that need strengthening
- The current staffing model for HPOC (and possibly other facilities) relies on personnel who may be minimally trained or lack significant experience, leading to challenges integrating them into an active scenario.

RESPOND

R.2.2 EOC operating procedures and plans – Score 5

Strengths and best practices

- All EOCs follow the national Incident Management System (IMS), which includes standard operating procedures and job action sheets for all roles.

Challenges and areas that need strengthening

- While there are ample numbers of written plans and procedures, not all of them are readily available or organized into an appropriate context, which affects efficient development and execution of a response.

R.2.3 Emergency operations program – Score 4

Strengths and best practices

- PHAC and the provincial and territorial emergency management programmes maintain emergency management training appropriate to their respective scopes and geographic distributions.

- The practice of conducting after-action review is an integral component of the emergency management cycle, with a detailed, multi-year audit of the federal programme published in March 2018.

Challenges and areas that need strengthening

- Current training programmes and staffing models result in too few highly experienced personnel for complex, multiple, or protracted emergency responses.

- F/P/T emergency management programmes maintain separate training and staffing models, potentially leading to difficulty aligning roles and responsibilities during a response.

R.2.4 Case management procedures implemented for IHR relevant hazards – Score 5

Strengths and best practices

- Provinces and territories organize their case-management protocols based on local resources and resource limitations following guidance provided by PHAC.

- Special measures for transport of highly infectious patients are in place and can be deployed from the federal level as needed.

Challenges and areas that need strengthening

- Patient transportation from isolated areas continues to be difficult, especially for infectious patients.

Linking public health and security authorities

Introduction

Public health emergencies pose special challenges for law enforcement, whether the threat is manmade (e.g. the anthrax terrorist attacks) or naturally occurring (e.g. influenza pandemics). In a public health emergency, law enforcement will need to quickly coordinate its response with public health and medical officials.

Target

Country conducts a rapid, multisectoral response in case of a biological event of suspected or confirmed deliberate origin, including the capacity to link public health and law enforcement, and to provide and/or request effective and timely international assistance, such as to investigate alleged use events.

Canada level of capacity

The *Security of Canada Information Sharing Act* (2015) provides a means for the Canadian security and intelligence community, PHAC, Health Canada and CFIA to share information on threats to national security, including public health-related threats. *Building Resilience Against Terrorism: Canada's Counter-terrorism Strategy* (2013) represents Canada's commitment to the principle that a response to a terrorism event requires an integrated approach by the Government of Canada, all levels of government, law enforcement agencies, the private sector and citizens; and collaboration with international partners and key allies, such as the United States. Supporting this overarching strategy, all levels of government have collaborated to develop the *Chemical, Biological, Radiological, Nuclear and Explosives Resilience Strategy for Canada* (2011), which provides the policy framework that guides the creation of sustainable capacities and common standards in chemical, biological, radiological and nuclear defence (CBRN) policies, programmes, equipment and training. Various memoranda link the functions and federal authorities in the Health Portfolio to those of Transport Canada, the Royal Canadian Mounted Police (RCMP), DND, and CBSA. Canada's Integrated Terrorism Assessment Centre (ITAC) analyses security intelligence from partner institutions and produces assessments related to terrorism threats. Threat assessments are then distributed to members of the Canadian security intelligence community, federal partners, including the Health Portfolio, provincial emergency authorities, first responders and the private sector. The RCMP maintains a specialized team to provide training and operational response to CBRN incidents.

At the national level, the *Federal Terrorism Response Plan* (2018) establishes coordination among security and intelligence agencies. It is designed to address domestic terrorist incidents, and acts of terrorism committed abroad that implicate domestic security and intelligence agencies. With a focus on the security and intelligence response, it links crisis response and consequence management to the coordination mechanisms of the *Federal Emergency Response Plan* (2011) and the *Health Portfolio Emergency Response Plan* (2013). To support national collaboration among all levels of government, the health sector has in place the *Federal, Provincial, and Territorial Public Health Response Plan for Biological Events* (2018). This plan facilitates formal coordination of responses to public health events that are biological in nature and of a severity, scope or significance to require the involvement of senior level decision-makers at a national level. At the provincial and territorial level, most public health jurisdictions maintain either memoranda of understanding (MoU), agreements, protocols or plans for engaging with and sharing information with law enforcement for specific public health emergencies such as bioterrorism. The *Federal/Provincial/Territorial Memorandum of Understanding on the Sharing of Information During a Public Health Emergency* (2012) establishes a framework for the sharing of information among F/P/T governments during a public health emergency.

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Work towards enhanced and disseminating protocols and mechanisms to share information and conduct joint investigations are ongoing. PHAC led a workshop in March 2015 at the Toronto Police College involving the Province of Ontario federal public health and law enforcement stakeholders whose responsibilities include identification, assessment and response to public health events of potential bioterrorist concern. Several PHAC employees have attended the Centers for Disease Control and Prevention (CDC)-Federal Bureau of Investigation (FBI) combined training in the model for criminal-epidemiological investigation developed for the United States. PHAC has also sponsored provincial and territorial public health authorities to obtain federal government security clearances that allow them to access classified threat and risk assessments to aid in the exchange of information concerning medical countermeasures. In March 2017, PHAC hosted a tabletop exercise with specific members of Canada's security and intelligence community to examine information sharing during an event. In April 2017, the Agency participated in a national-level exercise which brought together several members of Canada's security and intelligence community to examine information sharing and response during a major radiological event.

Challenges remain in linking public health experts, health care providers, and security authorities across all parts of Canada. For instance, in a situation where there are patients who need to be transported to a hospital with an unknown affliction linked to criminal activity, pre-event and post-event information sharing with law enforcement may be delayed or non-existent in some locations. Additionally, the pre-hospital emergency medical service or receiving medical providers may not consider the requirements of law enforcement and interdiction when focusing on patient care. Ultimately, health care legislation allows doctors to disclose necessary information, but it is not an embedded practice and varies by jurisdiction, and health care and public health professionals may not have the appropriate security clearance to receive highly sensitive information from the intelligence community. Additionally, although work commenced in 2015 to implement a joint criminal-epidemiological investigation framework at the federal level, additional effort is required to formalize and implement a process and training programme for public health and law enforcement entities on joint investigations and/or information-sharing.

Recommendations for priority actions

- Consider mechanisms to expand current training, especially to the local levels where first response timing and coordination are most critical.

- Consider the training and information needs for clinical staff (especially in emergency rooms).

Indicators and scores

R.3.1 Public health and security authorities (e.g. law enforcement, border control, customs) linked during a suspect or confirmed biological event – Score 5

Strengths and best practices

- Formalized coordination mechanisms through legislation, strategic documents, joint planning activities, and bilateral and multilateral agreements among relevant agencies at multiple levels of government.

- Well-developed schemes in many locations that link the functions of the public health system, health care, and law enforcement during a recognized terrorism event.

- Well-documented examples of local responses to suspicious materials/packages and some larger-scale national and provincial exercises that strengthen combined investigation and information sharing.

Challenges and areas that need strengthening

- Training and exercises to handle complex incidents when there is a substance/agent of unknown origin or composition, including the involvement of first-line responders and receivers.

- Enhancing the ability of relevant stakeholders to share sensitive and classified public health- and law enforcement-related information without significant administrative or technical delays.

Medical countermeasures and personnel deployment

Introduction

Medical countermeasures (MCM) are vital to national security and protect nations from potentially catastrophic infectious disease threats. Investments in medical countermeasures create opportunities to improve overall public health. In addition, it is important to have trained personnel who can be deployed in case of a public health emergency for response.

Target

National framework for transferring (sending and receiving) medical countermeasures, and public health and medical personnel among international partners during public health emergencies.

Canada level of capacity

Canada has the capacity to transfer medical countermeasures (MCM) and public health personnel domestically and internationally during public health emergencies, with roles and responsibilities are shared across F/P/T governments. In 2009, F/P/T Ministers of Health signed the *Federal/Provincial/Territorial Memorandum of Understanding on the Provision of Mutual Aid in Relation to Health Resources During an Emergency Affecting the Health of the Public* (2012) which guides all domestic response interactions. Provinces and territories have the responsibility for the frontline response to emergencies and each maintains its health emergency stockpiles, though there are a variety of bilateral, regional, national and international agreements in place for resources sharing if needed.

The National Emergency Strategic Stockpile (NESS) is a health emergency resource managed by PHAC. NESS assets may be deployed upon request from provinces or territories when their resources are insufficient or when surge capacity is required. NESS contains assets to respond to natural disasters, emerging and re-emerging diseases, as well as health consequences of exposure to harmful chemical, biological, radiological or nuclear threats. Assets include supplies for preventive (vaccines, potassium iodide) as well as curative (antibiotics and antivirals) measures, and equipment to deliver care (ventilators, personal protective equipment), social services supplies (beds, bedding) and mobile clinics. NESS was used during the H1N1 outbreak (2009), Fukushima disaster (2011), Ebola outbreak in West Africa (2014), the influx of Syrian refugees (2015) and the Fort McMurray wildfires (2016). In coordination with provincial and territorial governments, NESS supplies can be deployed and prepositioned for planned events, for example the Winter Olympics in Vancouver in 2010 and the G7 Summit in Quebec in 2018. PHAC develops strategies for the lifecycle of the MCM, including procurement, storage, deployment and disposition of MCM. International MCM deployments are guided by policies, agreements (such as the *Agreement between the Government of Canada and the Government of the United States of America on Emergency Management Cooperation* (2010)), plans and protocols. Preparedness plans and MCM deployment components have been tested in simulation exercises involving F/P/T authorities, neighbouring countries and international partners. Deployment of MCM has been considered in cross-jurisdictional and international scenarios.

Standing agreements and contracts are in place for the production of relevant supplies (such as vaccines) with options to expedite amendments to the contracts. Regulatory mechanisms are in place for importation and marketing of medicines/biologicals that are not licensed in Canada. Decisions are based on risk-benefit analyses and existing marketing authorizations by credible external regulatory authorities.

RESPOND

The CFEP training model includes at least one deployment for an emergency response during the two-year programme. The Province of Ontario maintains a 56-bed mobile medical unit with the Emergency Medical Assistance Team (EMAT) delivering emergency/acute care, intensive/critical care, response to infectious diseases, and primary care provision in an emergency, including psychosocial care. Similar resources are present in other populous provinces; other models for surge capacity are maintained elsewhere.

Recommendations for priority actions

- Revisit provisions for deployments of personnel across provincial borders and remove time-consuming obstacles.

- Develop opportunities for simulation exercises and trainings considering supplies, and specifically, equipment held in provincial and territorial stockpiles and NESS.

- Regarding emergency management and IMS surge capacity, consider benefits of developing a common training and standard equipment profile to ensure interoperability.

Indicators and scores

R.4.1 System in place for sending and receiving medical countermeasures during a public health emergency – Score 5

Strengths and best practices

- F/P/T stockpiles, including the NESS, provide a wide variety of health emergency assets strategically located across Canada.

- Standing agreements/contracts for procurement of relevant supplies with options for ad hoc modifications.

Challenges and areas that need strengthening

- Strengthening policies and regulatory directives related to the deployment and use of unapproved or unlicensed medical countermeasures.

- Some agent-specific products and guidance are not currently included in NESS.

- Improved understanding of importation and exportation regulations and requirements to ensure processes are clear and well-coordinated.

R.4.2 System in place for sending and receiving health personnel during a public health emergency – Score 5

Strengths and best practices

- The Health Portfolio's mandate to respond to international emergency response activities is supported through legislation, derived in part from the *Public Health Agency of Canada Act* (2006).

- International personnel deployment agreements (bilateral and multilateral).

- National pandemic preparedness plans address personnel deployments.

Challenges and areas that need strengthening

- Not all provinces and territories have measures in place to grant special permissions to non-physician health care professionals to deliver cross-border services.

Risk communication

Introduction

Risk communications should be a multilevel and multifaceted process that aims at helping stakeholders define risks, identify hazards, assess vulnerabilities and promote community resilience, thereby promoting the capacity to cope with an unfolding public health emergency. An essential part of risk communication is the dissemination of information to the public about health risks and events, such as disease outbreaks. For any communication about risk caused by a specific event to be effective, the social, religious, cultural, political and economic aspects associated with the event should be taken into account, including the voice of the affected population.

Communications of this kind promote the establishment of appropriate prevention and control action through community-based interventions at individual, family and community levels. Disseminating the information through appropriate channels is essential. Communication partners and stakeholders in the country need to be identified, and functional coordination and communication mechanisms should be established. In addition, the timely release of information and transparency in decision-making are essential for building trust between authorities, populations and partners. Engaging communities during emergencies helps ensure that those at risk receive the information they need and builds trust. Emergency communications plans should be tested regularly and updated as needed.

Target

State Parties use multilevel and multifaceted risk communication capacity. Real-time exchange of information, advice and opinions between experts and officials or people who face a threat or hazard (health or economic or social wellbeing) to their survival, so that informed decisions can be made to mitigate the effects of the threat or hazard and protective and preventive action can be taken. This includes a mix of communication and engagement strategies, such as media and social media communications, mass awareness campaigns, health promotion, social mobilization, stakeholder engagement and community engagement.

Canada level of capacity

Canada has a comprehensive system in place to communicate during emergencies at all levels of government and with a wide variety of stakeholders. A variety of mechanisms is used to coordinate the timely flow of information during health emergencies through a mix of communication and engagement networks and strategies. Communications strategies are integrated into emergency policies, plans and protocols, including most of the response plans for specific hazards. Canada has trained staff dedicated to risk communications, and there is a dedicated budget to sustain communications functions and responsibilities are well-defined at all levels. Both formal and informal networks and mechanisms exist to coordinate communication among different stakeholders and levels. Each level of the government develops and maintains networks that support information coordination and dissemination, considering cultural and regional diversity.

The PHN Communications Working Group is a critical centralized coordination mechanism. It regularly brings together F/P/T representatives to ensure that communications with the public on public health issues are consistent and well-coordinated. During multi-jurisdictional emergencies, this network is where F/P/T levels coordinate their communications activities. Federal, provincial and territorial governments maintain specific mechanisms to coordinate risk communication with First Nations and Inuit communities that are culturally appropriate and adapted to local languages/dialects, although in some places those mechanisms are strictly informal and/or available intermittently.

RESPOND

Because message development requires significant coordination at many levels and with different stakeholders, there remains a risk of inconsistency or contradiction in the initial phase of an emergency. Strong networks and individual relationships mitigate this risk because there is a common understanding of the importance of communications during emergencies across all levels. However, identifying rules of engagement and standardizing them would lead to greater efficiency and fewer misperceptions.

The Risk and Emergency Communications team in the Communication and Public Affairs Branch at HC coordinates risk communication preparedness, response and training with a variety of governmental organizations that are also responsible for public health communication. They have shared this training capacity with provinces and territories, and also with other governments and international organizations, as they have the tools and knowledge on how to conduct this kind of training. In times of emergencies, other communication officers from the Communication and Public Affairs Branch, with approximately 300 employees, can be assigned to the Risk and Emergency Communications team to provide surge capacity. However, because there is a high turnover rate among communications staff, there are times when there are not enough people available with the appropriate training or experience to adequately conduct all communications-related tasks.

Canada tests its emergency plans regularly through exercises, and communication is usually included in these activities, but not everyone is always able to participate due to limited human resources fully. Because of the scale and duration of exercises, they may not always fully reflect the current capacity of communications teams. Provinces and territories have communication officers, though relatively fewer numbers of dedicated specialists; many local Health Portfolio staff members have been cross-trained in communications, but there remains a significant gap in resources during complex and protracted events.

Health Canada's Communications and Public Affairs Branch provides a variety of services that includes strategic communications, media relations and monitoring, public consultations, regional communications, internal communications, creative services and digital communication (social media, web content, and so on). It also uses all channels and networks across the Government of Canada. Each province and territory manages a range of communications resources similar to the ones used at the federal level. All materials are produced in the two official languages (English and French), as well as in a variety of other languages including indigenous languages where needed.

Community engagement and rumour and misinformation monitoring are included in the various communication strategies, and efforts are made to provide accurate information to targeted affected communities. However, the capacity to detect and respond to rumours varies across the country. In an emergency, when rumours can propagate quickly, there are dedicated resources in most regions to monitor, detect and correct rumours, mostly using traditional media. The focus is mostly in sharing information, rather than addressing the source, misinformation, or rumour directly, including when such rumours spread via social media, which may or may not always be the most effective approach.

Recommendations for priority actions

- Consider developing and publishing an explanation of the communication network model, identifying "rules of engagement" that could support protocols, guidelines, and/or mechanisms to respond during emergencies.

- Expand risk communication training among dedicated and generalist staffs to provide surge capacity and support for extended emergencies responses.

- Develop guidance for the strategic use of social media and emergencies that includes protocols for coordination among F/P/T sectors and stakeholders.

- Consider strategies to target training and capacity building among provincial and territorial staff.

Indicators and scores

R.5.1 Risk communication systems (plans, mechanisms, etc.) – Score 4

Strengths and best practices

- Roles and responsibilities for risk communication are included in emergency response plans.

- There are clear lines of responsibility among F/P/T and local officials for communications during emergencies.

- There is a dedicated team in the Health Portfolio to build risk communication capacity and emergency preparedness function among communications and policy/programme staff.

- Systems are tested regularly in exercises; lessons are learned and shared among all levels.

Challenges and areas that need strengthening

- High turnover rate among communication staff at the federal level.

- More staff trained in risk communications to develop surge capacity to manage long term emergencies.

R.5.2 Internal and partner communication and coordination – Score 5

Strengths and best practices

- There are strong communications networks in place to coordinate public communications and risk communications, at all levels.

- During emergencies, communication activities can also be coordinated with NGOs and the private sector.

- Engagement with specific communities to develop appropriate messages for this audience (First Nations, for example).

Challenges and areas that need strengthening

- Message development for novel risks requires significant coordination and existing mechanism are somewhat inefficient during the initial phase of a response.

- High turnover rates among communications staff can affect built relationships among different levels.

R.5.3 Public communication – Score 5

Strengths and best practices

- Policies and plans ensure that the government communicates about risks in times of emergencies in appropriate languages.

- There are designated spokespersons across all government levels and a multitude of public communication channels to reach various audiences in emergencies.

Challenges and areas that need strengthening

- There is a need to ensure that trained communication officers are available to provide surge capacity, particularly during long-term emergencies.

- Consistent availability of staff at the provincial and territorial levels that can be dedicated to risk communications tasks during an emergency.

R.5.4 Communication engagement with affected communities – Score 4

Strengths and best practices

- All levels of government engage communities across a broad range of public health topics and can mobilize them in an emergency.

- Local community teams build relationships and networks that enable community action.

Challenges and areas that need strengthening

- While the federal government is not directly engaged in social mobilization, development of adaptable tools and methods would increase efficiency and consistency of community actions.

- Resources at the provincial and territorial levels are inconsistent and sometimes inadequate for complex or protracted events.

R.5.5 Dynamic listening and rumor management – Score 3

Strengths and best practices

- Traditional media and social media are monitored during emergencies to correct misinformation and rumours.

Challenges and areas that need strengthening

- There is a need for systematic evaluation of listening in emergencies to improve communication response and correct misinformation and rumours, particularly on social media.

- There is a need to develop a standard process to respond to rumours on social media.

OTHER IHR-RELATED HAZARDS AND POINTS OF ENTRY

Points of entry

Introduction

Points of Entry (PoE) represents the sole location/s within a State Party's territory where virtually all capacities detailed in Annex 1 of the IHR should be present and maintained, requiring both, inter-jurisdictional and inter-sectoral integration, as well as a multi-hazard approach.

Target
The sustained effective implementation of public health measures and arrangements at Points of Entry requires the presence of a national border health strategic framework embedded in the cross-Government approach to national security and mindful of international agreements.

Canada level of capacity

Formed in the context of the whole-of-government *Border Modernization Initiative*, the foundational vision of Canada's approach to travel and border health embodies the integration at PoE of the health and public health prevention, preparedness, response, and recovery cycle, requiring the day-by-day implementation of inter-jurisdictional, intersectoral and multisectoral operational arrangements, which are facilitated by a conducive legal and regulatory framework reflecting a holistic national travel and border health strategy. Considering the rapid changes of the global context, the Border Modernization Initiative aims, among other things, at protecting travellers' and migrants' health, at creating and maintaining a safe public health environment for travellers and migrants, and at preventing the introduction of hazards into the national territory while maintaining efficient transport operations. The *Evaluation of the Public Health Agency of Canada's Travel Health and Border Health Security Activities 2009-2010 to 2014-2015*, finalized in July 2015, exemplifies Canada's drive to cater for emerging needs in a deep-rooted quality improvement culture.

The breadth of Canada's approach to travel and border health goes far beyond the limitations of core capacities detailed in Annex 1.B of IHR as follows: core capacities to be present, exclusively at designated PoE, "at all times" (JEE indicator POE.1) and "for responding to events that may constitute a public health emergency of international concern" (JEE indicator POE.2). Although Canada has designated three airports (Montreal Pierre Elliott Trudeau International Airport, Toronto Pearson International Airport, and Vancouver International Airport) and two seaports (the Port of Halifax and Port Metro Vancouver), the national travel and border health strategy encompasses Canada's 140 international airports, 200 seaports, and five Quarantine Stations (Calgary, Montreal, Ottawa, Toronto, Vancouver), which, remotely, provide nationwide services. Also, Canada's comprehensive approach to travel and border health first and foremost recognizes PoE as an opportunity for prevention and health promotion, and not as a surveillance stronghold.

Travel and border health-related responsibilities are shared among the public sector, across federal (CBSA, Transport Canada, Health Canada, PHAC, CFIA), provincial and territorial governments (Ministries of Health, local public health authorities and local police), and the private sector (airport and seaport authorities, local paramedic services and conveyance operators). Public health-related actions along Canada's border with the United States (its only land border) - including at ground crossings, are the result of a close collaboration between federal authorities of the two countries as well as of authorities of the respective bordering provinces, territories and states, crystallized by numerous bilateral agreements.

OTHER

CBSA provides integrated border services that support national security and public safety priorities, and the _Umbrella memorandum of understanding between CBSA and Health Canada_ (2011) constitutes the basis for collaboration in the administration and enforcement of public health-related acts and regulations covering travellers, conveyances and cargo.

The core federal public health-related legislation and regulations to protect travellers' and migrants' health, to create and maintain a safe public health environment for travellers and migrants, and to prevent the introduction of hazards in the national territory, include but are not limited to, the following:

- _Quarantine Act_ (2005) and _Quarantine Regulations_ (2006, administered by PHAC).

- _Potable Water on Board Trains, Vessels, Aircraft and Buses Regulations_ (2016, administered by PHAC).

- _Immigration and Protection of Refugees Act_ (2001) and pre-departure provisions outlined in the Government of Canada's _Interim Federal Health Program for Refugees_.

- _Customs Act_ (1985) and related Regulations (administered by CBSA).

- _Human Pathogens and Toxins Act_ (2009) and _Human Pathogens and Toxins Regulations_ (2015, administered by PHAC).

- _Food and Drugs Act_ (1985) and _Food and Drug Regulations_ (last amended 2018, administered by CFIA).

- _Health of Animal Act_ (1990) and _Health of Animal Regulations_ (last amended 2017, administered by CFIA).

- _Plant Protection Act_ (1990) and _Plant Protection Regulations_ (last amended 2017, administered by CFIA).

- _Seeds Act_ (1985) and _Seeds Regulations_ (last amended 2017, administered by CFIA).

- _Export and Import Permits Act_ (1985), and _Import Permit Regulations_ (1979) and _Export Permit Regulations_ (last amended 2017, administered by GAC).

- _Canadian Containment Standards for Facilities Handling Plant Pests, First Edition_ (last amended in 2014, under the auspices of CFIA).

- _Canadian Biosafety Standard, Second Edition_ (2015, under the auspices of PHAC and CFIA);

- _Transportation of Dangerous Goods Act_ (1992) and _Transportation of Dangerous Goods Regulations_ (2001, administered by TC).

- _Memorandum of understanding_, related to radioactive materials in transport, between TC and the Canadian Nuclear Safety Commission (CNSC) (2018).

Provincial and territorial health acts and regulations address the prevention disease spread, vector and reservoirs control, inspection of food establishments, and enforcement of occupational health and safety standards.

The _Quarantine Act,_ updated in 2005 and fully empowering federal public health authorities, is regarded as sufficient for Canada to comply with IHR provisions related to the implementation of public health measures at PoE, including those concerning arriving and departing travellers, baggage, cargo, conveyances or goods.

PHAC's expertise has and is being instrumental worldwide and in the Region of the Americas in particular in supporting capacity building efforts in this technical area while promoting a multi-pronged, cross-governmental vision to travel and border health. PHAC has been exemplary in sharing with other States Parties its experience related to:

- Response multi-jurisdictional arrangements at PoE, including training activities targeting multiple sectors and the airlines; communicable disease contingency plans encompassing all steps related to the management of potentially contagious and exposed individuals, and that are regularly exercised.

- Inspection of conveyances and issuance of Ship Sanitation Certificates (SSC).

- Issuance of travel health-related advice for travelers, resulting from intrasectoral and intersectoral consultation efforts, factoring in both, safety and security considerations, including with the involvement of the Canadian Security Intelligence Service (CSIS) and Integrated Terrorism Assessment Centre (ITAC), and which is disseminated through a single governmental outlet (https://travel.gc.ca/travelling/advisories).

Recommendations for priority actions

- Align the *Quarantine Regulations* with relevant IHR provisions (see section *National legislation, policy and financing*).

- Information management needs to be systematized and systematically shared with PHAC:
  - The travel-related nature of a condition.
  - PoE, conveyances, and travellers related to public health events.
  - Public health events that have required domestic and/or international contact tracing operations.

- Contingency plans at PoE should be critically reviewed to ensure that:
  - Different public health scenarios that imply changes in the modus operandi of a facility are contemplated.
  - Risk communication anticipated needs and related operational arrangements are addressed, including in multiple languages.

Indicators and scores

PoE.1 Routine capacities established at Points of Entry – Score 5

Strengths and best practices
- Holistic, and commensurate to the risk, strategic and operational approach to border health.
- Well-oiled and extensive intersectoral collaboration between federal governmental institutions and relevant provincial and territorial local counterparts to create and maintain a safe public health environment for travellers and migrants.

Challenges and areas that need strengthening
- Suboptimal information management arrangements, at federal level across sectors, and across jurisdictions, potentially undermining the ability of federal authorities to target efforts and resources.

PoE.2 Effective public health response at Points of Entry – Score 5

Strengths and best practices
- The *Quarantine Act* is fully empowering federal public health authorities (see section *National legislation, policy and financing*).

Challenges and areas that need strengthening
- Some provisions of the *Quarantine Regulations* (2006) – such as the requirement for "valid evidence of immunization to smallpox" and for de-ratting/de-ratting exemption certificates – under the *Quarantine Act* (2005), are inconsistent with some IHR provisions (see section *National legislation, policy and financing*).
- Communicable disease contingency plans at PoE would benefit from being critically reviewed to ensure that scenarios encompassed also contemplate the implementation of entry and exit screening operations, and that needs for communication to the public, in the occasion of public health events, are anticipated, including in multiple languages.

OTHER

Chemical events

Introduction

Timely detection and effective response is essential to mitigate the impact of potential chemical risks and/or events and their subsequent impact on health. This requires cross-sectoral collaboration with chemical safety, industry, transportation authorities, culminating in remediation and safe disposal. State Parties need to have effective surveillance and response capacity to manage chemical risks or events, facilitated by good communication and a collaborative relationship with stakeholders.

Target

States Parties with surveillance and response capacity for chemical risks or events. This requires effective communication and collaboration among the sectors responsible for chemical safety, industries, transportation and safe disposal.

Canada level of capacity

Canada maintains an extensive regulatory environment for the management of chemicals and is a signatory to several international treaties, conventions, response protocols and non-proliferation agreements. Environment and Climate Change Canada (ECCC) protects Canadians and their environment from the effects of environmental emergencies through the provision of science-based expert advice and regulations. The *Canadian Environmental Protection Act* (1999) and *related documents*, the *Transportation of Dangerous Goods Act* (1992) and related *Regulations* (2001), the *Hazardous Products Act* (1985) and related *Regulations* (last amended 2018), the *Consumer Product Safety Act* (2010), and the *Pest Control Products Act* (2002) and related *Regulations* (last amended 2018) are among the principal regulatory mechanisms along with others specific to transportation, food, drugs, fisheries, and occupational health. Provincial and territorial governments and municipal authorities also have regulations aiming to protect health and the environment. Overall, Canadian laws support the principle of polluter responsibility. The Environmental Emergency Regulations (last amended 2011) require any person who owns, manages, or has the control of a regulated substance at a place in Canada to prepare and implement environmental emergency plans when specified quantity and container capacity thresholds are both met.

Canada is signatory to the *Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade* (1998), the *Stockholm Convention on Persistent Organic Pollutants* (2001), the *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal* (1989), the *Strategic Approach to International Chemicals Management* (SAICM), and the *Convention on the Transboundary Effects of Industrial Accidents* (1992). The *Globally Harmonized System of Classification and Labelling of Chemicals* (GHS) is an internationally consistent approach to classifying chemicals and communicating hazard information through labels and safety data sheets, and is being implemented in Canada.

Within the Health Portfolio, regulatory programmes conduct inspections on different types of consumer products, medical devices, foods, drugs and natural products as well as drinking water in First Nations communities. These programmes are supported by federal laboratory capacities. The monitoring of other matrices (such as air and water) for chemical contamination is also a part of the day-to-day operations of the regulatory authorities at all levels of government, with formal mechanisms for information exchange between the regulatory authorities and public health agencies when required.

The five poison centres in Canada provide specialized clinical toxicology advice for the treatment and management of poisoned patients (including administration of antidotes). While not a national service, arrangements are in place for most provinces and territories that do not have a poison centre to access a neighbouring centre for advice. Poison centre data are reported locally with periodic reporting to the federal government for trend analysis. However, the project *Toxicovigilance Canada* aims to bring together data from the five Canadian poison centres in a more timely manner to provide a better national perspective on chemical events and poisonings occurring across the country.

Chemical antidotes are available at the local, provincial and federal levels; stockpiles managed by local health facilities (such as hospital pharmacies) in collaboration with the provincial health authorities vary across Canada. There is currently no pan-Canadian antidote stockpile registry. Information about the content of National Emergency Strategic Stockpile (NESS) is neither routinely shared among federal government departments nor with provincial and territorial jurisdictions, due in part to security issues, which makes it difficult to obtain a comprehensive picture of chemical antidote stockpiles available across the country.

PSC, Transport Canada, and the provincial, territorial and municipal government emergency response agencies and the private sector owners have the primary responsibility for immediate chemical emergency management and decontamination. The *Federal Emergency Response Plan* (2011) specifies that the Health Portfolio will provide technical advice and support for chemical emergencies when needed, which is described in the Health Portfolio Policy for Chemical Emergency Management and the chemical annex to the Health Portfolio Emergency Response Plan (2013). Health Canada maintains the specialized Chemical Emergency Preparedness and Response Unit, which coordinates the chemical expertise within Health Portfolio programmes and liaises with other federal agencies and the provincial and territorial public health departments and agencies.

Within the national response framework, the Canadian Transport Emergency Centre (CANUTEC), the National Environmental Emergency Centre (NEEC), and GAC (among others) coordinate with PSC through the Government Operations Centre for a coordinated chemical event response, although no large-scale event or exercise has occurred. Transport Canada maintains *Emergency Response Assistance Plans* (ERAPs), which outline actions in the event of a transportation accident involving certain higher-risk materials. Transport Canada can assist local emergency responders with technical experts and specially trained and equipped emergency response personnel at the scene of an incident. For suspected intentional events, RCMP coordinates Canada's National Chemical, Biological, Radiological, Nuclear and Explosives Response Team, which is composed of experts from several government departments to evaluate potential crime scenes.

While local and regional emergency response systems are used regularly, there remain significant gaps in assigning/coordinating roles and responsibilities for environmental decontamination and other recovery activities following chemical events, including large-scale events that might be managed at the federal level. Additionally, a limited amount of information is collected nationally on chemical events; and it appears that lessons learned are formally documented and shared among F/P/T responders. There are gaps in understanding the risks and effects of chemical contamination on the population, and a pre-determined framework to conduct research during a chemical incident and a review process to accompany this framework would help integrate environmental public health research into the emergency response process. ECCC is currently developing an information system that will aggregate information from across the country to assess the effectiveness of current regulations, response systems, and surveillance methods.

Recommendations for priority actions

- Continue to develop *Toxicovigilance Canada,* with emphasis on aggregating poison control and environmental data to facilitate detection of chemical events.

- Develop a national registry of chemical antidotes and treatment guide linked to medical countermeasures.

- Develop nation-wide guidance to support the development of a recovery strategy following a chemical incident.

- Expand the current exercise strategy to culminate in a large-scale exercise on chemical events (response-recovery).

Indicators and scores

CE.1 Mechanisms established and functioning for detecting and responding to chemical events or emergencies – Score 4

Strengths and best practices

- Response to a chemical event occurs quickly at the local level, which can involve F/P/T assistance when needed.

- *Toxicovigilance Canada,* a collaboration centre in the Canadian Network for Public Health Intelligence (CNPHI), fosters collaboration on treatment, prevention and harm reduction.

- Poison centres, CANUTEC and NEEC can provide expert chemical exposure/event advice and assistance (in varying ways) 24 hours a day.

Challenges and areas that need strengthening

- Stockpiling and inventories of chemical antidotes.

- Pan-Canadian aggregation and analysis of poison centre data.

- Development of tools to support research during the acute response phase to chemical events with the aim of better enabling response and recovery efforts.

CE.2 Enabling environment in place for management of chemical events – Score 4

Strengths and best practices

- Provinces and territories have strategic, operational and tactical responsibilities similar to the federal government with respect to the management of emergencies that occur within their jurisdiction.

- Canadian laws support the principle of polluter responsibility, which means industry is accountable for taking adequate preventive actions and for having effective response plans in place.

- Internationally, Canada works with several partners and in bilateral and multilateral arrangements to advance and share knowledge in the area of emergency prevention, preparedness and response.

Challenges and areas that need strengthening

- Better integration of environmental public health research and information about past and ongoing responses.

- Standardization of chemical, biological, radiological and nuclear (CBRN) emergency response training.

- Resources to support the recovery phase of a chemical event.

Radiation emergencies

Introduction

To counter radiological and nuclear emergencies, timely detection and an effective response towards potential radiological and nuclear hazards/events/emergencies are required in collaboration with sectors responsible for radiation emergency management.

Target

States Parties with surveillance and response capacity for radiological and nuclear hazards/events/ emergencies. This requires effective communication and collaboration among the sectors responsible for radiological and nuclear emergency management.

Canada level of capacity

Under the *Emergency Management Act* (2007), Public Safety Canada (PSC) coordinates responses to radiological and nuclear emergencies. PSC supports the provinces and territories through the *Federal Emergency Response Plan* (2011), which provides an all-hazards framework for their respective radiation-related response plans that are commensurate to their assessed risks (for example the presence or absence of nuclear power plants or other industries that use radioactive material). Health Canada is the lead federal authority for the *Federal Nuclear Emergency Plan* (5th Edition, 2014), an event-specific annex to the Federal Emergency Response Plan that provides the supplemental arrangements for managing the health impacts of a nuclear emergency in areas of federal jurisdiction and in support of the provinces and territories. Health Canada also maintains the country-wide Canadian Radiological Monitoring Network (CRMN), specialized biodosimetry and reference laboratory capacities, decision-support systems and training and exercise programmes. CRMN provides both lab-based and online real-time updates of radiological monitoring. Health Canada also maintains mobile nuclear laboratories that can be deployed to perform radiation surveys, sampling and laboratory analysis in the field. The unique plans and systems maintained by Health Canada that ensure pan-Canadian coordination for specific radiation-related preparedness and emergency response are further supported by *Health Portfolio Emergency Response Plan* (2013) and the special provisions of its Nuclear Emergency Response Annex.

Licensed organizations or institutions that store or use radiological or nuclear material and devices are responsible for on-site surveillance and monitoring of their activities, which is enforced by the Canadian Nuclear Safety Commission (CNSC). CNSC, in part through the *Independent Environmental Monitoring Program* (IEMP), provides regulatory oversight for on-site activities of licensees, including surveillance/ monitoring, detection, assessment, and immediate response to a potential radiation-related emergency. Provinces and territories have primary responsibility for off-site issues, including monitoring and surveillance of radioactivity in the environment, which supplements the surveillance activities of CRMN. DND and CAF are responsible for monitoring at ports visited by nuclear-powered vessels, and will provide detection and notification of events involving such vessels. CFIA is responsible for food inspection, with additional analysis by Health Canada through the annual total diet study.

A federal technical assessment group supports or supplements the provincial and territorial expert advisory teams as needed to ensure alignment of protective actions, recommendations to the public, and other decisions in the event of a radiation-related emergency. In the provinces that have reactor facilities, the provincial plans, their associated hazard assessments, and their response capacities link directly to the *Federal Nuclear Emergency Plan* and the response plans of the facility operators. Two standing committees

also support the Federal Nuclear Emergency Plan: the Interdepartmental Radiological-Nuclear Emergency Management Coordinating Committee and the F/T/P Radiological-Nuclear Emergency Management Coordinating Committee. Canada is a signatory to the *Convention on Early Notification of a Nuclear Accident* (1986) and the *Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency* (1986), as well as an active contributor to the work of IAEA, including requesting an *Emergency Preparedness Review* (EPREV) in 2019. Health Canada and the CNSC are the national competent authorities for IAEA; CNSC reports on-site conditions and Health Canada reports off-site conditions, including coordinating as needed for appropriate IHR Annex 2 event assessment and reporting to WHO through the Canada NFP. CNSC issues licenses and certificates for certain kinds of packaging and transport of nuclear substances as stipulated in the *Packaging and Transport of Nuclear Substances Regulations* (2015). Transport Canada notifies the CNSC of reportable transport incidents involving radioactive material. An MoU between Transport Canada and CNSC outlines the regulatory responsibilities for enforceable actions involving radioactive materials in transport.

Canada has developed criteria for protective actions, including evacuation, sheltering, iodine thyroid blocking and relocation which are written into provincial nuclear plans. Federal guidance specific to radiological emergency response includes the *Generic Criteria and Operational Intervention Levels for Nuclear Emergency Planning and Response* (2018), which provides recommendations for protective action strategies during an emergency that apply to the public or off-site workers. The *Canadian Guide on Medical Management of Radiation Emergencies* (2015) provides information to medical responders and hospital personnel on screening, assessment and emergency room treatment of populations exposed to radiation or contaminated by radioactive materials. Provincial plans contain arrangements for monitoring and decontamination centres, including radiation screening, decontamination, and medical follow-up if necessary. Protocols exist for deploying federal assets, including equipment and expert personnel, to support decontamination following a radiation emergency. Provincial plans also designate and support preparedness at regional hospitals, although this varies considerably.

Despite the availability of interconnected and interoperable plans and systems across sectors and governments, the completeness and suitability of monitoring, preparedness and response capacities vary widely across the country but is generally aligned with the associated hazards. Despite having very low day-to-day risks, some provinces are suboptimally prepared for unexpected events, such as widespread contamination from a nearby or upstream province, a transportation accident or an intentional incident. Additionally, while there are small amounts of radiation countermeasures available, Canada lacks protocols for prioritized distribution in the event of an emergency, except for identified planning zones around nuclear reactors which are supported by detailed arrangements for potassium iodide distribution. Finally, participants in the evaluation recognized the challenges presented by responding to and recovery from a large-scale radiological incident; current preparedness strategies may not adequately address the size of effort, complexity of coordination, and communication challenges that would be faced, including the ability to quickly and comprehensively provide risk communication and address the psychosocial impacts of radiation-related events.

Recommendations for priority actions

- Complete and update the national hazard assessment to include psychosocial impacts of incidents and risk communication needs.

- Develop and promulgate a national radiation-related recovery framework that supports planning and capacity building among provincial stakeholders.

Indicators and scores

RE.1 Mechanisms established and functioning for detecting and responding to radiological and nuclear emergencies – Score 5

Strengths and best practices

- Robust detection systems with public access to real-time information and a well-developed regime/network for information, hazard assessment and mitigation planning.

- Top-down, multisectoral emergency management structures and comprehensive planning guidance with bottom-up stakeholder engagement and regulatory compliance with shared oversight.

Challenges and areas that need strengthening

- Low levels of planning and resource allocation for radiation incidents where day-to-day risks are typically low.

- Uncertainty regarding capacities among all federal agencies and across government levels to build and sustain response and recovery to a large-scale or protracted incident.

RE.2 Enabling environment in place for management of radiation emergencies – Score 5

Strengths and best practices

- Strong, well-organized regulatory environment comporting to international standards with buy-in across all sectors and levels of government.

- Arrangements are in place to identify and deploy federal resources to support local responses to radiation events, including provision of technical assistance and public communications.

Challenges and areas that need strengthening

- Lack of comprehensive recovery planning/guidance in existing plans.

- Gaps in understanding regarding public perceptions, behaviours, and information needs in the context of a radiation scare or incident.

Annex 1: JEE background

Overview of mission agenda, 11-20 June 2018

Date	Activities	Location
11 June	Preparatory meetings	Lord Elgin Hotel, Ottawa, Ontario
12 June	Welcome and opening remarks Overview of the Canadian public health system and relevant components of the national Health Portfolio	PHAC, Ottawa, Ontario
13 June	Visit to the Ontario Emergency Medical Assistance Team (EMAT), Health System Emergency Management Branch (HSEMB), Ministry of Health and Long-Term Care of Ontario Province, at the Sunnybrook Center for Prehospital Medicine Visit to Toronto Pearson International Airport	Toronto, Ontario
14 June	Visit to the Canadian Science Centre for Human and Animal Health (CSCHAH) hosting the National Microbiology Laboratory (NML) and the National Centre for Foreign Animal Diseases (NCFAD) Technical discussion: • National Laboratory System	Winnipeg, Manitoba
15 June	Technical discussions: • National legislation, policy and financing • Medical countermeasures and personnel deployment • Food safety • Zoonoses disease • Antimicrobial resistance	PHAC, Ottawa, Ontario
16 June	Visit to the Health Portfolio Operations Centre (HPOC) Technical discussions: • Preparedness • Emergency response operations • International Health Regulations coordination • Reporting	PHAC, Ottawa, Ontario
18 June	Technical discussions: • Chemical events • Radiation emergencies • Biosafety and biosecurity • Real-time surveillance • Immunization	PHAC, Ottawa, Ontario
19 June	Technical discussions: • Points of entry • Workforce development • Linking public health and security • Risk communications	PHAC, Ottawa, Ontario
20 June	Presentation of the mission's preliminary findings	PHAC, Ottawa, Ontario

Key host country participants and institutions:

Agencies' Leaders

Public Health Agency of Canada
- Siddika Mithani, President
- Theresa Tam, Chief Public Health Officer
- Howard Njoo, Deputy Chief Public Health Officer
- Carlo Beaudoin, Chief Financial Officer
- Roger Ermuth, Vice President, Health Security Infrastructure Branch (HSIB)
- Kim Elmslie, Vice President, Infectious Disease Prevention and Control Branch (IDPCB)
- Sally Thornton, Vice President, Health Promotion and Chronic Disease Prevention Branch (HPCDPB)
- Steven Guercio, Executive Director, National Microbiology Laboratory (IDPCB)
- Jim Harris, Director General, Centre for Emergency Preparedness and Response, HSIB
- Cindy Evans, Director General, Centre for Biosecurity, HSIB
- Theresa Redmond, Director General, Regional Operations, HSIB
- Matthew Gilmour, Scientific Director General, National Microbiology Laboratory, IDPCB
- Gina Charos, A/Director General, Centre for Immunization and Respiratory Infectious Diseases, IDPCB
- Bersabel Ephrem, Director General, Centre for Communicable Diseases and Infection Control, IDPCB
- Steven Sternthal, Director General, Centre for Food-borne, Environmental, Zoonotic and Infectious Diseases, IDPCB
- Shelley Borys, Director General, Evaluation and Chief Audit Executive, Office of Audit and Evaluation
- Sheriff Abdou, Executive Director, Office of Strategic Policy and Planning

Health Canada
- Robert Ianiro, Assistant Deputy Minister, Healthy Environments and Consumer Safety Branch (HECSB)
- Jennifer Hollington, Assistant Deputy Minister, Communications and Public Affairs Branch (CPAB)
- Tim Singer, Director General, Environmental and Radiation Health Sciences Directorate, HECSB
- Sara MacKenzie, Director General, Public Health Strategic Communications Directorate, CPAB

Canadian Food Inspection Agency
- Jaspinder Komal, Executive Director and Chief Veterinary Officer, Animal Health Directorate

Indigenous Services Canada – First Nations and Inuit Health Branch
- Tom Wong, Chief Medical Officer of Public Health & Executive Director, Office of Population and Public Health

Technical Discussion Sessions – Key Presenters

- Brian Ahier, Director, Radiation Protection Bureau, Environmental and Radiation Health Sciences Directorate, Health Canada

- Dorcas Taylor, Federal Lead, MLISA Technical Annex Development, PHAC

- Chris Archibald, Director, Surveillance and Epidemiology Division, Centre for Communicable Diseases and Infection Control, PHAC

- Christine Gagnon, Toxicologist, Chemical Emergency Preparedness and Response Unit, Health Canada

- Francois-William Tremblay, Manager, Canadian Field Epidemiology Program, PHAC

- Genevieve Lacroix, Director, Laboratory Biosecurity, PHAC

- Gina Howell, Director, Office of Border and Travel Health, PHAC

- James Scala, Exercise Program Manager, PHAC

- Jean-François Duperré, Acting Executive Director, Centre for Emergency Preparedness and Response, PHAC

- Jennifer Pennock, Director, Surveillance and Epidemiology, PHAC

- John Topping, Formerly Director, Office of Situational Awareness and Operations, Centre for Emergency Preparedness and Response, PHAC

- Katharine Acs-Charter, Program Manager, IHR Program, PHAC

- Laura Russo, Director, Public Health Strategic Communications, HC

- Lindsay Noad, Former Special Advisor for Antimicrobial Resistance, PHAC

- Lisa Filipps, Manager, Risk and Emergency Communications Division, Health Canada

- Lynn Menard, Chief, Health Portfolio Operations Centre, PHAC

- Mary Louise Graham, Director, Office of Biosafety and Biocontainment Operations, PHAC

- Melanie Kirkey, Senior Advisor, Travel Health Outreach and Promotion, PHAC

- Melissa Lee, Chief, Medical Countermeasures Unit, PHAC

- Narmin Kassam, National Manager, Travelling Public Program, PHAC

- Nicolas Gilbert, Senior Epidemiologist, PHAC

- Peter Buck, Manager, Domestic and International Zoonoses Technical Team, Policy Integration and Zoonoses Division, PHAC

- Raymonde Hickey, Public Health Advisory, Quarantine Program, PHAC

- Richard Wootton, Emergency Management Advisor, Chemical Emergency Preparedness and Response Unit, Health Canada

- Russell Mawby, Formerly Director, Centre for Public Health Capacity, PHAC

- Sara MacKenzie, Director, Public Health Strategic Communications, Health Canada

- Stephen Parker, Manager for Enteric Surveillance, Food-Borne Disease and Antimicrobial Resistance Surveillance Division, PHAC

- Tammy Delaney-Plugowsky, Senior Manager, Stockpile Review & Investment Planning, National Emergency Strategic Stockpile, PHAC

- Theodore (Ted) Kuschak, Director of Networks and Resiliency Development, National Microbiology Laboratory, Infectious Disease Prevention and Control Branch, PHAC

Technical Discussion Sessions – Additional Participants (Grouped by Agency)

- Canada Border Services Agency (CBSA): Dany Julien

- Canadian Food Inspection Agency (CFIA): Alfonso Clavijo, John Copps, Andrea Ellis, Michelle Illing, Daniel LeClair, Pierre Lafortune

- Canadian Nuclear Safety Commission (CNSC): Richard Tennant

- Department of National Defence (DND): Kirsten Barnes, Pierre Morissette, Heather Morin, Elizabeth Harris, Brent Jones, Vincent Beswick-Escanlar

- Environment and Climate Change Canada (ECCC): Sam Iverson, Tanya Bryant, Dale Gration

- Health Canada (HC): Kevin Buchanan, Denise MacGillivray, Barbara Lee, Dominique Nsengiyumva, Carolyn Koekman, Jocelyn Stoate, Manisha Mehrotra, Mary-Jane Ireland, Patricia Pelletier

- Indigenous Services Canada (ISC): Samina Aziz, Rene Dion, Patricia Huntly, Michele Mousseau-Bailey, Cassandra Crowder

- Public Safety Canada (PSC): Mike Ashman

- Public Health Agency of Canada (PHAC): Tracy Gibbons, Cathy Jorowski, Jan Trumble-Waddell, Jay Krishnan, Melissa Phypers, Shamir Mukhi, Sharla Beddome, Stacey Mantha, Todd Coulter, Nicolas Palanque, Martin Chartier, Dina Juras, Paul Partridge, Olga Cechmistro-Michie, George Golding, Mike Mulvey, Allan Lau, Laura Landry, Tracie Eisbrenner, Barbara Raymond, Gavin Brown

- Royal Canadian Mounted Police (RCMP): Jeff Thompson, Deanne Morgan

- Transport Canada (TC): David Jarell, Louis Marcotte, Joseph Satenstein

Representatives of Provinces and Territories

- Claire Betker, A/Executive Director Active Living, Population and Public Health, Government of Manitoba

- Clint Shingler, Director, Health System Emergency Management Branch, Ontario Ministry of Health and Long-Term Care

- Cristin Muecke, A/Deputy Chief Medical Officer of Health, Department of Health, Government of New Brunswick

- Dean Blue, Senior Public Health Advisor, Office of the Chief Medical Officer of Health, Alberta Health, Government of Alberta

- Jasmine Pawa, Deputy Chief Medical Officer of Health (Locum), Department of Health, Government of Nunavut

- Jason Letto, Manager, Health Emergency Management Program, Department of Health and Community Services, Government of Newfoundland and Labrador

- John Coyne, Manager, Emergency Management Unit, Health and Social Services, Government of Yukon

- Paul Van Caeseele, Medical Director, Cadham Provincial Public Health Laboratory, Government of Manitoba

JEE mission team members

- Anne Susanne Münstermann, BS Veterinary Medicine, Ph.D. (Parasitology/Serology), Specialization in Tropical Veterinary Medicine – Representing OIE, Bonn, Germany

- Carla Moretti, graduate in Political Science, Master in International Relations – Advisor on legislative issues and International Health Regulations, Ministry of Health, Buenos Aires, Argentina (Observer)

- Christopher L Perdue, MD, MPH – Chief for IHR Policies and Programs, US Department of Health and Human Services, Office of the Assistant Secretary for Preparedness and Response, Washington, DC, US (JEE Team Lead)

- Dina Pfeifer, MD, MSc (Microbiology and Parasitology) – Programme Manager for Food Safety, WHO Regional Office for Europe, Health Emergency Programme, Copenhagen, Denmark

- Jose Alberto Diaz Quiñonez, Ph.D. in Biomedical Sciences – Deputy Director of the Institute of Epidemiological Diagnosis and Reference (InDRE) and Head of the WHO Collaborating Centres MEX-29, MEX-31, and MEX-32, Secretary of Health, Mexico City, Mexico

- Lara Romano Daibert, Bachelor of Laws, Specialization in International Relations – PAHO/WHO Temporary Advisor, Brazil (Mission Rapporteur)

- Leticia Linn Campana, BA in Social Communication, MA Journalism – Advisor on Media Relations and Communication, Public Affairs Coordinator, PAHO/WHO, Washington DC, US

- Roberta Andraghetti, MD, MPH, DHTM – Regional Advisor - International Health Regulations, PAHO Health Emergencies Department, PAHO/WHO, Washington DC, US

- Stacey Marie Wyke, Ph.D. Cancer Biochemistry, BS, Diploma in Medical Toxicology, Post Graduate Certificate in Epidemiology and Statistics – Chemicals and Poisons Groups, Centre for Radiation Chemicals and Environmental Hazards and staff of the WHO Collaborating Centre UNK-179, Public Health England, London, United Kingdom

- Ximena Paz Aguilera Sanhueza, MD, MPH – Director of the Center for Epidemiology and Health Policy, Universidad del Desarrollo, Santiago, Chile, and member of the IHR Roster of Experts (JEE Team Co-lead)

- Dr. Isabella Danel, PAHO/WHO Deputy Director, accompanied the JEE mission on 12 June 2018.

Supporting documentation provided by host country

National legislation, policy and financing

- All Acts and Regulations of Canada are consolidated and available at http://laws.justice.gc.ca/eng/, which is regularly updated.
- *Privacy Act* (1985)
- *Department of Health Act* (1996)
- *Public Health Agency of Canada Act* (2006)
- *North American Plan for Animal and Pandemic Influenza* (NAPAPI, 2002)

IHR coordination, communication and advocacy

- Guideline for internal/external communication of an International Health Regulations (IHR) - Notification to PAHO/WHO (2017)
- Canada's International Health Regulations National Focal Point - Standard Operating Procedures (2018)

Antimicrobial resistance

- Embedded in the text

Zoonotic diseases

- Assessment of non-enteric zoonotic diseases of public health significance with the highest risk of emergence or re-emergence in Canada (2012)

Food safety

- Federal Food Safety Communications Protocol for National Food-Borne Illness Outbreaks (2005)

- Memorandum of Understanding between Health Canada and the Canadian Food Inspection Agency regarding roles during an event or emergency (1999)

- Memorandum of Understanding between Health Canada, the Public Health Agency of Canada, and the Canadian Food Inspection Agency for common issues that impact human health (2008)

Biosafety and biosecurity

- National Microbiology Laboratory's Biosafety Manual (2004)

Immunization

- Embedded in the text

Surveillance

- *Canadian Biosafety Guideline: Developing a Comprehensive Biosecurity Plan* (2016)

- *Plan for Administrative Oversight for Pathogens and Toxins in a Research Setting - Required Elements and Guidance* (2015)

Reporting

- Embedded in the text

Human Resources

- International Health Regulations National Focal Point (NFP) Office of Canada - Privacy Impact Assessment (2016)

- Guideline for internal/external communication of an International Health Regulations (IHR) - Notification to PAHO/WHO (2017)

- Federal Health Portfolio protocol for information sharing with international partners and under the International Health Regulations (IHR) for food safety or foodborne illness events (updated: 2017)

Emergency Preparedness

- *Evaluation of the Public Health Agency of Canada's Public Health Workforce Development Activities 2010-2011 to 2014-2015* (2016)

Emergency Response

- Embedded in the text

Linking public health and security authorities

- *Nuclear Terrorism Act* (2013)
- Health Portfolio Operations Centre (HPOC) - Standard Operating Procedures

Medical countermeasures and personnel deployment

- Embedded in the text

Risk Communication

- Protocols for Health Emergency Risk Communication- Health Canada's Communications and Public Affairs Branch (2013)
- Terms of Reference- Public Health Network Communications Group (Reviewed, 2016)
- Toolkit for Health Risk Communicators- Health Canada's Communications and Public Affairs Branch (2016)

Points of entry

- Embedded in the text

Chemical events

- Embedded in the text

Radiation

- *Radiation Emitting Devices Act* (1985) and related *Regulations* (last amended 2018)
- *Nuclear Safety and Control Act* (1997)
- *Generic Criteria and Operational Intervention Levels for Nuclear Emergency Planning and Response* (2018)