Rapid Review

NORTH AMERICAN OBSERVATORY on Health Systems and Policies

COVID-19 Case and Contact Management Strategies in Canada

A Rapid Review Prepared for the Public Health Physicians of Canada

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About

Public Health Physicians of Canada (PHPC) is the national specialty society for Public Health and Preventive Medicine (PHPM) specialists and other physicians working in public health across Canada.

The North American Observatory on Health Systems and Policies (NAO) is a collaborative partnership of interested researchers, research organizations, governments, and health organizations promoting evidence-informed health system policy decision-making.

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List of Acronyms and Abbreviations

AB	Alberta
AHS	Alberta Health Services
BC	British Columbia
CORES	Coronavirus Rapid Entry Case and Contact Management System
COVID-19	Coronavirus disease 2019
CTI	Contact Tracing Initiative
FNHA	First Nations Health Authority
GOARN	Global Outbreak Alert and Response Network
GPS	Global Positioning System
HHS	Home Health Monitoring (Telus)
iPHIS	Integrated Public Health Information System
IT	Information Technology
LPN	Licensed Practical Nurses
MB	Manitoba
NL	Newfoundland and Labrador
NS	Nova Scotia
OCAP	Ownership, Control, Access, and Possession (Principles)
P/T	Province/Territory
PCR	Polymerase Chain Reaction
PHAC	Public Health Agency of Canada
PHO	Public Health Ontario
PHPC	Public Health Physicians of Canada
PHU	Public Health Unit
PPE	Personal Protective Equipment
QC	Quebec
SARS-CoV-1	Severe Acute Respiratory Syndrome Coronavirus 1
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
SBAR	Situation, Background, Assessment, Response
SHA	Saskatchewan Health Authority
SK	Saskatchewan
WHO	World Health Organization

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Executive Summary

In Canada, the first case of coronavirus disease 2019 (COVID-19) was identified on January 25, 2020, and as of September 28, 2020, there have been 155,301 confirmed cases and 9,278 associated deaths. The number of cases initially peaked in Canada between April and May 2020, with the first wave being largely mitigated through large-scale response measures and restrictions. However, a second wave of infections has been expected at the start of fall 2020. Adequate case and contact management capacity – a core activity of communicable disease investigations – has been identified as an important component of a comprehensive response strategy for COVID-19.

There are few reports on how case and contact management efforts have been conducted across the Canadian jurisdictions to meet the challenges of the pandemic. In particular, understanding workforce upstaffing strategies, the use of technology, and adaptations to special populations, which have experienced the greatest burden of COVID-19 cases and deaths, is key for responding to future waves of infections. Building on a prior rapid review on COVID-19 case and contact management experiences from selected international jurisdictions, we conducted an environmental scan of the literature and consulted with a convenience sample of local experts, which primarily consisted of Medical Officers of Health, from seven Canadian provinces to understand case and contact management approaches and experiences across Canada. The goal of this report is to share promising practices and challenges with public health physicians in Canada in order to facilitate ongoing COVID-19 case and contact management efforts.

In the select provinces, upstaffing for case and contact management was typically achieved within two to four weeks by way of new hires, internal and external redeployment, and partnerships with health professional organizations. Innovative upstaffing practices included accessing and training federal employees and medical trainees. However, training new staff presented persistent challenges in terms of adequately matching staff expertise with the required roles, developing training programs, and increasing staff workload. In addition, few jurisdictions have specified workforce targets, concrete surge plans, or criteria for activating the surge plans.

Most cases across Canada are laboratory-confirmed and case and contact follow-up is performed via telephone. Some jurisdictions specified targets to reach cases within 24 hours of laboratory notification and to reach contacts within 24-48 hours of their identification; however, some challenges in the case and contact management processes exist. These include the use of paper-based methods (e.g., batched fax) for laboratory notification, resulting in duplicate records; limited access to testing and misunderstanding of the role of testing; and an inability to reach cases and contacts by telephone, which significantly extends follow-up times. The limitations of information technology platforms, routinely used for investigations of reportable diseases, further compound these issues due to their limited interoperability with other systems, reliance on manual data entry, and limited data extraction and data sharing capabilities.

Many provinces have considered or developed a contact tracing/exposure notification smartphone application (“app”); however, these efforts were halted in favour of the federally commissioned Bluetooth-based app (COVID Alert), which uses the international Apple/Google “privacy-preserving” framework. COVID Alert was launched in Ontario in late July 2020 and, as of September 2020, has been rolled out in Newfoundland and Labrador, New Brunswick, and Saskatchewan. While in theory such technologies may be promising for identifying asymptomatic contacts not known to cases, several

limitations regarding their effectiveness exist, including the lack of interpersonal interaction, the possibility of inadequate uptake and use, accessibility and privacy concerns, and imprecision in exposure identification. To address the identified challenges, the following considerations and best practices have emerged from the environmental scan and local expert consultations:

- **Setting staffing targets and developing rapid training programs and templates** that minimize the time requirements for experienced staff can help achieve staff capacity in a short amount of time. Specific staffing targets (e.g., ratio of staff to the number of cases or testing volume) may also help inform the criteria for activating the surge plan.
- Developing **information technology systems that are integrated** with laboratories and electronic medical records, where feasible, may eliminate the reliance on paper-based documentation and manual data entry. Such systems may also help prioritize and streamline test result notifications (e.g., for those with negative results) and follow-up (e.g., for low-risk contacts) through automated means (e.g., SMS texting, email).
- **Using other communication technologies** (e.g., SMS texting, Facetime, Zoom, Microsoft Teams) may be helpful for communicating with cases and contacts that are less likely to follow public health guidance. Such tools may also be useful for information-sharing among case and contact management teams, particularly those working across jurisdictions.
- **Improving communication and information sharing** with laboratories and other partners may reduce the identified time delays. Improved communication pathways may also help disseminate best practices, guidelines, and training resources, that way reducing duplication in these efforts.
- **Involving public health professionals in app development and developing standard performance indicators** may help mitigate the challenges related to the use of exposure notification apps, including the lack of interpersonal communication, limited uptake and use, and imprecision in exposure detection. Regardless, apps should be viewed as supplementary tools to existing case and contact management processes, rather than as their replacements.
- **Establishing specialized working groups** is a best practice for case and contact management in settings or populations deemed to be at an increased risk of infection or poor COVID-19 outcomes (e.g., remote areas, long-term care facilities, meat processing plants, homeless shelters, and schools). The activities of such working groups include developing rapid response resource teams, tailoring infection prevention and control guidelines, and establishing partnerships with relevant community stakeholders.
- Publishing case count data from low-density areas may present privacy challenges, while aggregated data could impede understanding of disease transmission mechanisms. **Considerations of the local context and community engagement are necessary to inform data sharing decisions**.
- Innovative practices in case and contact management, such as door-to-door **active case finding and supported isolation and quarantine** (including support with housing, finances, substance use, and cleaning supplies) may help reduce the barriers to testing and follow-up among higher-risk populations.

Considering the already strained public health and healthcare systems, many of these mechanisms may not be feasible for immediate implementation and may be more relevant for longer-term planning. Adaptation to the local context and expertise are important in interpreting these considerations.

Introduction and Background

In Canada, the first case of coronavirus disease 2019 (COVID-19), a respiratory illness caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), was identified on January 25, 2020 (1,2). As of September 28, 2020, there have been 155,301 confirmed cases and 9,278 associated deaths in Canada (1). In the absence of safe and effective vaccines and antiviral treatments, countries have relied on large-scale public health response measures to mitigate the spread of COVID-19. In Canada, interventions have included state of emergency declarations, physical distancing announcements, school and nonessential business closures, and restrictions on travel and social gatherings (3–6).

Public health systems focus on the health of communities and populations – this includes work in population health assessment, health surveillance, health protection, health promotion, disease and injury prevention, and emergency preparedness and response (7). Case and contact management is a routine activity of communicable disease follow-up, which involves "identifying, assessing, and managing people who have been exposed to a disease to prevent onward transmission" (8,9). The World Health Organization (WHO) considers case and contact management to be an important component of a comprehensive response strategy for COVID-19 (8,10). The WHO has further urged governments to scale-up case and contact management capacity by establishing an appropriate workforce, implementing information technology (IT) platforms, and enhancing surveillance in populations deemed to be at high risk of infection (8). This need has been reflected among Canada's provincial and territorial (P/Ts) reopening strategies (11–14).

In light of public health and healthcare system variation among P/Ts, there are few reports on how case and contact management efforts have been adapted across Canadian jurisdictions to meet the challenges of the pandemic (15,16). Considering that a greater burden of the first wave of the pandemic was borne by poorer, racialized, migrant (17,18), and older long-term care populations (19,20), more targeted case and contact management approaches may be helpful.

Building on our prior rapid review on COVID-19 case and contact management experiences from selected international jurisdictions (21), the aim of this rapid review is to describe COVID-19 case and contact management approaches and experiences across Canada. Specifically, we focus on the necessary workforce capacity, processes and guidelines, use of technology, and approaches for special settings and populations to conduct case and contact management. Considering the already strained public health and healthcare systems, it should be noted that many mechanisms may not be feasible for immediate implementation and may be more relevant to longer-term planning. Adaptation to the local context and expertise are important in interpreting the identified considerations and best practices.

Methods

In this rapid review, we performed an environmental scan and local expert consultations to explore COVID-19 case and contact management approaches across Canadian jurisdictions.

Environmental Scan

The environmental scan involved targeted searches of databases and search engines (e.g., MEDLINE and Google Scholar), COVID-19 databases (e.g., Johns Hopkins Coronavirus Resource Center, University of Toronto Gerstein Science COVID-19 Information Guide), and grey literature sources (municipal, P/T, and federal government websites, medical associations, and other health information organizations, technical reports, as well as press releases and media reports). This was an iterative process whereby the initial scan identified literature gaps that informed the local expert survey and interview guide; subsequent scans were performed to ensure information was recent, and to supplement information obtained from the local experts. A standard template was used for data extraction.

Interviews and Surveys with Local Experts

The environmental scan of the literature was supplemented with local expert consultations. Local experts were public health professionals in Canada who are involved in COVID-19 case and contact management. Local experts were identified by the Public Health Physicians of Canada (PHPC) network and were invited by the North American Observatory on Health Systems and Policies (NAO) to take part in an interview and/or survey on case and contact management. The complete interview guide is reproduced in **Appendix A** and the complete list of survey questions is provided in **Appendix B**. Interview and survey participants were also invited to share the case and contact management resources used in their jurisdiction (e.g., case report forms, contact list forms, daily monitoring forms, communicable disease protocols, or training materials). Interviews were conducted using tele- and videoconferencing technologies (telephone, Zoom, Microsoft Teams), and lasted from 30 minutes to 1 hour. Interviewers (DB, KV) took detailed notes of the conversations. In some cases, local experts completed both the interview and the survey. Responses have been categorized by region to maintain anonymity. **Table 1** provides a regional distribution of the local expert participants. As discussed below in the Limitations section, it should be noted that not every province in each geographic region is represented in the report.

Table 1. Overview of local experts by region

Region	Local Experts	
	Interview	Survey
Western (BC, AB, SK, MB)	4	3
Central (ON, QC)	9	5
Atlantic (NS, NB, PEI, NL)	3	-
Other	1	-
Total	17	8

Limitations

Due to the expedited nature of this report, convenience sampling methods were used. All but two respondents were public health physicians (primarily local and regional Medical Officers of Health). Thus, we are missing perspectives of other clinical and non-clinical staff involved in COVID-19 case management and contact tracing efforts. Some local experts were independent contractors brought on to consult with health authorities; as such, they may not have been directly involved in decision-making and their views may not represent those of the health authorities themselves.

We were able to reach local experts from seven provinces and as a result, focus on key highlights from those areas in this report. Given the differing levels of health authority organization and centralization, the reported processes and practices may be more representative of some provinces over others.[1] It is also likely that many reported processes, practices, and examples are occurring more broadly across the country, including the P/Ts that we were unable to capture. In addition, this report is focused on the urban context, as there is limited information on remote contexts and the territories. Notably, we were unable to recruit individuals from Indigenous health agencies/governments conducting COVID-19 case and contact management in Indigenous communities, including those on reserves.

Literature searches were conducted and updated on a rolling basis between May 19 and September 20, 2020, while local expert interviews and surveys took place between July 9 and August 28, 2020; the information contained here thus reflects the situation at that time. In addition, as acknowledged by other evidence synthesis experts, much of the COVID-19 information is available in non-peer-reviewed sources, including press releases, news articles, technical reports, and unpublished research/preprints (22).

Finally, this review focuses on case and contact management of COVID-19 only, and does not explore other public health or government actions that may contribute to its containment.

[1] Some health authorities (Alberta, Nova Scotia, Saskatchewan) are actually single provincial agencies and thus, the identified practices are likely to be representative at the province-level despite the fact that few local experts were consulted. Findings from the other Canadian jurisdictions may be less comprehensive due to a lower number of local experts reached and a higher degree of health system decentralization. One exception may be Ontario: although Ontario has the most decentralized public health system in the country, we were able to reach more local experts at both the local/municipal and provincial level, which allowed us to identify congruent practices. Where possible, we sought to close these gaps through the environmental scan of the literature, which was updated on an ongoing basis. While a detailed discussion of Canada's public health context is beyond the scope of this review, additional information can be obtained elsewhere (see: Public Health Physicians of Canada Resident Council [2019, December]. Public Health Systems in Canada. Available at: http://www.phpc-mspc.ca/resources/Documents/PHSC-24Jul20.pdf. Last accessed: September 29, 2020).

Analytic Overview

Given its rapid nature, this report provides highlights from seven provinces for which both literature and local expert information was available. The report is organized by four themes that emerged from the literature scan and local expert consultations; these themes are outlined in **Table 2**.

Table 2. Thematic overview

Theme	Description
Workforce	The workforce resources required to support case and contact management, including strategies to increase staff, capacity targets, and surge plans; innovative practices and challenges related to increasing staff capacity; and essential skills and training processes.
Processes and guidelines	The specific targets, innovative practices, and challenges related to case and contact identification and management processes.
Technology	The use of technology in case and contact management, including promising practices and limitations of information technology systems and smartphone applications.
Special populations	Case and contact management processes used among specific populations and settings deemed to be at a higher risk of poor COVID-19 outcomes (e.g., individuals experiencing homelessness, those living in long-term care facilities, Indigenous communities, rural and remote populations, and other congregational settings). The use of working groups and local partnerships is highlighted.

Workforce and Skills for Case and Contact Management

Staff capacity

Workload for public health teams has been substantial and sustained throughout this pandemic. Variation in outbreak epidemiology and local context exist; however, most local experts reported that their jurisdictions did not have specific staff capacity targets for case and contact management. Local experts further noted that, on average, increased staff capacity was achieved within two to four weeks of when the need for more staff was identified (e.g. first case surge). **General staff capacity targets** included:

- To have enough staff to be able to finish the contact tracing work, ideally without requiring extended work hours, as described in one Western and one Central province.
- To substantially increase staff, ranging from a two- to five-fold increase, as described in one Western and one Atlantic province.
- The European Centre for Disease Control staffing estimation of one case investigator managing two cases per day (as long as the number of contacts is not more than 10) (23), as described in one Central province.

One jurisdiction in Central Canada reported a specific target of approximately 1,400 staff, which was based on the maximum daily number of cases identified there (approximately 300 individuals per day). Another suburban jurisdiction in Central Canada noted that they had enough capacity for each case to be reviewed by a Medical Officer of Health, which was viewed as a strength.

Case and contact management **public health teams were described to be staffed as follows**: (i) public health nurses supervising registered nurses involved with contact management; (ii) registered nurses performing case investigation and contact identification, while other nursing and non-nursing staff perform contact notification and daily monitoring; (iii) a designated COVID Response Team, composed of public health nurses and public health inspectors, conducting case and contact management; and (iv) trained Communicable Disease Investigators performing case and contact management. At least one jurisdiction was exploring the use of Licensed Practical Nurses (LPNs) as well as logisticians to support the rapid response team deployment.

Strengths related to building staff capacity identified by local experts included: (i) having a centralized workforce to facilitate the coordination of resources and share information, and to streamline the command system and communication; (ii) redeploying staff (both internally and externally); (iii) bringing on recently retired nurses, hiring new staff through job postings, and establishing new partnerships, such as that with the Registered Nurses Association of Ontario (24); and (iv) working with teams of volunteer medical students, residents, and staff physicians to conduct case and contact management. In Ontario, emergency orders facilitated the formation of mutual aid agreements between non-adjacent public health units (PHUs), enabling redeployment of staff.

Specific upstaffing innovations from Public Health Ontario (PHO)[2] in Ontario and a joint effort by Alberta Health Services (AHS)[3] and the University of Calgary in Alberta are highlighted in **Box 1**.

Some local experts from Western and Central Canada stated that their surge plan was in progress or that it would be developed as the need arose. Others noted that the **surge plan to increase case and contact management staff capacity** could include:

- Reaching out to neighbouring jurisdictions for additional staff, as noted in a Central jurisdiction.
- Identifying specific individuals who could be redeployed at short notice, as noted in the Atlantic and Central jurisdictions.
- Redeploying more public health nurses or environmental health officers or hiring additional nurses, as noted in a Western jurisdiction.
- Identifying specific criteria to initiate the surge plan. For example, a local expert noted that the surge plan may be triggered by an increase in the number and rate of cases, the number of cases with unknown epi-links, the amount of testing, and/or staff workload, such as overtime hours.

[2] PHO is an arm's-length Crown agency created in 2008 after the SARS-CoV-1 outbreak to provide scientific and technical guidance to Ontario's PHUs and the Ministry of Health and Long-Term Care, as well as to manage the province's public health laboratory system.

[3] AHS is Alberta's single centralized health authority with both healthcare delivery and public health responsibilities.

Box 1. Innovative practices for increasing case and contact management staff capacity

In Alberta, as the number of cases surged mid-March 2020, an urgent request was put out by the University of Calgary to recruit volunteer medical students to perform contact tracing. The initial positions were filled within 24 hours and 150 individuals were trained by AHS within five days of the request (25,26). Physicians, as well as students and residents from the University of Alberta were also subsequently engaged (25,27) and the training materials from this initiative have been shared with public health physicians across the country by PHPC (26). This effort more than quadrupled the province's contact tracing capacity (26). At the height of the pandemic in April and May, over 400 individuals were performing contact tracing, tracing over 10,000 cases per day and making as many as 18,000 telephone calls per day (28). An average of four to six people were contacted along a potential chain of infection (28). The size of the contact tracing team was reduced to 240 people in July 2020 (28). The personal rapport established during the investigations was reported to be beneficial in encouraging people to self-isolate (27,28). Other strengths of the approach included the adaptability and technological savvy of medical trainees, the flexibility of team roles, and a reduced medical hierarchy.

In Ontario, PHO created the Contact Tracing Initiative (CTI) to provide contact follow up support to Ontario's PHUs (29). The local PHU first identifies high-risk contacts, and then sends a referral to the CTI with this list. Information is relayed centrally via the Canadian Network for Public Health Intelligence to a team of callers, termed the COVID-19 Workforce. These callers include federal staff from Health Canada and Statistics Canada, trained by PHO. These callers conduct daily contact monitoring. Weekly updates are sent to PHUs, and contacts who do not adhere to public health guidance or who could not be reached are referred back to PHUs. CTI has been used by at least 12 of Ontario's 34 PHUs. A key challenge involved developing a standardized script for callers that would meet the needs of all the PHUs, due to a need for revisions as protocols among PHUs changed.

Skills and training

The essential **knowledge and skills required for case and contact management** were described to include healthcare, public health, and communicable disease knowledge (e.g., understanding basic disease transmission principles and epidemiology, health protection frameworks, public health ethics, health information, privacy legislation and legal considerations, and the ability to answer health-related questions); excellent communication and interpersonal skills; collaborative problem solving and conflict resolution skills; and computer literacy. Local experts also noted that responding to COVID-19 involved leveraging the skills of public health staff in investigating more routine outbreaks of reportable communicable diseases (e.g., hepatitis, tuberculosis, sexually transmitted infections).

Specific training approaches included job shadowing or mentoring, didactic and virtual modules[4], and using process maps or question templates. Access to job shadowing, mentoring, or opportunities to be paired with more experienced staff were noted as being particularly valuable resources for new staff. Process maps and templates helped to maintain a consistent approach to case and contact management between staff, as noted by local experts from Atlantic and Central Canada. In some jurisdictions, **specific training content** included COVID-19 epidemiology; privacy and confidentiality; internal standard operating procedures; the Situation, Background, Assessment, Recommendation (SBAR) tool[5]; a list of red

[4] Modules were developed locally or adapted from other jurisdictions, such as the Johns Hopkins School of Public Health six-hour online course on contact tracing, available free-of-charge on Coursera.

[5] The SBAR tool was originally developed to structure team communication in acute care settings. This method prompts healthcare providers to articulate critical situations clearly and succinctly and is widely cited in the quality improvement and patient safety literature.

flags to alert staff to notify the Medical Officer of Health; and adaptations to specific local contexts (e.g., long-term care facilities or occupational exposures).

Strengths related to training practices identified by local experts included: (i) rapid development of accelerated training programs; (ii) continuous improvement or "fine-tuning" of training programs as more staff were added; and (iii) provision of additional in-depth training on COVID-19 specifics.

Challenges related to achieving staff capacity and training new or redeployed staff noted by local experts included logistical barriers, varying levels of skill and training needs, high demand for qualified staff in surge times, team cohesion and remote work, physical space limitations, lack of pre-existing training opportunities, and an increased workload:

- Local experts from Western and Central Canada noted an abundance of individuals willing to do contact tracing from the federal government's National COVID-19 Volunteer Recruitment Campaign; however, union limitations, corporate policies restricting the use of volunteers, and privacy concerns presented **barriers to organizing, mobilizing, and training people**. Indeed, others from Western, Central, and Atlantic Canada noted that pooling a large volunteer contact tracing workforce alone is not sufficient, as **specialized skills are required**. The workload required to onboard the volunteers was prohibitive in some jurisdictions and the sensitivity of patient health information may also impede onboarding volunteer staff (24).
- There is a **lack of consensus on whether onboarding inexperienced staff is more beneficial than redeploying staff from other healthcare sectors**. While inexperienced staff may be easier to train, they may also have difficulty keeping up with changing protocols while still mastering the more basic concepts of case and contact management. On the other hand, while redeployed staff may have some skills that are relevant to case and contact management (e.g., taking patient histories), their expertise may vary, resulting in non-uniform training needs. In addition, redeployed staff may confound their existing healthcare roles with those required by case and contact management; as such, matching redeployed staff expertise with the required roles is a challenge.
- Continuous staff turnover and redeployment may impede **team cohesiveness**, which may be further limited by **remote work**. In addition, although remote work may be safer and more efficient, it results in **fewer opportunities for mentorship, collaboration, and mutual learning**.
- **Lack of suitable physical space** for staff to work (and at times for housing) presents a recurrent challenge in remote settings.
- Smaller P/T and remote settings are **less likely to have local pre-existing training opportunities**. For example, only one municipality in an Atlantic province has a public health inspection program, with the next closest training facility in a nearby province. Similarly, there are no universities in some northern areas, which makes it more difficult to form partnerships or access that capacity.
- According to local experts from Western and Central Canada, both the core and redeployed staff had concerns about an **increased workload and longer working hours**. For redeployed staff, this involved adapting to their new roles, while for the experienced staff, this involved rapidly training and orienting new staff. Redeployed staff also expressed concerns about the possibility of increased exposure risk in their new roles.

Processes and Guidelines for Case and Contact Management

Case identification and management

Cases are typically identified by public health through **laboratory notification of a positive test result.** [6] Local experts in Western and Central Canada reported that laboratory-confirmed cases represent the majority (>90%) of cases (30,31). However, a small number of cases are identified through **other means**:

- **Direct notification from hospital clinicians or infection control** regarding an inpatient before laboratory notification is received. A local expert from Central Canada reported this to account for 5% of cases, while a local expert from Western Canada reported this to be <1% of cases.
- In at least one jurisdiction in Central Canada, some individuals in the community may **access their own test results** and notify public health authorities before laboratory notification is received.
- **Epi-linked ("probable") cases without laboratory confirmation** ranged from <1%-10% of total cases in some jurisdictions (though most Canadian jurisdictions do not formally report these data) (30,31). One local expert from Central Canada noted that the number of epidemiological cases decreased as laboratory capacity increased, since more case contacts were encouraged to undergo testing, which would classify them as laboratory-confirmed cases. Currently, the majority of epidemiological cases in this jurisdiction comprise people who decline to be tested.

An innovative approach for case identification in rural and remote settings from the Saskatchewan Health Authority (SHA) [7] is highlighted in **Box 2**.

Box 2. Innovative practice for case identification in rural and remote settings

In Saskatchewan, an innovative practice for active case finding was reported by the SHA in early June 2020. Mobile SHA public health teams worked closely with community leaders in La Loche (a remote and largely Indigenous community in northern Saskatchewan) to develop a strategy to systematically test over 800 households for COVID-19 door-to-door (40-50 tests done per day) (32). Symptomatic individuals were tested with rapid, near-care testing. If these individuals were positive, asymptomatic individuals in the same household were tested with conventional testing (up to 48 hours to receive results). Mobile teams also brought along information about mental health and community supports to share with the households. Active case finding identified 50% of the jurisdiction's cases, and subsequent improvements were seen in their epidemic curve.

Logistics involved ensuring that a proper number of trained staff was available to perform door-to-door visits, coordination with the Roy Romanow Provincial Laboratory to ensure that samples could be shipped and tested quickly, and implementation of aggressive contact tracing to identify close contacts of the new cases. The Northern Inter-Tribal Health Authority was also engaged, as they were performing similar work in nearby First Nations communities. In addition to case identification, this effort informed a community-needs assessment and obtained feedback for further health planning and building sustained health capacity. Close community collaboration is credited with the strategy's success; it also built trust that may help in implementing future health interventions in the area (32).

Information about the use of technology for **case and contact follow-up** is described in the Technology for Case and Contact Management section.

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[6] Unless noted otherwise, most references to testing in the present report refer to polymerase chain reaction (PCR) testing.

[7] SHA is Saskatchewan's single centralized health authority with both healthcare delivery and public health responsibilities.

Contact identification and management

Many respondents reported that they are following the national Public Health Agency of Canada (PHAC)[8] guidelines to **define high/medium/low-risk contacts.**[9] Earlier versions of the Ontario provincial guideline used the PHAC high/medium/low-risk stratification, but more recent versions (V8.0 published June 23, 2020 and V9.0 published September 8, 2020) have been modified to dichotomize high and low risk (33,34).

The **contact management processes and targets**, as provided in the selected jurisdictions, are described in **Table 3**. For each contact, information was typically collected about demographics, symptoms, risk factors and risk stratification, whether self-isolation was occurring and if isolation support was needed, need for medical attention (e.g., 911 call), and testing history. Additional considerations included the contact's occupation, travel history, household composition, social activities, and use of municipal services (e.g., pools, libraries). Local experts in Ontario and British Columbia reported using provincial documents to guide information collection (33,35). In one region, additional forms were used for specific populations or circumstances, such as for retirement home residents, or to identify contacts who resided outside that jurisdiction. A local expert in a remote Western jurisdiction noted that cases were assured of the confidentiality of the information collected to help reduce fears related to COVID-19 stigma.

Table 3. Contact management processes and targets

Incubation period	The time from exposure to symptom onset is believed to be 2-14 days, with a median of 5 days. For follow-up purposes, a period of 14 days has been recommended (35).
Case exposure assessment	Ontario guidelines note that PHUs must assess for relevant acquisition exposures in the 14 days prior to symptom onset (or 14 days prior to positive specimen collection date if never symptomatic). Ascertainment of exposures enables identification of locations/settings where transmission may be occurring, particularly if additional cases are associated with that location/setting (also termed "backwards contact tracing") (33).
Case contact assessment	Contact tracing starts 48 hours prior to case symptom onset, or 48 hours prior to the date the test was collected for asymptomatic cases (9).
Time to trace all contacts	The length of time to trace all contacts ("forward contact tracing") depends on the number of cases and contacts. According to a local expert in Ontario, a single case investigation could take 2-3 hours, including contact identification and documentation (33). Another jurisdiction noted that the process could take about 24-48 hours.

[8] PHAC is an agency of the Government of Canada created in 2004 after the SARS-CoV-1 outbreak to advise on infectious and chronic disease prevention and control.

[9] PHAC has described three categories of contacts by the risk level of exposure (9):

- **High risk (close contacts)** are those that provided direct care for or had other close physical contact with the case (e.g., healthcare worker, caregiver, intimate partner), without appropriate personal protective equipment (PPE); those with close (less than two meters) and prolonged (more than 15 minutes) contact with the case; or those with direct contact with infectious body fluids, without appropriate PPE. Self-isolation for 14 days from last exposure and active daily monitoring by public health authorities for symptoms are advised.
- **Medium risk (non-close contacts)** are those that provided direct care for or had other close physical contact with the case, with appropriate PPE; or household members or others with prolonged contact, but not within two meters of the case. Self-monitoring for symptoms for 14 days from last exposure is advised; there is no active monitoring by public health authorities.
- **Low risk (no known risk)** are those with transient interactions only (e.g., being in the same room for a short period of time as a case or walking past a case). Community-level and individual advice is provided, if needed.

Contact tracing targets	Ontario has a provincial target of 90% of confirmed cases reached within 24 hours of the time of PHU notification, and 90% of contacts reached within 24 hours of being identified as a contact (33). British Columbia has a target to trace 95% of contacts in 48 hours (35). According to local experts from Central jurisdictions, local targets include: (i) to first call contacts within 24 hours of receiving contact information, and reaching contacts within 1-2 days of their identification; (ii) to follow-up with cases and contacts on the same day that public health receives their information; (iii) to start contact tracing within 48 hours of notification of a case; and (iv) to complete contact tracing within 24-48 hours.
Communicable period	The period of communicability is considered to occur between 48 hours prior to symptom onset to 10 days after symptom onset (35). Current PHAC guidance recommends that cases isolate for a minimum of 10 days after symptom onset or laboratory confirmation (9), though this may vary according to illness severity (35). The criteria for isolation discontinuation include a consideration of the case's need for hospitalization, febrile status, and degree of clinical improvement (9). Close contacts should self-isolate for 14 days since last exposure (9). One local expert noted that this could result in contacts self-isolating for up to 28 days if they had initially isolated with the case.

Contacts were monitored and screened for symptoms by public health authorities (daily in some cases) via telephone. Information technology platforms and other communication methods have also been used by some jurisdictions to streamline processes, as described in the Technology for Case and Contact Management section. Upon development of symptoms, a health assessment (including testing) and isolation were advised. Some jurisdictions offered **quarantine and isolation support**, as noted in **Box 3.**

Other contact identification methods

Processes routinely used during communicable disease investigations were employed to **identify contacts not known to the COVID-19 cases**. In regard to **workplace exposure**, employers and occupational health departments were engaged to obtain work logs. Similarly, in regard to **exposure in businesses or public events**, business owners were engaged to obtain attendance lists. In both situations, information was provided to the workplaces and the businesses describing how individuals may **self-identify as a contact** (e.g., through a non-emergency public health number, a hotline, or at an Assessment Centre [10]) and how to self-monitor for symptoms.

Asymptomatic contacts

Some jurisdictions in Canada **test asymptomatic close contacts of confirmed COVID-19 cases**. Local experts from the Atlantic region noted that many additional cases were identified using this strategy. In addition, a recent Canadian modeling study has estimated that systematic testing of close contacts of confirmed cases and "at-risk populations" (including hospital workers, essential workers, long-term care residents, and schoolchildren and staff) may be feasible (16,36). However, as significant debate and

[10] Assessment Centres are facilities where comprehensive screening and testing for COVID-19 are administered by healthcare professionals to members of the public who either self-present or are referred by public health authorities. Assessment Centres were set up during the COVID-19 pandemic in some jurisdictions to help manage flow and reduce the burden on hospital emergency departments.

variation in practices persists across Canada (37), an in-depth discussion of asymptomatic testing is beyond the scope of this review.

Box 3. Innovative practices to support isolation and quarantine

Isolation, which is an extension of the case and contact management process, can be associated with significant difficulties for people, including financial, psychological and social impacts (9). Many local experts described the importance of reciprocity, where public health works with people and communities to *support* isolation, rather than enforce it. While a full discussion of isolation support is outside the scope of this rapid review, local experts across the country described several innovative practices for support with housing, finances, substance use, and isolation kits.

Housing: Several groups can benefit from isolation housing, including underhoused individuals, those in crowded households, those living in remote settings (e.g., to facilitate isolation closer to a hospital), and those otherwise unable to safely self-isolate at home. Strategies to facilitate this included using: (i) hotels and motels; (ii) re-purposed empty facilities (e.g., newly built long-term care facilities, community recreation centers, social housing units); and (iii) work-camp trailers, which can move to communities where isolation support is required (38–43). One local expert also mentioned the importance of considering the needs of other household members if one individual is in isolation elsewhere (i.e., implementing a surrogate caretaking structure). Contracting housing services may not be cost-effective in case of low usage; as such, one local expert emphasized the importance of provincial government support in these efforts.

Finances: As described by local experts, contacts concerned about income loss during isolation may not engage with contact tracing efforts. Individuals may also encounter financial barriers that prevent them from adhering to public health measures (e.g., paying for transportation that is not public transit, paying for alternate accommodation). Strategies to mitigate this included paying for taxis, providing vouchers for groceries, or providing free alternate accommodations. Some jurisdictions also considered providing people with information about federal income support programs (e.g., Canada Emergency Response Benefit). One local expert was interested in learning whether other jurisdictions had implemented gift certificates or pay for lost time during a period of isolation.

Substance use: Local experts identified the importance of support services for individuals with a substance use disorder. In response to liquor store closures, SHA launched a managed alcohol program in La Loche, Saskatchewan, in early May 2020. The program was expected to improve adherence to isolation and minimize the risk of withdrawal through a harm-reduction approach (44,45). Program candidates were identified through referrals from local leaders and healthcare providers (46). Once the intake form was completed and approved by SHA, a prescription for alcohol was made. This program was implemented within one week of liquor stores being closed and was developed in consultation with Saskatoon, the largest city in Saskatchewan, where a similar program has been operating since 2017 (47). Another Canadian jurisdiction is reportedly working on a strategy for people in isolation to receive methadone.

Isolation kits: In March 2020, Region of Peel Public Health, a suburban region in Ontario, provided kits to people entering self-isolation. These kits included masks, gloves, cleaning supplies, and thermometers (48). While the program did not continue, another local expert identified this practice as one to learn more about.

Challenges related to case and contact identification and management noted by local experts included time delays in case identification, inefficiencies in receiving laboratory testing results, limited information transfer at different levels of government, challenges in reaching cases and contacts directly, funding limitations, and reductions in other public health activities.

- **Time delays associated with case identification** may result in a delayed start to contact tracing. In remote communities, local experts noted that time delays were owed to lack of access to testing, logistical issues with sending samples to a central laboratory (e.g., due to flight schedules, especially in the winter months in some jurisdictions), and long turnaround times for results. This challenge was mitigated by using rapid, near-care testing (GeneXpert) in some jurisdictions. In urban jurisdictions, time delays were owed to a limited laboratory capacity for sample processing, particularly in the event of asymptomatic testing or mass testing related to outbreaks (which may

exceed the typical turnaround time of two to three days for laboratory results) (24). The time-lag between symptom onset and seeking testing presents another delay. For instance, in June 2020, it was reported that it took an average of five days for persons experiencing symptoms to receive testing in Toronto (24).

- Relatedly, according to local experts from Central Canada, **the transfer of positive test result information from laboratories to public health** has multiple inefficiencies. First, there are many laboratories with different reporting patterns. Laboratories use a different information system than public health, and positive results are received in a batched fax in some jurisdictions. Each batch could contain up to 100 individual results, which need to be manually separated. In addition, each positive result may contain up to 5-8 additional copies, requiring staff to determine manually which results represent a new case versus a duplicate. In June 2020, it was reported that approximately 40% of the results received in Toronto are duplicates (24).
- One local expert from Central Canada noted that there is **limited information transfer between local, provincial, territorial, and federal levels**. Improved communication could facilitate better prioritization of people for case and contact follow-up. For example, better information transfer could identify more efficiently cases that have recently travelled by airplane.
- According to local experts from urban jurisdictions in Central Canada, **contacting cases** presents another challenge. First, there may be insufficient contact information for cases on laboratory reports, as the inclusion of phone numbers or emails is not a legislated requirement (24).
- According to local experts from Central Canada, staff tend to conduct case and contact management tasks **during business hours**. This hinders effective contact follow-up because people may be away or working during this time.
- As noted by local experts from Central Canada, there are inefficiencies related to how **cases and contacts from the same household** are handled. For example, in Ontario, some cases may be managed by the PHU, while the household contacts may be managed by the CTI COVID-19 workforce (29). Although this was avoided when possible, it may be difficult to identify people as members of the same household when they have different telephone numbers.
- One local expert noted that the **rapidly evolving COVID-19 evidence and guidelines** present a challenge to adapting case and contact management processes.
- Many local experts discussed **public health funding limitations**, which impacted staffing for case and contact management earlier in the pandemic and may contribute to future limitations in implementing case and contact management approaches.
- Local experts from Central and Atlantic Canada noted that nearly all other **public health programs were reduced or halted** to conserve resources for COVID-19 case and contact management (49). Programs included school immunizations, prenatal and postpartum care, syphilis outbreak management, dental care, substance use and health promotion, and research. In Central Canada, selected public health activities, such as reportable disease management, immunizations for children, and suicide prevention programs, were reported to be continued during the pandemic.

Technology for Case and Contact Management

Information technology systems

Information technology (IT) platforms are routinely used to document reportable infectious diseases; however, some provincial IT systems in Canada were strained during the COVID-19 pandemic. As shown in **Table 4**, a number of IT platforms were developed and rolled out jurisdiction-wide during the COVID-19 pandemic with the aim of reducing staff workload, eliminating paper-based systems, reducing lags between case reporting and contact tracing, improving integration with other data systems, and facilitating remote work and inter-jurisdictional collaboration. One local expert from Central Canada noted that a key takeaway from developing such platforms during the course of the emergency was that it is **possible to implement effective and modern systems rapidly**, with few administrative bottlenecks. A main challenge identified by another local expert in Central Canada was the **initial resistance to changes in practice among staff** – indeed, although automated and paperless systems are expected to reduce workload, transitioning to and learning how to operate new software requires additional staff time. Such issues with IT platform adoption may delay scale-up efforts.

Table 4. IT systems used for case and contact management in selected jurisdictions

IT System (Jurisdiction)	Description
Telus Home Health Monitoring (HHM) (BC)	• HHM has been used routinely in the province since 2013 to support chronic disease, palliative, and immunocompromised patients (50). • In July 2020, the system was adapted to COVID-19 to support case management. Once an individual tests positive for COVID-19, they receive an automated web link to a unique survey (standardized CDC case report form), accessible on smartphones, tablets, and computers, where they can enter their symptoms daily (a process that was previously telephone- and paper-based). Once an individual experiences a symptom, public health nurses receive an alert on their HHM dashboard and can follow-up with the individual by phone to escalate care, if necessary (51). Vulnerably housed individuals are provided with a 3G-enabled tablet in shelters, where the HHM can be used to monitor their symptoms on a daily basis (51). In practice, the use of this option was low.
Go.Data (SK)	• Provincial SHA contact tracing application; went live in late April 2020, during the COVID-19 pandemic. Go.Data was developed by the WHO and the Global Outbreak Alert and Response Network (GOARN) [11] to facilitate field data collection and visualization during routine outbreak investigations (52). The WHO has recommended the use of Go.Data in the COVID-19 context (8). The application can be accessed on mobile devices (52) and web-based training is available (53). • The system was launched in Saskatchewan as part of a collaboration between the SHA, First Nations partners, and Athabasca Health Authority, with the aim of reducing staff workload, facilitating a centralized contact tracing approach, and building capacity to respond to surges of new cases and contacts. The platform is viewed to be an "important component of a centralized contact tracing approach". SHA was first to deploy such a technology provincially; this platform is not currently used in other Canadian jurisdictions (54).

[11] GOARN is a global partnership established by the WHO that serves as a mechanism for engaging international resources or rapid identification, confirmation, and response to public health emergencies of international importance.

Panorama Public Health Information System (Some P/Ts across Canada)	• In response to the 2003 SARS-CoV-1 outbreak, the federal government mandated Canada Health Infoway [12] to collaborate with the P/Ts and the federal government to develop and implement Panorama as a national integrated public health surveillance platform to manage communicable diseases, outbreaks, immunizations, and vaccine inventory. The system was envisioned to be paperless and was designed to replace the existing provincial platforms. However, many challenges occurred during implementation, including system defects (55). • It has been reported that Nova Scotia was the first Canadian province to fully implement Panorama's three modules (Vaccine Inventory, Immunization, and Investigation and Outbreak Management) between 2017 and 2018, to provide a central data repository to inform public health programming. The province was also the first to successfully link its Laboratory Information System to Panorama (August 2019: connection to Cerner Millennium in Halifax, the primary microbiology reference laboratory; January 2020: connection to Meditech Client Servers, serving areas outside of Halifax) (56). Connection to laboratory services enabled automated communication of negative testing results through email and SMS texting to alleviate staff workload.
Integrated Public Health Information System (iPHIS) (ON)	• iPHIS is used by Ontario PHUs to report information on cases of reportable diseases. The platform requires significant manual data entry of case and contact information, including time and allocation of designated staff, as it is not integrated with the Ontario Laboratory Information System (24). • iPHIS was a 15-year old system when first implemented in Ontario in 2009 and quality issues have been noted by auditors in 2007, prior to implementation, and more recently, in 2017 (57). Users have described the system as "not user-friendly" and incapable of managing an outbreak of this scale (58). Quality issues noted by auditors included inconsistencies in data entry, duplication of data, significant delays in contact tracing, unavailability of laboratory data, and data linkage issues (57).
Salesforce (ON)	• Provincial cloud-based data entry system, developed as a replacement to iPHIS during the COVID-19 pandemic, in collaboration with private partners. The system is expected to be integrated with the Ontario Laboratory Information System, eliminating the need for manual data entry. The system is also expected to enable data extraction to analyze province-wide trends and hotspots, as well as to allow for remote work for staff. Patients are expected to be able to enter information about known contacts into a secure online form upon receipt of their laboratory results (59). • As of July 2020, three PHUs were early adopters of this system (60); one suburban PHU described how the system reduced staff workload ("do more with fewer people"). The generated data trail may enable the observation of patterns and catch "teachable moments" for system improvement.
Coronavirus Rapid Entry Case and Contact Management System (CORES) (Toronto, ON)	• Data system developed in late April 2020, during the COVID-19 pandemic in collaboration with private partners. The system is expected to be later integrated into Salesforce (60). • CORES was described as better meeting Toronto's needs, as it is a paperless system that enables the efficient documentation of case investigations (without data entry) and prioritizes severe cases that require healthcare follow-up; can be accessed remotely, enabling staff to work from home; and facilitates data sharing with the Ministry of Health and Long-Term Care. The system is also equipped with automated SMS texting capacity, to follow-up with low-risk cases and contacts and reduce staff workload (58,61). System usability was described as "intuitive" and required minimal staff training.
Akinox (QC)	• Data system developed by the Ministry of Health, in collaboration with private partners, and launched in late May 2020, during the COVID-19 pandemic. • The system allows further automation of the case and contact management process by sending an email with a standard questionnaire to a diagnosed case, following receipt of their laboratory testing results. The individual can report the severity of their symptoms and provide email addresses of

[12] Canada Health Infoway was established in 2001 as an independent not-for-profit organization, funded by the federal Government of Canada, with the goal of developing and implementing digital health approaches in Canada.

contacts. Contacts also then receive an automated email with a similar questionnaire regarding presence of symptoms and email addresses of people they have been in contact with (62). Challenges include inability to retrieve email addresses of certain individuals; this requires telephone follow-up from staff involved in contact tracing.

Smartphone applications

Smartphone applications ("apps") aimed at aiding case and contact management processes in Canada are outlined in **Table 5**. Apps can be categorized as those used for **education and symptom reporting** and those used for **contract tracing/exposure notification**. An education and symptom reporting app (Canada COVID-19) was initially deployed in British Columbia in late March 2020 and rolled out nationally by Health Canada in April 2020 (63). The first Canadian contact tracing/exposure notification app was developed and rolled out in early May 2020 in Alberta (ABTraceTogether), based on an open-source code developed in Singapore. Other apps were then considered or developed (but not rolled out) in New Brunswick, Newfoundland, and Quebec; however, these efforts did not proceed due to the development of the federal exposure notification app (64–68). The federal app (COVID Alert) is using the international Apple/Google "privacy preserving" framework and was launched as a pilot in Ontario in late July 2020 (69). Throughout September 2020, the app has been rolled out in Newfoundland and Labrador, New Brunswick, and Saskatchewan (65,70,71). In early August 2020, Alberta announced plans to switch to the federal app as well (72). Quebec has presently decided against implementing the federal app, but may re-evaluate this decision (73).

Table 5. Smartphone apps for case and contact management in selected jurisdictions

App Name (Jurisdiction)	Key Features	Details
Canada COVID-19 (Canada)	Installation: Voluntary Purpose: Education; Symptom reporting Tech/Device: iOS, Android Developer: Federal gov't + Thrive Health (Vancouver) Launch dates: March 23, 2020 (BC) April 1, 2020 (Canada)	• Provides brief information about the virus, prevention mechanisms (including hygiene and physical distancing), symptoms, travel advisories, and government financial supports related to the pandemic. The app also states explicitly that the government has not "approved any product to prevent, treat or cure COVID-19" (74). • The Self-Assessment (symptom reporting) Tool collects anonymized information under Section 4 of the *Department of Health Act*. This information is provided on anonymized and aggregated basis to support Health Canada programming and planning (74).
COVID Alert (Canada)	Installation: Voluntary Purpose: Exposure notification Tech/Device: Bluetooth - iOS, Android Developer: Federal gov't + Ontario Digital Service + Shopify (Toronto) Launch dates: July 31, 2020 (ON) September 3, 2020 (NL) September 18, 2020 (NB) September 20, 2020 (SK)	• Developed by Shopify volunteers (free, open-source code) based on the Apple/Google "privacy preserving" framework (21,75). • Operates by exchanging Bluetooth signals with nearby phones that have the app. BlackBerry volunteers have provided an external review of the app (75). Signal data are encrypted and stored locally on each user's device (decentralized approach). If someone tests positive for COVID-19, their public health authority provides a unique key to enter into the app. A notification is then sent to all phones (with the app) that have been within 2 meters of the diagnosed person for at least 15 minutes in the prior 14 days. Testing and self-isolation instructions are provided (69).

ABTrace Together (AB)	Installation: Voluntary Purpose: Exposure notification Tech/Device: Bluetooth - iOS, Android Developer: Gov't of Alberta Launch date: May 1, 2020	• Developed based on the TraceTogether app from Singapore's Government Technology Agency, whose code is open-source (21). • Requires users to provide their cellphone number upon registration. This information is encrypted and stored with the number on the Alberta Health server (centralized approach). Devices using the app exchange Bluetooth signals and stores an encrypted log of temporary IDs on the user's phone (deleted after 21 days). If a user tests positive for COVID-19, they can self-report this in the app and consent to share their log with AHS contact tracing team. The log is then decrypted using the central server key and contacts are reached by phone.
SafeContact (NB)	Installation: Not applicable Purpose: Location and symptom reporting Tech/Device: GPS - iOS, Android Developer: University of New Brunswick + Gray Wolf Analytics (Fredericton) Launch date: Not launched (developed April 2020)	• Funded by Gray Wolf Analytics, which focuses on tracing and tracking illegal activities through cryptocurrency (76). • Stores location data on the user's device behind a firewall. An anonymized personal identifier is generated; the user may choose to share these data to support contact tracing investigations (77). • Symptoms can be logged daily and stored locally, on the device. The user may choose to share these data with healthcare providers (77).
COVI App (QC)	Installation: Not applicable Purpose: Exposure notification (risk-stratified) Tech/Device: Bluetooth - iOS, Android Developer: Mila AI Institute (Montreal) Launch date: Not launched (developed May 2020)	• COVI relies on machine learning to calculate individualized risk level (based on proximity and duration of exposure). Recommendations are also risk-stratified (self-isolation vs. testing) (67,68).

Apps may facilitate identification of contacts not known to the case, particularly those who are asymptomatic. There are also many **limitations** related to app use for case and contact management:

- **Lack of interaction between cases/contacts and public health professionals** are important limitations, as directly communicating with a public health professional can help alleviate fears related to the diagnosis and exposure, navigate loneliness, and obtain relevant information. Building trust and rapport with the public is imperative for obtaining accurate information. Public health investigators are also skilled at tailoring interview questions to ensure comprehensiveness of information. Local experts noted, however, that apps could **supplement contact tracing**.
- There is **uncertainty about app uptake**. Simulation models have suggested that a population uptake rate of 60% will be necessary for the app to be effective in the absence of other public health interventions (78,79). A recent unpublished modeling study from Google Research and the University of Oxford has suggested that in combination with contact tracing and physical distancing, a lower app uptake may also have a moderate effect on reducing COVID-19 infections and deaths (80). Although a recent telephone survey found that 38% of Canadians were interested in downloading the federal COVID Alert app (81), uptake rates for both the current COVID Alert pilot in Ontario and the preceding ABTraceTogether app in Alberta have been modest

(approximately 15% and 5% of provincial population, respectively) (72,78,82). Further, upon being downloaded, the app must be actively used among persons that test positive. As of September 17, there have been 275 individuals in Canada that have self-reported their positive status through COVID Alert (70).

- Some experts have raised **concerns regarding app accessibility**; for example, the COVID Alert app only works on iOS and Android phones that have been made in the past five years, which may impede use among seniors and marginalized populations (83,84). To mitigate adoption issues among seniors, Newfoundland and Labrador is working with community organizations (e.g., The Gathering Place, Seniors NL, and the Office of the Seniors' Advocate) to provide demonstrations (65). The app also cannot be used among those unable to own smartphones or in areas where cellphone or WiFi connectivity may be limited.
- **Technical issues** may also present a barrier to reaching adequate uptake. For instance, during the first month of the launch, ABTraceTogether could not run on in the background of iOS devices and required the screen to be unlocked (this issue was not reported for Android devices) (85,86).
- **Privacy concerns** persist among experts and the public. In July 2020, ABTraceTogether underwent a Privacy Impact Assessment by Alberta's privacy commissioner. The commissioner raised concerns regarding the use of the app for law enforcement purposes, which resulted in a revision of the app policy, explicitly prohibiting its use for quarantine enforcement (87). In addition, similar to Singapore's TraceTogether app, privacy concerns persisted in relation to the centralized storage of user data and the requirement to enable WiFi and GPS on the device (21,88). In advance of the Ontario COVID Alert launch, the Office of the Privacy Commissioner of Canada stated that the app satisfies the privacy principles previously outlined by the federal, provincial, and territorial privacy commissioners, with the re-identification risk deemed to be "very low" (89,90). Nonetheless, a recent online survey about the federal COVID Alert app indicated that 52% of Canadians did not believe the government stating that the app does not geolocate users or collect personal info and 39% did not believe the app will "work" (78). In addition, despite public interest in an exposure notification app (91), an expert committee deemed Quebec's legal privacy framework inadequate, which led the province to decide against using the app in late August (73).
- Possible **imprecision in detecting exposure** is another concern related to the use of apps for contact tracing (85). Exposure notification is subject to significant time delays, as it is only relayed to contacts once an individual has undergone testing, received their results, and chosen to self-report their positive status in the app. Imprecisions in detecting distances, duration of contact, and environmental factors (e.g., ventilation, presence of barriers or PPE, and wind direction) may also lead to misclassifying contacts (79). This may result in wasteful use of public health staff time and undue burden on the public to follow self-isolation and quarantine recommendations.

The above limitations compound into an **overall uncertainty regarding app effectiveness**. Local experts have suggested that these issues may be mitigated by **involving public health professionals** in the app development process. Further, although there have been some reports of new COVID-19 cases being identified following app exposure notification (92), there are currently **no standard performance indicators** that could be used to monitor the impact of apps on COVID-19 containment.

Other communication technologies

Standard-use communication technologies, not specialized for public health purposes, were used to support case and contact management processes, as outlined below:

- Urban, suburban, and remote jurisdictions in Central and Atlantic provinces used **SMS texting to perform case and contact** follow-up. Two Atlantic jurisdictions also used the **SMS alert system to remind people to maintain physical distancing**.
- One suburban jurisdiction in Central Canada noted that they would **remind cases and contacts to review their credit card records and GPS location history** as a "memory jog" during contact tracing telephone interviews.
- Another jurisdiction in Central Canada noted that the use of **Microsoft Teams within case and contact management teams was an effective means of information sharing**, as it was paperless, enabled remote work, and did not require staff to travel. This communication tool was seen as particularly helpful during transitions to new IT systems, which may take time to learn.
- One Atlantic province described using **videoconferencing technologies (Zoom, Facetime) to communicate with cases** during follow-up. The use of videoconferencing methods was particularly encouraged when public health professionals were communicating with cases and contacts less likely to follow isolation guidance.
- Several jurisdictions have used **radio broadcast programs to provide regular COVID-19 updates to the public**. In at least one jurisdiction, this program was translated into local Indigenous languages.

Ensuring Care for Local Communities and Special Populations

Working groups for case and contact management

In multiple jurisdictions, public health authorities established **designated working groups responsible for case and contact management in specific populations or settings deemed to be of higher risk.** These include remote settings, racialized communities, migrants and newcomers, individuals experiencing homelessness, and various congregational settings (e.g., workplaces and factories, schools, universities, daycares, long-term care facilities, and correctional facilities).

Such working groups **tailored provincial guidelines** on surveillance and outbreak management for the specific populations and settings and **performed outreach** to conduct case and contact management (including facilitating testing through mobile teams, identifying contacts, and securing resources and locations for self-isolation and quarantine). A local expert from Central Canada noted that a **challenge of working groups** included difficulties in reassigning contact tracing staff, should a surge in cases occur. Selected examples of case and contact management working groups are highlighted in **Table 6**.

One Atlantic jurisdiction highlighted that **in addition to public health staff, their designated case and contact management working groups included stakeholders from the community and other government sectors**, relevant to the population or setting of interest, with a Medical Officer of Health attached for oversight. Inclusion of government stakeholders outside of the public health system was

viewed as an opportunity to "break down silos," as it expanded and clarified the roles other sectors could play in a public health emergency. Engaging primary care and mental health and addictions sectors was also deemed important. Other jurisdictions similarly included representation from multiple community and government stakeholders in their Incident Command Systems and Emergency Operations Centres, established to streamline the COVID-19 response (93).

Partnerships with sectors outside of public health

Many local experts discussed the importance of **establishing local partnerships to facilitate case and contact management**. Partnerships were usually facilitated by the case and contact management working groups, though some were also established between health authorities and other sectors without the designated working group structure. Partnerships included those with long-term care facilities and homeless shelter administration, primary care organizations and social services, and organizations serving migrants and refugees. Two Central jurisdictions stated that partnerships with public schoolboards were considered in advance of school re-openings. Such partnerships helped establish trust with populations that have been historically marginalized or harmed by institutions, and enabled better understanding of disease transmission mechanisms "on the ground." A local expert from the Central region noted that the latter may be particularly important for tracing individuals experiencing homelessness, whose contact information may change or be inconsistently documented. Selected examples of such partnerships are highlighted in **Table 6**.

Case and contact management in Indigenous communities

In some jurisdictions, case and contact management in Indigenous communities is overseen by **Indigenous governments, which are relatively autonomous of P/T governments**. British Columbia has a unique public health structure, where all health services among Indigenous populations are coordinated by the First Nations Heath Authority (FNHA) (94). The FNHA collaborates closely with the regional health authorities in the province to perform case investigations, contact tracing, and follow-up of individuals residing in Indigenous communities (95,96). Similarly, the Northern Saskatchewan Population Health Unit, which serves a remote and largely Indigenous population, is a unique collaborative public health structure that includes the Athabasca Health Authority, Keewatin Yatthé Regional Health Authority, and Mamawetan Churchill River Regional Health Authority (97).

In two Atlantic jurisdictions with many rural and remote populations, the regional health authorities and Indigenous governments have a **long history of collaboration**. This relationship enabled **redeployment of public health nursing staff**, regardless of whether they were employed at the health authority or healthcare facilities operated by the Indigenous governments. Should a case be detected, nursing staff and clinics employed by Indigenous governments would also be engaged to perform testing, case identification, and contact tracing. Relatedly, this collaboration allowed for the availability of healthcare staff that could speak Indigenous languages, as English is not widely spoken in certain communities and the use of telephones may be limited in remote settings.

Case and contact management privacy issues in remote settings

Some jurisdictions noted that there was **pressure to publish "hyperlocalized" or small area case count data**, which presented privacy challenges when reporting on rural and remote areas. This could result in

negative repercussions for individuals, as they could be identified, and for the relationship between public health authorities and the community, which could be damaged. Privacy issues were mitigated by publishing more aggregated data; however, suppressing clusters also impedes the public understanding of community transmission, and could lead to misconceptions (e.g., perceiving that transmission is more widespread due to overall higher case counts). This challenge of balancing privacy concerns with the need to capture geographic variation was noted to predate the COVID-19 pandemic, as it was encountered during more routine communicable disease outbreaks as well (e.g., tuberculosis investigations).

Interestingly, one remote jurisdiction initially chose not to publish community-level COVID-19 case count information due to privacy concerns. However, community members were closely engaged in the pandemic response as **members of the case and contact management working groups**. They expressed a strong interest in reporting community-level information, which led to the publication of these data and better central allocation of resources.

The general **Canadian Institute for Health Information guidance for publishing small-cell data** states that case counts of five or fewer need to be suppressed (98). However, the consultations with local experts suggest that a consideration of the local context and community engagement may be necessary to inform data sharing decisions.

Table 6. Selected examples of working groups and partnerships for case and contact management in special populations and settings

Group/Partnership (Jurisdiction)	Target population	Description
Working group (AB)	Migrant workers	Established a taskforce dedicated to responding to COVID-19 outbreaks in meat packing facilities, which are largely staffed with migrant workers, following the large outbreak at the Cargill meat processing plant (99,100). This effort involved partnerships with primary care, immigrant and refugee organizations, and other social services to perform contact tracing (100).
Partnership (AB)	Indigenous communities	The existing partnership between AHS and Alberta's Primary Care Networks provided a pool of clinical staff that could be mobilized to perform contact tracing during outbreaks in certain settings, such as Siksika First Nations (101).
Partnership (AB)	Underhoused populations	The existing partnership between AHS and the Community Paramedicine program of Emergency Medical Services Mobile Integrated Healthcare, allowed to mobilize community paramedics for COVID-19 testing and tracing among populations experiencing homelessness (102). Community paramedics receive training in preventive care and public health principles during their education and have a history of caring for homeless populations in urban settings since the program's launch in 2012 (103).
Partnership (AB)	Long-term care facilities	During the COVID-19 pandemic, AHS established partnerships with long-term care facilities; in case of a COVID-19 outbreak, AHS takes over the management and operations of the facility to perform testing, contact tracing, establish infection control protocols, and supply additional staff (e.g., nurses, pharmacists, respiratory therapists) (104,105).
Working group (BC)	Underhoused populations	The working group focused on underhoused populations partnered with BC Housing and contracted community service providers (AVI Health, SOLID, and Cool Aid) to provide sheltering, social supports, mental health, substance use, and harm reduction services to individuals experiencing homelessness,

		including those who may need to self-isolate due to COVID-19 exposure or symptoms (106). Established a COVID-19 Outreach Assessment Team, staffed with nurses, to screen individuals for symptoms, provide basic first aid, and facilitate testing in downtown Victoria and Vancouver (106,107).
Working group (BC)	Long-term care facilities	The working group focused on long-term care established a rapid response resource team, composed of six nurses and infection prevention and control experts, to respond to outbreaks in long-term care facilities, including plans for contact tracing. Comprehensive testing protocols and restrictions on staffing have also been implemented (with long-term care staff being confined to working in only one site) (108). Additional guidelines and safety checklists were developed for long-term care inspection officers, to ensure that the homes are equipped to protect their residents and staff from COVID-19 (108).
Working groups (Toronto, ON)	Underhoused populations, long-term care facilities, schools	Established liaison teams for case and contact management related to community transmission, congregate settings (e.g., homeless shelters), and long-term care facilities. Relationships between liaison teams and community partners, such as shelter, hospital, and long-term care administrative staff, predated the pandemic, as they were leveraged during routine investigations in these settings (109). A September 9, 2020 announcement stated that a school liaison team was established to provide advice on infection prevention and control measures, train staff, and work with investigators if cases emerge. Over 200 staff have been assigned to support schools (110).

Conclusions

In this rapid review, we conducted an environmental scan of the literature and consulted with a convenience sample of local experts from seven Canadian provinces to understand case and contact management approaches and experiences across Canada. We focused on the necessary workforce capacity, processes and guidelines, use of technology, and approaches for special settings and populations to share promising practices and challenges with public health physicians involved in COVID-19 case and contact management efforts in Canada.

Key challenges related to case and contact management included: (i) adequately matching redeployed and new staff expertise with the required roles, (ii) meeting non-uniform staff training needs, (iii) providing training resources without undue burden on the experienced staff's time, (iv) time delays and inefficiencies in laboratory case identification, (v) reliance on paper-based documentation and manual data entry, (vi) limited information system integration, (vii) uncertainty regarding smartphone exposure notification app effectiveness, and (viii) adapting processes for specific populations and settings.

To address the identified challenges, the following considerations and best practices have emerged from the environmental scan and local expert consultations:

- **Setting staffing targets and developing rapid training programs and templates** that minimize the time requirements for experienced staff can help achieve staff capacity in a short amount of time. Specific staffing targets (e.g., ratio of staff to the number of cases or testing volume) may also help inform the criteria for activating the surge plan.
- Developing **information technology systems that are integrated** with laboratories and electronic medical records, where feasible, may eliminate the reliance on paper-based documentation and manual data entry. Such systems may also help prioritize and streamline test result notifications (e.g., for those with negative results) and follow-up (e.g., for low-risk contacts) through automated means (e.g., SMS texting, email).
- **Using other communication technologies** (e.g., SMS texting, Facetime, Zoom, Microsoft Teams) may be helpful for communicating with cases and contacts that are less likely to follow public health guidance. Such tools may also be useful for information-sharing among case and contact management teams, particularly those working across jurisdictions.
- **Improving communication and information sharing** with laboratories and other partners may reduce the identified time delays. Improved communication pathways may also help disseminate best practices, guidelines, and training resources, that way reducing duplication in these efforts.
- **Involving public health professionals in app development and developing standard performance indicators** may help mitigate the challenges related to the use of exposure notification apps, including the lack of interpersonal communication, limited uptake and use, and imprecision in exposure detection. Regardless, apps should be viewed as supplementary tools to existing case and contact management processes, rather than as their replacements.
- **Establishing specialized working groups** is a best practice for case and contact management in settings or populations deemed to be at an increased risk of infection or poor COVID-19 outcomes (e.g., remote areas, long-term care facilities, meat processing plants, homeless shelters, and

schools). The activities of such working groups include developing rapid response resource teams, tailoring infection prevention and control guidelines, and establishing partnerships with relevant community stakeholders.

- Publishing case count data from low-density areas may present privacy challenges, while aggregated data could impede understanding of disease transmission mechanisms. **Considerations of the local context and community engagement are necessary to inform data sharing decisions**.
- Innovative practices in case and contact management, such as door-to-door **active case finding and supported isolation and quarantine** (including support with housing, finances, substance use, and cleaning supplies) may help reduce the barriers to testing and follow-up among higher-risk populations.

Considering the already strained public health and healthcare systems, many of these mechanisms may not be feasible for immediate implementation and may be more relevant to longer-term planning. Adaptation to the local context and expertise are important in interpreting these considerations.

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Appendix A. Interview Questions

Successes and challenges with contact tracing

1. What contact tracing successes or strengths have you identified (or experienced) in your jurisdiction?
2. What contact tracing challenges or limitations have you identified (or experienced) in your jurisdiction?
   Prompts:
   i) What strategies have helped overcome these challenges? What challenges persist?
   ii) What public health activities/programs unrelated to COVID-19 have been postponed or reduced to enable increased contact tracing activity/capacity?
3. What would you like to know about contact tracing practices in other jurisdictions? (e.g., have heard them doing something different or interesting)
   Prompts:
   i) Within Canada?
   ii) Internationally?
4. What contact tracing information-sharing strategies have you found helpful, if any?

Use of technology in contact tracing

5. What do you think about the use of digital contact tracing approaches (e.g., smartphone apps)?
6. Other than telephone calls, is technology used to support contact tracing in your jurisdiction?
   Prompts:
   i) *If YES*, what technologies are used (e.g., smartphones, internet/social media, GPS, Bluetooth, cloud-based approaches/linked data)?
   ii) *If NO*, are any technologies being considered and/or in development? Please describe.
   iii) What role does/will technology have (e.g., case ascertainment, exposure notification)? Is technology supplementing, facilitating, or replacing conventional (or manual) contact tracing methods?
   iv) Are technological methods seen as effective? Why or why not?
7. Were technological tools and/or the necessary infrastructure already in place or has it been/is it being developed specifically to support the COVID-19 response?
   Prompts:
   i) What technological capability is required (e.g., IT infrastructure)?
   ii) If developed for COVID-19 response, who was/is tasked with developing these approaches? How long did this take?
8. How are any privacy concerns regarding the use of technology considered, addressed, or minimized?
   Prompts:
   i) What information is collected from users?
   ii) What is the user consent process?
   iii) Where is user information stored?

iv) What measures are taken to minimize the risk of re-identification (e.g., encryption, aggregation of data)
v) Who is the data custodian?

Considerations for local context and special populations

9. What adaptations were/are being made to support contact tracing for specific populations and/or settings in your jurisdiction?
   Prompts:
   i) Consider the differing practices for:
      a. Rural/remote vs. urban centers
      b. Long-term care settings (residents, staff, caregivers)
      c. Migrant workers
      d. Factory workers and other specific work settings (e.g., meat-packing plants)
      e. Indigenous communities
   ii) Were privacy issues considered in regard to contact tracing in small (rural/remote) communities? *If YES*, how were they addressed? *If NO*, why not?
   iii) What are the privacy and data collection considerations for Indigenous peoples? How does your jurisdiction follow an Indigenous data collection framework, such as the OCAP Principles [13]?
   iv) Who in your jurisdiction is responsible for contact tracing for on-reserve First Nations communities? Are the procedures and responsibilities for contact tracing for on-reserve First Nations communities different from off-reserve populations?
   v) How are cultural/language sensitivities considered and addressed in contact tracing processes?
      a. Do you have contact tracing staff with the same ethnic and cultural identities as your local communities? Do you have contact tracing staff who speak Indigenous languages and local dialects?
      b. Are contact tracing staff working with other staff, community members, or others trained in cultural safety?
10. If known, in what ways is your jurisdiction similar to other jurisdictions in approaching contact tracing in these populations or settings? In what ways is it different?

Concluding questions:

11. Is there anything you would like to add regarding your jurisdiction's experience with COVID-19 contact tracing, that was not captured in our questions?
12. What resources are you finding helpful as you plan/implement contact tracing processes? If not done already in the survey/pre-interview, please kindly forward any supporting resources to the NAO team.

[13] The Principles of OCAP™ (ownership, control, access, and possession) mean that First Nations have a right to own, protect and control how their information is collected and used. This right is fundamentally tied to self-determination and to the preservation and development of First Nations culture.

Appendix B. Survey Questions

Your jurisdiction (province, territory): _____

What is your involvement with COVID-19 case and contact tracing? _____

Contact tracing processes and guidelines:	
1. How is contact tracing for COVID-19 implemented in your jurisdiction (e.g., province or territory)? Please consider the following:	
a) In addition to laboratory notification, how are cases identified and contacted? Roughly what proportion would you estimate are identified through non-laboratory notification mechanisms.	
b) How are contacts identified and contacted? Who performs these tasks?	
c) What information is collected for contact tracing? (Please feel free to share a blank copy of your contact tracing form or protocol section if helpful)	
d) How are the contacts not known to the case identified? What mechanisms to allow contacts to self-identify (i.e., come forward independently)?	
e) What information system is used to track cases and/or contacts (Panorama, iPHIS, paper, MS Access, etc.)	
f) Is your jurisdiction considering or currently using any app-based contact tracing supports (e.g., exposure notification app)? If YES, please note the type of technology, its purpose, target users, privacy considerations, and uptake.	
g) Do you follow the high/med/low risk definition of a contact from the national PHAC guidance?	
2. Are contacts regularly monitored for symptoms and/or adherence to quarantine? How frequently? What happens if contacts develop symptoms?	
3. How long does it take to trace all contacts?	

Does your jurisdiction have any specific targets (e.g., X% of contacts traced in Y time)? *If YES*, is this target local, regional, or province/territory-wide?	
4. Has the contact tracing protocol changed throughout COVID-19? *If YES*, how?	
Skills and workforce for contact tracing:	
1. What resources are required to support case and contact tracing? Please consider the following:	
a) What is the target staff capacity for contact tracing? Was it achieved? *If YES*, how quickly? *If NO*, why not?	
b) Was additional staff hired or redeployed from elsewhere? *If YES*: Where from? What was the recruitment process?	
c) What skills are essential for staff involved in contact tracing? What is the training process for these staff?	
d) What is the surge plan in your jurisdiction if increased contact tracing capacity is needed in the future for COVID-19?	
Contact tracing in special populations:	
1. How have contact tracing processes and guidelines been adapted for the following populations/settings (as applicable)?	
a) Rural, remote, and small communities	
b) Newcomers and migrants (including migrant workers)	
c) Factory workers	
d) Long-term care residents, staff, and caregivers	
e) Indigenous communities	
f) Under- or marginally housed populations	

Any other comments to share:

Please feel free to share blank copies of your case report form, contact list form, daily monitoring form, and communicable disease protocol, as applicable. These will not be public nor posted on the PHPC or other website, unless you expressly ask for this or consent. They will be used for the purposes of gathering information in aggregate for this review. Please feel free to email directly to phpc@cpha.ca if helpful.

NORTH AMERICAN
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The North American Observatory on Health Systems and Policies (NAO) is a collaborative partnership of interested researchers, health organizations, and governments promoting evidence-informed health system policy decision-making. Due to the high degree of health system decentralization in the United States and Canada, the NAO is committed to focusing attention on comparing health systems and policies at the provincial and state level in federations.