EVIDENCE SYNTHESIS BRIEFING NOTE

TOPIC: COVID-19 TESTING – EVIDENCE AND BEST PRACTICES

Information finalized as of June 25, 2020.[a]

This Briefing Note was completed by the Research, Analysis, and Evaluation Branch (Ministry of Health) based on information provided by members of the COVID-19 Evidence Synthesis Network. Please refer to the Methods section for further information.

Purpose: This note provides a summary of evidence sources and jurisdictional experiences on testing for COVID-19, including symptomatic and asymptomatic testing. It addresses the following questions: 1) who should be tested and with what frequency; 2) where should testing take place; 3) what part of the health system should lead the testing; 4) what is the rationale for testing decisions; 5) what approaches directly complement testing strategies; and 6) what are the testing capacities of non-Canadian jurisdictions. Information is also provided on the availability, accuracy, guidelines, benefits, and limitations of point-of-care diagnostic tests in Canada.

Key Findings:

- Guidelines recommend testing for symptomatic people based on the likelihood of contracting the infection or testing that targets specific groups (e.g., home care patients recovering from COVID-19 prior to being released from home isolation, admissions to long-term care facilities, mass or population-wide testing).
  - Asymptomatic testing: Not widely used due to risks of false negative results, and uncertainty regarding the true prevalence of asymptomatic cases.
  - Antibody tests: Antibody tests conducted one week after first symptoms only detected 30% of people who had COVID-19. Accuracy increased in week two with 70% detected and was highest in week three with more than 90% detected.
- Best practices for COVID-19 testing include:
  - Frequency of Testing: A minimum of two negative tests at least 24-hours apart prior to release after being in isolation.
  - Location of Testing: Expanded testing capacity, accessibility, and reducing hospital traffic in the community through developments such as drive-in testing facilities.
  - Health System Lead: Health system testing leads are variable and can include primary care, long-term care homes, or a central agency.
  - Rationale for Testing: Strategies for making decisions about testing include: 1) clinical and epidemiological factors; 2) prioritizing testing based on transmission scenarios (e.g., clusters of cases or community transmission); and 3) establish a priority system based on the availability of tests.
  - Complement to Testing: Contact tracing, self isolation, and leveraging data (e.g., from mobile phones).
  - Testing capacity: Viral testing capacities vary: 700,000 per week in France; 157,150 per day in Germany; 12,500 per day in New Zealand, and 662 swabs per 1,000 population in Italy.

Analysis for Ontario:

- Ontario is prioritizing COVID-19 testing for: 1) those who have been in contact with a positive COVID-19 case; 2) new hospital admissions; 3) patients being transferred from hospital to home or other health care facilities; and 4) health care providers. Ontario has expanded testing to include asymptomatic persons who request a test or are referred by a physician or nurse practitioner.

[a] This briefing note includes current available evidence as of the noted date. It is not intended to be an exhaustive analysis, and other relevant findings may have been reported since completion.

Supporting Evidence

This section summarizes key findings on COVID-19 testing from relevant evidence documents, as well as testing experiences in Canadian provinces and territories and other countries. Additional details are provided in the Appendix: Table 7 (for experiences of Canadian provinces and territories); Table 8 (for international experiences); Table 9 (non-Canadian testing capacities); Table 10 (an overview of evidence documents);[b] Table 11 (Canadian asymptomatic testing policies); Table 12 (international asymptomatic testing policies); and Table 13 (case studies, including information on testing capacity). For information about the availability, accuracy, guidelines, benefits and limitations of point-of-care diagnostic tests in Canada, see Table 14.

1. Who should be tested and frequency of testing? Table 1
2. Where should individuals be tested? Table 2
3. What part of the health system should lead testing? Table 3
4. What is the rationale for testing decisions? Table 4
5. What approaches directly complement testing? Table 5
6. What are the testing capacities of non-Canadian jurisdictions? Table 6

Table 1: Who should be tested and frequency of testing?

Scientific Evidence	• Guidelines for testing: Guidelines developed using a robust process recommend testing for symptomatic individuals based on the likelihood of infection (e.g., a person who is suspected of having COVID-19 or has had contact with a COVID-19 case).[1] • Testing of Specific populations: The following groups were identified for testing: 1) home care patients recovering from COVID-19 prior to being released from home isolation with at least two negative tests at least 24-hours apart; 2) patients and residents who enter long-term care facilities; 3) mass testing all persons at the site of an outbreak (e.g., long-term care homes, hospitals or homeless shelters);[c] and 4) people undergoing surgeries perceived as high risk for those in the operating room (e.g., upper gastrointestinal, ear nose and throat, and neurosurgery).[2] • Asymptomatic testing: This is not widespread in part due to risks of false negative results. Further, there is a lot of uncertainty regarding the true prevalence of asymptomatic cases. In health care settings, the proportion of asymptomatic health care workers and patients was similar to the general population.[3,] o Potential benefits of asymptomatic testing: Population-based surveys may provide key insight regarding the prevalence of the virus or immunity to the virus in the community when planning to ease large-scale public health restrictions, as they indicate the effectiveness of containment efforts and the estimated size of a possible second wave of the infection such as in Iceland, Israel, and Germany.[4] Mathematical models have demonstrated that testing of asymptomatic individuals is an important step in combatting the current pandemic; especially in high-risk professions (e.g., health care), individuals who work in crowded settings, and in the older adults and vulnerable populations (e.g., long-term care facilities).[5]

[b] The relevance of each evidence document in this table was assessed by the authors and is indicated by colour-coding: high (darkest blue) to low (lightest blue) (Wilson et al., 2020).
[c] Singapore offers an example of mass testing: Nearly 3,000 migrant workers living in dormitories have been tested daily by the end of April 2020, amounting to a total of over 21,000 individuals. (Bhatia, et al., May 2020).

	▪ Evidence from testing all international arrivals, individuals who were on cruise ships (e.g., Diamond Princess) and persons evacuated from Wuhan, China show that asymptomatic individuals were often pre-symptomatic or asymptomatic carriers. Early identification allowed quarantine, close observation, and contact tracing.[6] • Potential harms of asymptomatic testing: Currently, the potential harms to individuals (e.g., anxiety of false diagnosis), organizations (e.g., procedural changes) or society (e.g., added cost of mass testing, prophylaxis) are not fully established.[7] • Accuracy of antibody testing: Antibody tests conducted one week after first symptoms only detected 30% of people who had COVID-19. The accuracy of tests increased in week two with 70% detected and was highest in week three (more than 90% detected). Little evidence was available after week three. Tests gave false positive results in 2% of those without COVID-19.[8,d]
International Scan	• Asymptomatic testing: Policies from 28 countries demonstrate that policies for testing asymptomatic persons is variable; dependent on region, risk-level and work setting. Most allow testing for contact tracing and as indicated by a physician.[9] o China: the principle of testing for all who need and for all who seek it has been implemented, however, specific population groups targeted for testing include: inbound passengers; patients in fever clinics; newly admitted patient and their caregivers; staff in medical institutions; customs staff; staff in prisons; and staff in nursing homes.[10] o South Korea: population-wide testing has been implemented.[11] o Germany: virus testing prioritization is given to: those are symptomatic; are asymptomatic but have had contact with a confirmed COVID-19 patient in the last two weeks; those with pre-existing conditions; and those whose employment places them in contact with vulnerable populations.[12] o Denmark: virus testing has been prioritized for: those in close contact with a confirmed COVID-19 case; inhabitants of institutions such as nursing care homes; patients who are going to be hospitals or receiving elective procedures; women giving birth, and employees at a range of heath and social organizations (e.g., probation services, homeless shelters, those providing community care to vulnerable and immunosuppressed patients).[13] o Sweden: virus testing is being prioritized for: all patients seeking any type of health care; patients with particular risk factors (e.g., immunocompromised); people living in long-term care institutions; and staff working in health and social care organizations.[14] o Switzerland: virus testing is being prioritized for: all symptomatic individuals; asymptomatic persons seeking care from hospitals; and older adults living in nursing homes.[15] o United Kingdom: virus testing has been prioritized for the following groups: anyone who is symptomatic; all critical care admissions; anyone exposed to an outbreak; anyone discharged from hospital to home care; those who continue to go to work; asymptomatic health and social care workers; and pupils, teachers and family members who are attending school.[16] • Frequency of testing: In Denmark, when outbreaks occur all those in contact are tested twice, a week apart, to establish whether the outbreak is under control.[17]

[d] The authors note that sensitivity of the antibody test has mainly been evaluated in hospitalized patients, so it is unclear whether the tests are able to detect lower antibody levels seen with milder and asymptomatic COVID-19 infections.

	• Antibody testing: In Germany, antibody testing is available for medical personnel; in Switzerland, a university network is undertaking a study. The UK is in the process of rolling out widespread testing beginning with health care professionals.[18]
Canadian Scan	• In addition to those experiencing symptoms of COVID-19, Canadian provinces are prioritizing groups for testing including: those that have been in contact with a positive COVID-19 case (British Columbia [BC], Alberta [AB], Saskatchewan [SK], Manitoba [MB], Ontario [ON], Prince Edward Island [PEI]); residents and staff of long-term care facilities and other institutions with vulnerable populations (BC, AB, SK, MB, ON, PEI); individuals requiring admissions to hospital (BC, MB, ON, PEI); patients transferring from hospital to home or between health care facilities (AB, ON); patients that are immunocompromised including cancer patients or those on hemodialysis (BC, SK); residents of remote, isolated or Indigenous communities (BC); those living in vulnerable settings such as homeless shelters (SK); essential service providers and first responders (BC, AB, ON); essential workers with frequent travel outside of the province (PEI); and temporary foreign workers following the end of their 14 day self-isolation (PEI; Yukon [YK]).[19] • Asymptomatic provincial testing: Alberta, Manitoba, Ontario, and Saskatchewan have expanded testing to include asymptomatic persons who request a test or are referred by a physician. British Columbia and Northwest Territories (NWT) are not recommending testing asymptomatic persons with some exceptions.[20,e]
Ontario Scan	• Ontario is prioritizing testing for: 1) those who have been in contact with a positive COVID-19 case; 2) new hospital admissions; 3) patients being transferred from hospital to home or other health care facilities; and 4) health care providers. [21] Ontario has expanded testing to include asymptomatic persons who request a test, or are referred by a physician or nurse practitioner.[22,f]

Table 2: Where should individuals be tested?

Scientific Evidence	• Moving diagnostic testing for COVID-19 from laboratory settings to the point of care is potentially transformative for the rate and quantity of testing; in particular the antibody-based tests could help to ascertain suitability of infected health care workers to return to frontline health services and inform public health strategies at the end of periods of lockdown or as social distancing restrictions were relaxed.[23]
International Scan	• Jurisdictions such as Israel and Iceland have sought to make SARS-CoV-2 testing more widely accessible in the community to expand testing capacity and reduce hospital traffic with drive-in testing facilities being a popular approach.[24] Other examples include: o United Kingdom: testing has shifted from hospitals to 50 drive through testing facilities, mobile testing units, and self-testing for health and social care staff; and o South Korea: established a range of testing centres including drive throughs and testing "phone booths".[25] o Germany, Israel, and Iceland: established dedicated non-emergency hotlines and home-based testing to manage cases outside the hospital. These hotlines encourage patients

[e] Policies for testing asymptomatic persons in New Brunswick, Newfoundland and Labrador, Nova Scotia, Prince Edward Island, Quebec, Yukon and Nunavut were not identified; even though policies are available for symptomatic individuals and contact tracing.
[f] Public Health Ontario notes that requests for testing can only be obtained through a health care provider including nurse practitioners (PHO, June 18, 2020).

	with mild symptoms or those without symptoms but history of contact with a confirmed case to self-identify to enable closer monitoring in the community setting.[26]
Canadian Scan	• Saskatchewan has established mobile worksite testing for high volume work settings including factors and other industrial worksites for those requiring a test.[27]
Ontario Scan	• No information was identified.

Table 3: What part of the health system should lead testing?

Scientific Evidence	• A guideline from the Centers for Disease Control and Prevention (CDC) advises that patients and residents who enter long-term care facilities should be screened through testing.[28]
International Scan	• Denmark: the government recently announced the development of a new agency to take over responsibility for the coordination of testing; and • Sweden: testing is largely being directed by primary care.[29]
Canadian Scan	• Newfoundland and Labrador (NL) and NWT: established drive-by or drive-through testing sites.[30]
Ontario Scan	• No information was identified.

Table 4: What is the rationale for testing decisions?

Scientific Evidence	• Guidelines recommend a range of strategies for making decisions about testing: 1) based on clinical and epidemiological factors, and linked to an assessment of the likelihood of infection; 2) prioritizing testing based on four transmission scenarios: i) when there are no cases; ii) sporadic cases; iii) clusters of cases; and iv) community transmission); 3) establish a priority system based on the availability of tests; and 4) repeated testing to account for false-negative test results.[31]
International Scan	• No information was identified.
Canadian Scan	• No information was identified.
Ontario Scan	• No information was identified.

Table 5: What approaches directly complement testing?

Scientific Evidence	• Guidelines developed using a robust process recommend that home care patients with COVID-19 presenting with mild symptoms should only be released from home isolation, including returning to work, after testing negative twice at least 24 hours apart.[32]
International Scan	• China: contact tracing has been prioritized by actively testing close contacts of COVID-19 cases as well as all of those in contact with cluster investigations.[33] o Asymptomatic persons who have been in contact and test positively are put under a 14-day centralized medical observation.[34]

	• Germany: following testing, individuals are asked to self-isolate until they receive the results from their tests at which time, they are provided with additional instructions from local public health authorities.[35] • Denmark: contact tracing is taking place to complement testing with those who have been in contact with a positive case asked to self-isolate until their own test results are returned. • South Korea: strong contact tracing measures have been implementing leveraging data from mobile phones, credit card transactions and CCTV cameras.[36]
Canadian Scan	• All provinces recommend individuals to self-isolate while awaiting test results and have maintained their self-isolation requirements for those with positive tests unless treatment is needed.[37]
Ontario Scan	• No additional information was identified.

Table 6: What are the testing capacities of various jurisdictions?

Scientific Evidence	• No information was identified.
International Scan	• Current viral-testing capacity: China (3,000,000 per day); France (700,000 per week); Germany (157,150 per day); Italy (662 swabs per 1,000 population); New Zealand (12,500 per day); UK (target of 100,000 per day but have not reached capacity); and the US (varies by state). • Current antibody testing capacity: Germany (short-term capacity target over the summer is 15,000 people every two weeks in 150 regions, and a set of 2,000 samples from four hot-spot areas); Italy (several regions have implemented routine testing, but no targets identified); and UK (plans to implement point-of-care antibody testing, but experiencing challenges with test validity). • Targeted viral and antibody testing for Fall 2020: No information was identified.[38]
Canadian Scan	• No information was identified.
Ontario Scan	• No information was identified.

Methods

The COVID-19 Evidence Synthesis Network is comprised of groups specializing in evidence synthesis and knowledge translation. The group has committed to provide their expertise to provide high-quality, relevant, and timely synthesized research evidence about COVID-19 to inform decision makers. The following members of the Network provided evidence synthesis products that were used to develop this Evidence Synthesis Briefing Note:

- Wilson MG, Waddell K, Gauvin FP, Mansilla C, Moat KA, Wang Q, Voorheis P, Bhuiya AR, Ahmad A, Lavis JN. COVID-19 rapid evidence profile #12: What insights from the available evidence and jurisdictional scans can inform who should be tested for COVID-19 and how frequently, where, by whom and with what follow-up actions they should be tested? Hamilton: McMaster Health Forum, 2 June 2020.

- Abou-Setta AM, Okoli G, Lam O, Kasireddy V, Askin N, MacKenzie L, Straus SE, Tricco AC. Testing for asymptomatic COVID-19: A rapid systematic review and jurisdictional/healthcare organizational scan. (Draft). June 2, 2020.[g]
- Kelly SH, and Wells GA. Rapid and Point-of-Care Diagnostic Tests for SARS-CoV-2 (COVID-19): A Rapid Summary of Tests available in Canada. June 3, 2020.[h]
- Bhatia, D., Morales-Vazquez, M., Song, K., Roerig, M., Allin, S., & Marchildon, G. (May 2020). COVID-19 Case and Contact Tracing: Policy Learning from International Comparisons. Toronto: North American Observatory on Health Systems and Policies. *Rapid Review* (No. 30).
- Waddell K, Wilson MG Gauvin FP, Mansilla C, Moat KA, Wang Q, Lavis JN. COVID-19 rapid query response #1: What are large non-Canadian jurisdictions' planned daily (viral and antibody) testing capacity by the fall? Hamilton: McMaster Health Forum, 10 June 2020.[i]
- Deeks, J.J., Dinnes,J., Takwoingi,Y., Davenport,C., Spijker,R., Taylor-Phillips,S., Adriano,A., Beese,S., Dretzke,J., Ferrante di Ruffano,L., Harris,I.M., Price,M.J., Dittrich,S., Emperador,D., Hoo, L., Leeflang,M.M.G., Van den Bruel,A.. Antibody Tests for Identification of Current and Past Infection with SARS-CoV-2. *Cochrane Database of Systematic Reviews* 2020, Issue 6. Art. No.: CD013652.

For more information, please contact the Research, Analysis and Evaluation Branch (Ministry of Health).

[g] This document is not publicly available. Please contact Research, Analysis and Evaluation Branch (Ministry of Health) for the full-text document.
[h] This document is not publicly available. Please contact Research, Analysis and Evaluation Branch (Ministry of Health) for the full-text document.
[i] This document is not publicly available. Please contact Research, Analysis and Evaluation Branch (Ministry of Health) for the full-text document.

APPENDIX

Table 7: Canadian Provinces' and Territories' Experiences with Testing for COVID-19[39]

Province/ Territory	Key Findings
British Columbia	• As of 2 June 2020, testing is recommended for anyone with cold, influenza or COVID-19-like symptoms, even mild ones (e.g., fever, chills, cough, shortness of breath, sore throat and painful swallowing, stuffy or runny nose, loss of sense of smell, headache, muscle aches, fatigue, and loss of appetite). The public can use the BC COVID-19 Self-Assessment Tool to help determine if they need further testing by a health care provider or at a local collection centre. • On 1 June 2020, the COVID-19: Testing Guidelines for British Columbia indicated that individuals in the following groups should be prioritized for testing: o Residents and staff of long-term care facilities; o Individuals requiring admission to hospital or likely to be admitted, such as pregnant individuals near-term; o Patients on hemodialysis, or cancer patients receiving radiation or chemotherapy; o Health care workers; o Individuals with a higher probability of being infected with COVID-19 such as contacts of a known case of COVID-19 and travellers just returned to Canada; o Residents of remote, isolated, or Indigenous communities; o People living in congregate settings such as work-camps, correctional facilities, shelters, group homes, assisted living and seniors' residences; o People who are homeless or have unstable housing; and o Essential service providers, such as first responders. • Asymptomatic individuals do not require a test. • Health care providers can order a COVID-19 test for any patient based on their clinical judgment. • Individuals should self-isolate while they wait for their test result. • After a negative COVID-19 test, there are still self-isolation requirements for: those with symptoms; those exposed to a case of COVID-19; international travellers returning to Canada; and health care providers.
Alberta	• As of 2 June 2020, testing is available in Alberta to any person without symptoms who wants to be tested, but the following groups continue to be prioritized for testing: o Any person exhibiting any symptom of COVID-19 (e.g., fever, cough, shortness of breath); o All close contacts of confirmed COVID-19 cases; o All workers and/or residents at specific outbreak sites; o All workers and residents at long-term care and level 4 supportive living facilities; and o All patients admitted to continuing care or transferred between continuing care and hospital settings. • In addition, testing will be prioritized for individuals in the following roles: o Health care workers; o Group home, disability support and shelter workers; o First responders, including firefighters and EMS;

Province/ Territory	Key Findings
	o Those involved in COVID-19 enforcement, including Police, Peace Officers, Bylaw Officers, Environmental Health Officers, and Fish and Wildlife Officers; and o Correctional facility staff, working in either a provincial or federal facility. • Individuals can book a testing appointment with the online COVID-19 self-assessment tool.
Saskatchewan	• As of 2 June 2020, testing is strongly recommended in Saskatchewan for anyone who has unexplained new or worsening symptoms (even mild symptoms) that may include one or more of the following: fever; cough; headache; muscle and/or joint aches and pains; sore throat; chills; runny nose; nasal congestion; conjunctivitis; dizziness; fatigue; nausea/vomiting; diarrhea; loss of appetite (difficulty feeding for children); loss of sense of taste or smell; shortness of breath; and difficulty breathing. • Testing will also be available for: o Immunocompromised asymptomatic individuals (e.g., cancer patients); o Patients being admitted to an acute care hospital for a stay anticipated to be greater than 24 hours (including all expectant mothers entering a health facility to give birth); o Individuals who are homeless or living in other vulnerable settings; o Health care workers caring for certain immunocompromised patients; o Any one working outside the home, including those currently working, or returning to work as part of the Reopen Saskatchewan plan, who desire a test; and o Mobile (worksite) testing for high volume work settings (factories, industrial settings, etc.) for individuals requesting a test. • Testing for COVID-19 is available through by referral only and not for walk-in testing.
Manitoba	• As of 2 June 2020, Manitoba is offering testing to all symptomatic individuals (symptoms include fever, cough, runny nose and sore throat). o Individuals are advised to take the self-assessment test ahead of visiting a screening location. • On 20 May 2020, testing was expanded to some asymptomatic individuals, including: o Those visiting an ER, Urgent Care or a community-testing site; and o Those admitted to acute care or long-term care facilities.
Ontario	• On 28 May 2020, Ontario updated its COVID-19 Provincial Testing Guidance. o Any individual presenting with at least one symptom or sign should be considered for testing (fever, new or worsening cough, shortness of breath, sore throat, difficulty swallowing, new olfactory or taste disorders, nausea/vomiting, diarrhea, abdominal pain; runny nose or nasal congestion). Other atypical symptoms should be considered, particularly in children, older adults, and people living with a developmental disability. o Asymptomatic individuals that have been in contact with a confirmed case should be considered for testing. If they test negative and the contact becomes symptomatic, they should be re-tested, and they should remain in self-isolation for 14 days from their last exposure to the case. o Guidance is also offered for specific settings (e.g., facility transfers, hospitals, long-term care facilities and retirement homes, workplaces and community settings) and for specific populations (e.g., health care workers, caregivers, first responders, essential workers, cross-border workers, newborns, asymptomatic cancer patients, pre-operative patients).
Quebec	• Since 4 May 2020, anyone who has symptoms similar to those of COVID-19 will have to call the line 1-877-644-4545, where their condition will be assessed in order to schedule an appointment with them. a designated screening clinic (CDD), if applicable, or a designated assessment clinic (CDE). • Six groups have been prioritized for testing: o G1: symptomatic patients hospitalized or requiring regular care in hospital settings, in particular symptomatic hospitalized patients (including the tests required for the lifting of isolation), symptomatic patients of hemodialysis units, symptomatic emergency patients whose condition justifies

Province/ Territory	Key Findings
	hospitalization or who have risk factors for complications, symptomatic pregnant women in the third trimester and people who must accompany a woman to a delivery, when symptomatic at the end of the pregnancy; o G2: symptomatic health professionals in direct contact with patients (including the tests required for return-to-work measures); o G3: users and staff in residential and long-term care centers, private seniors' residences and intermediate and family-type resources as soon as a new non-isolated positive case is identified, those experiencing hospital-to-home transitions, symptomatic people living in other at-risk environments (e.g., homeless shelters) and in living environments with older adults (70+); o G4: symptomatic individuals from all communities (including areas in reopening: schools, daycare, factories, mines, construction, etc.) o G5: first responders or workers in the public security system (e.g., police and firefighters, correctional officers) and other symptomatic workers providing services deemed critical/essential; and o G6: close contacts of cases, symptomatic or asymptomatic. • Symptomatic individuals can get tested at a designated screening or assessment clinic, a drive-through screening clinic, or an outdoor clinic. • On 1 May 2020, the government released detailed instructions for people with COVID-19 symptoms who are waiting to be tested or waiting for their test result.
New Brunswick	• As of 2 June 2020, New Brunswick continues to encourage all symptomatic people to present for COVID-19 testing. Individuals can access testing independently by calling 811 or through their primary-care provider. • On 28 April 2020, the government expanded the list of symptoms required to get a test (from eligibility for testing with two of five listed symptoms to two of nine listed symptoms).
Nova Scotia	• The Nova Scotia Health Authority has established COVID-19 assessment centres. If an individual needs in-person assessment, 811 will refer them to a centre. • Individuals waiting for their test results should self-isolate for 14 days.
Prince Edward Island	• As of 2 June 2020, PEI recommends testing for COVID-19 for the following individuals: o Any person with COVID-19 symptoms; o Any person who was in close contact of a laboratory-confirmed case starting 48 hours prior to the case developing symptoms; o Any person hospitalized with influenza-like-illness: fever and new or worsening cough, sore throat, joint pain, muscle aches, fatigue; o Any person admitted to the intensive care unit with any respiratory symptom; o Admitted patients to Hillsborough Hospital, Provincial Addictions Treatment Facility, and Prince County Hospital Inpatient Psychiatry Unit; o Any health care worker with fever, new or worsening cough, sore throat, runny nose, sneezing, congestion or unusual fatigue; o Health care workers who travel to PEI to work or who traveled out of the province; o Staff of the Queen Elizabeth Hospital Microbiology Laboratory; o Long-term and community care residents and staff; o New residents are to be tested prior to admission; o Any resident with fever, new or worsening cough, sore throat, runny nose, sneezing, congestion or unusual fatigue; o All staff and residents who are close contacts of a positive case; o Long-term care staff who work at more than one health care site should be tested on a regular basis; o Patients transferring between health care facilities as per protocol; o Temporary foreign workers prior to the end of their 14-day self-isolation; o Essential workers with frequent travel outside of PEI (e.g., long-haul truck drivers); and o Any other individual or group as indicated by PEI's Chief Public Health Officer or Medical Microbiologist.

Province/ Territory	Key Findings
Newfoundland and Labrador	• As of 2 June 2020, individuals who develop symptoms of COVID-19 are advised to complete the 811 self-assessment tool to determine if they should call 811. • If it is determined by 811 that an individual requires testing, this will be arranged through Public Health. • Testing may be completed in the home, at a drive-thru testing site, or another location as determined by Public Health.
Yukon	• Individuals should take the COVID-19 self-assessment to determine if they should be tested. o Individuals should be tested if they have travelled or have had close contact with a person with a recent travel history who was or is now symptomatic or are a known close contact to a confirmed case of COVID-19, and have any of the following symptoms: cough, fever/chills, sore throat, headache, runny nose or nasal congestion, vomiting, diarrhea, fatigue or muscle aches or difficulty breathing. o Individuals should also be tested if they have not travelled outside of Yukon but have the following symptoms: cough, fever and/or chills, or difficulty breathing.
Northwest Territories	• The government recommends that anyone experiencing symptoms of COVID-19 should call a health care provider, who may recommend a test. • Test swabs are collected by a health care provider and then sent to Alberta to be processed. Some health facilities in the are collecting swabs in "drive-by" testing sites.
Nunavut	• The government of Nunavut produced a self-assessment tool to help determine whether individuals should be tested for COVID-19. Testing is recommended based on symptoms and identified exposure either by high risk contact and/or returned from travel.

Table 8: International Experiences with Testing for COVID-19[40]

Country	Key Findings
China	• Implementing the principles of "testing all who need" and "testing all who seek" o Based on the capacity for testing and the needs for epidemic prevention and control, different regions may take the principles of "testing all who need" for key populations such as those with close contact to cases, inbound passengers, patients in fever clinic, newly admitted patients and their caregivers, staff in medical institutions, customs (immigration inspection, health and quarantine) staff, staff in prisons and social welfare nursing homes. For other populations, the principle is "testing all who seek". o On April 8, Wuhan City lifted the control measures for channels and passage. In order to promote the safe and orderly flow of people leaving Wuhan, key groups of people who are leaving Wuhan (i.e., people who go to their destinations to work in public places, transportation services, pension institutions, prisons and other special places; and teachers, health care workers, and workers in relatively closed places) should follow the principle of "testing all who need" to go to qualified health facilities and other institutions for nucleic acid-based testing for COVID-19. The cost of the test for people flowing the principle of "testing all who need" was covered and coordinated by Hubei Province and Wuhan City. Other population should follow the principle of "testing all who seek" and the costs will be paid by themselves. Those who have received serum specific IgG antibody test and got a positive result will not need nucleic acid test. o In areas with relatively dense populations with higher mobility, and other key areas with borders and ports, the disease prevention and control institutions at the county-level and higher, and secondary or higher hospitals, shall strive to strengthen capacity for nucleic acid testing; and encourage qualified societal testing bodies to provide testing services and expand commercial applications. Each region should promptly issue lists of testing agencies. • On 8 April 2020, China's State Council Joint Prevention and Control Mechanism Against COVID-19 issued the protocol for the management of asymptomatic persons infected with COVID-19 virus.

Country	Key Findings
	o Testing of asymptomatic persons has been prioritized by: actively testing close contacts of COVID-19 cases; actively testing during cluster investigations; actively testing people who have been found to be exposed while tracing an infection source; actively testing people that have a travel or residential history in areas abroad with sustained COVID-19 transmission; and actively testing individuals found through epidemiological investigation. o Asymptomatic infected persons should be placed under medical observation for 14 days and close contacts of asymptomatic infected persons should be put under 14-day centralized medical observation. • On 7 March 2020, the National Health Commission of the People's Republic of China published the protocol for prevention and control of COVID-19 (Edition 6) and it included the following recommendations about testing for different populations in different settings: o For individuals with respiratory symptoms such as fever and dry cough and digestive tract symptoms such as diarrhea of unknown cause in health care facilities, their specimen should be collected for testing. o For people who travelled to or resided in Wuhan and its surrounding areas within 14 days, people who travelled to or resided in communities where confirmed cases have been reported, and people who travelled to or resided in countries and areas with COVID-19 pandemic, if they developed who developed respiratory symptoms such as fever and dry cough and digestive tract symptoms such as diarrhea, their specimen should be collected for testing. o For individuals with respiratory symptoms such as fever and dry cough and digestive tract symptoms such as diarrhea in the inbound and outbound ports, their specimen should be collected for testing. For close contacts who developed respiratory symptoms such as fever and dry cough and digestive tract symptoms such as diarrhea, their specimen should be collected for testing.
Germany	• In Germany, testing prioritization is given to those: o Displaying COVID-19 symptoms; o Who have had contact with a confirmed COVID-19 patient in the last two weeks; o With pre-existing conditions (e.g., immunocompromised); and o Those whose employment places them in contact with individuals who are considered vulnerable (e.g., working in hospitals, elderly care). • In addition, large scale, system wide testing and voluntary antibody testing for employed medical personnel was established in early April. • Following testing, individuals are asked to self-isolate and respect hand-hygiene and use a mask where contact with others in not avoidable. • Testing strategies have been run primarily by public health in particular those at the local authority level, who are also responsible for contact tracing. • As a follow-up measure, the government launched the development of a voluntary smartphone app with Bluetooth to trace possible chains of COVID-19.
Denmark	• The Danish Health Authority has asked that those who are symptomatic, and the following asymptomatic individuals are prioritized for testing: o Those who have been in close contacts with a person with confirmed COVID-19 case; o Inhabitants of nursing care homes (and other institutions) as well as front line nursing home personnel in case of infection among inhabitants or colleagues; o Patients expected to be hospitalized for 24 hours or more, independent of the patient's condition; o Patients who are going to attend certain elective procedures at a specialist, dentist or out-patient clinic at a hospital; and o Women giving birth, regardless of the duration of their stay in hospital. • In addition, systematic, standardized testing is being rolled out for: o Employees in the health care sector; o Employees of other social institutions such as those working in probation services or in homeless shelters o Employees working with people at increased risk including patients in ongoing immunosuppressive treatment, innate or acquired compromised immune system, immobile persons, and the elderly (over the age of 80).

Country	Key Findings
	• When outbreaks are suspected, systematic testing of all those affected by the outbreak is undertaken with a repeat test provided one week later to establish whether the outbreak is under control. • As of April 22, the Danish Health Authority has asked regions to establish temporary testing facilities away from hospitals. • With respect to tracing, individuals testing positive for COVID-19 will be asked to provide a list of those individuals with whom they have been in contact: o Close contacts will be offered testing on day four and day six of the initial contact and urged to enter into self-isolation until they have received a negative result of their own testing. • The government has announced the development of a new agency, which will be in operation in August, to take over responsibility for the coordination of testing and provision of personal protective equipment.
South Korea	• South Korea has established strong testing infrastructure including test kit production, distribution and laboratory analysis and has combined this with tracking and tracing efforts. • General population-wide testing has been implemented using a number of innovative models including testing drive throughs as well as testing "phone booths" where health workers administered throat swabs using thick rubber gloves built into walls. • After testing suspected cases, the ones testing positive are tracked, provided with treatment (where necessary), and ordered into self-isolation o Those in isolation following a positive test are asked to download a mobile phone application, which alerts officials if a patient breaks isolation • A wide range of tracing strategies are begin used including data from mobile phones on locations, the use of CCTV cameras, as well as credit and debit card transactions: o When a person tests positive, detailed information regarding their movements is sent by text message to residents living near by as well as alerting individuals with whom the individual had contact. • Concerns around privacy with these measures act as a significant downside and are thought to prevent some infected people from coming forward.
Sweden	• To confirm COVID-19 PCR-tests are performed in the following priority order: o All patients seeking any type of health care, individuals with specific risk factors, and persons in long-term care; o Personnel in the health care and social care systems; o Personnel in other critical societal sectors; and o Other relevant parts of society. • The government has tasked the Public Health Agency to develop their testing strategy and to increase testing capacity.
Switzerland	• Testing is being recommended for all persons with: o Symptoms of an acute respiratory disease and/or with sudden onset anosmia or ageusia; o Asymptomatic persons seeking care from hospitals; and o Older adults living in nursing homes. • Testing for asymptomatic populations is prioritized by cantons and primary care professionals who refer patients to be tested o Cantons are also responsible for determining the procedure for diagnostic investigation of patients with suspected COVID-19 cases. • Discussions are ongoing related to antibody testing with a network of twelve Swiss universities recently launching a nationwide study to examine the number of people that have already been infected with COVID-19 and to examine immunity and its lasting effects.
United Kingdom	• Testing is prioritized for the following groups: o Anyone displaying symptoms of COVID-19; o All critical care admissions; o Symptomatic and asymptomatic individuals exposed to an outbreak;

Country	Key Findings
	o Anyone discharged from hospital to a care home; o Asymptomatic care home residents and members of the public over the age of 65; o Anyone who must go out to work; o Asymptomatic health and social care workers; and o Pupils, teachers and family members who are attending school as of June 1. • Widespread antibody testing is presumed to be rolled out beginning with health and social care workers. • Testing has gradually shifted away from hospitals, with the establishment of 50 drive through testing facilities, mobile testing units for frontline essential workers, and implementation of self-testing kits via a national self-referral portal. o In addition, self-testing is being implemented for health and social care staff members using on-site assessment pods previously used for testing ambulatory patients in the community.

Table 9: International Jurisdictions' Testing Capacity and Testing-Capacity Targets[41]

Country	Viral-testing capacity or capacity targets	Antibody-testing capacity or capacity targets
Australia	• Unable to find planned daily testing capacity for Fall 2020	• Unable to find planned daily testing capacity for Fall 2020
China	• Current capacity is 3,000,000 tests per day • Unable to find planned daily testing capacity for Fall 2020	• Unable to find planned daily testing capacity for Fall 2020
France	• As of 31 May, capacity objective was 700,000 tests per week • Unable to find planned daily testing capacity for Fall 2020	• Unable to find planned daily testing capacity for Fall 2020
Germany	• As of 20 May, testing capacity was 157,150 tests per day • Unable to find planned daily testing capacity for Fall 2020	• Short-term capacity target over the summer months is 15,000 people every two weeks in 150 regions, as well as a second set of 2,000 samples from the four areas most affected by COVID-19 • Unable to find planned daily testing capacity for Fall 2020
Italy	• As of 8 May, while in a shift from phase 1 to phase 2, testing capacity was 662 swabs per 1,000 population • Unable to find planned daily testing capacity for Fall 2020	• Several regions have implemented routine antibody testing, however, no targets were identified • Unable to find planned daily testing capacity for Fall 2020
New Zealand	• Expanded testing capacity to 12,500 tests per day • Unable to find planned daily testing capacity for Fall 2020	• Unable to find planned daily testing capacity for Fall 2020
United Kingdom	• Current target of 100,000 tests per day, however, Public Health England has yet to meet that objective on a given day • Unable to find planned daily testing capacity for Fall 2020	• The government is working to implement point-of-care antibody testing, however, there are currently challenges with the tests' validity • Unable to find planned daily testing capacity for Fall 2020

United States	• Unable to find a daily target given this is left up to states, where there is significant variation.[j] • Criteria established to indicate robust testing programs, including: o Phase 1: Test availability such that % of positive tests is less than 20% for 14 days, and the median time form test order to result is less than four days. o Phase 2: Test availability such that % of positive tests is less than 15% for 14 days, with median time from test order to result is less than three days. o Phase 3: Test availability such that % of positive tests is less than 10% for 14 days and the median time from test order to result is less than two days. • An interactive calculator that models the minimum daily testing needed to contain an outbreak.	• Unable to find planned daily testing capacity for Fall 2020

Table 10: Evidence Documents that Address the Question, Organized by Document Type and Sorted by Relevance to the Question and COVID-19[42,k]

Type of Document	Relevance to Question	Focus	Recency or Status
Guidelines developed using a robust process (e.g., GRADE)	• Who should be tested for the virus? o Symptomatic • How frequently should they be tested? o With fixed periodicity • What approaches directly complement testing? o Isolation of confirmed cases	Home care patients with COVID-19 presenting with mild symptoms should only be released from home isolation after testing negative using PCR testing twice from samples collected at least 24 hours apart (WHO technical guidance)	17 March 2020
	• Who should be tested for the virus? o Symptomatic o Asymptomatic ▪ High risk based on contextual factors ▪ High risk based on individual factors	Nucleic acid testing for all symptomatic individuals suspected of having COVID-19 is recommended, as well as for asymptomatic individuals with known or suspected contact with a COVID-19 case (Infectious Diseases Society of America)	6 May 2020

[j] This report noted that per capita testing was not used because it is difficult to determine a widely applicable benchmark for a per capita level of viral testing that is sufficient to have confidence in the adequacy of COVID-19 case-ascertainment. It noted that jurisdictions can consider evaluating their per capita testing to assist in judging whether testing levels are adequate for effective COVID-19 surveillance.
[k] The relevance of each evidence document in this table was assessed by the authors and is indicated by colour-coding: high (darkest blue) to low (lightest blue) (Wilson et al., 2020).

Type of Document	Relevance to Question	Focus	Recency or Status
	▪ High risk based on a combination of contextual and risk factors		
	• Who should be tested for the virus? o Symptomatic o Asymptomatic ▪ High risk based on contextual factors ▪ High risk based on individual factors ▪ High risk based on a combination of contextual and risk factors • What is the basis for the above decisions? o Other	The decision to test should be based on clinical and epidemiological factors, and should be linked to an assessment of the likelihood of infection (WHO technical guidance)	2 March 2020
	• Who should be tested for the virus? o Asymptomatic ▪ High risk based on a combination of contextual and risk factors • What part of the health system should lead the testing? o Other	Patients and residents who enter long-term care facilities should be screened for COVID-19 through testing (Centers for Medicare & Medicaid Services and U.S. CDC)	2 April 2020
	• Who should be tested for the virus? o Symptomatic • How frequently should they be tested? o With fixed periodicity • What approaches directly complement testing? o Isolation of confirmed cases	To return to work after a COVID-19 illness, employees should have at least two consecutive nasopharyngeal swab specimens collected more than 24 hours apart that test negative (U.S. CDC)	22 April 2020
	• What is the basis for the above decisions? o Optimizing test allocations given supply limitations	Prioritized testing strategies could vary based on four transmission scenarios: when there are no cases, sporadic cases, clusters of cases, and community transmission (WHO technical guidance)	21 March 2020
	• Who should be tested for the virus? o Symptomatic o Asymptomatic ▪ Other • What is the basis for the above decisions? o Optimizing test allocations given supply limitations	It is recommended to establish a priority system for diagnostic testing for SARS-CoV-2 infection based on the availability of tests (U.S. CDC)	3 May 2020
	• Who should be tested for the virus? o Symptomatic • What is the basis for the above decisions? o Optimizing the value of the test given sensitivity and specificity considerations	False-negative test results can occur, thus a single negative test does not completely exclude SARS-CoV-2 infection, and testing should be repeated (especially in people with a high likelihood of infection based on exposure history and/or clinical present(US National Institutes of Health)	12 May 2020

Type of Document	Relevance to Question	Focus	Recency or Status
	• What approaches directly complement testing? o Prospective quarantining of exposed or potentially exposed individuals while awaiting test results o Isolation of confirmed cases ▪ Contact tracing	For home care patients, testing may be complemented with the isolation of pending diagnosis and confirmed cases of COVID-19 and contact tracing of those who have been exposed to individuals between two and 14 days after the onset of the symptoms (WHO technical guidance)	Published 17 March 2020
Full systematic reviews	• Where should they be tested? o Regular health care settings • What is the basis for the above decisions? o Optimizing the value of the test given sensitivity and specificity considerations	Rapid point-of-care diagnostic tests for COVID-19 are necessary, but need to be adequately sensitive and specific (AMSTAR rating 8/11)	Literature searched until 13 April 2020
Rapid reviews	• Who should be tested? o Asymptomatic ▪ High risk based on contextual factors	COVID-19 testing before surgery is recommended for people undergoing surgeries perceived as high risk, notably upper gastrointestinal, ear nose and throat, neurosurgery and interventional cardiac services (AMSTAR rating 3/9)	Last updated 21 April 2020
	• Who should be tested? o Asymptomatic ▪ High risk based on contextual factors • How frequently should they be tested? o With a clear decision rule around other triggers ▪ Outbreak management	Accumulating case reports suggest that testing of all persons at the site of outbreaks in places such as long-term care residences, hospitals and homeless shelters can reduce transmission chains (AMSTAR rating 3/9)	Last updated 29 April 2020
	• Where should they be tested? o Centralized testing centres o Mobile clinics o Regular health care settings • What is the basis for the above decisions? o Optimizing the value of the test given sensitivity and specificity considerations o Other	Moving diagnostic testing for COVID-19 from laboratory settings to the point of care is potentially transformative in the rate and quantity of testing, in particular the antibody-based tests could help to ascertain suitability of infected healthcare workers to return to frontline health services and to inform public health strategies at the end of periods of lockdown or as social distancing restrictions were relaxed (AMSTAR 1/9)	Last updated 7 April 2020
	• Who should be tested for the virus? o Asymptomatic ▪ High risk based on contextual factors ▪ Other • Where should they be tested? o Other	No literature or evidence-based guidelines were identified regarding clinical effectiveness or recommendations of testing all new admissions or mass testing (i.e., testing everyone within the facility) for COVID-19 in correctional facilities.	Last updated 1 May 2020
Guidelines developed using some type of	• What part of the health system should lead the testing? o Other	Labs play key roles in diagnostic and serological testing, as well as biomedical monitoring (e.g., for severity assessment of COVID-19 patients), and must have extensive independent analytics	

Type of Document	Relevance to Question	Focus	Recency or Status
evidence synthesis and/or expert opinion		validation, strict preanalytical operating procedures to reduce errors, clear consideration of patient characteristics and test time, as well as ongoing advocacy for the appropriate implementation of diagnostic tests	
	• Who should be tested for the virus? o Symptomatic o Asymptomatic ▪ High risk based on contextual factors ▪ High risk based on individual factors ▪ High risk based on a combination of contextual and risk factors	Testing should first be prioritized for hospitalized patients and symptomatic healthcare workers, and then for symptomatic patients who are 65 years or older and reside in a long-term care facility, patients with underlying medical conditions and first responders	
Protocols for reviews that are underway			
Titles/questions for reviews that are being planned	• Who should be tested for the virus? o Symptomatic o Asymptomatic ▪ Random ▪ High risk based on contextual factors ▪ High risk based on individual factors ▪ High risk based on a combination of contextual and risk factors ▪ Concerned individuals ▪ Other • How frequently should they be tested? o With fixed periodicity o With a clear decision rile about other triggers ▪ Outbreak management ▪ Targeted campaigns where outbreak concerns exist • What is the basis for the above decisions? o Optimizing the value of the test given sensitivity and specificity considerations o Optimizing test allocations given supply limitations o Other	What is the most effective Covid-19 screening strategy	Question in development
	• Who should be tested for the virus? o Symptomatic o Asymptomatic ▪ Random	Universal screening for SARS-CoV-2	Question in development

Type of Document	Relevance to Question	Focus	Recency or Status
	▪ High risk based on contextual factors ▪ High risk based on individual factors ▪ High risk based on a combination of contextual and risk factors ▪ Concerned individuals ▪ Other • How frequently should they be tested? o With fixed periodicity o With a clear decision rile about other triggers ▪ Outbreak management ▪ Targeted campaigns where outbreak concerns exist • What is the basis for the above decisions? o Optimizing the value of the test given sensitivity and specificity considerations o Optimizing test allocations given supply limitations o Other		
	• Who should be tested for the virus? o Symptomatic o Asymptomatic o Random ▪ High risk based on contextual factors ▪ High risk based on individual factors ▪ High risk based on a combination of contextual and risk factors ▪ Concerned individuals ▪ Other	Antibody tests for identification of current and past infection with SARS-CoV-2	Question in development
	• How frequently should they be tested? o With fixed periodicity o With a clear decision rile about other triggers ▪ Outbreak management ▪ Targeted campaigns where outbreak concerns exist	Routine laboratory testing to determine if a patient has COVID-19 pneumonia or SARS-CoV-2	Question in development
	• What approaches directly complement testing? o Prospective quarantining of exposed or potentially exposed individuals while awaiting test results o Isolation of confirmed cases	Population screening as an option for the long-term isolation of COVID-19 in the entire population	Question in development

Type of Document	Relevance to Question	Focus	Recency or Status
	o 'Closing' settings with one or more positive tests to visitors o Contact tracing o Other		
	• Who should be tested for the virus? o Symptomatic o Asymptomatic ▪ Random ▪ High risk based on contextual factors ▪ High risk based on individual factors ▪ High risk based on a combination of contextual and risk factors ▪ Concerned individuals ▪ Other	Rapid point-of-care tests for diagnosis of SARS-CoV-2 infection	Question in development
Single studies in areas where no reviews were identified	• Who should be tested for the virus? o Symptomatic o Asymptomatic ▪ High risk based on individual factors	An evidence-based approach to COVID-19 testing which at least includes fever and loss of taste or smell should be utilized when determining which healthcare workers should be tested	Published 12 May 2020
	• Who should be tested for the virus? o Asymptomatic ▪ High risk based on individual factors • How frequently should they be tested? o With fixed periodicity	Tests were performed at day zero and day five on 337 asymptomatic passengers who were repatriated to France, and it was found that by optimizing the sampling process, sending samples sequentially and reducing the time-scale for biological analysis, it was possible to test the samples within five hours (including sampling, shipment and biological tests)	Published 14 March 2020
	• How frequently should they be tested? o With fixed periodicity	Early active case detection combined with daily sequential sampling of upper respiratory tract specimens over two days has allowed for detection of the majority of COVID-19 cases in a cohort from the National Centre for Infectious Diseases (Singapore), but caution should be taken in interpreting negative results in patients with suspicious clinical or epidemiological features, and a decision-making matrix or adjunctive CT scans of the thorax could be implemented to guide decisions on further repeat testing and de-isolation in such patients.	Published 19 April 2020
	• How frequently should they be tested? o With fixed periodicity	Data from 70 patients in the United States (Virginia) who underwent repeat testing suggest that short-interval testing is low yield, and that assuming that specimen collection is appropriate, the presence or absence of virus in the nasopharynx or other sites is not expected to change dramatically within 24 hours	Published 25 April 2020

Type of Document	Relevance to Question	Focus	Recency or Status
	• Where should they be tested? o Other	A hospital team-based COVID-19 assessment program in the United States was used to evaluate patients outside of the traditional healthcare setting, and was found to benefit both the public health and clinical healthcare systems by increasing safety and efficiency while reducing the costs and complexity of testing for patients who do not require emergency evaluation or hospitalization	Published 12 March 2020
	• What is the basis for the above decisions? o Optimizing test allocations given supply limitations	When the incidence rate of SARS-CoV-2 infection is 10% or less, group testing will result in the saving of reagents and personnel time with an overall increase in testing capability of at least 69%	Published 18 April 2020
	• What is the basis for the above decisions? o Optimizing test allocations given supply limitations	A single positive sample can be detected in pools of up to 32 samples using standard kits and protocols with an estimated false negative rate of 10%, and detection of positive samples diluted in even up to 64 samples may also be attainable but likely with additional amplification cycles	Published 2 May 2020
	• What is the basis for the above decisions? o Optimizing test allocations given supply limitations	Pooling of up to 30 samples per pool can increase test capacity with existing equipment and test kits and detects positive samples with sufficient diagnostic accuracy, but borderline positive single samples might escape detection in large pools (correspondence)	Published 28 April 2020
	• What is the basis for the above decisions? o Optimizing test allocations given supply limitations	For a prevalence of 10% of positive tests, 40.6% of tests can be saved using testing groups of four subjects; for 20% prevalence, 17.9% of tests can be saved using groups of three subjects; for higher prevalence rates, the strategy flattens and loses effectiveness	24 April 2020
	• Where should they be tested? o Other (home) • What is the basis for the above decisions? o Optimizing the value of the test given sensitivity and specificity considerations • What approaches directly complement testing? o Other (telehealth)	Saliva oropharyngeal swab or dried blood spot specimens collected a home by patients with clinician telehealth support are suitable for testing for both SARS-CoV-2 RNA and serology	Published 29 May 2020
	• Where should they be tested? o Other	Strategic planning to augment COVID-19 testing capacity in India indicated that adopting the following interventions could help increase public sector daily testing capacity to nearly 100,000-120,000 tests/day: moving to a 24-hour working model in the existing approved laboratories can enhance daily testing capacity to 40,464 tests/day (from 5,500); leveraging qRT-PCR and nucleic acid amplification test (NAAT)-based machines available with the	Published 28 April 2020

Type of Document	Relevance to Question	Focus	Recency or Status
		Multidisciplinary Research Units (MRUs), National AIDS Control Organisation (NACO) and National Tuberculosis Elimination Programme (NTEP); using combination/multiplex kits; and provision of automated RNA extraction platforms at all laboratories could also optimize run time and contribute to capacity increase by 1.5-2 times.	
	• What part of the health system should lead the testing? o Hospitals o Other (research environments that have laboratory capabilities)	Capacity to facilitate SARS-CoV-2 RNA testing during surge in cases can be facilitated by twinning research environments with clinical laboratory capabilities	Published 23 May 2020
	• What approaches directly complement testing? o Prospective quarantining of exposed or potentially exposed individuals while awaiting test results o Isolation of confirmed cases o Contact tracing	Rapid identification and isolation of cases, quarantine of close contacts, and active monitoring of other contacts have been effective in suppressing expansion of the outbreak	Published 20 March 2020
	• Who should be tested for the virus? o Asymptomatic ▪ High risk based on a combination of contextual and risk factors • How frequently should they be tested? o With clear decision rule abut other triggers o Other	Given potential for negative test results in pre-symptomatic patients, it is important to conduct repeat tests for those likely to be infected	Published 19 April 2020
	• Who should be tested for the virus? o Symptomatic	Testing symptomatic healthcare workers is crucial for ruling out SARS-CoV-2 and optimizing health workforce capacity during the COVID-19 pandemic	Published 9 April 2020
	• Where should they be tested? o Mobile clinics o Other (home-based testing)	Setting up a community testing team can be a cost-effective, safe and necessary step to enable individuals in self-isolation to be tested in their own homes to prevent overwhelming healthcare setting	Published 25 March 2020

Table 11: Policies for Testing Asymptomatic Persons In Canadian Provinces and Territories[43,l]

Province/ Territory	Key Findings
British Columbia [Not testing]	• BC Centre for Disease Control – Not testing asymptomatic persons unless recommended by a medical health officer or a health care provider, even if they are a contact of a confirmed case or a returning traveler. • Fraser Health – Not testing asymptomatic persons including patients in health care units. • Vancouver Island Health – Not testing asymptomatic persons. • Vancouver Coastal Health – Not testing asymptomatic persons.
Alberta [Testing]	• From May 25, 2020, testing expanded to include: o Asymptomatic close contacts of confirmed COVID-19 cases; o Asymptomatic workers and residents at specific outbreak sites such as health care facilities; and o Asymptomatic workers and residents at LTC and level four supportive living facilities.
Manitoba [Testing]	• Testing expanded to: o Asymptomatic persons that visits an ER, Urgent Care or a community-testing site; and o Asymptomatic persons admitted to acute care or long-term care facilities.
Saskatchewan [Testing]	• From May 19, 2020, testing expanded to asymptomatic cancer patients receiving inpatient and/ or outpatient treatment.
Ontario [Testing]	• Eastern Ontario Health Unit – Testing expanded to include asymptomatic persons. • KFL & A Public Health – Testing expanded to include asymptomatic high-risk health care workers, and workers in congregate (e.g. LTC, retirement homes, correction institutions, shelters and group homes). • Hamilton Health Services – Testing expanded to include asymptomatic persons (e.g., newborns of positive mothers, pre-operative patients, some chronic care and long stay patients, patients admitted from LTC facilities, prior to bone marrow transplantation, some new admissions especially those from outbreak units, and upon request by receiving facility for transfer). • Lakeridge Health Services – Testing expanded to include asymptomatic staff that work within LTC or retirement home facilities with exposure or outbreak sites or as directed by Public Health Unit. • Niagara Health Services – Testing expanded to include asymptomatic persons & staff that work within LTC or retirement home facilities. • Simcoe Muskoka District Health Unit – Testing expanded to include asymptomatic persons who are new/ re-admissions to LTC home or retirement home, transferred from a hospital to LTC home, living in the same room with a symptomatic resident or confirmed case in outbreak sites (e.g., LTC, retirement home).

[l] Policies for New Brunswick, Newfoundland and Labrador, Nova Scotia, Prince Edward Island, Quebec, Yukon and Nunavut make no recommendations for testing asymptomatic persons (but did not clearly recommend against it either) except for contact tracing.

Table 12: Policies for Testing Asymptomatic Persons from Other Countries[44]

Country	Key findings
United States [Variable testing]	• US Centers for Disease Control – Testing of asymptomatic individuals in the community is not currently a priority; given the limited availability of testing. Clinician judgment is needed for who should be tested. • Alabama – Testing asymptomatic persons in LTC facility in case of confirmed case or outbreak; asymptomatic persons who have underlying medical conditions or disability placing them at a higher risk of complications, residency in a congregate housing setting such as a homeless shelter or LTC facility, based on a case-by-case review and approval by the state health department or local health jurisdiction. • Alaska – Testing asymptomatic patients upon admission to a health care facility, patients undergoing urgent/emergent procedures that put health care personnel at high exposure risk, asymptomatic contacts of confirmed COVID-19 patients, asymptomatic residents and health care o Workers in hospitals and congregate living settings, and people coming in to remote communities from areas where COVID-19 is circulating. • Arizona – Does not test asymptomatic persons. • California – Based on availability, asymptomatic persons will be tested in higher-risk populations (e.g. group living facilities) and essential jobs. • Colorado – Does not test asymptomatic persons. • District of Columbia – Testing asymptomatic patients who are greater than 65 years of age. • Georgia – Testing is available to all who request it, including asymptomatic persons. • Illinois – Testing asymptomatic persons who work in health care facility or provide home health services, correctional facilities, such as jails or prisons, first responders, such as paramedics, emergency medical technicians, law enforcement officers or firefighters, and those who support critical infrastructure, such as workers in grocery stores, pharmacies, restaurants, gas stations, public utilities, factories, childcare, eldercare and sanitation. • Massachusetts – Testing of asymptomatic persons only on recommendation of their health care provider, a state agency, or an employer However, recommended persons are encouraged to confirm if their insurance will cover the cost. • Minnesota – Does not test asymptomatic persons. • Mississippi – Does not test asymptomatic persons. • Missouri – Testing asymptomatic persons if they are registered residents of the state. • New Jersey – Testing prioritized for health care workers, first responders, personnel in congregate living settings, and those who have been in contact with an individual who has tested positive for COVID-19 Other asymptomatic persons considered for testing if recommended by their health care provider. • New Mexico – Testing asymptomatic people who are close contacts or household members of New Mexico residents who have already tested positive for the coronavirus, asymptomatic residents in nursing homes, and asymptomatic people in congregant settings such as homeless shelters, group homes, and detention centers. • North Carolina – Testing of asymptomatic residents or staff in congregate living facilities with cases or outbreaks of COVID-19 but considered on a case-by-case basis in consultation with local and state public health if other testing options are not available. • Oklahoma – Testing open to everyone including asymptomatic persons. • Rhode Island – Periodic voluntary of asymptomatic health/social care staff and staff of congregate and nursing home/LTC facilities. • Vermont – Testing asymptomatic persons.

Country	Key findings
United Kingdom [Variable testing]	• Asymptomatic testing prioritized for travelers returning from Wuhan (China), Iran, Daegu or Cheongdo (Republic of North Korea) or Northern Italy. • From May 3rd, asymptomatic health and social care workers being tested. • From June 1st, teachers, students and their families will be eligible for testing. • England – Testing expanded to include asymptomatic persons in care homes (residents and workers) as well as National Health Services workers, and patients. • Ireland – Asymptomatic persons who are part of contact tracing. • Scotland – Testing expanded to include asymptomatic persons in care home (residents and workers).
Australia [Variable testing]	• Australian Health Protection Principle Committee about COVID-19 – Testing expanded to include: o Asymptomatic persons at risk of exposure who present with atypical symptoms, such as health care workers and residential aged care facility workers; o Asymptomatic contacts of cases, including upstream contacts of those without an epidemiological link; and o Asymptomatic vulnerable populations and settings in which a single case or outbreak is identified (e.g. residential care settings, health care settings, remote Aboriginal and Torres Strait Islander communities, and workers in critical infrastructure). • New South Wales – Not testing asymptomatic persons. • Victoria – Not testing asymptomatic persons except in special circumstances such as recovered cases wishing to return to work in a health care facility or aged care facility or where requested by the department as part of outbreak management or enhanced surveillance.
New Zealand [Variable testing]	• Southern Health – Testing expanded to include asymptomatic health care and other workers, Maori and Pacific people, and those with a history of international travel. • Nelson Marlborough Health Services – From May 04, 2020, targeted testing of asymptomatic persons from the following priority groups: returning international travelers, essential workers who have been in direct contact with a confirmed case, including hospital, primary care, ambulance, welfare support staff, community-based assessment centre staff and police, and staff at a supermarket and vineyard.
China [Testing]	• Wuhan: Mass testing of 10-11 million individuals occurred within 10 days (identified 300 new cases).
Hong Kong [Variable testing]	• From April 22, 2020, testing expanded to include asymptomatic inbound international travelers.
Singapore [Variable testing]	• Asymptomatic persons may be tested based on physician's recommendations.
South Korea [Variable testing]	• Asymptomatic persons may be tested based on physician's recommendations.
Japan [Variable testing]	• No mention of testing asymptomatic persons; focus on symptomatic persons.
Sweden [Variable testing]	• Testing mainly limited to symptomatic persons or high-risk populations. No recommendation for testing asymptomatic persons from the average-risk, general population.
Italy [Variable testing]	• Testing mainly limited to symptomatic persons or high-risk populations. No recommendation for testing asymptomatic persons from the average-risk, general population.
Germany [Variable testing]	• No mention of testing asymptomatic persons; focus on symptomatic persons.

Country	Key findings
Austria [Not testing]	• Not testing asymptomatic persons.
Belgium [Variable testing]	• No mention of testing asymptomatic persons; focus on symptomatic persons.
Czech Republic [Not testing]	• Not testing asymptomatic persons.
Denmark [Variable testing]	• From May 20, 2020, testing mainly limited to symptomatic persons or high-risk populations. No recommendation for testing asymptomatic persons from the average-risk, general population.
Finland [Not testing]	• Not testing asymptomatic persons.
France [Variable testing]	• From April 13, 2020, testing mainly limited to symptomatic persons or high-risk populations. No recommendation for testing asymptomatic persons from the average-risk, general population.
Iceland [Not testing]	• Not testing asymptomatic persons.
Netherlands [Variable testing]	• From June 01, 2020, testing mainly limited to symptomatic persons. No recommendation for testing asymptomatic persons from the average-risk, general population.
Norway [Variable testing]	• Testing mainly limited to symptomatic persons or high-risk populations. No recommendation for testing asymptomatic persons from the average-risk, general population.
Spain [Variable testing]	• Planning on testing asymptomatic persons working in essential services (health care workers, workers in senior residences, police, delivery workers, staff from the food supply chain). • Catalonia: not clearly stated that asymptomatic persons to be tested but as of April 07, and for six weeks, mass testing of the population to take effect.
Switzerland [Variable testing]	• Testing mainly limited to symptomatic persons or high-risk populations. No recommendation for testing asymptomatic persons from the average-risk, general population.
Russia [Variable testing]	• Moscow – asymptomatic persons may be tested based on physician's recommendations.
Ukraine [Not testing]	• Testing mainly limited to symptomatic persons.
South Africa [Variable testing]	• Testing mainly limited to symptomatic persons or high-risk populations. No recommendation for testing asymptomatic persons from the average-risk, general population.
United Arab Emirates [Variable testing]	• Asymptomatic testing allowed but person pays out of pocket for test.
India [Variable testing]	• Testing asymptomatic direct and high-risk contacts of a confirmed case.

Table 13: Summary of the Case Studies on Six Jurisdictions Regarding Testing, Case Management, and Contact Tracing[45]

Germany	
Date of first case	January 28, 2020
Total cases / deaths (May 2020)	168,551 cases / 7,369 deaths (total population of over 83 million).
Party responsible for testing and contact tracing	Robert Koch Institute (RKI) oversight, including guidelines and recommendations; contact tracing implemented through 375 local public health units.
Testing criteria	Laboratory testing is recommended for individuals with: • Acute respiratory tract infection and history of close contact with a confirmed or probable case in 14 days prior to symptom onset. • Clinical or radiologic characteristics of viral pneumonia in the context of increased number of pneumonias in care facilities or hospitals. • Clinical or radiologic characteristics of viral pneumonia with no indication of any other cause, and no contact with a confirmed case. • Acute respiratory tract infection and (a) history of medical related activities, (b) a pre-existing medical condition, or (c) no known risk factors. German residents are encouraged to immediately, irrespective of symptoms, contact their health office, get in touch with a doctor or call the non-emergency medical service, and stay at home if they have contact with a person with confirmed SARS-CoV-2 infection. The operator from the non-emergency medical service decides whether testing is warranted and discusses the next steps.
Testing capacity	• End of April: 141,815 tests per day or 860,494 tests per week. • May 13: 157,150 tests per day or 1,038,223 tests per week. • PCR test processing: 134 laboratories of university hospitals, research institutions, and clinical and outpatient settings were equipped for processing samples on May 13. • Testing capacity has both been increasing with the regard to the number of laboratories equipped to process the tests and the number of tests processed per laboratory. • Total of 3,147,771 tests have been performed in Germany by May 13.
Contact definition	There are three categories of contact with specific follow-up instructions for each. Broadly, close contacts are defined as: • Speaking to the confirmed case for at least 15 minutes; or • Being coughed or sneezed on at a time when the confirmed case was infectious (i.e., two days before symptom onset).
Contact tracing and case management process	1. Local public health unit registers positive SARS-CoV-2 test result. 2. Contact tracing team situated within the public health unit calls the infected individual to communicate test results and inquire about any contacts that occurred in the two days preceding symptom onset. 3. Due to strict privacy laws, the use of digital tools to support contact tracing is not widespread; SORMAS app is used by public health units to contact exposed individuals in Berlin; Corona App (Bluetooth exposure notification app) is in development. 4. Contacts are called by contact tracers and informed of exposure. Contacts are classified into three categories, depending on the nature of exposure. Recommendations vary depending on contact category, but generally, they are advised to isolate for 14 days. 5. Contacts' symptoms are monitored through regular calls from contact tracers; if symptoms develop or worsen, individuals are advised to call a health office or a non-emergency medical service hotline to determine whether a test may be warranted. 6. If individuals are unable to leave the house, public health units or outreach teams of ambulatory physicians may dispatch a health care worker to perform the diagnostic test at the individual's home.

	7. Some cities use "corona taxis", in which health care providers and medical students visit confirmed cases in their homes to monitor their symptoms, perform a medical exam, and escalate management if necessary (i.e., transfer the patient to the hospital). 8. Voluntary smartwatch app "Corona Data Donation", released in early April, allows cases to record their symptoms alongside other biometrics; when aggregated at zip code level, these data may help identify "hotspots" (see Appendices C and D in the source document for detail).
Contact tracing capacity	• Germany's goal is to have a team of five contact tracers per 20,000 inhabitants (amounting to 21,000 individuals nationally). • To meet this capacity goal, medical students, health care workers, and public employees from other areas of the bureaucracy have been redeployed into contact tracing teams, with additional assistance from the armed forces in the most affected areas.
Effectiveness of contact tracing	• Germany's viral basic reproduction factor (R0) was estimated to be at 0.76 on May 5. • This change may not be attributed to testing and contact tracing alone, as Germany implemented border closures and large-scale restrictions throughout early to mid March.
Iceland	
Date of first case	February 28, 2020
Total cases / deaths (May 2020)	1,801 cases / 10 deaths (total population of over 360,000).
Party responsible for testing and contact tracing	Department of Civil Protection and Emergency Management (National Commissioner of Icelandic Police) in collaboration with Directorate of Health and Chief Epidemiologist, mandated by the Minister of Health.
Testing criteria	• Those presenting with symptoms (any severity) should contact their primary care clinic or call a designated helpline to determine whether a test is warranted, based on physician judgment. • Health care workers and persons whose medical history may put them at risk of experiencing more severe symptoms are prioritized for testing.
Testing capacity	• Outbreak peak (March-April): 1,000 tests per day. • Current: 500 tests per day. • Tests done outside primary care clinics on a drive-through basis. • Total of 51,663 tests completed (141,931 tests per million individuals). • PCR test processing: one central lab (National University Hospital in Reykjavík, NUHI). • Test results turnaround time: 24 hours.
Contact definition	Individuals that, within the 14 days preceding diagnosis, have been within 1-2 meters of: • A symptomatic person. • A confirmed case.
Contact tracing and case management process	1. Contact tracing team within Civil Protection Department receives test results from NUHI. 2. Contact tracers call the infected individual to administer a questionnaire re: 14-day history before symptoms onset (dates, locations, individuals contacted). 3. For unknown contacts, use: police records, travel records, open source info (e.g., social media), employer of the patient (if relevant/available). 4. Voluntary app "Ranking C-19", released in early April, tracks the user's 14-day GPS history; upon COVID-19 diagnosis, user may submit these data to the contact tracing team to supplement efforts to identify unknown contacts (see Appendices C and D in the source document for detail). 5. Contacts are instructed to quarantine for 14 days immediately. 6. Time to trace all contacts: 8 hours (March); 2 hours (May).

	7. Contacts' symptoms monitored with regular calls from the contact tracers; if symptoms develop, individuals advised to call primary care clinic or helpline to determine if test is warranted. 8. If diagnosed, individuals isolate primarily at home. Those unable to isolate safely at home may book a hotel room. Hotels also available for foreign workers and houseless individuals.
Contact tracing capacity	• Early March: team of six individuals (detectives, criminologists, health care workers). • Current (May): 52 individuals (civil servants, health care workers, students).
Effectiveness of contact tracing	• May 6: each of 1,799 cases confirmed up to that point identified as either imported or community-linked. • May 12: 19,694 individuals have completed a 14-day quarantine, 564 were in quarantine, 18 were in isolation, and one was hospitalized (no ICU). • 57% of individuals eventually diagnosed with COVID-19 were already undergoing quarantine at the time of diagnosis.
Israel	
Date of first case	February 21, 2020
Total cases / deaths (May 2020)	16,444 cases / 245 deaths (total population of over 9 million).
Party responsible for testing and contact tracing	• Testing: centralized through Magen David Adom (MDA), national EMS service (February); de-centralized through four national HMOs (current). • Contact tracing: district-level Health Bureaus of the Ministry of Health (seven districts).
Testing criteria	Eligibility for testing is decided by physicians. Symptomatic individuals may be eligible if they: • Had close contact with a confirmed case in the past 14 days. • Were in the same location as a confirmed case in the past 14 days. • Have travelled to Israel from abroad in the past 14 days. • Have a severe health condition. Mass testing in special groups: • Health care workers in some hospitals. • Elderly individuals in long-term care (LTC). • Marginalized groups (asylum seekers, foreign workers, houseless individuals, ultra-orthodox communities, Arab communities) in urban centers as recruited by NGOs (e.g., Physicians for Human Rights, Levinsky clinic (clinic for STIs)).
Testing capacity	• Outbreak peak (April): 10,000 tests per day. • Current: 8,000 tests per day. • Tests done at home, HMO clinics, four stationary units (metropolitan areas), eight drive-through facilities (for non-quarantined individuals). • MDA is staffed with 2,500 salaried workers and 24,000 volunteers. • Total of 245,460 individuals tested, with 96,065 in drive-through facilities, 88,272 in their homes, and 61,123 in LTC. • PCR test processing: one lab (National Virology Laboratory at Sheba Medical Center) in early March; 17 labs in late March; further increased since HMO involvement in testing. • Processing capacity increased through repurposing of existing research and hospital labs and recruiting and training lab technicians.
Contact definition	• Contact with individual with diagnosed COVID-19 within two meters of distance for at least 15 minutes.

Contact tracing and case management process	1. Ministry of Health has a record of all individuals that have a COVID-19 diagnosis. 2. Contact tracing teams in district-level Health Bureaus of the Ministry of Health call the infected individual to administer a questionnaire re: 14-day history (dates, locations, individuals contacted). 3. De-identified listing and map of all locations that infected individuals have visited in the past 14 days, with times, are posted publicly on the Ministry of Health website. 4. As contact tracing capacity became strained with increasing number of cases, Shin Bet secret services' cellphone tracking apparatus was involved in March to notify individuals of exposure (see Appendices C and D for detail). 5. Voluntary app "HaMagen", released in late March, cross-references the user's 14-day GPS history with the location history of confirmed cases and notifies users of possible exposure (see Appendices C and D for detail). 6. Contacts (identified by contact tracers or self-identified) are instructed to quarantine for 14 days immediately and to submit an online report to the Ministry of Health. 7. If contacts develop symptoms, they are advised to call their HMO clinic, their HMO hotline, the Ministry of Health hotline, or the MDA emergency hotline. 8. MDA emergency hotline operator screens the caller for epidemiological or clinical criteria consistent with COVID-19; if criteria are met, individual transferred to MDA's COVID-19 hotline, manned by EMS dispatchers and Ministry of Health staff. 9. Contacts' symptoms monitored with regular calls; a paramedic may be dispatched to the individual's home to administer a test, if deemed warranted by a physician. 10. Mid-March: all diagnosed cases isolated in hospitals, regardless of symptom severity. 11. Current: mild cases isolate at home or in "Corona hotels" rented by the Ministry of Health. Those in LTC quarantine in designated LTC units while awaiting test results. All severe cases or those with concurrent medical issues are taken to hospitals.
Contact tracing capacity	In emergency times, Health Bureaus can recruit nurses from district-level mother and child centers to aid contact tracing.
Effectiveness of contact tracing	• Late April to early May: daily number of new cases consistently fell below 100 and number of those recovered has surpassed the number of those actively ill. • May 6: Infection rate in Jerusalem, which experienced the highest burden of COVID-19, dropped from a mid-April high of 23 cases per 10,000 people to 15 per 10,000. • These changes may not be attributed to testing and contact tracing alone, as Israel implemented border closures and large-scale restrictions throughout early to mid March.
Singapore	
Date of first case	January 23, 2020
Total cases / deaths (May 2020)	21,707 cases / 20 deaths (total population of over 5.6 million).
Party responsible for testing and contact tracing	• Ministry of Health responsible for testing and contact tracing, in close collaboration with hospitals, Certis security (private auxiliary police force), Singapore Police Force, and Singapore Civil Defense Force. • Multi-Ministry Taskforce created to manage COVID-19 oversees these processes.
Testing criteria	The following individuals are prioritized for testing: • Those diagnosed with pneumonia; • Those with symptoms of acute respiratory infection and/or: o History of close contact with a confirmed COVID-19 case; and/or

	o Recent travel history. All individuals experiencing respiratory symptoms of any severity are advised to visit a primary care physician for close monitoring; if symptoms do not resolve after five days, individuals may be referred for further investigation and possible testing. Singapore's 900 Public Health Preparedness Clinics (PHPC) are the first point of contact for symptomatic persons. PHPCs are regular primary care practices whose clinicians and staff are trained in emergency outbreak protocols; this function of the clinics is activated during public health emergencies. Mass testing in special groups: • All 30,000 adult residential care home staff and residents (housing the elderly, houseless individuals, and those with disabilities). • Residents of foreign worker dormitories. As of late April, 21,000 individuals have been tested (3,000 individuals per day or 6,500 individuals per 100,000).
Testing capacity	• Early April: 2,900 tests per day. • Current (late April to early May): 8,000 tests per day. • By June/July, test rate expected to increase to 40,000 tests per day. • Total of 2,100 per 100,000 persons tested. • Tests done in acute care hospitals and the National Centre for Infectious Diseases (NCID). • PCR processing: tests processed in laboratories within public hospitals and the National Public Health Laboratory in NCID. The Multi-Ministry Taskforce scaled up processing capacity by repurposing private and research laboratories. • While awaiting test results, individuals are advised to self-isolate in their homes. • Those unable to safely isolate at home are directed to Swab Isolation Facilities (repurposed hotels with 4,000 bed capacity). • Those with severe symptoms or concurrent health conditions are isolated at hospitals.
Contact definition	Contact with individual with diagnosed COVID-19 within two meters of distance for 30 minutes or more.
Contact tracing and case management process	1. Contact tracing starts at the hospital; health care worker interviews the patient with COVID-19 about their history up to 14 days before symptoms (locations, dates, times, individuals contacted). 2. An "activity map" is produced and submitted by the hospital to the Ministry of Health. 3. Contact tracing team at the Ministry of Health verifies the map by calling the patient and their family/ friends, and reviewing transport records; full activity map is charted within 24 hours of diagnosis. 4. For unknown contacts, contact tracers review the activity maps of other confirmed cases and flag linkages as "hypotheses". 5. Hypotheses are then "proven" or "disproven" through phone interviews with the other cases and field investigations (e.g., street surveys, review of CCTV footage), which may involve engagement of the Police Force. 6. Voluntary app, "TraceTogether", released late March, records anonymized identifiers of nearby phones over 21 days via Bluetooth; upon diagnosis, user may submit these data to the contact tracing team to supplement efforts to identify unknown contacts (see Appendices C and D in the source document for detail). 7. SafeEntry QR code check-in/check-out system added to public venues in early May to enable identification of contacts in case of an outbreak (see Appendices C and D in the source document for detail). 8. Identified contacts are called and screened for symptoms. Those who are asymptomatic are advised to quarantine for 14 days (from the time of exposure). 9. Symptoms and quarantine adherence are monitored via regular calls from Ministry of Health official. 10. Contacts with symptoms are treated as "suspect cases" and may be transported to hospital for testing. 11. Time to trace all contacts: 48 hours after patient diagnosis.

	12. Depending on symptom severity and medical history, cases and contacts may quarantine/isolate at home or at government facilities. Only the most severe cases are admitted to hospitals.
Contact tracing capacity	• Ministry of Health epidemiologists and communicable disease experts train and supervise contact tracing teams, composed of redeployed personnel (e.g., medical residents, volunteers from other departments, Civil Defense officers). • February: five teams of 10 contact tracers (500 individuals). • Late March: seven teams of 10 contact tracers (700 individuals). • There are three contact tracing teams on duty during any single shift, and two contact tracing shifts per day. • April 21: To facilitate rapid triaging, case finding, and contact tracing within foreign worker dormitories, on Taskforce has deployed Forward Assurance and Support Teams (FAST Teams). • Hotels, university hostels, and convention centers converted to quarantine facilities (500-10,000 bed capacity); by end of June, capacity expected increase to 20,000 beds. • Over 200 Certis security services officers deployed to quarantine facilities to assist with check in and check out processes and monitor adherence.
Effectiveness of contact tracing	• Contact tracing was the primary method of containment in Singapore until early April, when the number of cases began increasing due to outbreaks in foreign worker dormitories, at which point a large-scale "circuit breaker" restrictions were imposed. • May 2: average number of new cases was 12 per day.
South Korea	
Date of first case	January 20, 2020
Total cases / deaths (May 2020)	10,936 cases / 258 deaths (total population of over 51.6 million).
Party responsible for testing and contact tracing	Korean Centers for Disease Control (KCDC) and Prevention within the Ministry of Health and Welfare.
Testing criteria	Patients classified as suspected cases and Patients Under Investigation (PUI) may get testing: • Suspected cases are those at high-risk of having been in close contact with a confirmed patient, who developed symptoms within 14 days of contact. • PUIs include those suspected to be a case due to (I) pneumonia of unknown causes, (ii) a fever or respiratory symptoms that occurred within 14 days of traveling to a country with local COVID-19 transmission, or (iii) an epidemiological link to the collective outbreak of COVID-19 in Korea and presence of symptoms.
Testing capacity	• February: 3,000 tests per day. • March: 18,000 tests per day. • Capacity increase attributed to the increase in diagnostic reagent companies approved by the government under emergency use authorization (five companies approved); under the authorization, tests were distributed not only to the 18 public health labs, but also private labs (which previously needed a lengthy authorization process). By late January, nearly 200 laboratories, 600 testing centers, and numerous private clinics had access to the government-approved test kits. • May: Total of 680,890 tests completed, 569 active testing centers across all 9 provinces and 55 drive-through testing facilities in seven out of nine provinces.
Contact definition	Close contact with a confirmed case, who developed symptoms within 14 days of contact.

Contact tracing and case management process	1. In cases of widespread transmission, local (rather than central) epidemiological investigation teams perform contact tracing. 2. Investigation phase: obtain information through patient, family, and physician interview to identify transmission route. 3. Risk assessment: the collected information is verified and supplemented by other sources (medical records, cellular GPS data, credit card transactions, CCTV footage). 4. Contacts are classified by risk status (close vs. casual contact). 5. Contacts are then reached by the epidemiological team, informed of their exposure, and counseled regarding next steps (self-quarantine and symptom monitoring). 6. Through collaboration with the Ministry of Land, Infrastructure and Transport, National Police Agency, Credit Finance Association of Korea, 3 telecommunication and 22 credit card companies, the Korean Centre for Disease Control and Prevention developed a COVID-19 data platform; this system draws on real-time GPS, mobile, and credit card transaction information to perform a spatio-temporal analysis. This automated "big data" approach allows to rapidly verify patient reporting and identify infection clusters. 7. This approach reduced the 24-hour manual contact analysis to a 10-minute automated one.
Contact tracing capacity	Not discussed.
Effectiveness of contact tracing	The number of new cases in South Korea stayed primarily in the single digits between mid-April and early May. Given its proximity to high-incidence settings and a lack of a widespread lockdown, the decrease in cases can likely be attributed to the country's effective testing and contact tracing practices.
Taiwan	
Date of first case	January 21, 2020
Total cases / deaths (May 2020)	440 cases / six deaths (total population of nearly 24 million).
Party responsible for testing and contact tracing	Taiwan Centers for Disease Control (CDC) in coordination with the National Health Command Center.
Testing criteria	All suspected cases are tested, defined as individuals who were in close contact with a symptomatic confirmed case within 14 days prior to symptom onset, and who present one or more of the following: • Fever (≥ 38°C) or symptoms of acute respiratory tract infection. • Abnormal sense of smell or taste, or diarrhea of unknown etiology. • Community-acquired pneumonia highly suspected to be COVID-19 by doctors. High-risk groups identified for increased surveillance: • Elderly • Individuals with comorbidities. The first point of contact and triage centre for mild symptomatic cases is the network of Community Healthcare Groups Prepared Clinics (CHGPC). These clinics do not perform testing but determine whether testing is warranted.
Testing capacity	• April 7: CDC announced establishment of a national testing network of 34 laboratories to expand testing capacity and reduce waiting times for test results. • This resulted in a testing rate of 3,800 tests per day in different settings across Taiwan.
Contact definition	• Individual that had close (less than two meters) face-to-face contact for more than 15 minutes with a confirmed COVID-19 case before they received a diagnosis.

	• In health care settings, contacts are medical staff, hospital workers, or other patients that had close contact (less than 2 meters) with a confirmed case for a longer duration than required, without protective equipment.
Contact tracing and case management process	1. The National Health Insurance (NHI) database was a key method of contact tracing in Taiwan. The database contains complete health history, underlying health conditions, recent progression of symptoms, treatments, and hospitalization related to respiratory syndrome. 2. The NHI Cloud was enriched with patients' 14-day travel history using the Customs and Immigration data of the National Immigration Agency. All hospitals, clinics, and pharmacies in Taiwan have access to patients' travel histories. 3. The NHI-based centralized Taiwan Health Cloud program generates automatic surveillance reports for infectious diseases using hospital electronic medical records.
Contact tracing capacity	Not discussed.
Effectiveness of contact tracing	• Despite its proximity to high-incidence settings and a lack of a national lockdown, Taiwan achieved the lowest incidence of COVID-19 cases per capita globally by late March. • May 1: Taiwan achieved a rate of zero new cases in six consecutive days.

Table 14: Availability, Accuracy, Guidelines, Benefits and Limitations of Point-of-Care Diagnostic Tests in Canada[46]

Question	Key Findings
What point-of-care diagnostic tests for COVID-19 are available in Canada?	• There are three point-of-care- (POC) polymerase chain reaction (PCR) diagnostic tests authorized or in the application phase in Canada as of June 1, 2020: • Two POC tests for SARS-COV-2 (COVID-19) are currently authorized for use by Health Canada – the Cepheid Xpert Xpress platform system, and the Spartan Bioscience Cube mobile system. One POC PCR mobile test system (Biomeme Go-Strips) has been submitted for authorization to Health Canada. • All other applications in the Health Canada database for POC tests were serological tests, which are out of scope in this review. • The Spartan Cube is currently authorized only for research use and cannot be used for diagnosis of COVID-19 until fully authorized. • A number of other mobile or platform-based POC PCR tests have been authorized for use in the United States, Europe, Australia and other jurisdictions.
How accurate are the point-of-care diagnostic tests authorized in Canada at identifying individuals with COVID-19?	• One rapid health technology assessment and two rapid reviews from a number of international sources were identified. • A protocol for a rapid review in-progress was also located in the Cochrane Library. • No reviews reported performance data for the Spartan Cube or Biomeme Go-strips tests. • Two reviews synthesized laboratory performance data for the Cepheid Xpert Xpress system based on information supplied by the manufacturer. • Although the tests are reported to be accurate (sensitive and specific) and have good agreement compared to the reference RT-PCR test, there may be limitations associated with the quantity and quality of evidence available (Although individual study quality was not assessed as part of this rapid review). • Manufacturer-reported sensitivity ranges from 86% to 100% and specificity from 88% to 100%. • Current data are for a small number of samples under optimal laboratory conditions and their validity and reliability in the real-world is currently unknown (Spartan Cube, Biomeme go-strips).

Question	Key Findings
	• Clinical use and evaluation of the Cepheid Xpert Xpress test: None of the studies were conducted in Canada, and some are pre-print studies which are not peer-reviewed or formally published in a journal. Studies showed that the Xpert Xpress test was accurate and in agreement with the reference test. o Test characteristics show that POC PCR tests can deliver results in 45 mins, compared to 6-8 hours or 1-2 days for the reference test, but throughput may be limited to single test at a time. o Reporting of review methods in all included reports were insufficient to assess methodological quality using the AMSTAR2 tool.
What recommendations and guidelines are there for the use of point-of-care diagnostic tests to identify individuals with current COVID-19?	• No formal guidelines were located relevant to the use or implementation of POC PCR tests for SARS-COV-2 (COVID-19). • Guidance for diagnostic tests for SARS-COV-2 (COVID-19) during the pandemic often do not specifically address POC tests, rather, they recommend continued use of RT-PCR laboratory tests as best practice, while acknowledging logistical and supply issues. o Scientific advice from the World Health Organization (WHO) in April 2020 recommends use of these new POC immunodiagnostic tests only in research settings and not for any other setting, including for clinical decision-making, until evidence supporting use for specific indications is available. o The United States Centers for Disease Control proposed POC rapid tests to supplement laboratory testing, enabling testing to be available for communities and populations that cannot readily access laboratory testing or need to quickly address emerging outbreaks.
What are the key benefits of the point-of-care diagnostic tests authorized in Canada?	• Faster than the current reference standard RT-PCR tests – results to patient < 1 hour. • Simple, no expertise required to run or interpret the test. • "Hands-off" test processing. • Test are portable and no laboratory required. • May ease pressure for certain swabs or reagents in shortage situations. • Allows health care resources to focus where needed (versus on testing). • Can be used anywhere – hospital, clinic, cruise ship, remote or rural locations without access to lab, drive through clinic, workplace.
What are the key limitations of the point-of-care diagnostic tests authorized in Canada?	• Tests are likely run one at a time, which could limit throughput and use in environments where volume of testing is high unless multiple testing platforms are purchased. • Tests may require supplies (i.e., swabs) that are in limited supply at times, and kits for POC tests may still be subject to order backlogs • While adequate test accuracy and precision may be achieved under ideal circumstances in the laboratory, these may be negatively impacted when used at the point-of-care. • Appropriate staff training and use of robust standardized operating procedures may be required to moderate any sources of error. • There is limited evidence of use in real world settings, especially in Canadian settings.

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