EVIDENCE SYNTHESIS BRIEFING NOTE

TOPIC: RAPID COVID-19 TESTS COMPLEMENTING LAB-BASED PCR TESTS ACROSS SELECT JURISDICTIONS

Information finalized as of December 24, 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 Canadian and international experiences with the use of rapid COVID-19 tests (i.e., diagnostic, screening) have been used to complement lab-based polymerase chain reaction (PCR) testing across jurisdictions, including mass testing, testing target populations, tests used (i.e., rapid molecular, antigen tests), and outcomes of testing programs.

Key Findings:

- Rapid point-of-care antigen tests for COVID-19 are currently being used in Canada, the United States (US), England, United Kingdom (UK), Germany and Slovakia; tests are being deployed both for asymptomatic general public screening and for symptomatic screening, with positive results being confirmed by reverse transcription- (RT-)PCR tests.
- Two point-of-care tests have been reviewed for use in managing the pandemic—Abbott ID NOW (molecular) test and Panbio COVID-19 Ag (antigen) test.[a]
  - The US has employed the Abbott ID Now test, prioritized for rural and remote regions.
  - Effects and costs of implementing and broadly using the Abbott ID NOW and Panbio COVID-19 Ag antigen point-of-care tests in managing the pandemic remain unknown.
- Use of rapid point-of-care tests has been shown to fast-track triage, free up resources, and prevent bottlenecks in testing.

"Re-testing" for COVID-19

- Given point-of-care tests do not have adequate accuracy (i.e., sensitivity, specificity), repeat testing and confirmatory RT-PCR testing have been suggested.

Limitations:

- No identified studies have reported the impact of rapid point-of-care testing on the transmission of COVID-19, including the Abbott ID NOW molecular test or Panbio COVID-19 Ag antigen test.
- No identified studies evaluated the effectiveness of the identified mass testing strategies, how they compared to each other, or the feasibility or cost-effectiveness of adopting them in Ontario.

Analysis for Ontario:

- Guidance from Ontario indicates rapid antigen COVID-19 testing should only be considered for asymptomatic individuals if they are high-risk or part of a screening pilot.

[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

Table 1 below summarizes the status of rapid point-of-care testing across jurisdictions. In addition, information about testing for screening and monitoring for COVID-19 is provided in Table 2.

Table 1: Rapid Point-of-Care Testing for COVID-19

Scientific Evidence	**Outcomes of Rapid Point-of-Care Testing** • No identified studies have reported the impact of rapid point-of-care testing on the transmission of COVID-19.[1,2] • No identified academic or grey literature have evaluated the impact the Abbott ID NOW molecular test or Panbio COVID-19 Ag antigen test.[3]

International Scan	**Use of Rapid Point-of-Care Tests**
	• Rapid point-of-care antigen tests for COVID-19 are currently being used in Canada, the United States (US), England, United Kingdom (UK), Germany and Slovakia.[4]
	  ○ Tests are being deployed both for asymptomatic general public screening and for symptomatic screening, with positive results being confirmed by reverse transcription polymerase chain reaction (RT-PCR) tests. Table 5 in the Appendix summarizes the current use of rapid antigen testing programs for COVID-19 across jurisdictions.[5]
	Specific Point-of-Care Tests
	• Two point-of-care tests have been reviewed for use in managing the pandemic—Abbott ID NOW (molecular) test and Panbio COVID-19 Ag (antigen) test.[6]
	  ○ Only the US explicitly mentioned use of the Abbott ID Now test, prioritized for rural and remote regions; no jurisdictions mentioned use of the Panbio COVID-19 Ag Rapid Test Device.[7]
	  ○ The effects and costs of implementing and broadly using the Abbott ID NOW and Panbio COVID-19 Ag antigen point-of-care tests in managing the pandemic remain unknown.[8]
	  ○ Additional information about the uses of Abbott's ID NOW COVID-19 Test and Panbio COVID-19 Ag Rapid Test in the United States, Italy, and Spain is provided in Table 6 in the Appendix.
	"Re-testing" for COVID-19
	• Many jurisdictions report that point-of-care tests do not have adequate accuracy (i.e., sensitivity, specificity).[9]
	• Where rapid point-of-care testing is used for asymptomatic populations, repeat testing has been suggested (i.e., after two to three days); confirmatory RT-PCR testing is also recommended.[10]
	Outcomes of Rapid Point-of-Care Testing
	• Use of rapid point-of-care tests has been shown to fast-track triage, free up resources, and prevent bottlenecks in testing.[11]

Canadian Scan	• Rapid point-of-care molecular diagnostic testing promises to increase testing volume in Canada, and reduce lab volumes and wait times.[12] ○ *Xpert Xpress SARS-CoV-1* (aka GeneXpert) is a Health Canada-approved point-of-care molecular testing device that is used in various provinces and territories, largely in smaller labs that otherwise would need to have specimens transported to larger labs located in urban centers.[13]

	• Additional information about the current uses of rapid molecular tests in Canada, the United States, the United Kingdom, and Italy is provided Table 7 in the Appendix.
Ontario Scan	• Guidance from Ontario indicates rapid antigen testing should only be considered for asymptomatic individuals if they are high-risk or part of a screening pilot.[14]

Table 2: Use of Mass Testing for COVID-19[15,b]

Scientific Evidence	**Outcomes of Mass Testing** • No identified studies have evaluated the impact of mass testing in the jurisdictions of interest; i.e., United Kingdom, Germany, Iceland, Slovakia, and China. ○ A formal evaluation of the City of Liverpool pilot program is ongoing. The evaluation will focus on the immediate biological, behavioural and systems integration aspects of testing, then on the longer-term public health impacts.[16]
International Scan	**Purpose of Mass Testing** • The reviewed mass testing programs examined virus spread, particularly asymptomatic cases, in the defined population. ○ Information was used to trace and isolate cases and close contacts and to inform decisions on future public health measures (e.g., reopening of schools or avoiding a lockdown).[17] **Reasons for Mass Testing** • Thresholds leading to the initiation of mass testing varies by jurisdiction. In China, a few cases (i.e., two or three) led to localized mass testing, whereas in Germany mass testing was initiated when the local community was overwhelmed (e.g., insufficient staff to respond to emergencies).[18] **Implementation** • Mass testing campaigns were typically government run, but most often implemented on a voluntary basis in local settings.[19] • Mass testing initiatives had large resource needs (e.g., staffing) and some jurisdictions were supported by bodies such as the Armed Forces or the Red Cross.[20] **Tests Used** • Slovakia,[21,22] the City of Liverpool (UK),[23,24] and Hildburghausen (Germany)[25] used rapid antigen tests. • Iceland and China used the World Health Organization (WHO) recommended laboratory RT-PCR tests, with China applying pooled sample processing.[26,c]

[b] The term "mass testing" in the context of COVID-19 typically refers to testing members of the population *en masse*, either an entire population or in a defined setting, thereby identifying cases that are asymptomatic or pre-symptomatic. The aim of mass testing is to screen the population and identify cases that may otherwise go undetected. Mass testing can identify individuals with an active infection as well as providing information on the rate of infection in a population at a given time. This differs from other surveillance strategies such as wastewater monitoring or serosurveillance, which can only support the understanding of an infection rate in a populous without identifying the individuals affected (Ontario Health, December 2020).

[c] Pooled sample processing involves mixing several samples together, testing the pooled sample, and testing people in the group individually if the result comes back positive. The process has been proposed as a strategy to reduce costs and increase throughput of tests, and it has already been deployed at some UK universities to help stop outbreaks and keep campuses open (British Medical Journal, 2020).

Table 8 in the Appendix provides available details on the target populations and contexts, testing methods, and any reported information on the implementation and the impact of mass testing in the United Kingdom (City of Liverpool), Germany, Iceland, Slovakia, and China.

Table 3: Additional Testing for Screening and Monitoring for COVID-19[27]

In addition to antigen and molecular testing, there are a variety of other testing methods (e.g., pooled saliva-based testing) and settings (e.g., airports, cruise ships) that are being evaluated, as described below.

Jurisdiction	Population and Setting	Test or Program	Date Implemented	Outcomes
Province of Alberta Canada	• Canadians showing no symptoms of COVID-19 returning to Canada at the Calgary International Airport and the Coutts land border crossing. • Participants have the option to provide a sample for a test upon entry. • They will then be required to quarantine until they receive their test results in one or two days. • If the results come back negative, they will be allowed to leave quarantine and take another test at a local pharmacy six or seven days after arrival. All participants in the pilot must stay in Alberta for 14 days, report on their health daily, and adhere to a list of conditions.	• A pilot project to reduce the currently required 14-day quarantine period for Canadians who have travelled internationally.	• November 2, 2020.	• None available.[28,29]
United States	• The cruise ship industry has agreed to mandatory SARS-CoV-2 testing prior to boarding for all ships carrying more than 250 passengers.	• One cruise line has installed a full-scale testing lab onboard one of their ships in preparation for their return to sailing. • The lab has the capacity to test all passengers and crew onboard each day using saliva samples and PCR testing.	• November 2020.	• None available [30]
United States University of South Florida	• At the University of South Florida, pooled saliva samples are being used to test groups of athletes prior to competition.[31,32]	• None available.	• None available.	• None available.[33,34]

Jurisdiction	Population and Setting	Test or Program	Date Implemented	Outcomes
Finland	• Testing has begun at airports prior to travel or upon arrival at the airport. In Finland, COVID sniffing dogs have been seen in airports screening travelers.[35]	• None available.	• None available.	• Studies are underway in the UK and US to assess the accuracy and training requirements necessary to make dogs useful in this capacity.[36]

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 as the pandemic continues. The following members of the Network provided evidence synthesis products that were used to develop this Evidence Synthesis Briefing Note:

- Canadian Agency for Drugs and Technologies in Health (CADTH). (July 27, 2020). *CADTH Briefing Note: Workplace COVID-19 Prevention Measures and the Role of Testing in Workplace Safety*.
- CADTH. (2020). *CADTH Horizon Scan: COVID-19 Testing - A summary (Draft).*
- CADTH. (October 20, 2020). *CADTH Horizon Scan: Rapid Point-of-Care Antigen Testing for SARS-CoV-2 Infection (Version 2)*.
- CADTH. (December 2020). *Health Technology Review - Rapid Point-of-Care Testing for COVID-19.*
- Ontario Health (October 2, 2020). *An Expedited Summary of the Evidence and Jurisdictional Scan on the Use of Abbott's ID NOW COVID-19 Test and Panbio COVID-19 Ag Rapid Test Device for Assessing Individuals During the COVID-19 Pandemic.*
- Ontario Health Quality. (August 26, 2020). *A Jurisdictional Scan of Surveillance Strategies and Technologies Being Used to Monitor and Manage COVID-19 Spread.* Ontario Health Quality. (Confidential)
- Ontario Health (December 2020). *The Use of Mass Testing for COVID-19: A Jurisdictional Scan*. (Confidential Draft).

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

APPENDIX

Table 5: Current Use of Rapid Antigen Tests for COVID-19[37]

Country	Population and Setting	Test or Program	Date Implemented	Outcomes
Canada	• Asymptomatic general public in a community setting.	• Pop-up clinics in Nova Scotia (Halifax, Wolfville, Dartmouth). • Rapid antigen test, confirmation of positives with PCR test.	• November 22, 2020.	• 5,500 tested as of November 30, 2020 • 21 tests positive • 12 confirmed positive • 2 false positives
Canada	• Long term and personal care homes for rapid recurrent asymptomatic screening of staff and residents.	• Nine care homes received Panbio rapid antigen tests from Abbott Rapid Diagnostics, a German product that was very recently approved for use in Canada, on November 27, 2020 to begin the first two-week deployment of the pilot (Moose Jaw, Regina, Saskatoon, and Prince Albert)	• November 27, 2020.	• None available.
Canada	• Used as a screening test, not a diagnostic test. • Unclear how the program will run.	• 87,000 PanBio antigen tests (Manitoba).	• To be determined.	• None available.
Canada	• A screening program for long-term care homes and other workplaces in Ontario. • Cites that people who are symptomatic and close contacts are being tested.	• 1.2 million Panbio rapid antigen tests. • Panbio tests have been deployed to six long-term care operators for potential deployment in over 30 long-term care homes, 27 retirement homes, eight hospitals, and 11 industry partners such as Ontario Power Generation, Air Canada, and Magna, with plans to expand further across province.	• Announced November 2020.	• None available.
United States	• Distribution of rapid tests to targeted entities. • The Department of Health and Human	• HHS is distributing 150 million rapid, Abbott BinaxNOW™ COVID-19 tests to expand strategic,	• September 28, 2020.	• None available.

Country	Population and Setting	Test or Program	Date Implemented	Outcomes
	Services (HHS) has also distributed tests to nursing homes, assisted living facilities, home health and hospice agencies, Historically Black Colleges and Universities (HBCUs), the Indian Health Service, and States recovering from natural disasters.	evidence-based testing in the United States.		
United States	• Rapid Antigen tests deployed in more than 130 school districts in Massachusetts. • To be used for students, teachers, and staff who are already showing symptoms of COVID-19 with the goal of being able to continue in-person education. • Similar programs are or will be running in South Carolina[d]; Connecticut, where they may also do some random testing;[e] Texas;[f] and Idaho.[g]	• More than 130 school districts in Massachusetts will receive BinaxNow rapid antigen tests. • Positive tests will be confirmed with PCR.	• December 2020 (for Massachusetts).	• None available.
England	• Target asymptomatic people who would otherwise not go through the standard booking process for tests at home or at a regional testing site.	• NHS England plans to roll out a pilot in Bradford, West Yorkshire, which will see community pharmacies provide COVID-19 antigen tests to patients.	• To be determined.	• None available.
England	• Pilot project to test asymptomatic university students at De Montfort University (DMU).	• Selected De Montfort students will be contacted by their faculty. Testing is to be rolled out to include a wider population of DMU staff and students.	• October 2020.	• None available.

[d] McMaster: COVID test kits will allow SC schools to reopen | The State
[e] State Announces Rapid COVID Testing Pilot Program for Schools - Connecticut Education Association (cea.org)
[f] Houston-area school districts plan to participate in rapid COVID-19 testing program - ABC13 Houston
[g] First shipment of new COVID tests arrives, but details remain scarce (idahoednews.org)

Country	Population and Setting	Test or Program	Date Implemented	Outcomes
		• Additional details on testing will be available in due course.		
England	• Asymptomatic outdoor cinema attendees in London, Birmingham, and Ascot.	• Before arrival, attendees would be given the option to purchase an integrated testing service using Medatest's Spring rapid antigen test for CAD $31.37 added to the cost of the event which would then be administered inside their car.[h] • Alongside this, they would also be given access to Synoptics' Reactivate app, an innovative risk management solution which enables them to log their test and manage associated risk and infection spread.	• December 4 - 22, 2020.	• No outcomes reported.
United Kingdom	• Mass testing for COVID-19 using lateral flow tests.	• Several pilot studies of mass testing using lateral flow tests are underway to evaluate how well tests work in real-world settings. The way in which they will be evaluated is unclear. • This includes the National Health Service.	• November 23, 2020.	• One test chosen for a national rollout of mass testing of asymptomatic people across Local Authorities. • This is good at identifying when people do not have the infection, but it could miss as many as half of people who are infected.
Germany	• Federal Government's testing strategy introduced point-of-care testing and to include people without symptoms or a known exposure to the virus into the testing strategy. The directive	• Rapid antigen testing to reduce the risk of infection with Sars-Cov-2 in care homes and to enable homes to stay open to visitors. To be able to test residents and others, and receive	• Mid-October 2020.	• None available.

[h] The report reported a figure of GBP £18. All Canadian Dollar (CAD) amounts were calculated using Purchasing Power Parities (PPPs) as published by the Organisation for Economic Co-operation and Development (OECD) for 2020 (1 British Pound [GBP] = 1.7429 CAD). PPPs are the rates of currency conversion that eliminate the differences in price levels between countries (OECD, 2019).

Country	Population and Setting	Test or Program	Date Implemented	Outcomes
	requires reimbursement of antigen testing in priority settings such as care homes, hospitals, doctors' offices, and rehabilitation facilities.	compensation, care homes are required to produce a 'testing concept'. This involves defining the groups to be tested; the frequency of testing; the processes involved in administering tests (including the procurement of the tests, training requirements, the need for personal protective equipment); and a definition of cases in which an antigen test should be replaced by a PCR test.		
Slovakia	• Mass population testing at testing sites.	• Rapid antigen test. • Immediate 10-day quarantine for those who test positive.	• November 2020.	• 3,625,332 tests • 38,359 tests positive (1.06%).

Table 6: Use of Abbott's ID NOW COVID-19 Test and Panbio COVID-19 Ag Rapid Test Device[38]

Jurisdiction	Test	Setting	Use	Additional Comments
International Organizations				
United States Centers for Disease Control and Prevention	• Abbott PanBio COVID-19 Ag Rapid Test Device (antigen tests granted FDA emergency use authorization).	• Interim guidance suggests use in long-term care facilities (LTCFs).	• Testing of symptomatic long-term care (LTC) residents and health care providers. • Testing of asymptomatic residents and health care providers in facilities as part of a COVID-19 outbreak response. • Testing of asymptomatic health care providers in facilities without a COVID-19 outbreak as required by Centers for Medicare & Medicaid Services (CMS) recommendations.	• Confirmatory PCR tests required for those with negative test results.
United States Office of the Assistant Secretary for Health	• Rapid point-of-care testing platforms (manufacturers not specified).	• Rural hospitals, LTC facilities, correctional facilities.	• Symptomatic and asymptomatic individuals.	• Positive results from antigen tests are highly accurate, but with these tests, there is a higher chance of false negatives than with RT-PCR tests; thus, negative results do not rule out infection.

Jurisdiction	Test	Setting	Use	Additional Comments
				• Negative results from an antigen test may need to be confirmed with a PCR test prior to making treatment decisions or to prevent the possible spread of the virus due to a false negative.
International Governments				
Italy Ministry of Health website, Ministry of Health directive	• Rapid antigen test via nasopharyngeal sample (molecular PCR testing remains the reference test; manufacturer not specified).	• Useful in certain contexts such as rapid screening of large numbers of people (e.g., at schools, airports, and ports). • Unclear how widely test is being used.	• At schools: Symptomatic individuals or in cases of risk of possible exposure. • Other settings: Unclear.	• None available.
Spain Ministry of Health	• Rapid antigen test via nasopharyngeal sample (manufacturer not specified).	• N/A	**Symptomatic Individuals** • Ambulatory settings (i.e., primary care, outpatient settings, emergency departments, diagnostic centres): Rapid antigen test if symptom onset ≤ 5 days. • Hospitals (non-ICU patients hospitalized for reasons other than COVID-19 infection and health care providers): Either rapid antigen test or molecular PCR test according to availability and local practice; if negative test result but high clinical/ epidemiological suspicion of infection and/or test done > 5 days from symptom onset, molecular PCR test must be done. • LTC facilities, penitentiaries (residents and workers): Rapid antigen test; if negative test result but high clinical/ epidemiological suspicion of infection and/or test done > 5 days since symptom onset, molecular PCR test must be done; PCR test is preferred over rapid antigen test if PCR test result is expected within in < 24 hours. • Asymptomatic individuals with close contact with a confirmed COVID-19 case.	• None available.

Jurisdiction	Test	Setting	Use	Additional Comments
			• Community: Rapid antigen test in the community according to the epidemiological situation. • Hospitals: Rapid antigen test, but if negative, molecular PCR test must be done. **Asymptomatic Screening** • Population or specific groups: Molecular PCR test is preferred, but may use rapid antigen test if prevalence is expected to be high; if positive rapid antigen test and low prevalence, molecular PCR test must be done. • Hospitals and LTC facilities: Molecular PCR test.	
United States Department of Health and Human Services	• Abbott ID NOW	• Public health labs in all states and territories and Washington, D.C. • Procurement for the Strategic National Stockpile.	• Prioritization for vulnerable patients whose treatment or isolation requires rapid determination of COVID-19 status, or for outbreak investigations where immediate results are essential	• None available.
United States Indian Health Service	• Abbott ID NOW	• Indian Health Service given priority access to test to expand access to COVID-19 testing in rural communities. • Testing has now expanded to federal, tribal, and urban sites.	• Individuals suspected of COVID-19 infection by health care providers	• None available.
Iowa, United States Iowa Department of Public Health	• Rapid antigen test (manufacturer not specified).	• LTC facilities, health care clinics, high-risk congregate settings.	• Symptomatic and asymptomatic individuals.	• None available.
Idaho, United States Idaho Department of Health and Welfare	• Abbott PanBio COVID-19 Ag Rapid Test Device (antigen tests granted FDA emergency use authorization).	• LTC facilities, correctional facilities, congregate employment centres, schools, contact sports settings.	• Symptomatic and asymptomatic individuals, including those with COVID-19 symptoms who seek medical care within the first five to seven days of symptom onset.	• Providers should follow up negative rapid antigen test results with RT-PCR testing in settings with a high index of suspicion of COVID-19.

Table 7: Current Use of Rapid Molecular Tests for COVID-19[39]

Country	Population and Setting	Test or Program	Date Implemented	Outcomes
Canada	• Hospitals in Moose Jaw, Regina, Saskatoon and Prince Albert will receive rapid point-of-care testing units to screen asymptomatic patients, residents and staff, with results available as quickly as 15 minutes.	• Acute care facilities and mobile testing units piloting Abbott ID NOW tests, which are a polymerase chain reaction (PCR) test.	• November 27, 2020.	• None available.
Canada	• Residents of Saskatchewan who need COVID-19 results to travel or businesses looking to implement rapid testing privately.	• Quantum Genetix will administer rapid tests on a user-pay basis, with results provided within 24-48 hours.	• November 2020.	• None available.
Canada	• Manitoba remote communities, including Swan River, The Pas, Churchill, Thompson, Lynn Lake, Gillam and Flin Flon, where delays due to transportation issues, weather or other factors could affect access to traditional testing and a timely public health response. These communities also have existing lab infrastructure, which is needed for rapid tests.	• Abbott ID NOW. • Health-care providers will follow provincial guidance on when a rapid test is appropriate or may be valuable as an early screening tool to identify possible outbreaks as quickly as possible. Rapid tests cannot replace traditional COVID-19 testing in all circumstances because they can only be used if a person has symptoms.	• To be determined.	• No outcomes identified.
Canada	• Ontario deployed new COVID-19 rapid tests that are initially being used in hospitals and assessment centres in rural and remote communities, as well as to test people as part of early outbreak investigations in hotspot regions where there are high concentrations of COVID-19 cases.	• Ontario has received approximately 98,000 ID NOW tests.	• Announced November 2020.	• No outcomes identified.

Country	Population and Setting	Test or Program	Date Implemented	Outcomes
Canada	• Province of Manitoba is using a rapid COVID-19 test at Winnipeg's new first responders testing site to help measure the accuracy of the test kits.	• Pilot project to test the accuracy of the Abbott ID NOW rapid COVID-19 test kit.	• Announced December 2020.	• None available.
United States	• Airports deploying COVID-19 testing for passengers travelling to destinations (e.g., Hawaii) that require a negative test to travel: ○ Newark, NJ; Boston Logan International Airport, MA; San Francisco International Airport, CA; Dallas Fort Worth, TX; Tampa, FL.	• Rapid PCR testing for travel (Abbot ID NOW the most commonly cited). • Many offer the option of rapid PCR or rapid antigen testing (usually the cost is to the traveller; PCR usually more expensive). • Travellers can be tested at the airport to be allowed to travel.	• ~October 2020 (dates not mentioned for all locations).	• No outcomes identified.
United States	• Alaska, Florida, Louisiana, New Jersey, and Texas Receive first shipments of test. • Used in National Basketball Association (NBA) bubble.	• The U.S. Department of Health and Human Services (HHS) launched a pilot program of fast molecular POC test for COVID-19, that included portable, cartridge-based COVID-19 molecular test kits that provide rapid results. • The pilot program will assess how to best integrate diagnostic technology developed by Cue Health, Inc., into strategies for disease surveillance and infection control in institutions such as nursing homes.	• November 9, 2020.	• No outcomes reported.
United Kingdom	• London Heathrow Airport launched rapid testing of travelers.	• Rapid LAMP test; results available within an hour with the hope of reducing the 14-day quarantine period.	• October 2020.	• No outcomes reported.
Italy	• Hospital: Coronary Care Unit (patients admitted from ER or the field).	• Rapid Molecular Xpert • Xpress Test used in the CCU for patients requiring intervention who have not been properly triaged for COVID-19.	• December 2020.	• Time to result reported.

Table 8: Summary of COVID-19 Mass Testing Strategies by Jurisdiction

Target population & context	Intervention		Reported impact	Sources
	Test description, sample collection, testing protocols	Implementation approach, who led implementation, outreach method		
United Kingdom (City of Liverpool)				
• Whole-city testing was initiated on November 6, 2020 for anyone living or working in the city. ○ The pilot was completed December 2, 2020, when the city moved from Tier 3 (lockdown) to Tier 2. ○ Mass testing continues in the city and in surrounding boroughs. ○ Prior to the initiation of the pilot, Liverpool had one of the highest rates of COVID-19 in England (410.4 per 100 000 for 18-25 October) and was the first area of England to be placed under very high alert in October 2020 (November 3, British Medical Journal [BMJ] 2020).	• Two main types of testing: ○ Innova SARS-CoV-2 Antigen Rapid Qualitative Test: for people without symptoms. ○ RT-PCR: for people with symptoms. • Of note, concerns over the poor sensitivity of the Innova SARS-CoV-2 antigen rapid qualitative test in asymptomatic people have been voiced (December 11; BMJ 2020).	• Population invited to attend multiple testing centres situated throughout the city or request a home test kit. • School-aged children could be tested if accompanied by a parent or guardian. • Areas with lower uptake of mass testing were targeted with door-to-door visits. • Pilot was a partnership between the city council, NHS Test and Trace, the Ministry of Defence, and universities. • Supported by the military in the planning, coordination and delivery of whole-city testing. • Anyone who tested positive via the lateral flow testing was asked to self-isolate and to have a confirmatory RT-PCR test. If the confirmatory PCR test is positive, then the individual must continue to isolate for 10 days following the initial lateral flow test. Everyone in the individual's household will be considered a 'close contact' and must also self-isolate for 14 days.	• During the month-long pilot: ○ Approximately 160,000 people (a third of the city's population) had participated in mass testing ○ 118,257 lateral flow tests have been carried out, of which 784 (0.66%) were positive ○ 68,841 RT-PCR tests have been carried out, of which 2,407 (3.5%) were positive. ○ On November 23 the health secretary stated that "the combination of the mass testing, and the measures in Liverpool, have brought the cases down really quite remarkably". ○ Concerns have been voiced over attributing singular effect of mass testing (November 16, BMJ, 2020), as well as concerns that the pilot is not reaching most vulnerable population (December 11; Sky News). **Pilot evaluation** • The University of Liverpool is undertaking a formal evaluation of the pilot; with an interim	• Iacobucci November 3, 2020 BMJ • Gill & Gray November 16, 2020 BMJ 2020; editorial • November 23, Guardian • November 30, Department of Health and Social Care (UK) • December 1, Liverpool City Council • December 1, University of Liverpool • December 3; University of Liverpool • December 7, Liverpool City Council • Deeks & Raffle, December 11, 2020, BMJ; editorial • December 11; Sky News • December 12 Department of Health and Social Care (UK)

Target population & context	Intervention		Reported impact	Sources
	Test description, sample collection, testing protocols	Implementation approach, who led implementation, outreach method		
			report of first phase of pilot to be published shortly. **Pilot expansion** • Five boroughs adjacent to the city of Liverpool have started mass testing of people without symptoms. • On December 12, the English government, announced a roll out of community testing to 67 other local authorities, with guidance on implementation.	
Germany				
• Mass testing of travelers returning from high-risk countries. • Late July to August 2020.	• Testing at airports (e.g., Berlin's Tegel airport July 29, 2020), or designated sites at certain railway stations, or at a doctor's office within three days of arrival. • Unclear what test (presumed PCR); aimed for results within 24 hours.	• Put in place by Germany's Federal Ministry of Health. • German Red Cross assisting, Centogene lab doing tests at airports and test sites. • Mandatory for people returning from high-risk areas (list maintained by Federal Public Health Agency, Robert Koch Institute). • No cost to travelers. • People refusing to take a test could face a fine of up $43,572 CAD.[i] • If the testing booth is closed upon arrival, individuals are obliged to go for a test within 14 days and remain in quarantine until then.	• During the program nearly 900,000 tests per week completed in Germany (double previous national testing volumes). • Focused on shortening quarantine, if appropriate, during summer holiday months. • Ended late August to refocus testing symptomatic individuals or those with known exposure to a case. • Currently, voluntary testing available for pre-registration at some airports for a fee (not mass testing.	• July 29, Reuters • Aug 6, DW News • Aug 8, DW News • Aug 17, DW News • Aug 26, CP24 News

[i] The report cited a figure of GBP £25,000. All CAD amounts were calculated using PPPs as published by the OECD for 2019 (1 British Pound [GBP] = 1.7429 CAD) (OECD, 2019).

Target population & context	Intervention		Reported impact	Sources
	Test description, sample collection, testing protocols	Implementation approach, who led implementation, outreach method		
		• A negative test can shorten the required quarantine period.		
Germany				

• Mass testing preschool and school-aged children and their educators in the district of Hildburghausen (63,000 inhabitants; Thuringia state)
• Initiated Nov 26, 2020.
  ○ A hotspot with record 603 cases per 100,000 people in the past seven days, more than four times Germany's average incidence.
  ○ Hildburghausen had to close half of the daycare centers because employees were in quarantine, an ambulance could no longer move due to a lack of staff, and the fire brigade could no longer meet their legal arrival times.
	• Makeshift testing centre at a local vocational school.
	• Rapid antigen test COVID-19 (unclear which test).
	• Nasopharyngeal swab.
	• One-time test.
	• Concerns about poorer accuracy of rapid antigen tests in people under 18 years of age have been raised by some experts.
		• State and district government initiated.
		• Voluntary.
		• Open invitation for testing to target population (~9,000 people; 1,000 educators and ~8,000 children).
		• The German Red Cross, the Technical Relief Organization and the German Armed Forces provide support for the testing program (e.g., sample collection).
		• Children who have a negative result would be allowed to go to preschool again and do not have to wait until the temporary end of the planned lockdown in mid-December.
			• Uptake in first three to four days by approximately 2,000 individuals; by December 5 over 2,400 people tested.
			• By December 2, 2020 estimated 30% of target population registered.
			• Goal: Establish extent to which children have contributed to disease transmission and how safe schools and preschools are; allow them to reopen gradually.
			• Germany entered a national lockdown starting December 16 which includes school and childcare closures among other restrictions.
				• Nov 26, Guardian
				• Dec 1, AlKhaleej Today
				• Nov 26, Guardian
				• Dec 1, AlKhaleej News
				• Dec 2, DE24 News
				• Dec 2, NewsyList
				• Dec 5, Granthshala Europe

Iceland				

• National population screening
• March 13, 2020 – April 4, 2020
  ○ First confirmed case of SARS-CoV-2 February 28, 2020.
  ○ 1,308 cases by March 31, 2020.
	• Sample collection at one clinic in Reykjavik (capital).
	• Nasopharyngeal or oropharyngeal swab.
	• RT-PCR assay (World Health Organization [WHO] recommended method).
	• One-time test.
		• Study sponsored by company deCODE Genetics–Amgen, in collaboration with Iceland's Directorate of Health (National government).
		• Open invitation to all citizens who were asymptomatic or had only mild symptoms of the common cold, and text message invitation to additional random sample of 6,782 citizens.
		• People under quarantine not eligible for population screening but for targeted
			• 6% of population tested (13,080 people tested, 100 cases detected).
			• Information on the stability of the infection rate in the general population over study period which "appears to indicate that containment measures were working".
			• Scientifically accurate information about prevalence of
				• Gudbjartsson et al, 2020 NEJM.

Target population & context	Intervention		Reported impact	Sources
	Test description, sample collection, testing protocols	Implementation approach, who led implementation, outreach method		
		testing of high-risk individuals (i.e., symptomatic, recent travel, known exposure to a confirmed case; details in Gudbjartsson et al, NEJM, 2020).	asymptomatic cases. • Information on the incidence in different sex and age groups. • Viral haplotypes over time indicating origin of cases and viral evolution over time.	
Slovakia				
• Slovakia conducted mass testing from October 23-25, and early November 2020 of the entire population (>10yrs). • The number of COVID-19 cases had risen through the fall, 16% of tests were positive and there was concern about the impact on the country's hospital system.	• Rapid antigen test: SD Biosensor Standard Q antigen test, swab test collection by a medical professional. • PCR testing was not used to confirm results, and experts caution this as a potential source of error.	• Testing was not mandatory, but many places of work insisted on seeing a negative medical certificate confirmation to enter the premises, and all residents who did not get tested were required to self-isolate for 10 days. • Testing occurred in three rounds, pilot testing in four municipalities and then rolled out to the rest of the country (45 counties). • The program required the oversight of 20,000 medical staff and 40,000 non-medical staff.	• 84–87% eligible participants accessed testing, with a total of 50,466 positive cases identified (3.91% of the population). • COVID-19 infection rates were lower (by 58%) after the population wide testing, however experts could not separate the effect of testing and other restrictions implemented in tandem.	• Mahase, December 8; BMJ - News • Holt, Nov 6; Lancet – World Report
China				
• The federal government set the mandate, and it was up to individual regions to implement. It was mandated that the following key groups be tested: close contacts of confirmed positive cases, staff at medical institutions, prison staff, and staff in social welfare pension institutions. Additionally, municipalities were supported to test other willing groups.	• The federal plan stated the use of nucleic acid testing (presumed to be reverse transcription - polymerase chain reaction [RT-PCR]). • Preliminary testing could be done in batches of 5–10 samples.	• The National Health Commission supports due diligence by providing the personnel, equipment, and funds to improve testing capacity to regions. • Confirmed positive patients are transferred to government run centralized isolation medical units. Aggressive contact tracing efforts made, and contacts of positive cases are also mandated to be quarantined. • In the Qingdao mass testing initiative,	• Wuhan tested 90% of its population by June 1, 2020 (i.e., 9.9 of 10.9 million people) and identified 300 positive asymptomatic cases with 1,174 close contacts. • Shanghai tested 17,719 airport workers and identified one positive case • In Qingdao, the hospital of the initial cases immediately	• June 8; China Centre for Disease Control • June 8; BBC News • October 12; BBC News • November 24; CTV News • Xing et al, Dec 3, 2020; New England

Target population & context	Intervention		Reported impact	Sources
	Test description, sample collection, testing protocols	Implementation approach, who led implementation, outreach method		
• Localized mass testing upon a small outbreak (e.g., two positive cases) occurred in several regions. According to English language media: ○ Wuhan aimed to test all residents over the course of 10 days in May 2020. ○ Shanghai conducted a mass test of all workers at an airport in November 2020. ○ Qingdao aimed to test all city residents in five days in October 2020.	• Wuhan conducted 25% of their population wide testing using batches of five, and then individually processed if positive. • Qingdao used nasopharyngeal swabs pooled in groups of three to ten for preliminary processing.	staff were dispatched from other regions to support the effort. All residents were contacted and registered with an identity card, work or residential address and phone number. Residents were required to have a negative test results before being allowed on public transit and travel between other regions was limited.	stopped admitting new patients, 10.9 million people were tested, and intense contact tracing resulted in nine additional cases identified.	Journal of Medicine (NEJM) - Opinion

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