

EVIDENCE SYNTHESIS BRIEFING NOTE

TOPIC: RAPID COVID-19 TESTING DEPLOYMENT AND NON-ESSENTIAL BUSINESS SECTORS

Information finalized as of March 18, 2021.^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 summarizes the available literature on the use of rapid screening to support the re-opening of non-essential business sectors across jurisdictions, and the outcomes of these testing strategies.

Key Findings:

COVID-19 Testing in Non-Essential Businesses

- Between January and March, 2021, pilot rapid COVID-19 testing programs were launched across jurisdictions in four industries: travel (Toronto, ON), construction industries (ON), food production (Scotland), and the trucking industry (Singapore).
 - Ontario's pilot program at Pearson International Airport is evaluating the use of the LuminUltra rapid polymerase chain reaction test and the response biomedical rapid antigen test.
 - No outcomes of the four pilot programs have been provided.

Mass COVID-19 Testing

- Mass COVID-19 testing is currently being done in the City of Liverpool (UK), Germany, Iceland, Slovakia and China. No identified studies have evaluated the impact of mass testing in these jurisdictions.

Guidance and Recommendations

- The CDC's guidance on businesses and employers responding to COVID-19 suggests that repeated testing over time, also referred to as 'serial' testing, may be more likely to detect infection among workers with exposures than testing done at a single point in time.

Limitations:

- No high-quality evidence was identified that focused on the implementation of rapid COVID-10 testing in non-essential sectors. Reports of pilot testing programs are based on media releases only.
- 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:

- There is currently insufficient evidence to provide guidance on Ontario's rapid COVID-19 testing deployment in support of re-opening non-essential business sectors.

^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 findings from identified literature on testing deployment in non-essential business sectors. Additional details on rapid COVID-19 testing across industries are provided in [Table 2](#) in the Appendix.

Table 1: Testing Deployment and Non-Essential Business Sectors

Scientific Evidence	<p><u>Economic Benefits of COVID-19 Testing</u></p> <ul style="list-style-type: none"> Findings from a US-based modelling study on a nationwide COVID-19 screening testing program in the presence of a vaccine rollout suggest that a well-designed federally-funded screening testing program, coupled with self-isolation of those who test positive, would pay for itself in terms of increased gross domestic product. The reduction in the prevalence of the virus is predicted to lead to an increase in GDP between CAD \$10 and \$57 billion dollars.^{1,b}
International Scan	<p><u>COVID-19 Testing in Non-Essential Businesses</u></p> <ul style="list-style-type: none"> Between January and March, 2021, rapid COVID-19 testing programs were launched in two jurisdictions: Scotland (food production),² and Singapore (trucking industry).³ <ul style="list-style-type: none"> No outcomes of these programs have been identified. <p><u>Mass COVID-19 Testing</u></p> <ul style="list-style-type: none"> Mass COVID-19 testing is currently being done in the City of Liverpool (UK), Germany, Iceland, Slovakia and China. Table 3 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.⁴ <p><u>Guidance and Recommendations</u></p> <ul style="list-style-type: none"> The CDC's guidance on businesses and employers responding to COVID-19 suggests repeated testing over time, also referred to as serial testing, may be more likely to detect infection among workers with exposures than testing done at a single point in time.⁵
Ontario Scan	<ul style="list-style-type: none"> Between January and March, 2021, two identified rapid COVID-19 testing programs in Ontario were launched: travel (Toronto, ON),⁶ and construction industries.⁷ <ul style="list-style-type: none"> Ontario's pilot program at Pearson International Airport is evaluating the use of the LuminUltra rapid PCR test; and the response biomedical rapid antigen test.⁸ No outcomes of these programs have been identified.

^b The study reported figures of USD \$8 billion and \$46 billion dollars. 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 2019 (1 US dollar [USD] = 1.25 CAD). PPPs are the rates of currency conversion that eliminate the differences in price levels between countries ([OECD, 2019](#)).

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 member of the Network provided evidence that was used to develop this Evidence Synthesis Briefing Note:

- McMaster Health Forum; and
- Ontario Health.

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

Appendix

Table 2: Rapid COVID-19 Testing Across Industries

Jurisdiction & Program	Purpose	Test Location & Target Population & COVID-19 Status	Type of Test	Impact & Outcomes	Lessons Learned & Recommendations
Travel					
<p>Ontario⁹</p> <p>Greater Toronto Airports Authority Rapid COVID-19 Point-of-need Testing</p>	<ul style="list-style-type: none"> Beginning March 1, 2021, the Greater Toronto Airports Authority (GTAA) began a 10-week study at Toronto Pearson Airport that will examine the efficiency of rapid polymerase chain reaction (PCR) and antigen testing beginning March 1, 2021. 	<ul style="list-style-type: none"> Testing locations: Toronto Pearson International Airport. Target population: Eligible airport workers and select passengers who volunteer for testing. COVID-19 status: Asymptomatic employees and passengers. 	<ul style="list-style-type: none"> LuminUltra rapid PCR test; and Response Biomedical rapid antigen tests. 	<ul style="list-style-type: none"> None available. 	<ul style="list-style-type: none"> The findings of this study may have application in other settings, including schools and workplaces. The study will help identify, trace and isolate COVID-19 at work and at home in the communities that surround the airport. This initiative further deepens the GTAA's focus on contributing to local and national economic recovery, while protecting the airport's workforce and the community.
<p>Ontario¹⁰</p> <p>Workplace Antigen Testing Study</p>	<ul style="list-style-type: none"> Running parallel to the GTAA Rapid COVID-19 Point-of-need Testing program, this study will compare antigen and rapid PCR tests. Participants will receive multiple antigen tests per week for a period of approximately eight weeks. 	<ul style="list-style-type: none"> Testing locations: Toronto Pearson International Airport. Target population: Volunteer participants from Toronto 	<ul style="list-style-type: none"> Abbot's Panbio rapid antigen test. 	<ul style="list-style-type: none"> None available. 	<ul style="list-style-type: none"> The study will explore the viability of frequent antigen testing within a workforce as a method to quickly identify, trace and isolate COVID-19. By testing multiple times per week over multiple weeks, researchers will be able to study how frequent use of antigen tests can improve workplace safety by reducing the risk of spreading COVID-19.

Jurisdiction & Program	Purpose	Test Location & Target Population & COVID-19 Status	Type of Test	Impact & Outcomes	Lessons Learned & Recommendations
		Pearson's airport workforce. <ul style="list-style-type: none"> COVID-19 status: Asymptomatic employees. 			
Construction					
Ontario¹¹ Rapid Antigen Testing at Construction Sites	<ul style="list-style-type: none"> In February 2021, the Government of Ontario announced plans to roll out COVID-19 rapid antigen testing at construction sites across the province to quickly determine COVID-19 infection. 	<ul style="list-style-type: none"> Testing locations: Workplaces. Target population: Workers in essential sectors. COVID-19 status: Asymptomatic employees. 	<ul style="list-style-type: none"> Abbott Panbio Antigen Screen. 	<u>Outcomes:</u> <ul style="list-style-type: none"> EllisDon is currently conducting 8,000 rapid antigen tests per week at various construction sites across Ontario, including at The Well mixed-use project in Toronto, ON, the province's largest construction project. EllisDon is covering the costs of the health care staff needed to administer the tests, a commitment of hundreds of thousands of dollars. Some workers reported reluctance to agree to be tested. 	<ul style="list-style-type: none"> The new rapid testing initiative, along with screening measures, helped identify and respond to a budding outbreak at The Well, a 3.1-million square foot mixed-used development downtown.
Food Production					
Scotland¹² Routine Workplace COVID-19 Testing in High-risk Workplaces	<ul style="list-style-type: none"> In January 2021, the Scottish Government asked food production and processing businesses to sign up for routine staff testing to help 	<ul style="list-style-type: none"> Testing locations: Food production and processing businesses. 	<ul style="list-style-type: none"> Lateral flow antigen test. 	<ul style="list-style-type: none"> A number of businesses have already signed up as early adopters, including critical businesses such as the 	<ul style="list-style-type: none"> The Scottish Government strives to reach larger (over 25 employees) higher risk food processing businesses where the loss of a facility due to an outbreak could lead to impacts on food supply by reducing supplies to retail or hindering exports.

Jurisdiction & Program	Purpose	Test Location & Target Population & COVID-19 Status	Type of Test	Impact & Outcomes	Lessons Learned & Recommendations
	<p>identify cases of COVID-19, keep workforces safe and break chains of transmission.</p> <ul style="list-style-type: none"> Free lateral flow antigen test kits are available to eligible businesses that are essential to maintaining an adequate supply of food for the nation, and where outbreak risks can be higher due to the working environment such as abattoirs, meat and seafood processing facilities and dairies, as well as food distribution businesses. 	<ul style="list-style-type: none"> Target population: Workers in high risk food processing businesses. COVID-19 status: Asymptomatic employees. 		<p>Coupar Angus poultry plant and a number of seafood processors in the Grampian region.</p>	<ul style="list-style-type: none"> This program has implications for keeping high-risk, yet essential businesses in the food industry open in order to reduce impacts of COVID-19 cases and outbreaks on the food supply chain.
Trucking					
<p>Singapore¹³ Compulsory COVID-19 Antigen Rapid Tests</p>	<ul style="list-style-type: none"> A Ministry of Trade and Industry (MTI) media release reported that compulsory antigen rapid tests will be progressively rolled out for cargo drivers entering Singapore at the Tuas and Woodlands checkpoints beginning January 22, 2021. 	<ul style="list-style-type: none"> Testing locations: Land checkpoints. Target population: Randomly selected cargo drivers and accompanying personnel. COVID-19 status: Symptomatic and asymptomatic. 	<ul style="list-style-type: none"> COVID-19 antigen rapid tests. 	<ul style="list-style-type: none"> Drivers and personnel with negative test results will proceed to enter Singapore; Those with positive tests will be asked to return home and advised to take a confirmatory polymerase chain reaction (PCR) test. If the PCR test is negative, drivers can re-enter Singapore. If the result is positive, they can only enter 	<ul style="list-style-type: none"> The program is designed to ensure the smooth passage of goods between Singapore and Malaysia, as well as the important role cargo drivers and other personnel play. This new requirement is in line with Singapore's strengthened border controls, which require all travellers to take COVID-19 tests upon arrival to manage the growing risk of imported cases.

Jurisdiction & Program	Purpose	Test Location & Target Population & COVID-19 Status	Type of Test	Impact & Outcomes	Lessons Learned & Recommendations
				Singapore at least 21 days after the date of diagnosis.	
Economic Benefits of COVID-19 Testing					
United States¹⁴ Nationwide COVID-19 Screening Testing Program	<ul style="list-style-type: none"> Modelling study reports on macroeconomic cost-benefit analysis of a nationwide COVID-19 screening testing program in the presence of vaccine distribution during 2021. 	<ul style="list-style-type: none"> Target population: General population. COVID-19 status: Symptomatic and asymptomatic. 	<ul style="list-style-type: none"> Innova Medical Group's rapid antigen test. The screening and diagnostic tests are assumed to cost CAD \$6.25 and \$62, respectively.^c 	<p><u>Outcomes:</u></p> <ul style="list-style-type: none"> The hypothetical screening test programs avert between 28,000 and 91,000 deaths in the model. <p><u>Impacts:</u></p> <ul style="list-style-type: none"> The reduction in the prevalence of the virus leads to an increase in GDP between CAD \$10 and \$57 billion dollars.^d The impact of the testing program depends heavily on the rollout date: programs that start earlier will avert more deaths and lead to a larger increase in GDP. 	<ul style="list-style-type: none"> A well-designed federally-funded screening testing program, coupled with self-isolation of those who test positive, pays for itself in terms of increased GDP. The program is projected to save 20,000 or more lives. The sooner the testing program is put in place, the greater are its net economic benefits.
United States¹⁵ Rapid COVID-19 Testing and Reduction of	<ul style="list-style-type: none"> To define performance standards and predict the clinical, epidemiologic, and economic outcomes 	<ul style="list-style-type: none"> Target Population: US population. 	<ul style="list-style-type: none"> Home-based SARS-CoV-2 antigen testing. Time Horizon: 60 days. 	<ul style="list-style-type: none"> <u>Results of Base-Case Analysis:</u> Without a testing intervention, the model anticipates 11.6 million infections, 	<ul style="list-style-type: none"> High-frequency home testing for SARS-CoV-2 with an inexpensive, imperfect test could contribute to pandemic control at justifiable cost and warrants consideration as part of a national containment strategy.

^c The study reported figures of USD \$5 and 10 respectively. 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 2019 (1 US dollar [USD] = 1.25 CAD). PPPs are the rates of currency conversion that eliminate the differences in price levels between countries ([OECD, 2019](#)).

^d The study reported figures of USD \$8 and \$46 billion dollars. 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 2019 (1 US dollar [USD] = 1.20 CAD) ([OECD, 2019](#)).

Jurisdiction & Program	Purpose	Test Location & Target Population & COVID-19 Status	Type of Test	Impact & Outcomes	Lessons Learned & Recommendations
Community Transmission	<p>of nationwide, home-based antigen testing.</p> <ul style="list-style-type: none"> Design: A simple compartmental epidemic model that estimated viral transmission, portrayed disease progression, and forecast resource use, with and without testing. 			<p>119,000 deaths, and CAD \$12.62 billion in costs (CAD \$8.12 billion in inpatient care and CAD \$4.37 billion in lost productivity) over a 60-day horizon. Weekly availability of testing would avert 2.8 million infections and 15,700 deaths, increasing costs by CAD \$22.3 billion.^e</p> <ul style="list-style-type: none"> Lower inpatient outlays (CAD \$7.37 billion) would partially offset additional testing expenditures (CAD \$15.62 billion) and workdays lost (CAD \$17.50 billion), yielding incremental cost-effectiveness ratios of CAD \$9,859.97 per infection averted and CAD \$1,787,042 per death averted.^f <u>Results of Sensitivity Analysis</u>: Outcome 	

^e The study reported figures of USD \$10.1, \$6.5, \$3.5, and \$22.3 billion dollars respectively. 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 2019 (1 US dollar [USD] = 1.25 CAD) ([OECD, 2019](#)).

^f The study reported figures of USD \$5.9, \$12.5, \$14 billion dollars respectively, and \$7,890 per infection and \$1,430,000 per death averted. 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 2019 (1 US dollar [USD] = 1.25 CAD) ([OECD, 2019](#)).

Jurisdiction & Program	Purpose	Test Location & Target Population & COVID-19 Status	Type of Test	Impact & Outcomes	Lessons Learned & Recommendations
				<p>estimates vary widely under different behavioural assumptions and testing frequencies. However, key findings persist across all scenarios, with large reductions in infections, mortality, and hospitalizations.</p>	
General Information on Rapid Testing					
<p>International¹⁶ Strategies to Exiting the COVID-19 Lockdown for Workplaces and Schools</p>	<ul style="list-style-type: none"> This scoping review describes multiple population-wide strategies, including social distancing, testing, and contact tracing. Among the 43 research articles included in the analysis, most came from European countries (65%) and the USA (22%) and were published after April 2020. 	<ul style="list-style-type: none"> Testing locations: Schools and workplaces Target population: General population. COVID-19 status: Symptomatic and asymptomatic. 	<ul style="list-style-type: none"> Rapid antigen tests; and Serological tests. 	<ul style="list-style-type: none"> Overall, large-scale testing contact tracing and isolation strategies emerged as essential components that allowed easing of lockdowns. In particular, serological testing that detects immunoglobulins (IgM and IgG) specific for SARS CoV-2 emerged as an effective way to estimate the population exposure and to release workers with resulting immunity. Return to work: Social distancing was often associated with testing, contact tracing, and smartphone apps to track contagion, 	<ul style="list-style-type: none"> The evidence suggests that each strategy should be reliant on the situation of the outbreak and on several thresholds of safeguards to anticipate the possibility of resurgence. Mitigation strategies should be combined with other interventions (i.e., face masks and hygiene) contextualized at local circumstances and scaled up or down depending on the changing local epidemiological situation. The retrieved evidence lacks operational solutions and are mainly based on mathematical models and derived from grey literature. There is a need to report the impact of the implementation of country-tailored strategies and assess their effectiveness through high-quality experimental studies.

Jurisdiction & Program	Purpose	Test Location & Target Population & COVID-19 Status	Type of Test	Impact & Outcomes	Lessons Learned & Recommendations
				quarantine and isolation, and other NPIs, such as wearing a mask. <ul style="list-style-type: none"> ○ <u>School reopening</u>: Large-scale testing, contact tracing and isolation measures were considered relevant to limiting the spread. 	
Guidance and Recommendations					
<p>United States¹⁷</p> <p>Guidance for Businesses and Employers Responding to COVID-19</p>	<ul style="list-style-type: none"> • To provide guidance on the use of COVID-19 testing in workplace preparedness, response and control plans. 	<ul style="list-style-type: none"> • Testing locations: Non-healthcare workplaces. • Target population: Employees. • COVID-19 status: Asymptomatic employees. 	<ul style="list-style-type: none"> • Rapid antigen test. 	<ul style="list-style-type: none"> • Recommended approaches may include: <ul style="list-style-type: none"> ○ <u>Initial testing</u> of all workers before entering a workplace; ○ <u>Periodic testing</u> of workers at regular intervals; or ○ <u>Targeted testing</u> of new workers or those returning from a prolonged absence such as medical leave or furlough, or some combination of approaches. • Several factors may be helpful in determining the <u>interval for periodic testing</u>, including: <ul style="list-style-type: none"> ○ Availability of testing; 	<ul style="list-style-type: none"> • Implementation of testing strategies can supplement measures to reduce transmission in the workplace. • Repeated testing over time, also referred to as serial testing, may be more likely to detect infection among workers with exposures than testing done at a single point in time.

Jurisdiction & Program	Purpose	Test Location & Target Population & COVID-19 Status	Type of Test	Impact & Outcomes	Lessons Learned & Recommendations
				<ul style="list-style-type: none"> ○ Results of previous testing; and ○ Level of community transmission. 	

Table 3: Summary of COVID-19 Mass Testing Strategies by Jurisdiction⁹

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)				
<ul style="list-style-type: none"> Whole-city testing was initiated on November 6, 2020 for anyone living or working in the city. <ul style="list-style-type: none"> 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). 	<ul style="list-style-type: none"> Two main types of testing: <ul style="list-style-type: none"> 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). 	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> During the month-long pilot: <ul style="list-style-type: none"> 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). <p>Pilot evaluation</p>	<ul style="list-style-type: none"> 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)

⁹ This table is reproduced from a rapid review published by Ontario Health: Ontario Health (December 2020). *The Use of Mass Testing for COVID-19: A Jurisdictional Scan*. (Confidential Draft).

Target population & context	Intervention		Reported impact	Sources
	Test description, sample collection, testing protocols	Implementation approach, who led implementation, outreach method		
			<ul style="list-style-type: none"> The University of Liverpool is undertaking a formal evaluation of the pilot; with an interim report of first phase of pilot to be published shortly. <p>Pilot expansion</p> <ul style="list-style-type: none"> 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				
<ul style="list-style-type: none"> Mass testing of travelers returning from high-risk countries. Late July to August 2020. 	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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.^h If the testing booth is closed upon arrival, individuals are obliged to go for 	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> July 29, Reuters Aug 6, DW News Aug 8, DW News Aug 17, DW News Aug 26, CP24 News

^h 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		
		<ul style="list-style-type: none"> a test within 14 days and remain in quarantine until then. A negative test can shorten the required quarantine period. 	some airports for a fee (not mass testing).	
Germany				
<ul style="list-style-type: none"> Mass testing preschool and school-aged children and their educators in the district of Hildburghausen (63,000 inhabitants; Thuringia state) Initiated Nov 26, 2020. <ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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				
<ul style="list-style-type: none"> National population screening March 13, 2020 – April 4, 2020 <ul style="list-style-type: none"> First confirmed case of SARS-CoV-2 February 28, 2020. 1,308 cases by March 31, 2020. 	<ul style="list-style-type: none"> Sample collection at one clinic in Reykjavik (capital). Nasopharyngeal or oropharyngeal swab. RT-PCR assay (World Health Organization [WHO] recommended method). 	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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". 	<ul style="list-style-type: none"> 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		
	<ul style="list-style-type: none"> One-time test. 	<ul style="list-style-type: none"> People under quarantine not eligible for population screening but for targeted testing of high-risk individuals (i.e., symptomatic, recent travel, known exposure to a confirmed case; details in Gudbjartsson et al, NEJM, 2020). 	<ul style="list-style-type: none"> Scientifically accurate information about prevalence of 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				
<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> Mahase, December 8; BMJ - News Holt, Nov 6; Lancet – World Report
China				
<ul style="list-style-type: none"> 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, 	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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		
<p>municipalities were supported to test other willing groups.</p> <ul style="list-style-type: none"> • Localized mass testing upon a small outbreak (e.g., two positive cases) occurred in several regions. According to English language media: <ul style="list-style-type: none"> ○ 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. 	<p>batches of 5–10 samples.</p> <ul style="list-style-type: none"> • 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. 	<p>are also mandated to be quarantined.</p> <ul style="list-style-type: none"> • In the Qingdao mass testing initiative, 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. 	<ul style="list-style-type: none"> • In Qingdao, the hospital of the initial cases immediately stopped admitting new patients, 10.9 million people were tested, and intense contact tracing resulted in nine additional cases identified. 	<p>Journal of Medicine (NEJM) - Opinion</p>

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