Issue Note

Experience and evidence with COVID-19 transmission and spread across jurisdictions related to changes in border controls

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Executive summary

Question: what is the emerging evidence and experience across jurisdictions related to implementing changes in border controls to reduce risk of transmission and spread? For all ports of entry (air, land, water) which approaches were taken to change border control and what were the considerations?

The global spread of COVID-19 and its variants of concern (VOCs) has led many countries to implement border controls. This report explores the impacts, both intended and unintended, of border control measures including disease spread, wait times at the border, and frequency of travel as well as considerations in implementing such measures. It builds on the *Priority strategies to optimize testing and quarantine at Canada's border report* (1), by focusing on 'real-world' evidence related to border control measures, and measures being used in other countries. We cross-referenced our included papers with that report's reference list to find relevant information and avoid duplicating efforts.

Most papers we found did not distinguish between the type of port of entry (air, land, sea). The border controls typically involved testing (PCR and antigen) before and/or after travel, with quarantine required in some but not all cases. Many countries have determined lists of safe and less safe countries based on the epidemiological situation in those countries.

Considerations for policy

- Border policy should consider the epidemiological situation in the country of origin, the epidemiological situation in Canada, vaccination or previous infection status, type of test (PCR and antigen), and a likely increase in passengers over time.
- Testing and quarantine may not provide full protection against limiting the spread of COVID-19 across borders given that our testing methods may not identify all positive cases (2) and the challenges of ensuring quarantine is maintained (unless it is implemented with a supervised and enforced approach).
- The Centers for Disease Control and Prevention's guidance on developing a framework for assessing and managing individual-risk level for COVID-19 exposure in mobile populations may be tailored to the Canadian context. This framework provides a range of restrictive approaches to assess individual-level risk of COVID-19 exposure of mobile populations within and across borders (25).

The conclusions of this paper are limited due to the following:
- The search strategy focused primarily on variations around the term "border" and the literature that we identified was mostly related to air travel. Therefore, future scans should incorporate targeted searches for land and seaports to identify more information.
- We had a rapid timeframe (1 week) to complete the search and to write this report, which means that we may have missed relevant information.
- Although we did not find information about the impact of border controls on wait times at the border, this may be attributed to the current situation of limited travel.

Introduction

The spread of COVID-19 and its variants of concern (VOCs) across international borders has led many countries to impose border restrictions. These include, but are not limited to, screening for symptoms and temperature checks, quarantine, and testing in addition to travel bans from specific 'high-risk' countries. Much of the evidence for these measures is based on modelling data; there is limited observational data on which to base policy decisions. The COVID-19 Testing and Screening Expert Advisory Panel has recently released a report titled *Priority strategies to optimize testing and quarantine at Canada's border.*

This report seeks to answer the following question: what is the emerging evidence and experience across jurisdictions related to implementing changes in border controls to reduce risk of transmission and spread? For all ports of entry (air, land, water) which approaches were taken to change border control and what were the considerations?

The report provides a summary of the measures currently in place as well as evidence and recommendations for border measures (1). The present document builds on that report by cross-referencing our included papers with the report's reference list to ensure that we are complementary to this work. Our paper focuses primarily on 'real-world' evidence related to border control measures, and measures being used in other countries. It is anticipated that these measures will continue to rapidly evolve as the vaccination programs are implemented and the pandemic shifts in nature.

This rapid scan is based on information found through LitCovid, the WHO COVID-19 literature database, Google Scholar, and the University of Toronto library COVID-19 resources prioritizing higher-level evidence (i.e., systematic reviews, rapid reviews, and meta-analyses), but also including relevant pre-prints and single studies (see the appendix for more information about our search methods).

How are countries managing their borders?

Countries have applied a range of measures to control the spread of COVID-19 at their borders. However, some countries are geographically isolated (e.g., Australia, New Zealand, South Korea) while others have many borders to manage (e.g., European countries). The measures implemented at borders include screening measures, quarantine, and restrictions or exemptions for countries and essential workers. Table 1 summarizes the border control measures implemented by selected countries with high levels of land and air traffic from multiple regions of the world.

Public health measures: Testing, quarantine, and vaccine documentation

Testing is presently required by most countries before and/or after international travel. A negative polymerase chain reaction (PCR) test result 2-3 days before departure is most common. Some countries accept rapid antigen tests including Italy (48 hours before travel), the Netherlands (PCR 24 hours before travel or antigen test with PCR 72 hours before travel), Slovenia, and the United States of America (USA). Testing after travel is typically required in combination with quarantine. Many European countries require a second test (the first being the pre-departure test) 3-5 days after arrival.

Quarantine is required in most of the countries we examined, though there are many variations in implementation. For example, Austria has a 10-day quarantine that can be ended if the 5-day test comes

back negative. Countries such as Sweden, Iceland, and the United Kingdom (UK) recommend getting tested at/near arrival and about a week later. South Korea has a mandatory 14-day quarantine for travellers from all countries.

Considerations for quarantine measures

- Travellers that were not able to get a test before travel may be required to quarantine for up to two weeks (e.g., Slovenia, Finland).
- Travellers coming from a list of 'low-risk' countries are often exempt from quarantine.
- Travellers coming from a list of 'high-risk' countries often have mandatory quarantine.
- Travellers that are vaccinated or can show proof of past-infection are often exempt from quarantine and sometimes from testing.
- Non-essential travel is allowed between many European countries and sometimes also allowed for citizens of low-risk countries.

Based on experience among European countries, the European Centre for Disease Control (ECDC) suggests that testing and quarantine are appropriate measures to implement for countries that have successfully reached COVID-19 levels close to zero. But this may not be an effective use of public health resources for countries experiencing widespread transmission of COVID-19 given that the importation of COVID-19 from travellers is low compared to community spread within these countries (2).

The UK Department of Transport in their Report of the Global Travel Taskforce, The Safe Return to International Travel, outlines a framework for a risk-based approach to managing a restart of international travel. The following was recommended (3):

- A risk-based reopening of international travel using a traffic light system, applying nimble restrictions as the COVID-19 situation evolves, and requiring a test and vaccine status for UK residents traveling to other countries.
- Coordination with travel industries to ensure that various digital vaccine certificate systems (and apps), are well integrated, interoperable, safe, and secure.
- International cruises to restart according to vetted COVID-19 Management Plans including working closely with port operators and health authorities, and ensuring passengers remain in bubbles to minimize COVID-19 transmission to communities at the ports.

Table 1: Summary of border control measures implemented by selected countries* (4)

Country	Testing	Quarantine	Additional measures
Austria	Negative PCR (72 hours) or antigen (48 hours).	10-day quarantine (shorter with negative test at 5 days).	Travellers from Brazil, India, South Africa, and UK need to quarantine. Vaccinated travellers from other countries are exempt from quarantine.
Finland	Can do 2 tests instead of quarantine.	14 days if no tests are taken.	
Netherlands	If arriving from high-risk country - negative PCR 24 hours prior or	10-day quarantine if arriving from high-risk country. Can reduce	

	negative PCR no more than 72 hours prior and negative rapid test.	quarantine with test on day 5.	
Spain	Travellers from high-risk regions require negative test within 72 hours prior to arrival.	10-day quarantine mandatory for travellers from India.	These measures only apply to air and seaports. No information on arrival by train and road.
France	Negative PCR test result, carried out less than 72 hours before departure + PCR test on arrival.	Mandatory 7-day quarantine for exempt low-risk countries and mandatory 10-day quarantine for high-risk countries.	Mandatory travel declaration regarding COVID-19 symptoms and contacts prior to departure.
United States of America	Pre-departure negative COVID-19 test within 72 hours prior to departure + second test within 3-5 days upon arrival.	Mandatory 7-day quarantine with negative test or 10 days without test post arrival for unvaccinated individuals and no quarantine requirements for fully vaccinated persons.	Restriction on non-essential travel for land and air.\n\nBan high risk regions.
United Kingdom	Negative COVID-19 test within 3 days of departure to England and 2 tests on day 2 and day 8 post arrival.	Mandatory 10-day quarantine for travellers from the red and amber lists at a hotel or at home, respectively. No quarantine if travelling from a green list country.	

*Note that many countries have exemptions for vaccinated travellers.
European source (https://reopen.europa.eu/en), USA source (CDC)

What is the evidence and experience around what may work?

Border closures and restrictions

Generally speaking, border closures seem to be most effective if implemented early in a pandemic, with less benefit once community transmission has taken hold (5–8). Multiple studies examined the impact of non-pharmaceutical interventions (NPIs) – including border restrictions – and found that border restrictions in combination with other NPIs were effective in reducing COVID-19 cases and deaths (9–13). Note that most studies did not account for local travel restrictions that often went into place simultaneously with border restrictions making it difficult to determine which of these was beneficial (6).

By contrast, a study comparing Gaza with Hong Kong (two high-density areas) found that despite stricter border measures implemented in Gaza, COVID-19 cases increased more in Gaza than in Hong Kong. The authors attribute this difference to differences in implementation and adherence to other public health measures (14).

The majority of Nordic countries have implemented strict border policies, including full international air travel restrictions (i.e., travel restrictions from high-risk countries, quarantine for travellers from hot spots, and testing/screening) for a period of time, except for Sweden. In 2020, early implementation of travel restrictions and stringent preventative public health measures by Nordic countries, reduced per capita COVID-19 cases and fatalities (15). Further, according to some modelling on the effects and responses of COVID-19 in Nordic countries, Sweden may have reduced their COVID-19 cases and fatalities if they had followed similar border restrictions as the Nordic countries (16).

Quarantine and screening

A review identified four studies that combined quarantine with screening (testing or symptom-based screening). Passengers underwent various forms of screening along with a mandatory 14-day quarantine. A PCR test on the last day of quarantine was used to determine the 'true' number of cases. This number was compared with the number that were identified through testing on arrival, on pre-specified days, or based on symptoms. Quarantine combined with screening identified 68% to 92% of cases. The proportion identified may vary as a function of the days on which testing is conducted and whether testing was conducted for all participants or only for symptomatic ones (17). A study (pre-print) that looked at the positivity rate of travellers arriving through Pearson airport in Toronto found that most cases (94%) will be detected by testing on arrival and again on day seven of quarantine, supporting the idea that reduced quarantine with testing can be as effective as a 14-day quarantine (18).

Screening travellers for symptoms, with temperature checks or with rapid tests via telephone, online, in person, homes, clinics, in workplaces, in airports, or schools, is unlikely to be effective. A rapid review found low certainty of evidence suggesting that screening at airports, train, and bus stations, may only slightly slow the introduction of COVID-19 infected persons (19). Screening of travellers at US airports through observation for signs of illness, temperature check, and a questionnaire was found to be very inefficient (1 case identified per 85,000 travellers screened) (20). A study of a cruise ship in Taiwan in February 2020 found that quarantine, screening for symptoms, and testing those with symptoms identified no cases of COVID-19 (21). However, this was very early in the pandemic and does not reflect the current epidemiological situation in the world.

Consequences of border control

The scientific literature generally shows that border control measures in combination with other public health measures have prevented or slowed the spread of COVID-19. However, there were other negative consequences including decreased air travel and a risk of increased food insecurity.

Globally, in 2020, the number of passengers on flights decreased by 60%, and led to 371 billion USD less revenue for airlines (22). In Canada, international travel declined from 96.8 million to 25.9 million travellers from 2019 to 2020. There were 90% fewer travellers that entered Canada from December 2019 to December 2020 (1). Stock prices of major airlines has been reduced by about 30% (23). Cruise ship companies also suspended activity and some observed a roughly 60% reduction in stock prices (23).

Activity at seaports in the first few months of the pandemic (until about May 2020) also decreased. Trade volume fell in Los Angeles (22%), there were fewer weekly vessel calls in Shanghai (20%), and there was

a decrease in imports of 17% in Long Beach, California (23). One article makes the case that border restriction *may* lead to food insecurity issues if trucks are held up at borders, if food companies shut down, and if migrant workers are not allowed to travel for work (24).

Limitations

- Our search strategy focused primarily on variations around the term "border". Most of the literature found was around air travel. Therefore, future scans should incorporate targeted searches for land and seaports to identify more information. We had a rapid timeframe (1 week) to complete the search and to write this report, which means that we may have missed relevant information.
- Although we did not find information about the impact of border controls on wait times at the border, this may be attributed to limited travel at the moment.

Conclusion and considerations for policy

Countries have implemented a range of border control measures including quarantine, screening, and additional restrictions or exemptions based on that balance risk and a need for essential services. Most of the information did not distinguish between the type of port of entry (air, land, sea). The border controls usually involved testing (PCR and antigen) before and/or after travel, with quarantine required in some but not all cases. Many countries have determined lists of safe and less safe countries based on the epidemiological situation in those countries. At the time of writing, there is very little evidence or policy that distinguishes partially and fully vaccinated travelers.

Considerations for policy:

Border policy should consider the epidemiological situation in the country of origin, the epidemiological situation in Canada, vaccination or previous infection status, type of test (PCR and antigen), and a likely increase in passengers over time. Testing and quarantine may not provide full protection against limiting the spread of COVID-19 across borders given the limitations to our testing methods (2) and the challenges of ensuring that quarantine is maintained (unless it is implemented with a supervised and enforced approach). Finally, the Centers for Disease Control and Prevention's guidance on developing a framework for assessing and managing individual-risk level for COVID-19 exposure in mobile populations may be tailored to the Canadian context. This framework provides a range of restrictive approaches to assess individual-level risk of COVID-19 exposure of mobile populations within and across borders (25).

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Appendix

Methods

We searched for information on border control measures taken in response to COVID-19. This included looking at scientific literature as well as a jurisdictional scan examining government reports and websites to determine what border control measures were taken.

In the scientific literature, most of the information was about air travel or referred to border restrictions broadly without defining them; there was little information about sea and land borders.

In the jurisdictional scan, we undertook custom Google Searches (as per Gerstein Librarian at University of Toronto) for international and Canadian governmental and public health websites. Most of the resources were national guidance documents, technical reports, and frameworks focused on air travel, and a relevant resource on restarting cruise ship operations.