Effectiveness of border closures/travel restrictions, screening and/or quarantine to control the international spread of COVID-19

An updated rapid review

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General Disclaimer

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EXECUTIVE SUMMARY

Background: *The COVID-19 pandemic proved difficult to manage for many reasons. This included the global interconnectedness of the world today, with evidence that movements of people internationally and domestically throughout the pandemic, contributed to the initial and subsequent spread of SARS-CoV-2 and variants of concern (VOCs). As such, in an effort to limit the introduction and onward transmission of the virus across international borders, virtually all governments worldwide implemented varied types of travel-related measures. These measures sought to mitigate public health risks by managing who was able to travel and under what conditions. The objective of the Cochrane rapid review (2021), update by Abou-Setta et al. (2022) and this rapid review was to identify, critically appraise, and summarize available evidence on the use of entry or exit restrictions/closures, screening, and/or quarantine to control the spread of COVID-19 across international borders.*

Methods*: This review used the protocol applied by Abou-Setta et al. which, in turn, adapts the methodology of the Cochrane rapid review entitled, "International travel-related control measures to contain the COVID-19 pandemic". In brief, we searched for observational (including ecological) studies in general health and COVID-19-specific bibliographic databases. The primary outcome categories were (i) cases avoided, (ii) cases detected, and (iii) a shift in epidemic development. Secondary outcomes, considered where studies included at least one primary outcome, were infectious disease transmission, healthcare utilization, resource requirements, adverse effects, and user acceptability. Quality assessment of observational studies was conducted using a modified version of the Newcastle-Ottawa Scale. Risk of bias of screening studies was conducted using the QUADAS-2 tool. Certainty of evidence was assessed using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group methodology.*

Results: *Further to the 15 relevant studies identified by the Cochrane rapid review, 25 studies in previous WHO rapid reviews, and 53 identified by Abou-Setta et al., we identified 16 new studies for review that met the inclusion criteria (109 studies in total). Peer-reviewed publications that were previously only available as pre-prints were also identified and reviewed. Most included studies were retrospective observational studies and generally were of moderate to high quality.*

The first update found that travel restrictions/border closures, comprehensive screening (especially with polymerase chain reaction [PCR] testing), and quarantine all carried potential benefits and harms (e.g., financial burden, anxiety, depression). While the most restrictive interventions showed the greatest potential public health benefit (e.g., limiting spread, delaying introduction of new variants, identifying most cases prior to entry into the community), no method was rigorously proven to be effective past a few weeks of implementation, and most were evaluated retrospectively in a short period of time (e.g., weeks to months). As such, while most studies reported some benefit to these interventions, others showed no benefit, mixed effects, or conflicting findings. Also, risk assessment and balancing the benefits and harms of interventions were regularly echoed in the study reports.

The added studies did not change the main conclusions of the Cochrane rapid review ("some travel-related control measures during the COVID-19 pandemic may have a positive impact on infectious disease outcomes") nor the quality of the evidence (very low to low certainty). However, the additional studies added to the evidence base for most outcomes.

This review echoed findings from the Cochrane rapid review and Abou-Setta et al. that interventions applied earlier and more stringently achieved public health benefits most effectively. However, the newly identified studies differed in two ways. First, while earlier studies focused on the initial weeks/months of the pandemic, and on border controls/travel restrictions, most of the new studies focused on various subsequent periods during the pandemic, notably periods when variants of concern (VOCs) emerged and circulated. Second, none of the new studies focused exclusively on travel restrictions and border closures but analysed the use of several types of travel measures simultaneously. Travel measures were also often applied simultaneously with other non-pharmaceutical interventions (NPIs) (e.g., social distancing) which are not assessed in any of the reviews. Thus, the available evidence does not allow us to determine the unilateral or exclusive effectiveness of individual types of travel measures (e.g., screening, quarantine).

Conclusions: *Abou-Setta et al. concluded that low to very low certainty evidence supports the balanced use of international border entry/exit restrictions/closures, screening, quarantine, or a combination of these measures to limit the spread of COVID-19 through air travel, especially during early stages of the outbreak, during epidemic waves, and for delaying (but not eliminating) introduction of new variants past countries' borders. Despite substantial new research attention to travel measures, this review also found continued low or very low certainty evidence to inform decision making. Thus, this review does not deviate from conclusions of preceding reviews.*

This review showed that there remains insufficiently robust or certain evidence to determine the effectiveness of specific types of travel measure as distinct interventions. As many of the studies acknowledge, the combined use of multiple types of travel measures simultaneously and the likely impact of context- and period- specific factors, also influenced outcomes. In alignment with the Abou-Setta et. al., though particular attention is paid to countries deemed to be comparable to Canada, there is need to acknowledge the uncertainty of available evidence due to often conflicting results over time and place; variations in community prevalence at the time the interventions were implemented; diverse approaches to testing and quarantine intervention (e.g., length, timing, enforcement); and divergent levels of immunity within and across communities. This review also identified the need to consider overarching factors such as a country's pandemic response strategy; the simultaneous use of other NPIs; interventions by other levels of jurisdiction in a given country; varying transmissibility and epidemiological dynamics of VOCs; the degree of enforcement and compliance with interventions; and differing travel modes (i.e., air, land or sea) and implementation approaches. For these reasons, this review finds newly identified study results to be limited in their generalizability.

This review underscored the need for research applying standardized terminology to define and describe specific types of travel measures, and comparable datasets across national settings. While Abou-Setta et al. identified the need for broad-based research on the comparative effectiveness of interventions, and the removal of these interventions, this review concluded that more context-specific research questions need to be addressed such as what circumstances justify the use of travel measures, what combination of travel measures is most effective, when and where to apply such measures, and with what degree of stringency.

Key Messages

- **General notes**

    - A general limitation to the evidence base found by Abou-Setta et al. was that most studies did not clearly report on the exact points of entry evaluated in the studies. As such, evidence from airports, international land and river crossings and seaports were often presented together. Further, even in studies that reported only one type of points of entry (e.g., airports only), this was often not limited to one airport and heterogeneity of practices at different ports of entry for a given country cannot be ruled out.

    - This review found that evidence of effectiveness varied over time, place, and within the context of different overall pandemic response strategies. Evidence of effectiveness in studies reviewed often was context- and period- specific. Many studies assessed travel measures as interventions within an early and overall strategy of elimination (e.g., Hong Kong, Cambodia, China), while Canada and other countries deemed comparable adopted a mitigation strategy. Spanning diverse settings and prolonged periods of the pandemic, the generalizability of findings in this review needs to be carefully considered.

    - Many studies were concerned with more than one type of travel measure and did not differentiate specific outcomes. Study findings reporting the greatest benefits from interventions analyze contexts where a combination of travel measures was simultaneously implemented, in addition to other NPIs. Screening (testing) and quarantine were frequently combined, often in parallel entry restrictions which reduced the volume of travellers to support effective implementation. The evidence base begins to illuminate, yet does not directly address, questions concerning which travel measures should be used in a given context; in what combinations; when to apply and lift them; and how they should be implemented.

    - This review suggests that interventions varied in effectiveness in response to different epidemiological and epidemic dynamics. Interventions, for example, were found in several studies to have varying effects on the introduction and onward transmission of different VOCs. More stringent measures applied to travellers arriving from countries considered higher risk reported mixed results.

    - Findings from reviewed studies which focused on the initial weeks and months of the COVID-19 pandemic supported a precautionary approach (early and stringent implementation before a pathogen spreads widely internationally). Many studies in this review also assessed the effectiveness of travel measures at later stages of the pandemic when VOCs began to circulate. These studies provide important insights into the complex challenge of effectively using travel measures during a prolonged pandemic event. Given the dynamic nature of travel-related risks over time, and the increase in potentially adverse secondary outcomes as a pandemic continues, these studies suggest further research is needed to support real-time risk analysis and improve evidence to inform decision-making trade-offs between public health benefits and broader economic and social costs.

- **International border closures/travel restrictions**

  - Cases avoided due to measure: In the review by Abou-Setta et al., most studies reported that stricter and earlier implemented border closures (e.g., complete ban on inbound travellers at all points of entry) and travel restrictions (e.g., ban on inbound/outbound travel to/from higher-risk areas) were more effective than looser (e.g., many categories of exemption), or later implemented measures. In this update, previous findings about the time-limited benefits of early and stringent implementation were reinforced. All of the newly identified studies also went beyond the initial weeks of the pandemic. The findings suggest that, to varying degrees, such restrictions are less effective over time, as community transmission is established. There is mixed evidence that risk-based use of restrictions (e.g., traffic light system) reduced introductions by limiting travel from what are deemed higher-risk countries. The dynamic nature of travel-related risks posed by inbound and outbound travellers, and real-time data gaps, posed decision making challenges.

  - Shift in epidemic development: Both Abou-Setta et al. and this review showed that, while border closures/travel restrictions did not prevent the eventual introduction of SARS-CoV-2 variants and a corresponding rise in cases, they did, in certain circumstances, delay the epidemic peak. The impact of interventions on epidemic development were particularly evident in studies of countries which maintained border closures/travel restrictions on an ongoing basis. Findings also showed the effective use of travel restrictions across varying national contexts in reducing the importation and proportionate impact of different VOCs as they emerged and circulated worldwide.

  - Cases detected due to the measure: Studies reviewed by Abou-Setta et al. showed that stricter border controls/travel restrictions were associated with identifying more cases at the border and delaying the introduction of VOCs. This review underscores that it is difficult, if not impossible, to differentiate effectiveness of border controls/travel restrictions from other concurrently implemented interventions, often including screening (testing) and quarantine.

  - Secondary outcomes: While studies reported the benefits of decreasing transmission, they also reported varying economic, social, and mental health effects on individuals and their close contacts who were denied entry or exit.

- **Screening at borders**
  - Cases avoided due to measure: Abou-Setta et al. found only a few studies reported on this outcome, with conflicting results, possibly due to the type of screening conducted and the simultaneous use of other measures (e.g., quarantine). As such, it was difficult to draw firm conclusions regarding the effectiveness of screening of international arrivals at points of entry. In general, while screening at the border was reported to be beneficial in identifying imported cases, and thus reducing the number of test-positive individuals from having direct contact with the wider population, screening alone did not completely prevent introduction due to variations in testing regimes (timing, type, and number of tests), efficacy of tests, and changing knowledge of incubation periods. This led to the eventual introduction and spread into and within countries including community (secondary) transmission. It should be noted that studies did not usually report on pre-boarding testing from the countries of origin and so this may

have affected the certainty of the evidence. In this review, many new studies reported on this intervention. This evidence suggests pre-departure and upon-arrival testing reduced the introduction of cases by infected inbound international arrivals, including asymptomatic individuals. However, studies also showed the effectiveness of repeated testing (i.e., pre-departure, upon arrival, post-arrival) in combination with quarantine. Pre-departure and upon-arrival testing alone were largely ineffective at preventing the introduction of VOCs.

- Shift in epidemic development: In Abou-Setta et al., only a few studies reported on this outcome. There was no clear correlation between screening at borders and epidemic development. Other factors (e.g., dominant circulating variant, vaccine status of travellers) may be better correlated. In this update, no studies support the effectiveness of screening alone. Findings on effectiveness, when combined with quarantine and travel restrictions, varied. This review did not assess the evidence on immunity certification which may be a further intervention to be used in combination with other travel-related measures.

- Cases detected due to the measure: Most studies reviewed by Abou-Setta et al. on screening at borders, reported this outcome with mixed results. Most studies reported that screening through testing (e.g., PCR) was more effective than other modalities (e.g., syndromic screening), and differed according to the dominant circulating variant. It should be noted that some countries required pre-departure screening and/or testing within a designated period (e.g., 72 hours before arrival). This may have confounded the results, as individuals who screened positive at pre-departure were not permitted to travel. Most studies in this review focused on diagnostic screening (PCR tests) and collection of traveller information; only one assessed the effectiveness of symptom-based screening (e.g., temperature checks). The studies largely supported the effectiveness of testing for case detection but there was need for repeated testing. While on-arrival testing can be effectively used, infection was frequently not detected until post-arrival. An important additional role of screening of international arrivals was early detection and genomic sequencing of cases for sentinel surveillance.

- Secondary outcomes: There was general agreement in studies reviewed by Abou-Setta et al., which reported on resource requirements, that screening required substantial resources. As such, significant logistical challenges were posed by screening of all travellers irrespective of source/destination country, citizenship/residence, medical history, purpose of travel, immunity status, availability of personnel and monitored quarantine facilities at points of entry, and other factors. For other secondary outcomes, the available evidence from reviewed studies was not clear if screening had a direct impact on infectious disease outcomes or healthcare utilization.

- **Quarantine**
- Cases avoided due to measure: Abou-Setta et al. found only a few studies reported on this outcome, and the results were conflicting. While quarantine is intended to eliminate interaction between potentially infected and non-infected individuals to reduce transmission risk, evidence reported in the included studies did not demonstrate a value of quarantine above and beyond other measures (e.g., border closure/ travel restrictions and/ or screening). Additionally, it was not clear if a longer quarantine period was better (e.g., leave after 1st negative test vs. remain for 14 days). The studies in this review provided

new supporting evidence of the effectiveness of quarantine in reducing travel-related onward transmission. Only one study explicitly assessed the optimal quarantine period, finding that 14-day quarantine ensured non-infection among international inbound travellers with a probability of 95%.

- Shift in epidemic development: Only a few studies reviewed by Abou-Setta et al. reported on this outcome. These studies reported that quarantine was beneficial in delaying the peak of illness. Since cases may have been asymptomatic, the effect on this outcome was generally difficult to evaluate. In this review, one study found that infection control was important during mandatory quarantine in designated sites, to prevent the intervention from becoming a cause of infection and transmission among international arrivals undergoing quarantine.

- Cases detected due to the measure: Most studies on quarantine at borders reviewed by Abou-Setta et al. also reported on this outcome with mixed results. The results were similar to screening at borders, as quarantine was often coupled with screening (i.e., all quarantined individuals are screened – often multiple times). Studies in this review which supported evidence of quarantine effectiveness in case detection all relied on concurrent, often repeated, PCR or antigen testing as interventions.

- Secondary outcomes: Studies reviewed by Abou-Setta et al. noted that, in addition to the limitations on the rights of free movement, adverse effects of quarantine on individuals (e.g., insomnia, quarantine system failures) and associated resource requirements were important considerations. Additionally, the benefits of quarantining on reducing community transmission were not clear and seeding within the community from infected travellers still occurred. VOCs were still introduced into countries implementing quarantine. As such, quarantine alone was not found to prevent imported cases over prolonged periods. Certain studies acknowledged that some travellers were exempt from travel restrictions (e.g., essential workers), though the impacts of these exemptions were not assessed. Moreover, it was not clear in most studies whether quarantine was mandatory, how it was enforced, and what, if any consequences of non-compliance there were. This is a limitation of the implementation of the intervention and the reporting of the studies. Studies reviewed by this update reported greater effectiveness of quarantine of international arrivals at reducing case-positive introductions and onward transmission, when used for optimal periods, with limited or no exemptions, and where combined with repeated testing. However, the cost of implementing quarantine stringently over a prolonged period was recognized as substantial. The equity considerations of quarantine use were noted as a secondary outcome although not assessed.

Introduction

In humans, coronaviruses may cause respiratory infections ranging from the common cold to severe disease. The 2003 Severe Acute Respiratory Syndrome (SARS-CoV-1), the 2012 Middle East Respiratory Syndrome (MERS), and the Severe Acute Respiratory Syndrome-related coronavirus (SARS-CoV-2), that causes the Coronavirus Disease 2019 (COVID-19), are all notable diseases caused by novel coronaviruses.

COVID-19 has proven to be more difficult to manage, compared to previous coronavirus outbreaks, for many reasons including its high infectivity rate (R naught/ R_0), multiple modes of transmission (droplets and aerosols), and viral evolution (variants). To combat the transmission of SARS-CoV-2, governments and public health organizations and officials have implemented a broad range of policies to decrease the spread of the virus, including international border closures/travel restrictions, screening and/or quarantine largely focused on inbound international travellers.

There have been several efforts to systematically synthesize and evaluate the available evidence on the effectiveness of travel measures during the COVID-19 pandemic (Box 1). A Cochrane review[1] showed that there was low to very low certainty evidence for most international travel measures, and that the theorized effects (mainly from modelling studies) may be substantially different from the reality on the ground. As such, further research is required to make firmer conclusions on the effectiveness of these interventions.

The objective of the rapid review by Abou-Setta et al.[2] as a limited update of the Cochrane review[1] was to identify, critically appraise and summarize evidence on international border closures/travel restrictions, screening and/or quarantine to control the spread of SARS-CoV-2 transmission between countries and regions. This updated rapid review (henceforth "review") identified and reviewed new observational (real world) studies available since April 2022 that meet the inclusion criteria applied by Abou-Setta et al.[2]

Box 1: Selected reviews of the evidence on the effectiveness of travel measures during the COVID-19 pandemic

Burns et al. 2020[3] (Initial Cochrane review)
The authors conducted a rapid review of the effectiveness of travel-related control measures in containing COVID-19, as well as on SARS and MERS for additional evidence. Studies available as of 26 June 2020 were included. The authors identified 36 unique modelling and observational studies (40 records total). The authors found that modelling studies suggested that early implementation of cross-border travel restrictions could reduce new cases by 26 % – 90 % and delay outbreaks. The authors concluded that screening at borders without quarantine showed limited effectiveness but combining screening with quarantine and PCR testing improved outcomes. Overall, certainty of evidence, especially where generated from modelling studies, was low and the authors highlighted the lack of observational studies using 'real-life' evidence.

Burns et al. 2021[1] (updated Cochrane review; full update of Burns et al. 2020)
The authors conducted a full update on their 2020 rapid review based on 62 studies (49 modelling, 13 observational) available as of 13 November 2020. For this review, studies concerned with SARS or MERS were no longer included. The authors found that travel restrictions showed varied efficacy in reducing cases and slowing spread. Screening at borders, especially PCR testing, indicated benefits. While quarantine measures were deemed generally beneficial, effectiveness varied depending on duration and compliance. A combination of both interventions improved outcomes. The certainty of evidence was deemed low, underscored by a lack of real-world evidence.

Abou-Setta et al. 2022[2] (limited update of Burns et al. 2021)
The authors conducted a limited update of Burns et al. (2021) which excluded modelling studies due to the low certainty of evidence. In addition to relevant studies identified by Burns et al. 2021 (n=13), the authors included studies identified by a WHO review (n=15) and conducted an updated search from November 2020 to April 2022. A total of 93 study reports were assessed. Findings aligned with those of the previous reviews and certainty of evidence remained low. The authors concluded that there was insufficient evidence to determine the effectiveness of single interventions as they were often employed in combination. Furthermore, generalizability of results was limited due to the limited range of countries and regions in which the studies were conducted.

Movsisyan et al.[4] *[in progress]* **(limited update of Burns et al. 2021)**
The authors initially planned a second full update of Burns et al. (2020). However, the authors have subsequently limited the scope of this update to one intervention category ('border screening measures'). This review will only consider studies that provided real-world evaluation of the performance of such measures (referred to in the first update as "observational studies evaluating screening at borders, which are more closely related to diagnostic studies than intervention evaluations). This update is anticipated to be finalized in 2024 (Email communication, 11 February 2024).

Methods

Abou-Setta et al.[2] is largely based on the methodology of the Burns et al. (2020, 2021) reviews: "International travel-related control measures to contain the COVID-19 pandemic."[1] In conducting this review, we repeated the methodology applied by Abou-Setta et al., according to guidelines detailed in the Methodological Expectations of Cochrane Intervention Reviews (MECIR), and reported according to the Preferred Reporting

Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.[5] The Cochrane review protocol is available in the Cochrane Library.[1] The research question was "What is the effectiveness of international border closures/travel restrictions, screening, quarantine or a combination of these interventions on the spread of SARS-CoV- 2?"

Population, interventions, comparators, outcomes, study designs (PICOS)

The population of interest for Abou-Setta et al[2] and this review was human travellers crossing/attempting to cross an international border (all countries). Under the International Health Regulations (IHR, 2005),[6] human travellers are termed "traffic". Non-human travellers and goods are termed "trade". Studies focusing on domestic travel (e.g., across provincial borders) were excluded. The interventions of interest were:

- Travel restrictions reducing or stopping international cross-border travel via points of entry (e.g., air, land, sea)
- Screening at borders (e.g., syndromic screening, rapid testing, polymerase chain reaction [PCR] testing)
- Quarantine of inbound international travellers
- Combination of the above (e.g., quarantine and screening at an international border)

It should be noted that documentation on the immunity status of international travellers, including vaccination, as a travel measure, was not included as an intervention in this review. Immunity/vaccination status was not one of the interventions included in the Cochrane reviews or by Abou-Setta et al. Moreover, the use of this intervention by countries to mitigate travel-related risks was highly complex, due to the impacts of vaccine hesitancy, (in)equity of access, and the lack of standardized and secure systems for recording and demonstrating proof of immunity. For this reason, synthesis of the available evidence on the effectiveness of immunity status for mitigating travel-related risks during the COVID-19 pandemic warrants a separate systematic review.[7]

The comparators were no border measures, less restrictive border measures, no border measures or other border measures. This review notes, however, that many travel measures as interventions were not necessarily or consistently applied at borders (i.e., points of entry). The lack of explicitly stated comparators was not, alone, grounds for exclusion.

The primary outcome categories for this review were: (i) cases avoided due to the measure; (ii) shift in epidemic development due to the intervention; and (iii) cases detected due to the measure. The secondary outcomes, considered only where studies reported on at least one primary outcome, were: (i) any other infectious disease transmission outcome (e.g., number of severe cases in the community); (ii) healthcare utilization (e.g., number of cases requiring treatment in the intensive care unit (ICU), time until ICU capacity is reached); (iii) resource requirements for implementing the intervention (e.g., costs associated with intervention, additional personnel, number of tests required); (iv) any adverse effects (e.g., health, economic and social outcomes), and (v) user acceptability (e.g., passenger confidence).

We included any relevant non-randomized or observational studies that were used to assess the impact of interventions. The non-randomized studies included prospective or retrospective cohort studies, case-controlled studies, cross-sectional studies, interrupted time series, or ecological studies (cross-sectional, time-trend, or descriptive). In alignment with Abou-Setta et al.[2], modelling studies were excluded. Limited exceptions were made for modelling studies which otherwise met the inclusion criteria, and integrated both modelling and observational methods in their study designs. We excluded case reports/series, opinion papers, editorials, study protocols and trial registries.

Search strategy for identification of studies

The search strategy used by Abou-Setta et al.[2] was applied to conduct an updated search for studies made publicly available from 13 April 2022 to 5 February 2024. The search was conducted in general health and COVID-19-specific bibliographic databases [i.e., Medline (Ovid), Embase (Ovid), Cochrane COVID-19 Study Register, and the WHO COVID-19 Global literature on coronavirus disease]. Each database was searched using an individualized search strategy as in Abou-Setta et al. (Appendix 1)[2]. When necessary, search strategies were adapted, or filters used to reflect the change in timeframe (13 April 2022 to 5 February 2024), as well as to adapt to changes in available WHO database search filters. Finally, the reference lists of identified narrative and systematic reviews, as well as newly identified studies in this review, were manually searched for any further relevant citations. We performed reference management in Zotero and Covidence. All searches were conducted on 5 February 2024.

Study selection

We developed, standardized, and pilot-tested screening forms. For title/abstract screening, all unique citations were reviewed by one reviewer to determine if a citation met the inclusion criteria. Full texts of all included citations were reviewed independently and in duplicate. All conflicts were resolved through discussion, consensus or by a third reviewer, as required. We recorded the number of ineligible citations at the title/abstract screening stage, and both the number and reason for ineligibility at the full-text screening stage according to Abou-Setta et al.'s[2] methodology. Study selection was performed using Covidence.

Data abstraction and management

Following pilot testing, one reviewer extracted and summarized the findings from included study reports and a second reviewer reviewed the summaries for accuracy and completeness. Discrepancies between the two reviewers were resolved by discussion and consensus. Data management was performed using Microsoft Excel™ for Microsoft 365 MSO (Version 2402, Microsoft Corp., Redmond, WA, USA).

Assessment of methodological quality and potential risk of bias

Non-randomized comparative studies were assessed using the Newcastle-Ottawa Scale (NOS). NOS uses a 'star' system with eight items, categorized into three domains: the selection of the study groups, the comparability of the groups, and the ascertainment of outcome of interest for cohort studies.[8] Since the included studies were not expected to be true cohort studies, some of the items could not be assessed. Following the methodology of Abou-Setta et al., we used NOS instead of ROBINS-I tool. For diagnostic accuracy studies, following preceding review methodologies, we used the QUADAS-2 tool which was designed to assess risk of bias in diagnostic studies. QUADAS-2 is categorized into four domains: patient selection, index test, reference standard, and flow and timing.[9]

Data summary

All data are summarized descriptively and in tabular form. Similar to the Cochrane review, we present specific characteristics of all included studies in tabular form. The analysis of the extracted data is descriptive as the data did not allow for any meta-analytic techniques to be used, except for the diagnostic accuracy of screening tests. As such, we are presenting counts and percentages, where possible, and descriptive summaries of the results per outcome. Further, we have summarized the results in summary tables including GRADE summary of findings tables (Tables 3-8).

In addition to the main analysis, where data are available, we have provided a summary of evidence related to:

1. countries deemed comparable to Canada with regards to COVID-19-related restrictions for the first update (see Table 1 and Appendix 2). For this, we rely on the country list which was finalized during the first update after consultation with decision-makers, knowledge users and content experts.
2. voluntary vs mandatory requirements of travellers (e.g., testing, quarantine).

Table 1: Countries of reviewed studies* deemed comparable to Canada

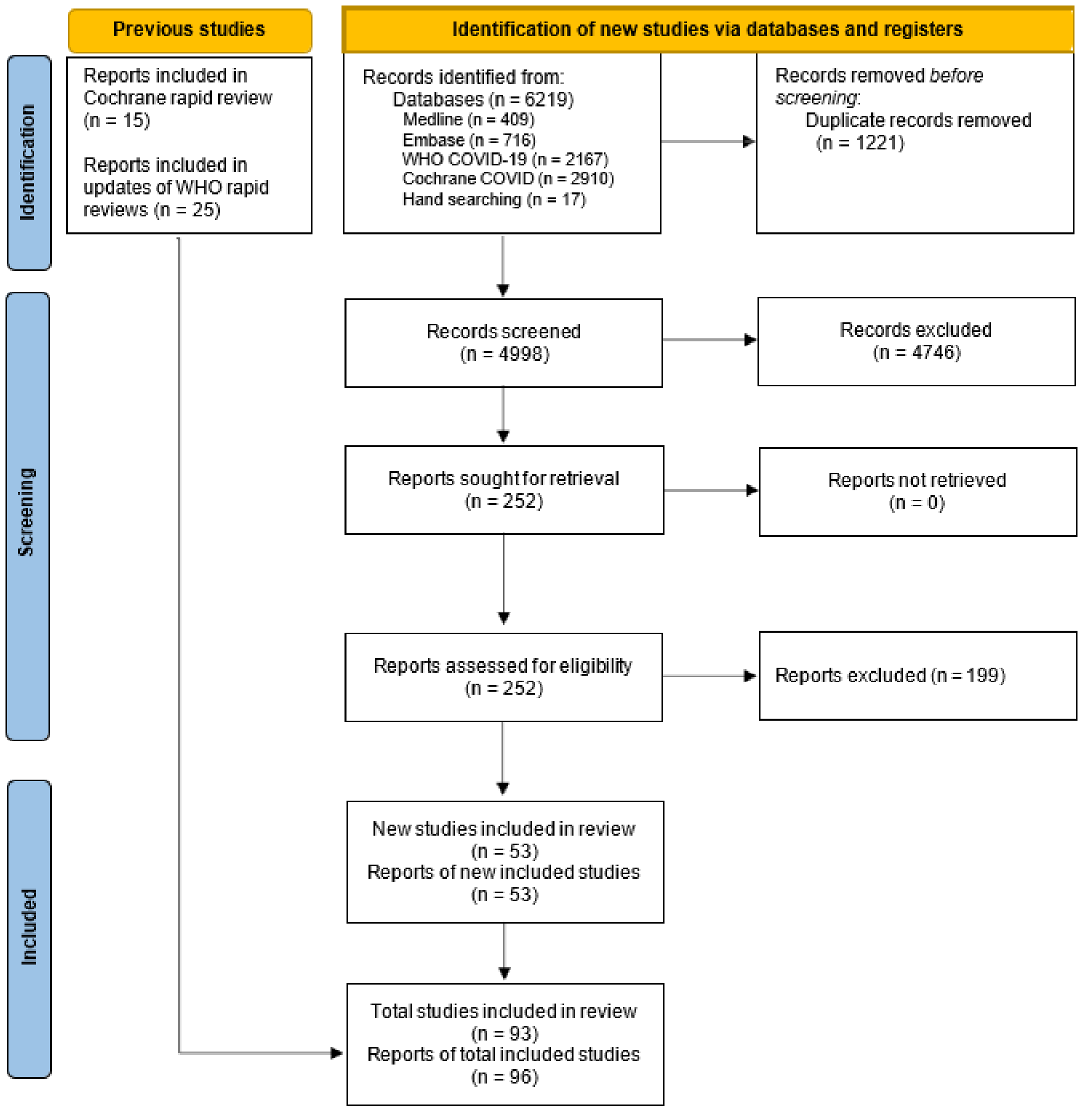
Black: countries of studies reviewed by Abou-Setta et al.*
***Blue:** *countries of studies identified in both reviews*

Australia	Denmark	Italy	Poland
Austria	Finland	Japan	Spain
Belgium	France	Luxembourg	Switzerland
Bulgaria	**Germany**	Netherlands	**UK**
Cyprus	Greece	New Zealand	**USA**
Czech Republic	Ireland	**Norway**	

Results

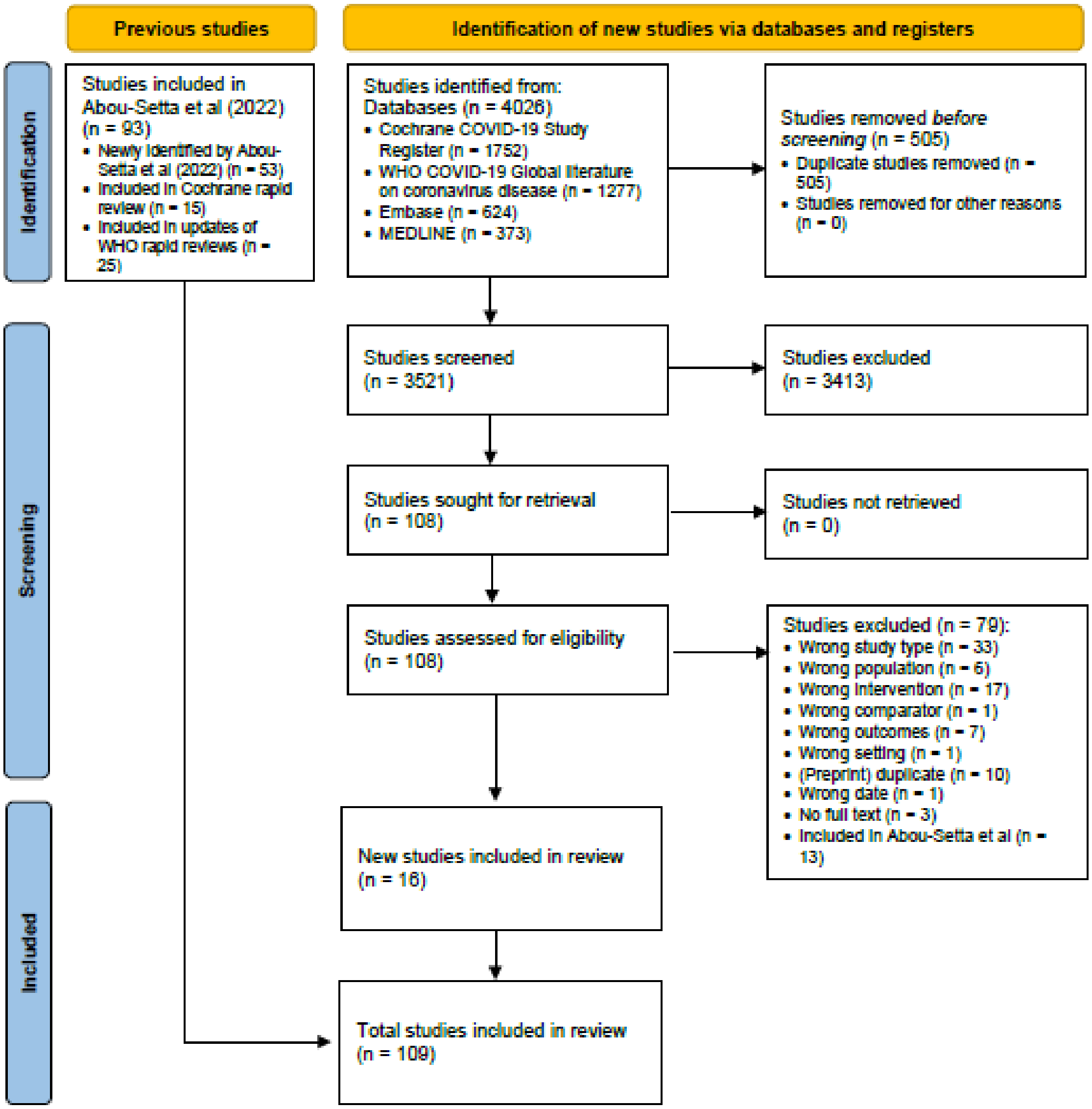
The Cochrane review[1], from 5586 records screened (after duplicates removed), included 15 studies relevant to this review. Abou-Setta et al.[2], from 4998 records screened (after duplicates removed), identified 53 studies that met the inclusion criteria. In addition, the 15 study reports identified in the Cochrane review, and an additional 25 study reports which were identified in previous WHO rapid reviews, were included. In total, this limited review included 96 study reports representing 93 studies (3 study reports were companion publications) (Figure 1).

Figure 1 PRISMA 2022 Flow Diagram



In this review, from 3521 records screened (after duplicates removed), we identified 16 new studies that met the inclusion criteria (Figure 2). These studies are considered alongside the evidence from the 93 studies reviewed by the first update. In total, 109 studies and 3 companion publications were included in the Cochrane review, Abou-Setta et al. and this review.

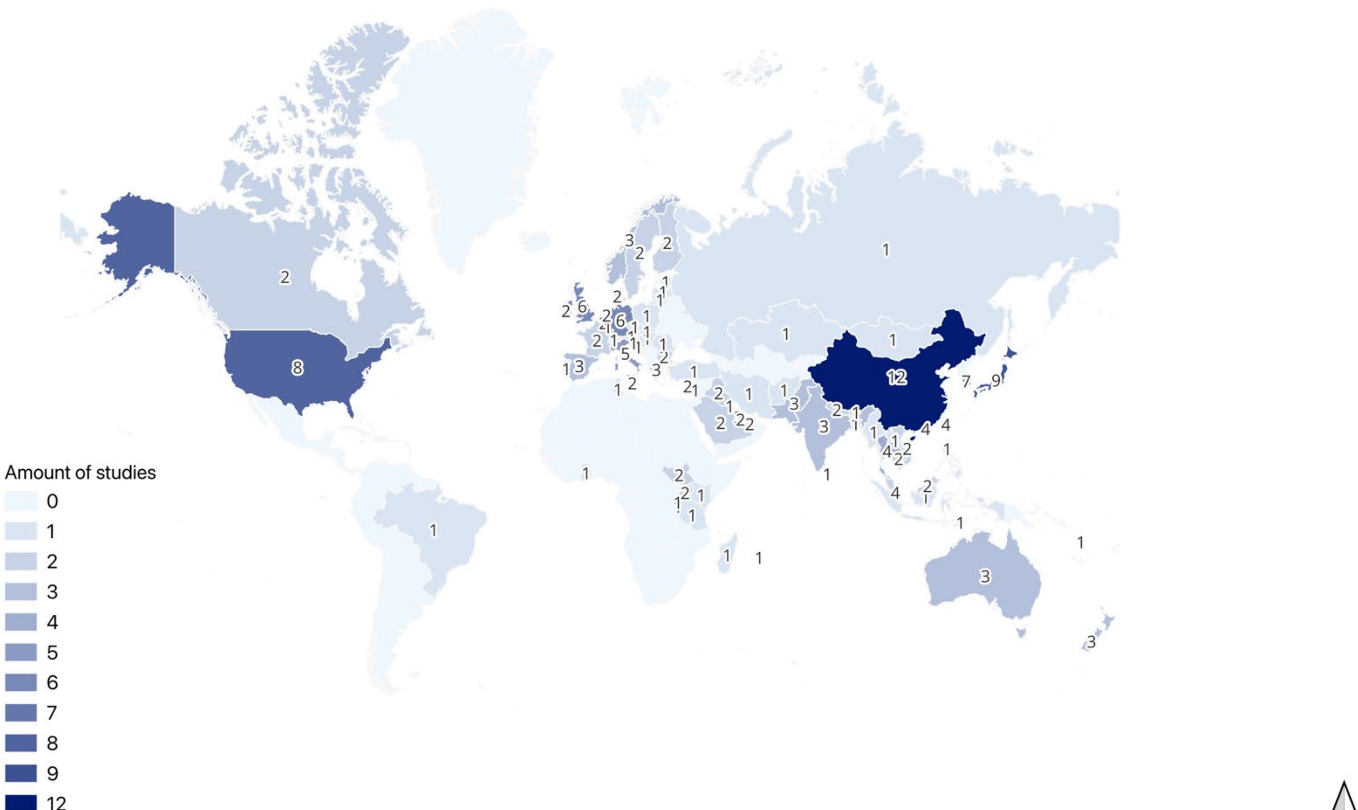
Figure 2 PRISMA 2024 Flow Diagram



In Abou-Setta et al.'s review, 37 studies were conducted in Canada and what were deemed comparable countries. These countries are mostly in North America, Europe, Australia, and Asia as follows (Figure 3): Australia[10–12] (n = 3), Bulgaria[13] (n = 1), Canada[14–17] (n = 4), Cyprus[18] (n = 1), France[19] (n = 1), Germany[20–22] (n = 3), Greece[23,24] (n = 2), Ireland[25] (n = 1), Italy[26–28] (n = 3), Japan[29–35] (n = 7), Netherlands[36] (n = 1), New Zealand[11,37,38] (n = 3), Spain[39] (n = 1), UK[38,40] (n = 2), USA[23,28,41,42] (n = 4).

In this review, we identified an additional nine studies conducted in Canada and comparable countries as defined by Abou-Setta et al.: Belgium[43] (n=1), Canada[44,45] (n = 2), Germany[46] (n = 1), Norway[47] (n=1), the UK[48,49] (n = 2), and USA[50,51] (n = 2).

Figure 3: **Distribution of countries studied implementing international travel-related interventions in Abou-Setta et al and this review**



On risk of bias (screening studies) and study quality (observational studies), most studies were not adequately designed as either a diagnostic test accuracy study or a cohort, cross-sectional or case- control studies. As such, we had to adapt the QUADAS-2 and Newcastle-Ottawa Scales accordingly, with several domains noted as not being applicable (Tables 1-2).

The evidence for border closures/travel restrictions, screening, and/or quarantine are presented in Tables 3-5, respectively. Studies identified in this review shared many of the same limitations reported by previous reviews. Studies rarely reported in detail the exact definitions of the interventions used, length of interventions implemented, exceptions permitted (e.g., for the repatriation of citizens), or characteristics of dominant circulating VOCs during the study period. Due to time constraints and feasibility, this review did not attempt to identify this information from other sources. When reported, these details varied markedly from study to study. As such, only general inferences about the effectiveness of these interventions can be assumed.

Additionally, border closures/travel restrictions, comprehensive screening (especially with PCR), and quarantine all carried potential benefits and harms. The most restrictive interventions continued to show the greatest potential public health benefits (e.g., limiting spread, delaying introduction of new variants, identifying most cases prior to entry into the community). Abou-Setta et al.[2] found no intervention was rigorously proven to be effective past a few weeks of implementation, and most were evaluated retrospectively over a short period (e.g., weeks to months) of the pandemic. The majority of studies included in this review assessed the impact of interventions on outcomes over longer periods of the pandemic (i.e., several months or years).[44,45,49,52–55]

These extended study periods generated findings and new insights into the complexities of applying risk-based approaches amid evolving epidemiological and epidemic dynamics. While Abou-Setta et al.[2] noted risk assessment and balancing benefits and harms of interventions were regularly echoed in the study reports, studies in this review provided new assessments of the effectiveness of risk analysis approaches in the utilization of travel measures. Nevertheless, cumulatively, new findings did not change the overall assessment of evidence from Abou-Setta et al[2]. While most studies reported some benefit of these interventions, others showed no benefit/mixed effects/conflicting findings.

The added studies from Abou-Setta et al.[2] did not change the main conclusions of the Cochrane review ("some travel-related control measures during the COVID-19 pandemic may have a positive impact on infectious disease outcomes") nor the quality of the evidence (very low to low certainty). However, they did add to the evidence base for most outcomes.

The added studies from this update once again confirmed the initial Cochrane review findings. We assessed the quality of the evidence similarly to previous reviews (very low to low certainty). Studies in this review underscored certain notable dimensions of evidence on the effectiveness of border closures/travel restrictions, screening and quarantine interventions. In particular, the studies supported the need to understand and implement these measures as a suite of interventions to be combined at different times and in different ways. Moreover, early, stringent, and optimal uses of such interventions, were found to have the greatest potential effectiveness in achieving and sustaining public health outcomes.[56] The evidence limited to Canada and comparable countries is presented in Tables 6-8. The evidence for most outcomes comprised only one study or was not reported by any of the included studies. Where evidence was available, it was generally not different from the global evidence assessment.

Most studies from Abou-Setta et al.[2] reported or implied that the restrictions being assessed were mandatory. Only three studies[14,15,26] implemented voluntary interventions, two of which were Canadian.[14,15] These studies reported on screening[14,15] and quarantine[15,17] interventions and, on number or proportion of cases seeded by imported cases, proportion of cases detected and healthcare utilization. Lunney et al.[15]

reported that quarantine did not appear to fully protect against transmission to contacts. Also, travellers who received a negative first test result, and were allowed to leave quarantine, did not cause a greater number of secondary infections (n=8) than those who remained in quarantine for 14 days. All three reported that the interventions were of benefit for detecting cases at the border. Lunney et al.[15] reported that among participants with positive tests, only 2.0% were hospitalized for COVID-19, and none required critical care or died.

All but one study identified in this review reported or implied that restrictions were mandatory. While mandatory travel restrictions for international arrivals to the USA were in place during the study period, Wegrzyn et al.[50] assessed the possibility of early detection of SARS-CoV-2 variants using traveller-based genomic surveillance. In September 2021, the start of the study period, a voluntary SARS-CoV-2 genomic surveillance pilot program was launched by the US Centers for Disease Control and Prevention in collaboration with private partners. Out of 161,000 eligible travellers, Wegrzyn et al. (2023)[50] recruited 16,149 voluntary participants for in-airport pooled nasal swab self-collection, at-home saliva sample collection 3-5 days after arrival, or both. They were able to identify early importation of SARS-CoV-2 variants because of this pilot program. A total of 16% of pooled tests were positive.

Overall completeness and applicability of evidence

The goal of Abou-Setta et al.[2] and this review was to update the evidence base of observational and ecological studies regarding border closures/travel restrictions, screening and/ or quarantine. Other study designs (e.g., modelling studies, qualitative studies) were excluded and may provide valuable information regarding the effectiveness of these interventions at a given point in time of the pandemic and within specific national settings. Additionally, we did not review the effectiveness of vaccine requirements alone, or in combination with the interventions outlined above.

Strengths in the review methods

Abou-Setta et al.[2] and this report have many strengths, including searching several bibliographic databases and hand-searching previous relevant reviews. Additionally, we incorporated interpretations of the evidence from content experts and decision makers.

Weaknesses and potential biases in the review methods

Abou-Setta et al.[2] found that, as most aspects of the study selection, data extraction, quality/risk of bias assessments were conducted by a single reviewer, errors of omission or interpretation may have been inadvertently introduced. Additionally, only evidence from English-language sources were included, and this may have introduced language bias.

Alongside the above weaknesses and potential biases, this update also found that, while the volume of scientific literature on travel measures and COVID-19 has continued to grow since April 2022, only 16 studies (0.45% of 3521 records screened) met the applied inclusion criteria. This is a higher proportion than the Cochrane review (0.27%) but a lower proportion than Abou-Setta et al. (0.10%). The excluded studies may potentially offer novel and important insights on secondary outcomes and other knowledge gaps.

Implications of this rapid review

For current practice

Abou-Setta et al.[2] found that early interventions may be effective in slowing down the introduction of the pathogen through points of entry. However, these studies often insufficiently accounted for the many confounding factors, as well as potentially adverse individual and societal effects, of these interventions.

This review found that travel measures as interventions can achieve certain public health benefits (e.g., limiting spread, delaying introduction of VOCs, identifying most cases prior to traveller entry into the community), but few studies quantified or assessed the anticipated or observed adverse secondary outcomes. While studies acknowledged the need to better understand trade-offs between public health and secondary outcomes, limited empirical attention is given to secondary outcomes in studies considering the optimal scope, stringency, and duration of international travel measures. Given that insufficient attention to adverse secondary outcomes can undermine public support and compliance, this gap in findings suggests that the need for improved consideration of these outcomes in future assessments of the public health effectiveness of travel measures.

For future research

Abou-Setta et al.[2] found that future high-quality research is required to determine the best timing of the introduction of interventions, the comparative effectiveness of interventions, and the removal of these interventions; and that well-designed diagnostic accuracy tests are required to determine the diagnostic accuracy and most cost-effective approach to screening travellers. All reviews have found a low number of studies using observational (what the Cochrane review calls "real life") data, compared to the relatively large number of modelling studies.

This review supports the need for future research on which travel measures, combined in what ways have been the most effective in achieving public health goals. Alongside the timing of adoption and lifting of specific types of travel measures, and their comparative effectiveness, the studies reviewed suggest the need for complex interventions that may combine restrictions, screening, quarantine, contact tracing and vaccination. Given the resource requirements, scientific uncertainty, and broader social and economic impacts of precautionary use of travel restrictions, future research is needed on how screening and quarantine requirements may be most effectively, efficiently, and equitably applied.

This review also found a continued lack of precision, and sometimes inaccuracy, in how travel measures (as interventions) were defined and characterized. For example, McLaughlin et al.[45] define travel restrictions as "a class of NPI applied to mitigate pandemic burden; they include restricted entry of foreign nationals, flight bans, border entry requirements such as testing or vaccination, and quarantine requirements."[45] In Yang et al.,[54] "travel-related measures include entrance restrictions, inbound traveller testing, quarantine, and exemptions."[54] Other studies refer generally to "strict travel restrictions," or "border measures" without further detail or definition.

Alongside varied use of terminology and definitions, there is generally limited detail provided on how a travel measure is implemented, for example, in terms of stringency, duration, and degree of compliance. This is problematic for several reasons. First, this limits the comparability and generalizability of findings. Second, public health effectiveness of such measures is affected by whether and which travel measure is adopted, as well as how it is implemented. For example, Aziz et al.[48] concluded that, based on the number of positive test results among travellers arriving from Red and Amber list countries, quarantine requirements specific to these contexts may have contributed towards limiting the transmission and impact of the Gamma VOC. However, the study does not include, for example, the international arrivals who were exempted from quarantine (e.g., essential workers), even if arriving from Red and Amber countries. There is need for international agreement on standardized terminology to describe travel measures and a commensurate gradient for measuring stringency.

Further, the immunity/vaccination status of travellers was excluded as an intervention in the Cochrane review (and thus subsequent reviews). When the Cochrane review protocol was initially developed, COVID-19 vaccines had only begun to be available, were not accessible in many countries, and had not yet been used or assessed as a travel measure. The use of this intervention to mitigate travel-related risks was made even more complex by vaccine hesitancy, and the lack of standardized and secure systems for recording and demonstrating immunity/vaccination status. However, immunity/vaccination status was used from 2021 onwards in risk-based approaches to travel measures, including as a basis for lifting many such measures in 2022. For example, immunity/vaccination status was used to ease travel restrictions and quarantine requirements, and to reduce adverse secondary outcomes of disruptions to international travel. Evidence on the use of immunity/vaccination status as a further type of travel measure warrants a separate evidence review.

Finally, this review identified a lack of observational evidence and research on risk-based approaches to travel measures. This research should support real-time decision making in the context of emerging and then shifting risks from a novel pathogen; evolving evidence and information gaps; the need for timely action; probable public pressure; and trade-offs between beneficial public health outcomes and adverse secondary outcomes.

Given these persistent limitations in the existing evidence identified by the Cochrane review and subsequent updates, a critical review of what type of data should be collected and analyzed going forward, and how this can be achieved, is needed to better support evidence-informed decision-making ahead of future pandemic events.

Conclusion

Abou-Setta et al.[2] concluded that low to very low certainty evidence supports the balanced use of international border entry restrictions/closures, screening, and/ or quarantine to limit the spread of COVID-19, and for delaying (but not eliminating) introduction of new variants past the countries' borders. It is important to acknowledge the uncertainty of evidence due to factors including: the large variation in effect sizes; often conflicting results; differing levels of community spread at the time the interventions were implemented; the duration and length of quarantine; vaccine uptake by the community; and vaccination status of travellers. Also, generalizability of the results may be problematic as not all countries/regions of the world were represented by these studies. Moreover, health systems and available resources across countries/regions vary widely. Even for countries reporting evidence, this represents a snapshot in time, and may not be continuously or consistently applicable due to the dynamic nature of pandemics and corresponding policy responses. Due to the aforementioned challenges, the evidence should be viewed as continuously evolving. Lastly, it is important to balance the potential benefits of these measures with the potential harms and negative consequences on both an individual and societal level.

Future high-quality research is required to determine the best timing of the introduction of interventions, the comparative effectiveness of interventions and the removal of these interventions in specific contexts. Studies evaluating the diagnostic accuracy of screening tools against a reference standard in this setting are required.

This review concluded that there remains insufficiently robust or certain evidence to determine the effectiveness of specific types of travel measure as separate interventions. The combined use of multiple types of travel measures simultaneously and, as many of the studies acknowledge, likely impact of context- and period- specific factors, also impacted outcomes. While the review gives particular attention to countries deemed to be comparable to Canada, like the first update, there is need to acknowledge the uncertainty of available evidence due to often conflicting results over time and place, variations in community prevalence at the time the interventions were implemented, diverse approaches to testing and quarantine interventions (e.g., length, timing, enforcement), and divergent levels of immunity within and across communities. This review also identified the need to consider a country's pandemic response strategy, the simultaneous use of other NPIs, interventions by other jurisdictions, varying VOC transmissibility and epidemiological dynamics, degree of enforcement and compliance of interventions, and differing approaches to implementation.

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Table 2. Newcastle-Ottawa Scale Assessments

Legend: Rows highlighted grey=Abou-Setta et al; blue=2024 rapid review update

Reference	Selection 1	Selection 2	Selection 3	Selection 4	Comparability	Outcome 1	Outcome 2	Outcome 3	Score
Akowuah 2022	0	1	1	N/A	1	1	N/A	N/A	4/5
Aziz 2022	1	1	1	N/A	0	1	N/A	N/A	4/5
Martin-Sanchez 2022	1	N/A	1	N/A	N/A	1	N/A	N/A	3/3
Huang 2022	1	1	1	N/A	N/A	1	N/A	N/A	4/4
McLachlan 2023	1	1	1	1	N/A	1	N/A	N/A	5/5
Seidl 2023	0	1	1	1	N/A	1	1	0	5/7
SuYCF 2023	1	1	1	1	N/A	1	N/A	N/A	5/5
Van Elslande 2022	0	1	1	1	1	1	N/A	N/A	5/6
Yang 2023	1	1	1	N/A	N/A	1	N/A	N/A	4/4
Zhang 2022	1	1	1	N/A	N/A	1	N/A	N/A	4/4
McLaughlin 2023	0	1	1	1	N/A	1	N/A	N/A	4/5
McLaughlin 2022	1	1	1	1	N/A	1	N/A	N/A	5/5
Aggarawal 2022	1	1	1	0	N/A	1	1	1	6/7
Atsawawaranunt 2021	0	N/A	1	1	N/A	1	1	1	5/6
Aubry 2021	1	N/A	1	1	N/A	1	1	1	6/6
Badshah 2020	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1/1
Bae 2020	1	N/A	1	0	N/A	1	1	1	5/6
Benslimane 2021	0	N/A	N/A	N/A	N/A	1	N/A	0	1/3

Cao-Lormeau 2021	1	N/A	1	1	N/A	1	1	1	6/6
Chan 2020	1	N/A	0	0	N/A	1	N/A	1	3/5
Chen 2021	0	N/A	1	0	0	1	1	1	4/7
Cherif 2021	0	N/A	N/A	N/A	1	N/A	N/A	0	1/3
Chilla 2022	1	N/A	N/A	N/A	0	1	N/A	1	3/4
Colavita 2021	1	N/A	1	0	N/A	1	N/A	1	4/5
Douglas 2021	1	N/A	N/A	N/A	N/A	1	N/A	1	3/3
EASO 2020	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fernandes 2020	0	N/A	1	N/A	N/A	1	N/A	1	3/4
Fotheringham 2021	1	N/A	1	0	N/A	1	1	1	5/6
Fox-Lewis 2022	0	N/A	1	1	N/A	1	1	1	5/6
Gao 2021	1	N/A	N/A	N/A	N/A	1	N/A	1	3/3
Gehre 2021	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0/0
Gordon 2021	1	N/A	N/A	N/A	N/A	N/A	N/A	1	2/2
Grout 2021	1	N/A	1	N/A	0	N/A	N/A	N/A	2/3
Gwee 2021	1	0	1	1	0	1	1	1	6/8
Han 2022	1	N/A	N/A	N/A	N/A	1	N/A	1	3/3
Huy 2022	1	N/A	0	0	1	1	N/A	1	4/6
Kong 2021	1	0	1	0	N/A	1	1	1	5/7
Kostaki 2021	1	N/A	N/A	N/A	N/A	1	N/A	1	3/3
Laha 2021	0	N/A	N/A	N/A	N/A	1	N/A	1	2/3
Layer 2022	1	N/A	0	1	N/A	1	1	1	5/6

Lokuge 2022	1	N/A	N/A	N/A	N/A	1	N/A	1	3/3
Matsvay 2021	1	N/A	N/A	N/A	N/A	1	N/A	1	3/3
McDermid 2021	0	N/A	N/A	N/A	1	N/A	N/A	1	2/3
McDermid 2022	0	N/A	N/A	N/A	1	N/A	N/A	1	2/3
Melillo 2020	1	N/A	0	0	N/A	N/A	N/A	1	2/4
Middleton 2021	1	N/A	N/A	N/A	0	N/A	N/A	0	1/3
Murall 2021	1	1	N/A	N/A	N/A	1	N/A	N/A	3/3
Myers 2020	1	N/A	1	0	N/A	1	1	1	5/6
Norizuki 2021	1	N/A	1	1	N/A	1	1	1	6/6
Nsawotebba 2021	1	N/A	1	0	N/A	1	N/A	1	4/5
O’Donnell 2021	1	N/A	1	0	N/A	1	1	1	5/6
Ohlsen 2021	1	N/A	1	0	N/A	1	1	1	5/6
Papadopoulos 2020	1	N/A	N/A	N/A	1	1	N/A	1	4/4
Piryani 2020	1	N/A	N/A	N/A	N/A	N/A	N/A	1	2/2
Potdar 2020	1	N/A	N/A	N/A	N/A	1	N/A	1	3/3
Potdar 2021	1	N/A	N/A	N/A	N/A	1	N/A	1	3/3
Prapaso 2021	1	N/A	N/A	N/A	1	N/A	N/A	1	3/3
Randremanana 2021	1	N/A	1	0	N/A	1	N/A	1	4/5
Regehr 2021	1	N/A	1	0	1	1	1	0	5/7
Savini 2021	1	N/A	0	0	N/A	1	N/A	1	3/5
Shragai 2021	1	N/A	1	1	N/A	1	1	1	6/6

Song 2021	1	N/A	1	0	1	1	N/A	1	5/6
Stokes 2020	1	N/A	N/A	N/A	1	1	N/A	1	4/4
Tande 2021	1	N/A	1	1	N/A	1	1	1	6/6
Tegally 2021	0	N/A	N/A	1	N/A	1	1	1	4/5
Tokumasu 2021	1	N/A	N/A	0	N/A	1	N/A	1	3/4
Tsuboi 2020	1	1	0	0	1	1	1	1	6/8
Tsuboi 2021	1	1	1	1	N/A	1	1	1	7/8
Walker 2021	1	N/A	1	0	0	1	1	1	5/7
White 2022	1	N/A	1	1	N/A	1	1	1	6/6
Williams 2021	1	N/A	1	1	N/A	1	1	1	6/6
Yang 2022	0	N/A	0	N/A	1	N/A	N/A	1	2/4
Yordanova 2021	1	N/A	1	N/A	N/A	1	1	N/A	4/4
Zeng 2020	1	N/A	N/A	N/A	0	1	N/A	1	3/4
Zhang 2021	1	N/A	1	0	N/A	1	1	1	5/6
Zhu 2021	1	N/A	0	0	N/A	1	1	1	4/6

Table 3. QUADAS-2 Assessments.
Legend: Rows highlighted grey=Abou-Setta et al; blue=2024 rapid review update

Study Blue: Updated studies 2024 Grey: Abou-Setta et al 2022	**Risk of bias**				**Applicability**		
	Participant selection	**Index test**	**Reference standard**	**Flow & timing**	**Participant selection**	**Index test**	**Reference standard**
Elgersma 2022	Low	Low	Unclear	High	High	Low	Unclear
Wegrzyn 2022	High	Unclear	Low	Unclear	Low	Unclear	Low
Salih 2022	Low	Unclear	Low	Low	Low	Unclear	Low
Shaum 2023	Low	High	Unclear	Unclear	Low	Unclear	Unclear
Abdulrahman 2021	Low	Unclear	Low	Low	Low	Low	Low
Al-Qahtani 2021	Low	Unclear	Unclear	Unclear	Low	Unclear	Low
Al-Tawfiq 2020	High	Low	Low	Low	Unclear	Unclear	Low
Arima 2020	Unclear	Low	Low	Unclear	High	High	Low
Chen 2020	Low	Unclear	Low	Unclear	High	Low	Low
Goel 2021	Unclear	Unclear	Low	Unclear	Unclear	Low	Low
Hallowell 2020	Low	Low	Low	Low	Low	Low	Low
Hoehl 2020	Low	Low	Unclear	Unclear	High	High	Low
Imran 2021	Low	Low	Low	Unclear	Unclear	Low	Low
Joob 2020	Low	Low	Low	Unclear	Low	Low	Low
Kim 2020	Low	Low	Unclear	Low	High	Unclear	Low

Lagier 2020	High	Unclear	Low	Unclear	High	Low	Low
Lio 2020	Unclear	Low	Low	Low	High	Unclear	Low
Liu 2020	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear
Lunney 2021	Low	Low	Low	Low	Low	Low	Low
Luo 2021	Low	Low	Low	Low	Low	Low	Low

Tables 3-5 GRADE Summaries of Findings

Legend: Black text=Abou-Setta et al;

Blue text= new or change with 2024 rapid review update

Blue bold text= Existing in Abou-Setta + duplicate or added from 2024 rapid review update

Table 3. GRADE Summary of Findings – Border closures/ travel restrictions for reducing or stopping cross-border travel			
Disease: COVID-19 **Interventions:** implementing border closures/ travel restrictions for reducing or stopping cross-border travel; maintaining the measure; early implementation of the measure; implementing a highly stringent measure **Comparators:** no measure; relaxation of the measure; late implementation of the measure; implementing a less stringent measure			
Outcome	**Number of studies**	**Summary of findings**	**Certainty of evidence**
Outcome category: 1. Cases avoided due to measure			
Number or proportion of cases in the community	1 Observational study Brazil (Jan 2020)[57]	This study reported that asymptomatic cases, and symptomatic cases that did not fit the description (at the time) of COVID, were allowed port access. That led to an epidemic outbreak that was traced back to the infected crew members.	**Low** ⊕⊕◯◯
Number or proportion of cases in the community	7 Ecological studies[58–64] 4 – 130 countries per study (Dates varied by country)	Of these seven studies, most (n = 5) reported a negative association between strict (early) border closures/ travel restrictions on cases per capita (e.g., 1.48% reduction) and deaths with countries that used looser or later implementation of restrictions (e.g., Sweden, United States, Spain, Italy) reporting growth in per capita COVID cases (e.g., 15% increase) and COVID deaths per 100,000 (e.g., 63 vs. 0.03). Of the remaining two studies, one reported that the potential benefit of border closures/ travel restrictions (especially land crossings) was	**Very low** ⊕◯◯◯ Inconsistency

		inconsistent across epidemic waves and country pairs. The second study reported no consistent trend in the rate of change of local cases and that no discernable correlation was observed between imported and local cases following the implementation of border closures/ travel restrictions.	
Number or proportion of imported or exported cases	2 + 4 Observational studies Thailand (Apr 2020)[65] Greece (NR)[23] Hong Kong (Jan 2020-December 2022)[54] Cambodia (Jan 2020- Feb 2021)[66] Canada (Nov 2020-Mar 2022)[45] Canada (Jan 2020-Mar 2021)[44]	These studies reported that stricter border closures/ travel restrictions (e.g., bans international travellers from high-risk regions) led to decreased rates of imported cases; proportion decreased by ~30% in one study and that a month after all international flights were suspended, no further imported cases were registered in the second study. These positive effects were also noted as effective only for a short duration before cases were imported from lower-risk regions. These studies support findings that strict travel restrictions, including on limits on entry, contributed to decreased rates of imported cases and onward transmission in specific contexts and periods of the pandemic. The low prevalence (only 12,631 (0.5%) of total cases, corresponding to 1.6 cases per 1000 population) in Hong Kong during the first four waves was dominated by the SARS-CoV-2 ancestral strain. Phylogenetic analysis in Cambodia shows very limited local SARS-CoV-2 transmission observed between April-October 2020 due to travel restrictions and other measures, with multiple variants subsequently introduced from November 2020 to February 2021. In Canada, periods following the implementation of certain travel restrictions correspond to decreases in the importation of variant sub-lineages; conversely increases in importation rates were associated with the relaxation of travel restrictions during certain periods.	**Low** ⊕⊕◯◯
Number or proportion of imported or exported cases	1 Ecological study[60] 5 Asian Pacific Countries (Dates varied by country)	This study reported that imported cases fell by 1.08–1.43 following border closures/ travel restrictions on departures from China. However, this benefit only lasted a few weeks as imported cases were imported from lower-risk regions.	**Low** ⊕⊕◯◯

Number or proportion of imported sub-lineages	2 Observational studies Canada (Nov 2020- Mar 2022)[45] Canada (Jan 2020-Mar 2021)[44]	The first study reported varying effects of targeted flight bans and other travel measures for travellers arriving in Canada by air from the UK, Brazil and Southern African countries. The study reported that the UK flight ban likely prevented 724 additional travellers from the UK, 12 (9-16) additional Alpha sublineages that could have resulted in upwards 10 of 5,682 (3,849-7,132) descendant cases. Suspension of flights from India to counter the Delta variant in 2021 was associated with a significant 2.4 (1.8- 3.0)-fold reduction of the sublineage importation rate from India within two weeks and 7.5 (4.6- 10.4)-fold within four weeks. However, the Omicron-related entry ban for foreign nationals arriving from southern African nations was largely ineffective towards reducing importations of BA.1 and BA.1.1. The second study reported that border closures that were less strict resulted in more sublineage importations.	**Very low** ⊕◯◯◯ **Inconsistency**
Number or proportion of deaths	1 Observational study Canada (Nov 2020- Mar 2022)[45]	The study reported that travel restrictions were variably effective towards reducing SARS-CoV-2 VOC importations and cases, but cumulatively may have averted more than 440 hospitalizations and 24 deaths.	**Low** ⊕⊕◯◯
Number or proportion of deaths	1 Ecological study[67] 165 countries (Jan – Jul 2020)	This study reported that enactment of any international travel controls delayed the time in which cumulative incidence rates or deaths peaked. However, enactment of the strongest control was not associated with a reduced time to peak death or cumulative incidence of 5 cases/ 100,000 persons.	**Low** ⊕⊕◯◯
Risk of importation or exportation	1 Ecological study[68] 23 regions (Feb 2020)	This study reported that widespread international air-travel bans imposed against China by early February 2020 coincided with a significant reduction in geographic viral spread. In North America, the efficacy of this travel ban was temporary, possibly due to the lack of both containment measures against other infected regions and domestic mitigation measures.	**Low** ⊕⊕◯◯
Outcome category: 2. Shift in epidemic development			

Outcome	Number of studies	Summary of findings	Certainty of evidence
Effective reproduction number (Rt)	1 Observational study[69] Qatar (Mar - Aug 2020)	This study reported that the Rt was >1 at the beginning of the pandemic, but <1 during the summer and till the end of 2020. By March 2021 it had rebounded to 1.5 due to the introduction of the Alpha and Beta lineages.	**Low** ⊕⊕◯◯
Number or proportion of cases at peak	1 Observational study[69] Qatar (Mar - Aug 2020)	This study reported that despite banning entry of foreign nationals (beginning March 17, 2020), Qatar witnessed a large outbreak, with the highest confirmed cases of 2,355 per day reported on May 30, 2020. As such, the ban did not prevent the eventual rise in cases within 2 weeks of implementing the border closures/ travel restrictions.	**Low** ⊕⊕◯◯
Epidemic curve peak	1 Ecological study[67] 165 countries (Jan – Jul 2020)	This study reported that early implementation of international travel controls led to a mean delay of 5 weeks in the first epidemic peak of cases. Although border closures/ travel restrictions did not prevent the virus from entering most countries, delaying its introduction bought valuable time for local health systems and governments to prepare to respond to local transmission.	**Low** ⊕⊕◯◯
Outcome category: 3. Cases detected due to the measure			
Outcome	**Number of studies**	**Summary of findings**	**Certainty of evidence**
Number or proportion of cases detected	8 Observational studies UK (Mar 2020)[40] Hong Kong (Jan – Mar 2020)[70] New Zealand (Aug 2020	Of these 8 studies, most (n = 7) reported benefits of border closures/ travel restrictions with up to 90% of registered cases being stopped at the border. The remaining study reported no decrease in imported cases even when border closures/ travel restrictions were implemented.	**Very low** ⊕◯◯◯ Inconsistency

	– Feb 2021)[37] The Netherlands (NR)[36] Malta (NR)[71] Nepal (Jan – Mar 2020)[72] Thailand (Apr 2020)[65] China (Feb – Mar 2020)[73]		
Number or proportion of cases detected	1 Ecological study[67] 165 countries (Jan – Jul 2020)	This study reported that countries that implemented their strictest international travel controls before detecting any COVID-19 cases reported their first case a median of 57 days (95% CI 14–70 days) later than countries that imposed their strongest controls after the first case was reported (p = 0.04). The average time to detection of the first case occurred 1.22 (95% CI 1.06–1.41) times later in countries that implemented any restrictions than in countries that implemented no border closures/ travel restrictions. This time ratio was extended to 1.31 (95% CI 1.02–1.68) if countries implemented their strongest border closures/ travel restrictions. Such associations still held when adjusting for time-varying nonpharmaceutical interventions.	**Low** ⊕⊕◯◯
Outcome category: 4. Secondary outcomes			
Outcome	**Number of studies**	**Summary of findings**	**Certainty of evidence**
Infectious disease transmission outcomes	3 + 2 Observational studies Germany (Jan 2020)[20] Qatar (Mar - Aug 2020)[69] Russia (Mar - Aug	These studies reported benefits of border closures/ travel restrictions with one reporting that when border closures/ travel restrictions were reduced, the prevalence of imported variants increased, and succeeded in eliminating all other local lineages. The second study reported several new mutations had emerged post-travel-ban and were on the rise in specific countries. The third study reported that Russia imported variants at least 82 times, resulting in 457 Russian transmission lineages and	**Low** ⊕⊕◯◯

	2020)[74] Canada (Nov 2020-Mar 2022)[45] Canada (Jan 2020-Mar 2021)[44]	that two Russian exports to New Zealand resulted in 33 cases (including two staff members at the isolation facility). The fourth and fifth studies reported varying decreases in mean transmission events with international origins following travel restrictions.	
Adverse effects	2 Observational Studies Western Pacific (Oceania) (Jun – Sep 2021)[75] Western Pacific (Oceania) (Jul – Sep 2021)[52]	These studies reported harms of border closures/ travel restrictions with one study reporting that overall, 64.2% of individuals surveyed reported financial distress while stranded abroad, 64.4% reported moderate/ severe depression, 41.7% reported anxiety, and 58.1% reported stress. The second study suggested a significant financial burden on those impacted by border closures/ travel restrictions, with respondents' average expenditure incurred $7,285USD and 71.2% reporting financial stress. Additional financial distress was found in family members of those stranded abroad as well.	**Low** ⊕⊕◯◯
Adverse effects	1 Ecological study 26 EU states + 4 Schengen-Associated Countries (Mar – Jul 2020) [53]	This study reported that since 2020 asylum applications have drastically decreased, partly due to border closures. They also concluded that these measures may have violated the right to asylum protected by EU law.	**Low** ⊕⊕◯◯
User acceptability	1 Observational study Cyprus (NA)[18]	This study reported that most (>90% of individuals surveyed) believe that strict border closures/ travel restrictions are a necessary measure for reducing rates of new cases.	**Low** ⊕⊕◯◯
Healthcare Utilization	1 Observational study Canada (Nov 2020- Mar 2022)[45]	The study reported that Canadian COVID-19 travel restrictions were variably effective towards reducing SARS-CoV-2 VOC importations and cases, but cumulatively may have averted more than 440 hospitalizations and 24 deaths.	**Low** ⊕⊕◯◯

Table 4. GRADE Summary of Findings – Screening at borders			
Disease: COVID-19 **Interventions:** implementing entry and/ or exit symptom/ exposure-based screening; implementing entry and/ or exit test-based screening; implementing a highly stringent screening measure **Comparators:** no measure; implementing an alternative measure; implementing a less stringent screening measure			
Outcome	**Number of studies**	**Summary of findings**	**Certainty of evidence**
Outcome category: 1. Cases avoided due to measure			
Number or proportion of imported or exported cases	2 + 3 Observational studies Greece (NR)[23] India (Nov/ Dec 2021)[76] Hong Kong (Jan 2020-Dec 2022)[54]; Hong Kong (Nov 2020-Jan 2022)[55] Canada (Nov 2020 – Mar 2022)[45] Belgium (April 2021)[43]	These studies reported varying benefits of travel measures, including testing and other screening requirements for travellers, in reducing importation and onward transmission of cases over different periods and jurisdictions. In one study, the proportion of imported strains decreased the most with targeted public health measures including entry testing (8.8% from 41%). In the second study, 55.9% of overseas travellers tested positive for omicron. Had no testing been in place, these travellers would have been allowed entry and potentially led to community spread. In Hong Kong, the first four waves accounted for only 12,631 (0.5%) of total cases, predominated by the SARS-CoV-2 ancestral strain, corresponding to 1.6 cases per 1000 population. In the second half of 2021, in total there were 841 (98%) imported cases but only five sporadic/index local cases reported. Moreover, the second Hong Kong study addressed how out of all the imported cases that were symptomatic when detected, most (56.6%, n=334) reported after arrival; the median amount of time until symptom onset was four days.	**Very Low** ⊕◯◯◯ Inconsistency

		In the Canada study, enhanced screening restrictions for Brazil were initially not associated with significant reduction in sublineage importations but later associated with a significant 1.6 (1.27-1.93)-fold reduction in the proportion of sublineages from Brazil. Enhanced screening and quarantine enacted for travellers who had been to South Africa, was associated with a significant 6.25 (2.72-9.78)-fold reduction of the Beta sublineage importation rate from South Africa. In another study, it was reported that despite negative pre-departure and on-arrival tests 13 asymptomatic travellers tested positive while in quarantine.	
Number or proportion of cases seeded by imported cases	2 Observational studies Canada (Nov 2020)[15] India (Nov/ Dec 2021)[76]	These studies reported that routine testing did not prevent seeding of cases. One Canadian study reported that on average, one contact was identified for each infected participant, with 22 cases of secondary transmission, irrespective of first test result (positive leading to quarantine – negative leading to no refusal of entry). The second study reported that 44% of contacts of overseas travellers tested positive for omicron.	**Low** ⊕⊕◯◯
Risk of imported or exported cases	1 Observational study UK (Scotland) (Feb 2021 -May 2022)[49]	This study of the UK Red-Amber-Green (RAG) designations for country-specific testing and quarantine requirements reported that when examined according to travel destination, SARS-CoV-2 importation risks did not strictly follow RAG designations, with Amber list countries ranking highly for SARS-COV-2 importations and national case incidence.	**Low** ⊕⊕◯◯
Number or proportion of secondary cases	1 +3 Observational studies Ireland (Dec 2020)[25] Hong Kong (Jan 2020 –	These studies reported varying impacts of screening measures on the number or proportion of secondary cases. One study reported that 7% of flight close contacts (41% had COVID) were PCR positive within 2 weeks. The positivity rate was higher in longer flights (>5-hr duration). Another reported secondary transmission despite reduction in onward transmission associated with screening and other travel measures: in over	**Very Low** ⊕◯◯◯ Inconsistency

	Dec 2022)[54] UK (Scotland) (Feb 2021-May 2022)[49] Belgium (April 2021)[43]	2000 infections in arriving travellers, three independent introductions accounted for 90% of the local cases between the second and fourth waves. The UK study reported that despite travel screening requirements, Amber countries showed the highest frequency of travel resulting in relatively high numbers of imported SARS-CoV-2 cases when coupled with importation risk and high population impact. For a certain period, a number of green list countries ranked higher than red list countries for population impact. In the Belgium study, contact tracing confirmed that testing during quarantine helped prevent onward transmission regarding a specific cluster.	
Number or proportion of cases in the community	1 Observational study UK (Scotland) (Feb 2021 -May 2022)[49]	This study reported a 324% increase in SARS-CoV-2 cases comparing the weeks with the highest travel frequency in the pre-traffic light (w/c 5th April 2021) and traffic light (w/c 13th September 2021) periods.	**Low** ⊕⊕◯◯
Outcome category: 2. Shift in epidemic development			
Outcome	**Number of studies**	**Summary of findings**	**Certainty of evidence**
Effective reproduction number (Rt)	1 Observational study Qatar (Mar - Aug 2020)[69]	This study reported that the Rt was associated with the dominant circulating variant; being <1 until the introduction of Alpha and Beta lineages in Dec 2020 when it rose to 1.5 by Mar 2021.	**Low** ⊕⊕◯◯

Number or proportion of cases at peak	1 Observational study Qatar (Mar - Aug 2020)[69]	This study reported that despite banning entry of foreign nationals (beginning March 17, 2020), Qatar witnessed a large outbreak, with the highest confirmed cases of 2,355 per day reported on May 30, 2020.	**Low** ⊕⊕◯◯
Epidemic curve peak	1 Observational study Japan (Feb 2020)[33]	This study reported that the epidemic curve shows infections were occurring amongst Australians before ship-based quarantine and screening commenced. The illness peaked around 3–5 days after quarantine started which supports previous findings that the movement restrictions placed on 5 February reduced the risk of infection among those passengers who had no known close contact with an infected individual.	**Low** ⊕⊕◯◯
Outcome category: 3. Cases detected due to the measure			
Outcome	**Number of studies**	**Summary of findings**	**Certainty of evidence**
Number or proportion of cases detected	59 + 10 Observational studies Afghanistan[77], Australia[10], Brunei[78], Bulgaria[13], Canada[14,15], Cambodia[66], **China**[73,79–83,110], France[19], French Polynesia[84,85], **Germany**[21,22,46], Ghana[86], Greece[24], **Hong Kong**[55,70],	Across studies, the proportion of cases detected by screening ranged from 0 to 100%. This differed markedly based on the screening modality (e.g., symptoms, thermal, etc.). In general, the more invasive screening procedures (e.g., PCR testing) had a higher sensitivity than less invasive procedures (e.g., syndromic screening). Across studies, the proportion of cases detected by screening ranged from 0.017% to 95%, with varying CI. This spectrum of proportion of cases detected is more correlated to pre-boarding requirements than to screening modality. In the studies that reported the lowest proportions of cases detected by screening mandates (n=5; proportions of cases detected were 0.017%, 0.39%, 0.91%, 3.3%, and 6.69%), there was a	**Very low** ⊕◯◯◯ Inconsistency

	India[87], Kurdistan region (Iraq)[88], Ireland[25], Italy[26–28], Japan[29–31,33,34], Kingdom of Bahrain[89], Madagascar[90], Malaysia[91], Mauritius[92], Nepal[72], New Zealand[37,38], Norway[47], Pakistan[93,94], Saudi Arabia[95], Singapore[96], South Korea[97–99], South Sudan[100], Spain[39], Taiwan[101,102], Thailand[103,104], Uganda[105], United Arab Emirates[106], **UK**[40,49,107], **USA**[41,42,50,51], Vanuatu[108], Vietnam[109]	pre-boarding requirement prior to arriving at the border: having a negative sample days before screening at the border, having a negative sample before travelling, or having documentation (COVID-19 certificate). Moreover, the studies (n = 8) that looked at PCR testing (PCR, RT-PCR, and PT-PCR) reported varying proportions of cases detected (ranging from 0.017% to 95%). Time when screening took place also correlates with proportion cases detected: the studies reporting high proportions of (imported) cases (n = 3; proportions were 16-21%, 34.5-48.6%, and 95%) consisted of either a sample that included travellers who voluntarily enrolled in a pilot screening program that provided the option of testing days after arrival (proportion of travellers that chose this testing option conflated with proportion of travellers who were tested immediately after landing), a sample of travellers who underwent screening throughout a mandatory 14-day quarantine (COVID-19 was detected during quarantine, and most were asymptomatic), or a sample of travellers who underwent screening upon arrival and during quarantine (most were symptomatic after arrival). Testing and genomic sequencing are identified as critical to identifying new variants soon after their emergence. One study reported that SARS-CoV-2 cases detections were less likely among travellers than non-travellers with the rate of SARS-CoV-2 cases detections estimated to be 17 per 1,000 among those with an international travel event, compared to 190 per 1,000 among 340 those without an international travel event over the same period.	

Number or proportion of cases detected	2 Ecological studies 5 African Countries (May 2020)[110] 26 countries (Jan 2020)[56]	These studies reported that using mobile labs, between 3 and 6% of positive PCR results can be expected and that 14.8% (95% CI 11.0–19.5) of imported COVID-19 cases can be detected through entry screening and related activities in countries which implemented entry screening.	
Positive predictive value (PPV)	3 Observational studies Italy (Aug - Oct 2020)[26] Uganda (May 2020)[105] South Korea (Mar 2020)[99]	These studies reported that the PPV ranged from 23.3% (95% CI: 10.1–45.0) to 69.6%, depending on the test.	**Very low** ⊕◯◯◯ Inconsistency
Risk of imported or exported cases	1 Observational study UK (Scotland) (Feb 2021 -May 2022)[49]	This study reported that Delta was primarily detected among travellers returning from non-red list countries (except for a short period from late April to end of May). Community transmission was evident from late-April, following which Delta was relatively more frequently identified among non-travellers. Delta then replaced Alpha to become the dominant variant.	**Low** ⊕⊕◯◯
Outcome category: 4. Secondary outcomes			
Outcome	**Number of studies**	**Summary of findings**	**Certainty of evidence**
Infectious disease transmission outcomes	6 + 7 Observational studies	These studies reported conflicting evidence regarding infectious disease transmission. One study reported that when travel restrictions, including screening, were reduced, the prevalence of imported variants increased,	**Very low** ⊕◯◯◯ Inconsistency

	Qatar (Mar – Aug 2020)[69], Uganda (May 2020)[105], Vietnam (Mar 2020)[109], Japan (Mar 2020)[31], Japan (Aug 2020)[111], Japan (Feb 2020)[33] Belgium (April 2021)[43] U.S. (Sept 2021-Jan 2022)[50] Hong Kong (Nov 2020 to Jan 2022)[55] UK (Scotland) (Feb 2021 - May 2022)[49] Germany (Nov-Dec 2021)[46] USA (Jan-July 2020)[51] China (Mar-Dec 2020)[110]	and succeeded in eliminating all other local lineages. A second study reported that mandatory testing at arrival may reduce contact tracing duration and should be considered as an integrated screening tool for flight passengers from high-risk areas when entering low-transmission settings with limited contact tracing capacity. A third study reported that a higher 14-day average incidence in the countries of stay was associated with higher test positivity (1.64 [1.16–2.33] and 3.13 [1.88–5.23] for those from countries and areas where the 14-day average incidence was from 10 to <100 and ≥100 cases per million, respectively). A fourth study reported that the median time to the first of two consecutive negative PCR-based assays was 13 days for asymptomatic cases and 19 days for symptomatic cases ($p = 0.002$). Two other studies reported strict policies did not prevent the introduction of new strains and that thermal screening lacks sensitivity to reliably detect COVID-19 (sensitivity: 9.9% (95% CI: 7.4–13.0), specificity: 99.5% (95% CI: 99.3–99.6, negative predictive value: 93.9 (95% CI: 93.3–94.4), positive likelihood ratio: 19 (95% CI: 12.4– 29.1), negative likelihood ratio: 0.9 (95% CI: 0.88–0.93). Another study reported that through PCR testing and contact-tracing, 22 contacts of study participants were identified and tested negative, suggesting that transmission to persons outside the group was prevented. Through PCR testing and genomic sequencing, another study identified a shift in proportion of variant sublineages, reporting a shift from, all but one unconfirmed sublineages of the Delta variant to 67% (145 of 215) of positive pooled samples collected identified as Omicron variant. Furthermore, one study reported that after the end of the U.K.'s traffic light system, Omicron (BA.1 sublineage) was first detected among non-travel-related cases, unlike Delta cases, where 22.1% of cases were associated with international travel. Overall, in Scotland, placing countries in different RAG categories (particularly the red list) did not stop variants from being imported. In the Germany study, reported symptoms included loss of taste or smell, but no hospital admissions were required. In the USA study, most confirmed COVID-19 cases were either symptomatic on arrival (86%, n=12) or symptomatic days later (71%, n=10). In the China study, the average	

		time to PT-PCR confirmation for most travellers (95% of travellers in each category) post-arrival happened within 13 days for pre-symptomatic cases, 14 days for symptomatic cases, and 15 days for asymptomatic cases. The final study identified different median time periods from isolation to first negative PCR tests for asymptomatic patients (median: 9 days, 95% CI: 9, 10) and symptomatic cases (median: 12 days, 95% CI: 12, 13) and for individuals detected after 14 days of quarantine (median: 0.5 days, 95% CI: 0, 2), compared to cases detected at arrival (median: 12 days, 95% CI: 11-13), and up to day 14 of quarantine (median: 9 days, 95% CI: 8, 9). The time from isolation to the first PCR result with Ct value at 33 or above was similar among cases with SARS-CoV-2 variants and the ancestral strain.	
Healthcare utilization	1 + 1 Observational studies Canada (Nov 2020)[15] Germany (Nov – Dec 2021)[46]	This Canadian study reported that among participants with positive tests, 2% were hospitalized, but none required critical care or died. The Germany study reported out of all the participants, there were no hospital admissions or death.	**Low** ⊕⊕◯◯
Resource requirements	3 + 2 Observational studies China (Mar 2020)[81], USA (Feb/ Mar 2020)[41], USA (Jun 2020)[42] USA (Sept 2021-January	These studies reported that routine testing was costly and resource intensive. The first study reported that 872 health-care workers staffed hospital designated for arrivals, including 102 physicians (specialists in respiratory medicine, infectious disease, critical care medicine, pediatrics or traditional Chinese medicine), 728 nurses and 42 technicians. The second study reported that during a 7-week period, staff members devoted an estimated 1,694 total person-hours (equivalent to six employees working full-time for 7 weeks) processing travellers; 34% of these person-hours occurred outside regular working hours. The third study reported that during Jun – Nov 2020, up to 22 screening personnel and five testing personnel per day were required. The associated budget was $26 million for Jun – Dec and non-resident travellers were required to pay $250 for	**Low** ⊕⊕◯◯

	2022)[50] Germany (Nov-Dec 2021)[46]	post-arrival testing. This study suggested that when COVID-19 rates are high, as was the case with the Omicron surge, a 10% participation rate in traveller-based viral genomic sequence surveillance to detect relatively rare sublineages and provide detailed epidemiological data as an early warning sentinel system for future outbreaks. The Germany study illustrated that screening post-arrival, when done in tandem with pre-departure screening, was resource intensive and impractical, as 3.3% (n = 90/2728) of travellers tested positive upon arrival.	
Resource requirements	1 Ecological study 5 African Countries (May 2020)[74]4/26/2024 4:06:00 PM	This study reported that with a basic setup (one centrifuge, two PCR machines) 4 – 6 lab staff can process ~400 samples per shift and diagnosis can be made within 8-hrs.	**Low** ⊕⊕◯◯

Table 5. GRADE Summary of Findings - Quarantine			
Disease: COVID-19 **Interventions:** implementing quarantine; implementing a highly stringent quarantine **Comparators:** no measure; implementing an alternative measure (e.g., screening); implementing a less stringent quarantine			
Outcome	**Number of studies** **Countries (dates implemented)**	**Summary of findings**	**Certainty of evidence**
Outcome category: 1. Cases avoided due to measure			

Number or proportion of cases in the community	1 +1 Observational studies South Korea (Apr 2020)[112] UK (Scotland) (Feb 2021-May 2022)[49]	Findings varied across studies. In one study, the association between 14-day quarantining all travellers from overseas countries and the cumulative number of COVID-19 cases reported in South Korea is: B=−0.226, 95% CI=−0.231, −0.222, Chi^2 7933.630, Significance=0. The other study reported an overall 324% increase in SARS-CoV-2 cases in Scotland, comparing the weeks with the highest travel frequency in the pre-traffic light (w/c 5th April 2021) and traffic light (w/c 13th September 2021) periods.	**Very Low** ⊕◯◯◯
Number or proportion of cases in the community	1 Ecological study Six countries (Dec 2019 – Apr 2020)[64]	This study reported a negative association between strict (early) travel restrictions, including mandatory quarantine, using digital tools on the number of deaths per 100,000.	**Low** ⊕⊕◯◯
Number or proportion of imported or exported cases	1 + 7 Observational studies Canada (Nov 2020)[15] UK (England) (Feb-Aug 2021)[48] Hong Kong (Jan 2020 to Dec 2022)[54] Hong Kong (Nov 2020 to Jan 2022)[55] Cambodia (Jan 2020 to Feb 2021)[66] Canada (Jan 2020 to Mar 2021)[44] Canada (Nov 2020 to Mar 2022)[45] Belgium (April 2021)[43]	These studies found that quarantine and other travel measures resulted in a varying impact on the number of imported cases. One Canadian study reported that quarantine did not appear to fully protect against transmission to contacts. Travellers who received a negative first result and were allowed to leave quarantine did not cause a greater number of secondary infections than those who remained in 14-day quarantine. One study reported that during the study period, 88 (35.1%) out of 251 confirmed COVID-19 cases (Gamma variant) in England were imported. Two studies reported early and significant reduction in importation and onward transmission, but that such measures were less effective against variants emerging later in the pandemic. An analysis of 2269 imported cases in Hong Kong indicated strict on-arrival measures, including quarantine, could reduce community introductions of the virus. Imported	**Very low** ⊕◯◯◯ Inconsistency

		cases were largely asymptomatic at confirmation and presented mild symptoms during hospital isolation. A study in Canada reported a drop in sublineage importation rate 3.4-fold (3.2–3.8) within 2 weeks; and 10.3- fold (8.3–15.0) within 4 weeks following the implementation of a mandatory 14-day at-home quarantine on 25 March 2020. The same study reported an increase in importation rates associated with the relaxation of travel restrictions including quarantine for certain categories of travellers in October 2020. Another study reports that enhanced screening and quarantine enacted for travellers who had been to South Africa was associated with a significant 6.25 (2.72-9.78)-fold reduction of the Beta sublineage importation rate from South Africa, as well as a 1.75 (1.33-2.18)-fold reduction of the proportion of sublineages from South Africa (Figs. 2B, 3). During the restriction, there was a rise in Beta sublineages likely to have originated in Europe and other African nations; following restrictions, Beta importations from Asia increased. In a study in Belgium, asymptomatic cases were identified and prevented from importation through extended quarantine and testing.	
Number or proportion of deaths	1 Ecological study[67] 165 countries (Jan – Jul 2020)	This study reported that the enactment of any international travel controls, including quarantine, delayed the time in which cumulative incidence rates or deaths peaked. However, enactment of the most stringent control was not associated with a reduced time to peak death or cumulative incidence of 5 cases/ 100,000 persons	**Low** ⨁⨁◯◯

Number or proportion of secondary cases	5 Observational studies UK (England) (Feb- Aug 2021)[48] China (Jan to Apr 2020)[113] Hong Kong (Jan 2020 to Dec 2022)[54] Belgium (April 2021)[43] UK (Scotland) (Feb 2021 to May 2022)[49]	These studies reported quarantine, along with other travel measures, was associated with a low rate in onward transmission during specific periods. In England, 88 imported cases (Gamma) and 14 travel-related secondary cases (Gamma) were identified during the study period. In China, there were 29 secondary cases associated with 843 imported cases during study period (centralized quarantine was more effective at averting secondary cases than home quarantine, with 8 secondary cases associated with 767 imported cases, P<0.05). A third study reported that through the application of quarantine and other travel measures, only three independent introductions to Hong Kong accounted for 90% of local cases between the second and fourth waves, despite over 2000 infections arriving in travellers. A Belgian study identified 22 contacts of travellers who all tested negative, suggesting that transmission to persons outside the group was prevented, further supported by no detection in nationwide genomic surveillance of genomes related to identified clusters for three months following the study. The Scotland study reported that the highest frequency of travel during the study period was seen for an amber list country, resulting in relatively high numbers of imported SARS-CoV-2 cases when coupled with importation risk (proportion of travellers testing positive) together with a high population impact (proportion of Scottish SARS-CoV-2 cases attributed to travel). Despite fewer travel events, the highest SARS-CoV-2 importation risk was associated with a green list country in June 2021 and by September, a number of green list countries ranked higher than red list countries for population impact, highlighting the complexity of proportionate applications of RAG systems. It is noted that this study does not assess the impact of quarantine and	**Very low** ⊕◯◯◯ **Inconsistency**

		isolation measures in place for those returning from red and amber list countries which is expected to have reduced the population impact of international travel.	
Risk of imported or exported cases	1 Observational study UK (Scotland) (Feb 2021 - May 2022)[49]	This study reported that in Scotland during the period of restrictions, including quarantine and self-isolation requirements based on RAG designations, Amber list countries were the most frequently visited and ranked highly for SARS-CoV-2 importations and contribution to national case incidence. SARS-CoV-2 importation risks did not strictly follow Red-Amber-Green (RAG) designations. Travel was most frequent to amber list countries during the traffic light period despite the mandatory requirement for self-isolation.	**Low** ⨁⨁◯◯
Outcome category: 2. Shift in epidemic development			
Outcome	**Number of studies Countries**	**Summary of findings**	**Certainty of evidence**
Epidemic curve peak	1 Observational study Japan (Feb 2020)[33]	This study reported that the epidemic curve shows infections were occurring amongst Australians before ship-based quarantine and screening commenced. The illness peaked around 3–5 days after quarantine started which supports previous findings that the movement restrictions placed on 5 February reduced the risk of infection among those passengers who had no known close contact with an infected individual.	**Low** ⨁⨁◯◯

Epidemic curve peak	1 Ecological study 165 countries (Jan – Jul 2020)[67]	This study reported that early implementation of international travel controls led to a mean delay of 5 weeks in the first epidemic peak of cases. Although travel restrictions did not prevent the virus from entering most countries, delaying its introduction bought valuable time for local health systems and governments to prepare to respond to local transmission.	**Low** ⊕⊕◯◯
Number or proportion of cases	1 Observational study Hong Kong (Jan 2020 to Dec 2022)[54]	One study in Hong Kong identified a superspreading event associated with a case of Omicron BA.2.2 acquired in a quarantine hotel. The onward transmission from this infection initiated a large fifth wave, with an increased cumulative incidence of 162 cases per 1000 persons during January–May 2022 (wave 5) compared to 1.6 cases per 1000 population in the prior four waves. The incidence rates dropped by 90% afterwards.	**Low** ⊕⊕◯◯
Outcome category: 3. Cases detected due to the measure			
Outcome	**Number of studies Countries (dates implemented)**	**Summary of findings**	**Certainty of evidence**
Number or proportion of cases detected	25 + 4 Observational studies Afghanistan[77], Australia[12], Bahrain[114], Canada[15,17], China[73,82,115,116], Germany[21], Japan[30,31,33,34], Mauritius[92], New Zealand[37], Pakistan[94], South Korea[97], Taiwan[101], Thailand[103], United Arab Emirates[106], UK[40], Vanuatu[108] China (Mar 2020 to Dec 2020)[117] Germany (Nov/Dec 2021)[46]	Across studies, the proportion of cases detected by screening ranged from 0 to 100%. This differed markedly based on the screening modality (e.g., symptoms, thermal, etc.). In general, the more invasive screening procedures (e.g., PCR testing) had a higher sensitivity than less invasive procedures (e.g., syndromic screening). Studies showed varying benefits of quarantine to detecting greater proportion of cases. One study showed that 95% of COVID-19 cases among 491 travellers arriving in Chengdu, China were detected during 14-day quarantine (95% CI 13–15). The other reported that 4.3% of travellers who initially	**Very low** ⊕◯◯◯ Inconsistency

	UK (Scotland) (Feb 2021 to May 2022)[49]4/26/2024 4:06:00 PM Hong Kong (Nov 2020 to Jan 2022)[55]	tested negative on arrival reported testing positive in the 14 days after arrival and high compliance with quarantine was presumed to limit post-flight transmission. In Scotland, rates of detection were higher among non-travellers than travellers during the study period, despite testing requirements based on Red-Amber-Green country risk rating (RAG) The rate of SARS-CoV-2 cases detections was estimated to be 17 per 1,000 among those with an international travel event, compared to 190 per 1,000 among 340 those without an international travel event over the same period. In the Hong Kong study, fifty-eight (2.6%) cases were detected after day 14 of quarantine, and only 10% of these were symptomatic. The median minimum Ct value during isolation was 24 (19-30), 27 (20-35) and 36 (31-45) for cases detected at arrival, within and after 14 days of quarantine, respectively (p<0.001).	
Outcome category: 4. Secondary outcomes			
Outcome	**Number of studies Countries (dates implemented)**	**Summary of findings**	**Certainty of evidence**
Infectious disease transmission outcomes	4 + 5 Observational studies Qatar (Mar – Aug 2020)[69], Canada (Mar 2020)[16], Japan (Mar 2020)[31], Japan (Feb 2020)[33] China (March 2020 to December 2020)[117] Canada (Nov 2020 - Mar 2022)[45] Cambodia (Jan 2020-Feb 2021)[66]	These studies reported that quarantining had mixed results. One study reported that when travel restrictions were reduced, the prevalence of imported variants increased, and succeeded in eliminating all other local lineages. The second study reported that transmission lineage size was greatly reduced after a quarantine order for returning travellers was enacted. The third study reported that even after strict quarantine policy was implemented, 12 distinct strains (10% of all strains) were still introduced. The fourth study reported that the relative risk of testing positive from an exposure to a known case during ship-based quarantine was 6.18 (95%	**Very low** ⊕○○○ Inconsistency

	UK (England) (Feb-Aug 2021)[48] Hong Kong (Nov 2020-Jan 2022)[55]4/26/2024 4:06:00 PM	CI 1.96–19.46). Another study reported that for cases detected during quarantine, there was no sex or occupation difference across different stages of infections (P > 0.05), however an imported continent difference and seasonal difference were observed (P = 0.007, Fisher's exact test; P = 0.025). The Canada study reported varying decreases in mean transmission events with international origins following travel restrictions. Variations across provinces may suggest slower implementation or compliance with quarantine guidelines in these provinces. In the Cambodia study, despite the implementation of quarantine measures, SARS-CoV-2 variants were still imported. In the England study, quarantine requirements for travellers returning from red- and amber-list countries (in RAG system) helped limit onward transmission: over half of the reported travel-related cases were travellers rather than secondary cases. Similarly, quarantine policies helped Hong Kong mitigate the spread of SARS-CoV-2 variants, with the median time to case detection differing between variants.	
Resource requirements	1 Observational study Taiwan (Mar 2020)[102]	This study reported that quarantining was costly with 13% of quarantined travellers receiving telehealth service with an associated cost of US $193,938, which equated to US $894 per traveller.	**Low** ⨁⨁◯◯

Adverse effects	4+1 Observational studies Tunisia (NR)[118], New Zealand (Aug 2020 – Feb 2021)[37], Australia/ New Zealand (Apr – Jun 2020)[11], Australia (Nov 2020 –Jun 2021)[12] Hong Kong (Nov 2020 to Jan 2022)[55]	These studies reported that quarantining was potentially harmful to the quarantined individuals and staff. The first study reported that 19% of surveyed quarantined individuals had symptoms of clinical insomnia. The second study reported 22 quarantine system failures in Australia and 10 in New Zealand. The third study reported that facility staff tested positive for COVID-19. The fourth study reported on breaches in quarantine facilities stemming from housing international travellers. In another study, patients were isolated for a median of 12 days (IQR: 8-17). 40 cases required extended isolation and two died. Among currently isolated or already discharged cases, only 6 had severe or serious disease.	**Low** ⊕⊕◯◯
Healthcare utilization	2 Observational study China (Jan-Apr 2020)[113] Belgium (Apr 2021)[43]4/26/2024 4:06:00 PM	In Mainland China, there have been over 1,600 imported COVID-19 cases were reported since April 21, 2020. Among those, no critical illness or death case occurred. Similarly, in a cohort of 41 nursing students travelling into Belgium, none of those who tested positive for COVID-19 required hospital admission.	**Low** ⊕⊕◯◯

Tables 6-8 Canada and similar countries - GRADE Summaries of Findings

Legend: Black text=Abou-Setta et al;
Blue text= new or change with 2024 rapid review update
Blue bold text= Existing in Abou-Setta + duplicate or added from 2024 rapid review update

Table 6. Canada and related countries* – GRADE Summary of Findings – Border closures/ travel restrictions for reducing or stopping cross-border travel			
Disease: COVID-19 **Interventions:** implementing border closures/ travel restrictions for reducing or stopping cross-border travel; maintaining the measure; early implementation of the measure; implementing a highly stringent measure **Comparators:** no measure; relaxation of the measure; late implementation of the measure; implementing a less stringent measure			
Outcome	**Number of studies**	**Summary of findings**	**Certainty of evidence**
Outcome category: 1. Cases avoided due to measure			
Number or proportion of imported or exported cases	1 + 2 Observational studies Canada (Jan 2020-Mar 2021)[44] Canada (Nov 2020-Mar 2022)[45] Greece (NR)[23]	In the Greece study, the proportion of imported strains was 41%, 11.5%, and 8.8% during the three periods of sampling, namely, March (no border closures/ travel restrictions), April to June (strict border closures/ travel restrictions), and July to September (lifting of border closures/ travel restrictions based on thorough risk assessment), respectively. The findings reveal low levels of onward transmission from imported cases during summer and underscore the importance of targeted public health measures that can increase the safety of international travel during a pandemic. The first Canadian study reported an increase in importation rates associated with the relaxation of travel restrictions for certain categories of travellers in October 2020. The second Canadian study	**Low** ⊕⊕◯◯

		reported that flights bans themselves varied in efficacy, but in lieu with other interventions, helped prevent more than 44,000 cases.	
Number or proportion of imported sublineages	2 Observational studies Canada (Nov 2020 to Mar 2022)[45] Canada (Jan 2020-Mar 2021)[44]	This study reported varying effects of targeted flight bans and other travel measures for travellers arriving in Canada by air from the UK, Brazil and Southern African countries. The second study reported that border closures that were less strict resulted in more sublineage importations.	**Low** ⊕⊕○○
Outcome category: 2. Shift in epidemic development			
No studies provided evidence for this outcome category.			
Outcome category: 3. Cases detected due to the measure			
Outcome	**Number of studies**	**Summary of findings**	**Certainty of evidence**
Number or proportion of cases detected	3 Observational studies UK (Mar 2020)[40], New Zealand (Aug 2020 – Feb 2021)[37], Netherlands (NR)[36]	Of these 3 studies, most (n = 2) reported benefits of border closures/ travel restrictions with up to 40% (rate ratio 0.60, 95% CI 0.37 to 0.95) lower rate of contacts with travel restrictions. The remaining study reported no decrease in imported cases even when border closures/ travel restrictions were implemented.	**Very low** ⊕○○○ Inconsistency

Outcome category: 4. Secondary outcomes			
Infectious disease transmission outcomes	1 + 2 Observational Studies Germany (Jan 2020)[20] Canada (Jan 2020 to Mar 2021)[44] Canada (Nov 2020-Mar 2022)[45]	One study reported several new mutations had emerged post-travel-ban and were on the rise in specific countries. Another study reported varying decreases in mean transmission events with international origins following travel restrictions. In Canada, variations across provinces may indicate slower implementation or compliance with quarantine guidelines. The third study approximated that Canada's flight ban on the UK helped prevent thousands of descendant cases and at least 44 singletons.	Low ⨁⨁◯◯
User acceptability	1 Observational study Cyprus (NA)[18]	This study reported that most (>90% of individuals surveyed) believe that strict border closures/ travel restrictions are a necessary measure for reducing rates of new cases.	Low ⨁⨁◯◯
Healthcare Utilization	1 Observational study Canada (Nov 2020 to Mar 2022)[45]	The study reports that Canadian COVID-19 travel restrictions were variably effective towards reducing SARS-CoV-2 VOC importations and cases, but cumulatively may have averted more than 440 hospitalizations and 24 deaths.	Low ⨁⨁◯◯

**As mentioned above, this is an arbitrary dichotomy with potential historical, geographic, and political bias, the country list was finalized only after consultation with decision-makers and content experts.*

Table 7. Canada and related countries* – GRADE Summary of Findings – Screening at borders
Disease: COVID-19 **Interventions:** implementing entry and/ or exit symptom/ exposure-based screening; implementing entry and/ or exit test-based screening; implementing a highly stringent screening measure **Comparators:** no measure; implementing an alternative measure; implementing a less stringent screening measure

Outcome	Number of studies	Summary of findings	Certainty of evidence
Outcome category: 1. Cases avoided due to measure			
Number or proportion of imported or exported cases	1 + 2 Observational studies Canada (Nov 2020-Mar 2022)[45] Belgium (April 2021)[43] Greece (NR)[23]	These studies reported varying benefits of travel measures, including testing and other screening requirements for travellers, in reducing importation and onward transmission of cases over different periods and jurisdictions. The Greece study reported that the proportion of imported strains decreased the most with targeted public health measures including entry testing (8.8% from 41%). In the Canada study, enhanced screening restrictions produced varying results. For screening measures against the Gamma variant (Brazil), there was not an immediate reduction in sublineage importations from Brazil into Canada, but the second period of restrictions did see a 1.6 (1.27-1.93)-fold reduction in the proportion of sublineages. Moreover, enhanced screening and quarantine measures for travellers who had been to South Africa resulted in a 6.25 (2.72-9.78)-fold reduction of the Beta sublineage importation rate, as well as a 1.75 (1.33-2.18)-fold reduction of the proportion of sublineages from South Africa. In the Belgium study, it was reported that despite negative pre-departure tests in India and on-arrival tests in France, 13 asymptomatic students nevertheless tested positive during quarantine, indicating that pre-departure and on-arrival testing was insufficient to prevent importation.	Very Low ⊕◯◯◯ Inconsistency
Number or proportion of imported sublineages	1 Observational study UK (Scotland) (Feb 2021 to May 2022)[49]	This study evaluates the impact of the UK "traffic light system" which imposed different quarantine and testing requirements for travellers on a country-specific basis through Red-Amber-Green (RAG) list designations. In the period from May 2021 to September 2021, the study reports an increase of international flight passengers arriving in Scotland by 754%, compared with a 12% increase over the same period in 2019. Amber list countries were the most frequently visited	**Low** ⊕⊕◯◯

		and ranked highly for SARS-CoV-2 importations and contribution to national case incidence...When examined according to travel destination, SARS-CoV-2 importation risks did not strictly follow RAG designations.	
Number or proportion of cases seeded by imported cases	1 Observational study Canada (Nov 2020)[15]	This Canadian study reported that on average, one contact was identified for each infected participant, with 22 cases of secondary transmission, irrespective of first test result (positive leading to quarantine – negative leading to no refusal of entry).	**Low** ⊕⊕◯◯
Proportion of secondary cases	1 + 2 Observational studies Ireland (Dec 2020)[25] UK (Scotland) (Feb 2021-May 2022)[49] Belgium (April 2021)[43]	The Ireland study reported that 7% of flight close contacts (41% had COVID) were PCR positive within 2 weeks. The positivity rate was higher in longer flights (>5-hr duration). The other study reported that more stringent travel screening requirements for Amber countries did not mitigate importation risks. Amber countries showed the highest frequency of travel resulting in relatively high numbers of imported SARS-CoV-2 cases when coupled with importation risk (proportion of travellers testing positive) together with a high population impact (proportion of Scottish SARS-CoV-2 cases attributed to travel). Despite fewer travel events, the highest SARS-CoV-2 importation risk was associated with a green list country in June 2021, and by September, a number of green list countries ranked higher than red list countries for population impact, highlighting the complexity of proportionate applications of RAG systems. In the Belgium study, contact tracing confirmed that testing during quarantine helped prevent onward transmission regarding a specific cluster.	Very low ⊕◯◯◯ Inconsistency
Number or proportion of cases in the community	1 Observational study UK (Scotland) (Feb 2021-May 2022)[49]	This study reported a 324% increase in SARS-CoV-2 cases comparing the weeks with the highest travel frequency in the pre-traffic light (w/c 5th April 2021) and traffic light (w/c 13th September 2021) periods.	Low ⊕⊕◯◯
Outcome category: 2. Shift in epidemic development			

Epidemic curve peak	1 Observational study Japan (Feb 2020)[33]	This study reported that the epidemic curve shows infections were occurring amongst Australians before ship-based quarantine and screening commenced. The illness peaked around 3–5 days after quarantine started which supports previous findings that the movement restrictions placed on 5 February reduced the risk of infection among those passengers who had no known close contact with an infected individual.	**Low** ⊕⊕◯◯
Outcome category: 3. Cases detected due to the measure			
Outcome	**Number of studies**	**Summary of findings**	**Certainty of evidence**
Number or proportion of cases detected	26 + 5 Observational studies[5,7-10,14,16,17,19-28,30,32-37,87] Australia[10,12], Bulgaria[13], Canada[14,15], France[19], Germany[21,22], Greece[24], Ireland[25], Italy[26-28], Japan[29-33,35], New Zealand[37,38], Spain[39], UK[38,107], USA[41,42] Norway (Nov to Dec 2021)[47] USA Sept 2021–Jan 2022)[20] USA (Jan to July 2020)[51] Germany (Nov to Dec	Across studies, the proportion of cases detected by screening ranged from 0 to 100%. This differed markedly based on the screening modality (e.g., symptoms, thermal, etc.). In general, the more invasive screening procedures (e.g., PCR testing) had a higher sensitivity than less invasive procedures (e.g., syndromic screening). Across studies, the proportion of cases detected by screening ranged from 0.017% to 16-21%, with varying CI. This spectrum of proportion of cases detected is more correlated to pre-boarding requirements than to screening modality. In the three out of the four studies that reported the lowest proportions of cases detected by screening mandates (n=3; proportions of cases detected were 0.017%, 0.39%, and 3.3%), there was a pre-boarding requirement prior to arriving at the border: having a negative sample days before screening at the border, having a negative sample before travelling, or having documentation (COVID-19 certificate). Moreover, the studies (n = 4) that looked at PCR testing (PCR, RT-PCR, and PT-PCR) reported varying proportions of cases detected (ranging from 0.017% to 16-21%). Time when screening took place also correlates with proportion cases detected: the study reporting highest proportion of (imported)	**Very low** ⊕◯◯◯ Inconsistency

	2021)[46] UK (Scotland) (Feb 2021-May 2022)[49]	cases (16-21%) consisted of either a sample that included travellers who voluntarily enrolled in a pilot screening program that provided the option of testing days after arrival (proportion of travellers that chose this testing option conflated with proportion of travellers who were tested immediately after landing). Testing and genomic sequencing are identified as critical to identifying new variants soon after their emergence. One study reported that SARS-CoV-2 cases detections were less likely among travellers than non-travellers with the rate of SARS-CoV-2 cases detections estimated to be more than ten times higher for those without an international travel event.	
Positive predictive value (PPV)	1 Observational study Italy (Aug - Oct 2020)[26]	This study reported that the PPV of the rapid antigen test was estimated to be 23.3% (CI 10.1 to 45.0).	**Low** ⊕⊕◯◯
Outcome category: 4. Secondary outcomes			
Infectious disease transmission outcomes	3 + 5 Observational studies Japan (Mar 2020)[31], Japan (Aug 2020)[32], Japan (Feb 2020)[33] Belgium (April 2021)[43] USA (Sept 2021 to Jan 2022)[50] UK (Scotland) (Feb 2021-May 2022)[49] Germany (Nov-Dec 2021)[46]	These studies reported conflicting evidence regarding infectious disease transmission. One study reported that a higher 14-day average incidence in the countries of stay was associated with higher test positivity (1.64 [1.16–2.33] and 3.13 [1.88–5.23] for those from countries and areas where the 14-day average incidence was from 10 to <100 and ≥100 cases per million, respectively). A second study reported that the median time to the first of two consecutive negative PCR-based assays was 13 days for asymptomatic cases and 19 days for symptomatic cases ($p = 0.002$). Even so, the third study reported that strict policies did not prevent the introduction of new strains. Another study reported that through PCR testing and contact-tracing, 22 contacts of study participants were identified and tested negative, suggesting that transmission to persons outside the	**Very low** ⊕◯◯◯ Inconsistency

	USA (Jan-July 2020)[51]	group was prevented. Genomes related to identified clusters were not identified across national samples for three months, suggesting onward transmission into the community was effectively prevented. Through PCR testing and genomic sequencing, the U.S. study identified a shift in proportion of variant sublineages, reporting a shift from, all but one unconfirmed sublineages of the Delta variant to 67% (145 of 215) of positive pooled samples collected identified as Omicron variant. Furthermore, one study reported that after the end of the U.K.'s traffic light system, Omicron (BA.1 sublineage) was first detected among non-travel-related cases, unlike Delta cases, where 22.1% of cases were associated with international travel. Overall, in Scotland, placing countries in different RAG categories (particularly the red list) did not stop variants from being imported. In the Germany study, reported symptoms included loss of taste or smell, but no hospital admissions were required. In the USA study, most confirmed COVID-19 cases were either symptomatic on arrival (86%, n=12) or symptomatic days later (71%, n=10).	
Healthcare utilization	1 + 1 Observational studies Canada (Nov 2020)[14] Germany (Nov to Dec 2021)[46]	The Canadian study reported that among participants with positive tests, 2% were hospitalized, but none required critical care or died. The other study reported no hospital admissions or death.	**Low** ⊕⊕◯◯
Resource requirements	2 + 2 Observational studies[76,77] USA (Feb/ Mar 2020)[41], USA (Jun 2020)[42] USA (Sept 2021 to Jan 2022)[50] Germany (Nov-Dec 2021)[46]	These studies reported that routine testing was costly and resource intensive. The first study reported during a 7-week period, staff members devoted an estimated 1,694 total person-hours (equivalent to six employees working full-time for 7 weeks) processing travelers; 34% of these person-hours occurred outside regular working hours. The second study reported that during Jun – Nov 2020, up to 22 screening personnel and five testing personnel per day were required. The associated budget was $26 million for Jun – Dec and nonresident travelers were required to pay $250 for post-arrival testing.	**Low** ⊕⊕◯◯

		The second USA study suggested that when COVID-19 rates are high, as was the case with the Omicron surge, a 10% participation rate in traveler-based viral genomic sequence surveillance would help detect relatively rare sublineages and provide detailed epidemiological data as an early warning sentinel system for future outbreaks. The Germany study illustrated that screening post-arrival, when done in tandem with pre-departure screening, was resource intensive and impractical, as 3.3% (n = 90/2728) of travellers tested positive upon arrival.	

** As mentioned above, this is an arbitrary dichotomy with potential historical, geographic, and political bias, the country list was finalized only after consultation with decision-makers and content experts.*

Table 8. Canada and related countries* – GRADE Summary of Findings – Quarantine			
Disease: COVID-19 **Interventions:** implementing quarantine; implementing a highly stringent quarantine **Comparators:** no measure; implementing an alternative measure (e.g., screening); implementing a less stringent quarantine			
Outcome	**Number of studies**	**Summary of findings**	**Certainty of evidence**

Outcome category: 1. Cases avoided due to measure			
Number or proportion of cases in the community	2 Observational studies UK (England) (Feb-Aug 2021)[48] UK (Scotland) (Feb 2021-May 2022)[49]	One study reported that during the study period, 88 (35.1%) out of 251 confirmed COVID-19 cases (Gamma variant) in England were imported. The other study reported an overall 324% increase in SARS-CoV-2 cases in Scotland, comparing the weeks with the highest travel frequency in the pre-traffic light (w/c 5th April 2021) and traffic light (w/c 13th September 2021) periods.	Very low ⊕◯◯◯
Number or proportion of imported or exported cases	1 + 3 Observational studies Canada (Nov 2020)[15] Canada (Jan 2020 to Mar 2021)[44] Canada (Nov 2020 to Mar 2022)[45] Belgium (April 2021)[43]	These studies found that quarantine and other travel measures resulted in a varying impact on the number of imported cases. A study in Canada reported a drop in sublineage importation rate 3.4-fold (3.2–3.8) within 2 weeks; and 10.3- fold (8.3–15.0) within 4 weeks following the implementation of a mandatory 14-day at-home quarantine on 25 March 2020. The same study reported an increase in importation rates associated with the relaxation of travel restrictions including quarantine for certain categories of travellers in October 2020. Another study reports that enhanced screening and quarantine enacted for travellers who had been to South Africa was associated with a significant 6.25 (2.72-9.78)-fold reduction of the Beta sublineage importation rate from South Africa, as well as a 1.75 (1.33-2.18)-fold reduction of the proportion of sublineages from South Africa (Figs. 2B, 3). During the restriction, there was a rise in Beta sublineages likely to have originated in Europe and other African nations; following restrictions, Beta importations from Asia increased. In a study in Belgium, asymptomatic cases were identified and prevented from importation through extended quarantine and testing. Another Canadian study reported that quarantine did not appear to fully protect against transmission to contacts. Travelers	Very low ⊕◯◯◯ Inconsistency

		who received a negative first result and were allowed to leave quarantine did not cause a greater number of secondary infections than those who remained in 14-day quarantine.	
Number or proportion of secondary cases	3 Observational studies UK (England) (Feb to Aug 2021)[48] Belgium (April 2021)[43] UK (Scotland) (Feb 2021 to May 2022)[49]	These studies reported quarantine, along with other travel measures, was associated with a low rate in onward transmission during specific periods. In England, 88 imported cases (Gamma) and 14 travel-related secondary cases (Gamma) were identified during the study period. A Belgian study identified 22 contacts of travellers who all tested negative, suggesting that transmission to persons outside the group was prevented, further supported by no detection in nationwide genomic surveillance of genomes related to identified clusters for three months following the study. The Scotland study reported that the highest frequency of travel during the study period was seen for an amber list country, resulting in relatively high numbers of imported SARS-CoV-2 cases when coupled with importation risk (proportion of travellers testing positive) together with a high population impact (proportion of Scottish SARS-CoV-2 cases attributed to travel). Despite fewer travel events, the highest SARS-CoV-2 importation risk was associated with a green list country in June 2021 and by September a number of green list countries ranked higher than red list countries for population impact, highlighting the complexity of proportionate applications of RAG systems. It is noted that this study does not assess the impact of quarantine and isolation measures in place for those returning from red and amber list countries which is expected to have reduced the population impact of international travel.	Very low ⊕◯◯◯ Inconsistency
Outcome category: 2. Shift in epidemic development			

Epidemic curve peak	1 Observational study Japan (Feb 2020)[33]	This study reported that the epidemic curve shows infections were occurring amongst Australians before ship-based quarantine and screening commenced. The illness peaked around 3–5 days after quarantine started which supports previous findings that the movement restrictions placed on 5 February reduced the risk of infection among those passengers who had no known close contact with an infected individual.	**Low** ⊕⊕◯◯
Outcome category: 3. Cases detected due to the measure			
Outcome	**Number of studies**	**Summary of findings**	**Certainty of evidence**
Number or proportion of cases detected	23 + 2 Observational studies Australia, Bulgaria[13], Canada[15,17], France[19], **Germany**[21,22,46], Greece[24], Italy[27,28], Japan[29-31,33,34], New Zealand[37,38], **UK**[38,40,49], USA[41,42,115]	Across studies, the proportion of cases detected by screening ranged from 0 to 100%. This differed markedly based on the screening modality (e.g., symptoms, thermal, etc.). In general, the more invasive screening procedures (e.g., PCR testing) had a higher sensitivity than less invasive procedures (e.g., syndromic screening). Studies showed varying benefits of quarantine to detecting greater proportion of cases. One study reported that 4.3% of travelers who initially tested negative on arrival reported testing positive in the 14 days after arrival and high compliance with quarantine was presumed to limit post-flight transmission. In Scotland, rates of detection were higher among non-travellers than travellers during the study period, despite testing requirements based on Red-Amber-Green country risk rating (RAG) The rate of SARS-CoV-2 cases detections was estimated to be 17 per 1,000 among those with an international travel event, compared to 190 per 1,000 among 340 those without an international travel event over the same period.	**Very low** ⊕◯◯◯ Inconsistency
Outcome category: 4. Secondary outcomes			

Infectious disease transmission outcomes	3 + 2 Observational studies Canada (Mar 2020)[16], Japan (Mar 2020)[31], Japan (Feb 2020)[33] Canada (Jan 2020 to Mar 2021)[44] UK (England) (Feb-Aug 2021)[48]	These studies reported that quarantining had mixed results. The first study reported that transmission lineage size was greatly reduced after a quarantine order for returning travelers was enacted. The second study reported that even after strict quarantine policy was implemented, 12 distinct strains (10% of all strains) were still introduced. The third study reported that the relative risk of testing positive from an exposure to a known case during ship-based quarantine was 6.18 (95% CI 1.96–19.46). Another Canadian study reported varying decreases in mean transmission events with international origins following travel restrictions. Variations across provinces may suggest slower implementation or compliance with quarantine guidelines in these provinces. In the England study, quarantine requirements for travellers returning from red- and amber-list countries (in RAG system) were found to help limit onward transmission: over half of the reported travel-related cases were travellers rather than secondary cases. Specifically, 51% of travel-related cases were travellers who had visited a country on the Amber list while 40% had visited a country on the Red list.	**Very low** ⊕◯◯◯ Inconsistency
Adverse effects	3 Observational studies New Zealand (Aug 2020 – Feb 2021)[37], Australia/ New Zealand (Apr – Jun 2020)[11], Australia (Nov 2020 –Jun 2021)[12]	These studies reported that quarantining was potentially harmful to the quarantined individuals and staff. The first study reported 22 quarantine system failures in Australia and 10 in New Zealand. The second study reported that facility staff tested positive for COVID-19. The third study reported on breaches in quarantine facilities stemming from housing international travelers.	Adverse effects

**As mentioned above, this is an arbitrary dichotomy with potential historical, geographic, and political bias, the country list was finalized only after consultation with decision-makers and content experts.*

Appendix 1. Search Strategies

Ovid MEDLINE® Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations and Daily <1946 to February 2, 2024>

(Search performed on 5 February 2024)

#	Searches	Results
1	exp Coronavirus/	178958
2	Coronavirus Infections/	46112
3	COVID-19.rs.	0
4	severe acute respiratory syndrome coronavirus 2.os.	0
5	(2019 nCoV or 2019nCoV or 2019-novel CoV).ti,ab,kf.	2195
6	(Coronavir* or corona virus* or Middle East Respiratory Syndrome* or MERS or Severe Acute Respiratory Syndrome* or SARS*).ti,ab,kf.	230472
7	COVID 19.mp.	391868
8	(COVID19 or COVID 2019).ti,ab,kf.	3883
9	(nCov 2019 or nCov 19).ti,ab,kf.	1265
10	or/1-9 [Set 1: Coronaviruses]	435266
11	Air Travel/	551
12	Travel/	28117
13	(border? adj3 (clos* or restrict* or control* or measure?)).ab,kf.	1763
14	((isolat* or quarantin*) adj6 (exposed or suspected or travel* or airport? or border?)).ti,ab,kf.	9752
15	((mobility or movement*) adj2 (reduc* or restrict*)).ti,ab,kf.	14000
16	((questionnaire* or RT-PCR or screen* or surveil* or test* or telethermographic* or temperature or thermal imag* or thermal scan* or thermomet* or thermograph*) adj4 (traveller? or entr* or exit or border? or airport?)).ti,ab,kf.	7043
17	(travel* or border?).ti.	31272

18	(travel adj4 (measure? or intervention? or NPI?)).ab,kf.	748
19	(travel* adj3 (restrict* or reduc* or control* or limit* or lockdown? or ban*)).ab,kf.	3617
20	visa?.ti,ab,kf.	2880
21	or/11-20 [Set 2: Travel measures]	85042
22	and/10,21 [Sets 1 & 2]	6490
23	epidemiologic studies/ or exp case control studies/ or exp cohort studies/ or cross-sectional studies/	3213771
24	((case control$ or case-control$ or cohort or cohort analy$ or cross sectional or cross-sectional or epidemiologic$ or follow up or longitudinal or observational) adj3 (study or studies)).tw.	1271289
25	(case report adj2 form$).tw.	2193
26	or/23-25 [Observational study designs]	3680478
27	22 and 26 [Observational studies + Travel restrictions + COVID]	821
28	consensus/ or (consensus development conference or consensus development conference, nih or guideline).pt. [Guidelines]	49435
29	abstract report/ or (congress or meeting abstract or poster).pt. [Conference abstracts]	67524
30	case study/ or letter/ or historical article/ or (blog or book review or case reports or catalog or clinical conference or clinical trial, veterinary or collected correspondence or comment or editorial or essay or handbook or historical article or index or interview or introductory journal article or laboratory manual or lecture or lecture note or letter or news or newspaper article or observational study, veterinary or patient education handout or personal narrative or practice guideline or randomized controlled trial, veterinary or textbook).pt. [Other publication types]	5043834

31	(exp animal experiment/ or exp animal model/ or exp transgenic animal/ or animal/ or chordata/ or vertebrate/ or tetrapod/ or amniote/ or exp amphibia/ or mammal/ or exp reptile/ or therian/ or placental mammals/ or exp marsupial/ or euarchontoglires/ or exp xenarthra/ or primate/ or exp scandentia/ or haplorhini/ or exp prosimian/ or simian/ or exp tarsiiform/ or catarrhini/ or exp platyrrhini/ or ape/ or exp cercopithecidae/ or hominid/ or exp hylobatidae/ or exp chimpanzee/ or exp gorilla/ or (animal or animals or pisces or fish or fishes or catfish or catfishes or sheatfish or silurus or arius or heteropneustes or clarias or gariepinus or fathead minnow or fathead minnows or pimephales or promelas or cichlidae or trout or trouts or char or chars or salvelinus or salmo or oncorhynchus or guppy or guppies or millionfish or poecilia or goldfish or goldfishes or carassius or auratus or mullet or mullets or mugil or curema or shark or sharks or cod or cods or gadus or morhua or carp or carps or cyprinus or carpio or killifish or eel or eels or anguilla or zander or sander or lucioperca or stizostedion or turbot or turbots or psetta or flatfish or flatfishes or plaice or pleuronectes or platessa or tilapia or tilapias or oreochromis or sarotherodon or common sole or dover sole or solea or zebrafish or zebrafishes or danio or rerio or seabass or dicentrarchus or labrax or morone or lamprey or lampreys or petromyzon or pumpkinseed or pumpkinseeds or lepomis or gibbosus or herring or clupea or harengus or amphibia or amphibian or amphibians or anura or salientia or frog or frogs or rana or toad or toads or bufo or xenopus or laevis or bombina or epidalea or calamita or salamander or salamanders or newt or newts or triturus or reptilia or reptile or reptiles or bearded dragon or pogona or vitticeps or iguana or iguanas or lizard or lizards or anguis fragilis or turtle or turtles or snakes or snake or aves or bird or birds or quail or quails or coturnix or bobwhite or colinus or virginianus or poultry or poultries or fowl or fowls or chicken or chickens or gallus or zebra finch or taeniopygia or guttata or canary or canaries or serinus or canaria or parakeet or parakeets or grasskeet or parrot or parrots or psittacine or psittacines or shelduck or tadorna or goose or geese or branta or leucopsis or woodlark or lullula or flycatcher or ficedula or hypoleuca or dove or doves or geopelia or cuneata or duck or ducks or greylag or graylag or anser or harrier or circus pygargus or red knot or great knot or calidris or canutus or godwit or limosa or lapponica or meleagris or gallopavo or jackdaw or corvus or monedula or ruff or philomachus or pugnax or lapwing or peewit or plover or vanellus or swan or cygnus or	5236682

	columbianus or bewickii or gull or chroicocephalus or ridibundus or albifrons or great tit or parus or aythya or fuligula or streptopelia or risoria or spoonbill or platalea or leucorodia or blackbird or turdus or merula or blue tit or cyanistes or pigeon or pigeons or columba or pintail or anas or starling or sturnus or owl or athene noctua or pochard or ferina or cockatiel or nymphicus or hollandicus or skylark or alauda or tern or sterna or teal or crecca or oystercatcher or haematopus or ostralegus or shrew or shrews or sorex or araneus or crocidura or russula or european mole or talpa or chiroptera or bat or bats or eptesicus or serotinus or myotis or dasycneme or daubentonii or pipistrelle or pipistrellus or cat or cats or felis or catus or feline or dog or dogs or canis or canine or canines or otter or otters or lutra or badger or badgers or meles or fitchew or fitch or foumart or foulmart or ferrets or ferret or polecat or polecats or mustela or putorius or weasel or weasels or fox or foxes or vulpes or common seal or phoca or vitulina or grey seal or halichoerus or horse or horses or equus or equine or equidae or donkey or donkeys or mule or mules or pig or pigs or swine or swines or hog or hogs or boar or boars or porcine or piglet or piglets or sus or scrofa or llama or llamas or lama or glama or deer or deers or cervus or elaphus or cow or cows or bos taurus or bos indicus or bovine or bull or bulls or cattle or bison or bisons or sheep or sheeps or ovis aries or ovine or lamb or lambs or mouflon or mouflons or goat or goats or capra or caprine or chamois or rupicapra or leporidae or lagomorpha or lagomorph or rabbit or rabbits or oryctolagus or cuniculus or laprine or hares or lepus or rodentia or rodent or rodents or murinae or mouse or mice or mus or musculus or murine or woodmouse or apodemus or rat or rats or rattus or norvegicus or guinea pig or guinea pigs or cavia or porcellus or hamster or hamsters or mesocricetus or cricetulus or cricetus or gerbil or gerbils or jird or jirds or meriones or unguiculatus or jerboa or jerboas or jaculus or chinchilla or chinchillas or beaver or beavers or castor fiber or castor canadensis or sciuridae or squirrel or squirrels or sciurus or chipmunk or chipmunks or marmot or marmots or marmota or suslik or susliks or spermophilus or cynomys or cottonrat or cottonrats or sigmodon or vole or voles or microtus or myodes or glareolus or primate or primates or prosimian or prosimians or lemur or lemurs or lemuridae or loris or bush baby or bush babies or bushbaby or bushbabies or galago or galagos or anthropoidea or anthropoids or simian or simians or monkey or monkeys or marmoset or marmosets or callithrix or cebuella or tamarin or tamarins or saguinus or	

	leontopithecus or squirrel monkey or squirrel monkeys or saimiri or night monkey or night monkeys or owl monkey or owl monkeys or douroucoulis or aotus or spider monkey or spider monkeys or ateles or baboon or baboons or papio or rhesus monkey or macaque or macaca or mulatta or cynomolgus or fascicularis or green monkey or green monkeys or chlorocebus or vervet or vervets or pygerythrus or hominoidea or ape or apes or hylobatidae or gibbon or gibbons or siamang or siamangs or nomascus or symphalangus or hominidae or orangutan or orangutans or pongo or chimpanzee or chimpanzees or pan troglodytes or bonobo or bonobos or pan paniscus or gorilla or gorillas or troglodytes).ti,ab,kf.) not (human/ or (human$ or man or men or woman or women or child or children or patient$).ti,ab,kf.)	
32	or/28-31 [Exclusions]	10231868
33	27 not 32	795
34	limit 33 to english language	778
35	limit 34 to yr="2022 -Current"	373
36	remove duplicates from 35	373

Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations and Daily <1946 to April 13, 2022>

exp Coronavirus/ 133810
Coronavirus Infections/ 45391
COVID-19.rs. 17
severe acute respiratory syndrome coronavirus 2.os. 17
(2019 nCoV or 2019nCoV or 2019-novel CoV).ti,ab,kf. 1953
(Coronavir* or corona virus* or Middle East Respiratory Syndrome* or MERS or Severe Acute Respiratory Syndrome* or SARS*).ti,ab,kf. 151537
COVID 19.mp.235659

(COVID19 or COVID 2019).ti,ab,kf. 2782
(nCov 2019 or nCov 19).ti,ab,kf. 696
or/ 1-9 [Set 1: Coronaviruses]271392
Air Travel/ 514
Travel/ 27069
(border? adj3 (clos* or restrict* or control* or measure?)).ab,kf. 1459
((isolat* or quarantin*) adj6 (exposed or suspected or travel* or airport? or border?)).ti,ab,kf. 9047
((mobility or movement*) adj2 (reduc* or restrict*)).ti,ab,kf. 11812
((questionnaire* or RT-PCR or screen* or surveil* or test* or telethermographic* or temperature or thermal imag* or thermal scan* or thermomet* or thermograph*) adj4 (traveller? or entr* or exit or border? or airport?)).ti,ab,kf. 6136
(travel* or border?).ti. 28658
(travel adj4 (measure? or intervention? or NPI?)).ab,kf. 604
(travel* adj3 (restrict* or reduc* or control* or limit* or lockdown? or ban*)).ab,kf. 2724
visa?.ti,ab,kf. 2473
or/ 11-20 [Set 2: Travel measures] 76948
and/ 10,21 [Sets 1 & 2] 4379
epidemiologic studies/ or exp case control studies/ or exp cohort studies/ or cross-sectional studies/ 2904592
((case control$ or case-control$ or cohort or cohort analy$ or cross sectional or cross-sectional or epidemiologic$ or follow up or longitudinal or observational) adj3 (study or studies)).tw.
1052800
(case report adj2 form$).tw. 1869
or/ 23-25 [Observational study designs] 3288474
22 and 26 [Observational studies + Travel restrictions + COVID] 490
consensus/ or (consensus development conference or consensus development conference, nih or guideline).pt. [Guidelines] 45581
abstract report/ or (congress or meeting abstract or poster).pt. [Conference abstracts] 67033
case study/ or letter/ or historical article/ or (blog or book review or case reports or catalog or clinical conference or clinical trial, veterinary or collected correspondence or comment or editorial or essay or handbook or historical article or index or interview or introductory journal article or laboratory manual or lecture or lecture note or letter or news or newspaper article or observational study, veterinary or patient education handout or personal narrative or practice guideline or randomized controlled trial, veterinary or textbook).pt. [Other publication types] 4738796

(exp animal experiment/ or exp animal model/ or exp transgenic animal/ or animal/ or chordata/ or vertebrate/ or tetrapod/ or amniote/

or exp amphibia/ or mammal/ or exp reptile/ or therian/ or placental mammals/ or exp marsupial/ or euarchontoglires/ or exp xenarthra/ or primate/ or exp scandentia/ or haplorhini/ or exp prosimian/ or simian/ or exp tarsiiform/ or catarrhini/ or exp platyrrhini/ or ape/ or exp cercopithecidae/ or hominid/ or exp hylobatidae/ or exp chimpanzee/ or exp gorilla/ or (animal or animals or pisces or fish or fishes or catfish or catfishes or sheatfish or silurus or arius or heteropneustes or clarias or gariepinus or fathead minnow or fathead minnows or pimephales or promelas or cichlidae or trout or trouts or char or chars or salvelinus or salmo or oncorhynchus or guppy or guppies or millionfish or poecilia or goldfish or goldfishes or carassius or auratus or mullet or mullets or mugil or curema or shark or sharks or cod or cods or gadus or morhua or carp or carps or cyprinus or carpio or killifish or eel or eels or anguilla or zander or sander or lucioperca or stizostedion or turbot or turbots or psetta or flatfish or flatfishes or plaice or pleuronectes or platessa or tilapia or tilapias or oreochromis or sarotherodon or common sole or dover sole or solea or zebrafish or zebrafishes or danio or rerio or seabass or dicentrarchus or labrax or morone or lamprey or lampreys or petromyzon or pumpkinseed or pumpkinseeds or lepomis or gibbosus or herring or clupea or harengus or amphibia or amphibian or amphibians or anura or salientia or frog or frogs or rana or toad or toads or bufo or xenopus or laevis or bombina or epidalea or calamita or salamander or salamanders or newt or newts or triturus or reptilia or reptile or reptiles or bearded dragon or pogona or vitticeps or iguana or iguanas or lizard or lizards or anguis fragilis or turtle or turtles or snakes or snake or aves or bird or birds or quail or quails or coturnix or bobwhite or colinus or virginianus or poultry or poultries or fowl or fowls or chicken or chickens or gallus or zebra finch or taeniopygia or guttata or canary or canaries or serinus or canaria or parakeet or parakeets or grasskeet or parrot or parrots or psittacine or psittacines or shelduck or tadorna or goose or geese or branta or leucopsis or woodlark or lullula or flycatcher or ficedula or hypoleuca or dove or doves or geopelia or cuneata or duck or ducks or greylag or graylag or anser or harrier or circus pygargus or red knot or great knot or calidris or canutus or godwit or limosa or lapponica or meleagris or gallopavo or jackdaw or corvus or monedula or ruff or philomachus or pugnax or lapwing or peewit or plover or vanellus or swan or cygnus or columbianus or bewickii or gull or chroicocephalus or ridibundus or albifrons or great tit or parus or aythya or fuligula or streptopelia or risoria or spoonbill or platalea or leucorodia or blackbird or turdus or merula or blue tit or cyanistes or pigeon or pigeons or columba or pintail or anas or starling or sturnus or owl or athene noctua or pochard or ferina or cockatiel or nymphicus or hollandicus or skylark or alauda or tern or sterna or teal or crecca or oystercatcher or haematopus or ostralegus or shrew or shrews or sorex or araneus or crocidura or russula or european mole or talpa or chiroptera or bat or bats or eptesicus or serotinus or myotis or dasycneme or daubentonii or pipistrelle or pipistrellus or cat or cats or felis or catus or feline or dog or dogs or canis or canine or canines or otter or otters or lutra or badger or badgers or meles or fitchew or fitch or foumart or foulmart or ferrets or ferret or polecat or polecats or mustela or putorius or weasel or weasels or fox or foxes or vulpes or common seal or phoca or vitulina or grey seal or halichoerus or horse or horses or equus or equine or equidae or donkey or donkeys or mule or mules or pig or pigs or swine or swines or hog or hogs or boar or boars or porcine or piglet or piglets or sus or scrofa or llama or llamas or lama or glama or deer or deers or cervus or elaphus or cow or cows or bos taurus or bos indicus or bovine or bull or bulls or cattle or bison or bisons or sheep or sheeps or ovis aries or ovine or lamb or lambs or mouflon or mouflons or goat or goats or capra or caprine or chamois or rupicapra or leporidae or lagomorpha or lagomorph or rabbit or rabbits or oryctolagus or cuniculus or laprine or hares or lepus or rodentia or rodent or rodents or murinae or mouse or mice or mus or musculus or murine or woodmouse or apodemus or rat or rats or rattus or norvegicus or

guinea pig or guinea pigs or cavia or porcellus or hamster or hamsters or mesocricetus or cricetulus or cricetus or gerbil or gerbils or jird or jirds or meriones or unguiculatus or jerboa or jerboas or jaculus or chinchilla or chinchillas or beaver or beavers or castor fiber or castor canadensis or sciuridae or squirrel or squirrels or sciurus or chipmunk or chipmunks or marmot or marmots or marmota or suslik or susliks or spermophilus or cynomys or cottonrat or cottonrats or sigmodon or vole or voles or microtus or myodes or glareolus or primate or primates or prosimian or prosimians or lemur or lemurs or lemuridae or loris or bush baby or bush babies or bushbaby or bushbabies or galago or galagos or anthropoidea or anthropoids or simian or simians or monkey or monkeys or marmoset or marmosets or callithrix or cebuella or tamarin or tamarins or saguinus or leontopithecus or squirrel monkey or squirrel monkeys or saimiri or night monkey or night monkeys or owl monkey or owl monkeys or douroucoulis or aotus or spider monkey or spider monkeys or ateles or baboon or baboons or papio or rhesus monkey or macaque or macaca or mulatta or cynomolgus or fascicularis or green monkey or green monkeys or chlorocebus or vervet or vervets or pygerythrus or hominoidea or ape or apes or hylobatidae or gibbon or gibbons or siamang or siamangs or nomascus or symphalangus or hominidae or orangutan or orangutans or pongo or chimpanzee or chimpanzees or pan troglodytes or bonobo or bonobos or pan paniscus or gorilla or gorillas or troglodytes).ti,ab,kf.) not (human/ or (human$ or man or men or woman or women or child or children or patient$).ti,ab,kf.)
4983419

or/ 28-31 [Exclusions] 9677596

27 not 32 471

limit 33 to english language 462

limit 34 to yr="2020 -Current" 411

remove duplicates from 35 409

Embase <1974 to 2024 February 2>

Search performed on 5 February 2024

#	Searches	Results
1	coronaviridae/	1709
2	exp coronavirinae/ 83888	137741

3	exp coronavirus infection/ 226785	417703
4	(2019 nCoV or 2019nCoV or 2019-novel CoV).ti,ab,kw.	2351
5	(Coronavir* or corona virus* or Middle East Respiratory Syndrome* or MERS or Severe Acute Respiratory Syndrome* or SARS*).ti,ab,kw.	262895
6	COVID 19.af.	425258
7	(COVID19 or COVID 2019).ti,ab,kw.	8204
8	(nCov 2019 or nCov 19).ti,ab,kw.	1548
9	or/ 1-8 [Set 1: Coronaviruses]	545331
10	air transportation/	408
11	aviation/	8728
12	travel/	64856
13	(border? adj3 (clos* or restrict* or control* or measure?)).ab,kw.	1948
14	((isolat* or quarantin*) adj6 (exposed or suspected or travel* or airport? or border?)).ti,ab,kw.	11830
15	((mobility or movement*) adj2 (reduc* or restrict*)).ti,ab,kw.	18343
16	((questionnaire* or RT-PCR or screen* or surveil* or test* or telethermographic* or temperature or thermal imag* or thermal scan* or thermomet* or thermograph*) adj4 (traveller? or entr* or exit or border? or airport?)).ti,ab,kw.	8682
17	(travel* or border?).ti.	34617
18	(travel adj4 (measure? or intervention? or NPI?)).ab,kw.	845
19	(travel* adj3 (restrict* or reduc* or control* or limit* or lockdown? or ban*)).ab,kw.	4450
20	visa?.ti,ab,kw. 2723	3333
21	or/ 10-20 [Set 2: Travel measures]	137802
22	and/ 9,21 [Sets 1 & 2] 6226	9714
23	clinical study/ or family study/ or longitudinal study/ or cohort analysis/ or (prospective study/ not randomized controlled trials/)	2172750

24	((case control$ or case-control$ or cohort or cohort analy$ or cross sectional or cross-sectional or epidemiologic$ or follow up or longitudinal or observational) adj3 (study or studies)).tw.	1813115
25	or/ 23-24 [Observational study designs]	3244109
26	22 and 25 [Observational studies + Travel restrictions + COVID]	1401
27	consensus/ or (consensus development conference or consensus development conference, nih or guideline).pt. [Guidelines]	105275
28	abstract report/ or (congress or meeting abstract or poster).pt. [Conference abstracts]	89837
29	case study/ or letter/ or historical article/ or (blog or book review or case reports or catalog or clinical conference or clinical trial, veterinary or collected correspondence or comment or editorial or essay or handbook or historical article or index or interview or introductory journal article or laboratory manual or lecture or lecture note or letter or news or newspaper article or observational study, veterinary or patient education handout or personal narrative or practice guideline or randomized controlled trial, veterinary or textbook).pt. [Other publication types]	2226499
30	(exp animal experiment/ or exp animal model/ or exp transgenic animal/ or animal/ or chordata/ or vertebrate/ or tetrapod/ or amniote/ or exp amphibia/ or mammal/ or exp reptile/ or therian/ or placental mammals/ or exp marsupial/ or euarchontoglires/ or exp xenarthra/ or primate/ or exp scandentia/ or haplorhini/ or exp prosimian/ or simian/ or exp tarsiiform/ or catarrhini/ or exp platyrrhini/ or ape/ or exp cercopithecidae/ or hominid/ or exp hylobatidae/ or exp chimpanzee/ or exp gorilla/ or (animal or animals or pisces or fish or fishes or catfish or catfishes or sheatfish or silurus or arius or heteropneustes or clarias or gariepinus or fathead minnow or fathead minnows or pimephales or promelas or cichlidae or trout or trouts or char or chars or salvelinus or salmo or oncorhynchus or guppy or guppies or millionfish or poecilia or goldfish or goldfishes or carassius or auratus or mullet or mullets or mugil or curema or shark or sharks or cod or cods or gadus or morhua or carp or carps or cyprinus or carpio or killifish or eel or eels or anguilla or zander or sander or lucioperca or stizostedion or turbot or turbots or psetta or flatfish or flatfishes or plaice or pleuronectes or platessa or tilapia or tilapias or oreochromis or sarotherodon or common sole or dover sole or solea or zebrafish or zebrafishes or danio or rerio or seabass or dicentrarchus or labrax or morone or lamprey or lampreys or petromyzon or pumpkinseed or pumpkinseeds or lepomis or gibbosus or herring or clupea or harengus or amphibia or amphibian or	4987600

	amphibians or anura or salientia or frog or frogs or rana or toad or toads or bufo or xenopus or laevis or bombina or epidalea or calamita or salamander or salamanders or newt or newts or triturus or reptilia or reptile or reptiles or bearded dragon or pogona or vitticeps or iguana or iguanas or lizard or lizards or anguis fragilis or turtle or turtles or snakes or snake or aves or bird or birds or quail or quails or coturnix or bobwhite or colinus or virginianus or poultry or poultries or fowl or fowls or chicken or chickens or gallus or zebra finch or taeniopygia or guttata or canary or canaries or serinus or canaria or parakeet or parakeets or grasskeet or parrot or parrots or psittacine or psittacines or shelduck or tadorna or goose or geese or branta or leucopsis or woodlark or lullula or flycatcher or ficedula or hypoleuca or dove or doves or geopelia or cuneata or duck or ducks or greylag or graylag or anser or harrier or circus pygargus or red knot or great knot or calidris or canutus or godwit or limosa or lapponica or meleagris or gallopavo or jackdaw or corvus or monedula or ruff or philomachus or pugnax or lapwing or peewit or plover or vanellus or swan or cygnus or columbianus or bewickii or gull or chroicocephalus or ridibundus or albifrons or great tit or parus or aythya or fuligula or streptopelia or risoria or spoonbill or platalea or leucorodia or blackbird or turdus or merula or blue tit or cyanistes or pigeon or pigeons or columba or pintail or anas or starling or sturnus or owl or athene noctua or pochard or ferina or cockatiel or nymphicus or hollandicus or skylark or alauda or tern or sterna or teal or crecca or oystercatcher or haematopus or ostralegus or shrew or shrews or sorex or araneus or crocidura or russula or european mole or talpa or chiroptera or bat or bats or eptesicus or serotinus or myotis or dasycneme or daubentonii or pipistrelle or pipistrellus or cat or cats or felis or catus or feline or dog or dogs or canis or canine or canines or otter or otters or lutra or badger or badgers or meles or fitchew or fitch or foumart or foulmart or ferrets or ferret or polecat or polecats or mustela or putorius or weasel or weasels or fox or foxes or vulpes or common seal or phoca or vitulina or grey seal or halichoerus or horse or horses or equus or equine or equidae or donkey or donkeys or mule or mules or pig or pigs or swine or swines or hog or hogs or boar or boars or porcine or piglet or piglets or sus or scrofa or llama or llamas or lama or glama or deer or deers or cervus or elaphus or cow or cows or bos taurus or bos indicus or bovine or bull or bulls or cattle or bison or bisons or sheep or sheeps or ovis aries or ovine or lamb or lambs or mouflon or mouflons or goat or goats or capra or caprine or chamois or rupicapra or leporidae or lagomorpha or lagomorph or rabbit or rabbits or oryctolagus or cuniculus or laprine or hares or lepus or rodentia or rodent or rodents or murinae or mouse or mice or mus or musculus or murine or woodmouse or apodemus or rat or rats or rattus or norvegicus or guinea pig or guinea pigs or cavia or porcellus or hamster or hamsters or mesocricetus or cricetulus or cricetus or gerbil or gerbils or jird or	

	jirds or meriones or unguiculatus or jerboa or jerboas or jaculus or chinchilla or chinchillas or beaver or beavers or castor fiber or castor canadensis or sciuridae or squirrel or squirrels or sciurus or chipmunk or chipmunks or marmot or marmots or marmota or suslik or susliks or spermophilus or cynomys or cottonrat or cottonrats or sigmodon or vole or voles or microtus or myodes or glareolus or primate or primates or prosimian or prosimians or lemur or lemurs or lemuridae or loris or bush baby or bush babies or bushbaby or bushbabies or galago or galagos or anthropoidea or anthropoids or simian or simians or monkey or monkeys or marmoset or marmosets or callithrix or cebuella or tamarin or tamarins or saguinus or leontopithecus or squirrel monkey or squirrel monkeys or saimiri or night monkey or night monkeys or owl monkey or owl monkeys or douroucoulis or aotus or spider monkey or spider monkeys or ateles or baboon or baboons or papio or rhesus monkey or macaque or macaca or mulatta or cynomolgus or fascicularis or green monkey or green monkeys or chlorocebus or vervet or vervets or pygerythrus or hominoidea or ape or apes or hylobatidae or gibbon or gibbons or siamang or siamangs or nomascus or symphalangus or hominidae or orangutan or orangutans or pongo or chimpanzee or chimpanzees or pan troglodytes or bonobo or bonobos or pan paniscus or gorilla or gorillas or troglodytes).ti,ab,kf.) not (human/ or (human$ or man or men or woman or women or child or children or patient$).ti,ab,kf.)	
31	or/ 27-30 [Exclusions]	7320786
32	26 not 31	1324
33	limit 32 to english language	1318
34	limit 33 to yr="2022 -Current"	633
35	remove duplicates from 34	626

Embase <1974 to 2022 April 13>

1 coronaviridae/ 1353

2 exp coronavirinae/ 83888

3 exp coronavirus infection/ 226785

4 (2019 nCoV or 2019nCoV or 2019-novel CoV).ti,ab,kw. 1961

5 (Coronavir* or corona virus* or Middle East Respiratory Syndrome* or MERS or Severe Acute Respiratory Syndrome* or SARS*).ti,ab,kw. 159514
6 COVID 19.af. 232399
7 (COVID19 or COVID 2019).ti,ab,kw. 4643
8 (nCov 2019 or nCov 19).ti,ab,kw. 733
9 or/ 1-8 [Set 1: Coronaviruses]305704
10 air transportation/ 249
11 aviation/ 7955
12 travel/ 55702
13 (border? adj3 (clos* or restrict* or control* or measure?)).ab,kw. 1595
14 ((isolat* or quarantin*) adj6 (exposed or suspected or travel* or airport? or border?)).ti,ab,kw. 10726
15 ((mobility or movement*) adj2 (reduc* or restrict*)).ti,ab,kw. 15433
16 ((questionnaire* or RT-PCR or screen* or surveil* or test* or telethermographic* or temperature or thermal imag* or thermal scan* or thermomet* or thermograph*) adj4 (traveller? or entr* or exit or border? or airport?)).ti,ab,kw. 7476
17 (travel* or border?).ti. 31550
18 (travel adj4 (measure? or intervention? or NPI?)).ab,kw. 679
19 (travel* adj3 (restrict* or reduc* or control* or limit* or lockdown? or ban*)).ab,kw. 3276
20. 20 visa?.ti,ab,kw. 2723
21. 21 or/ 10-20 [Set 2: Travel measures] 119602
22. 22 and/ 9,21 [Sets 1 & 2] 6226
23. 23 clinical study/ or family study/ or longitudinal study/ or cohort analysis/ or (prospective study/ not randomized controlled trials/) 1722508
24. 24 ((case control$ or case-control$ or cohort or cohort analy$ or cross sectional or cross-sectional or epidemiologic$ or follow up or longitudinal or observational) adj3 (study or studies)).tw. 1470479
25. 25 or/ 23-24 [Observational study designs] 2619013
26. 26 22 and 25 [Observational studies + Travel restrictions + COVID] 794
27. 27 consensus/ or (consensus development conference or consensus development conference, nih or guideline).pt. [Guidelines] 85819
28. 28 abstract report/ or (congress or meeting abstract or poster).pt. [Conference abstracts] 89541
29. 29 case study/ or letter/ or historical article/ or (blog or book review or case reports or catalog or clinical conference or clinical trial, veterinary or collected correspondence or comment or editorial or essay or handbook or historical article or index or interview or

introductory journal article or laboratory manual or lecture or lecture note or letter or news or newspaper article or observational study, veterinary or patient education handout or personal narrative or practice guideline or randomized controlled trial, veterinary or textbook).pt. [Other publication types] 2033949

30. 30 (exp animal experiment/ or exp animal model/ or exp transgenic animal/ or animal/ or chordata/ or vertebrate/ or tetrapod/ or amniote/ or exp amphibia/ or mammal/ or exp reptile/ or therian/ or placental mammals/ or exp marsupial/ or euarchontoglires/ or exp xenarthra/ or primate/ or exp scandentia/ or haplorhini/ or exp prosimian/ or simian/ or exp tarsiiform/ or catarrhini/ or exp platyrrhini/ or ape/ or exp cercopithecidae/ or hominid/ or exp hylobatidae/ or exp chimpanzee/ or exp gorilla/ or (animal or animals or pisces or fish or fishes or catfish or catfishes or sheatfish or silurus or arius or heteropneustes or clarias or gariepinus or fathead minnow or fathead minnows or pimephales or promelas or cichlidae or trout or trouts or char or chars or salvelinus or salmo or oncorhynchus or guppy or guppies or millionfish or poecilia or goldfish or goldfishes or carassius or auratus or mullet or mullets or mugil or curema or shark or sharks or cod or cods or gadus or morhua or carp or carps or cyprinus or carpio or killifish or eel or eels or anguilla or zander or sander or lucioperca or stizostedion or turbot or turbots or psetta or flatfish or flatfishes or plaice or pleuronectes or platessa or tilapia or tilapias or oreochromis or sarotherodon or common sole or dover sole or solea or zebrafish or zebrafishes or danio or rerio or seabass or dicentrarchus or labrax or morone or lamprey or lampreys or petromyzon or pumpkinseed or pumpkinseeds or lepomis or gibbosus or herring or clupea or harengus or amphibia or amphibian or amphibians or anura or salientia or frog or frogs or rana or toad or toads or bufo or xenopus or laevis or bombina or epidalea or calamita or salamander or salamanders or newt or newts or triturus or reptilia or reptile or reptiles or bearded dragon or pogona or vitticeps or iguana or iguanas or lizard or lizards or anguis fragilis or turtle or turtles or snakes or snake or aves or bird or birds or quail or quails or coturnix or bobwhite or colinus or virginianus or poultry or poultries or fowl or fowls or chicken or chickens or gallus or zebra finch or taeniopygia or guttata or canary or canaries or serinus or canaria or parakeet or parakeets or grasskeet or parrot or parrots or psittacine or psittacines or shelduck or tadorna or goose or geese or branta or leucopsis or woodlark or lullula or flycatcher or ficedula or hypoleuca or dove or doves or geopelia or cuneata or duck or ducks or greylag or graylag or anser or harrier or circus pygargus or red knot or great knot or calidris or canutus or godwit or limosa or lapponica or meleagris or gallopavo or jackdaw or corvus or monedula or ruff or philomachus or pugnax or lapwing or peewit or plover or vanellus or swan or cygnus or columbianus or bewickii or gull or chroicocephalus or ridibundus or albifrons or great tit or parus or aythya or fuligula or streptopelia or risoria or spoonbill or platalea or leucorodia or blackbird or turdus or merula or blue tit or cyanistes or pigeon or pigeons or columba or pintail or anas or starling or sturnus or owl or athene noctua or pochard or ferina or cockatiel or nymphicus or hollandicus or skylark or alauda or tern or sterna or teal or crecca or oystercatcher or haematopus or ostralegus or shrew or shrews or sorex or araneus or crocidura or russula or european mole or talpa or chiroptera or bat or bats or eptesicus or serotinus or myotis or dasycneme or daubentonii or pipistrelle or pipistrellus or cat or cats or felis or catus or feline or dog or dogs or canis or canine or canines or otter or otters or lutra or badger or badgers or meles or fitchew or fitch or foumart or foulmart or ferrets or ferret or polecat or polecats or mustela or putorius or weasel or weasels or fox or foxes or vulpes or common seal or phoca or vitulina or grey seal or halichoerus or horse or horses or equus or equine or equidae or donkey or donkeys

or mule or mules or pig or pigs or swine or swines or hog or hogs or boar or boars or porcine or piglet or piglets or sus or scrofa or llama or llamas or lama or glama or deer or deers or cervus or elaphus or cow or cows or bos taurus or bos indicus or bovine or bull or bulls or cattle or bison or bisons or sheep or sheeps or ovis aries or ovine or lamb or lambs or mouflon or mouflons or goat or goats or capra or caprine or chamois or rupicapra or leporidae or lagomorpha or lagomorph or rabbit or rabbits or oryctolagus or cuniculus or laprine or hares or lepus or rodentia or rodent or rodents or murinae or mouse or mice or mus or musculus or murine or woodmouse or apodemus or rat or rats or rattus or norvegicus or guinea pig or guinea pigs or cavia or porcellus or hamster or hamsters or mesocricetus or cricetulus or cricetus or gerbil or gerbils or jird or jirds or meriones or unguiculatus or jerboa or jerboas or jaculus or chinchilla or chinchillas or beaver or beavers or castor fiber or castor canadensis or sciuridae or squirrel or squirrels or sciurus or chipmunk or chipmunks or marmot or marmots or marmota or suslik or susliks or spermophilus or cynomys or cottonrat or cottonrats or sigmodon or vole or voles or microtus or myodes or glareolus or primate or primates or prosimian or prosimians or lemur or lemurs or lemuridae or loris or bush baby or bush babies or bushbaby or bushbabies or galago or galagos or anthropoidea or anthropoids or simian or simians or monkey or monkeys or marmoset or marmosets or callithrix or cebuella or tamarin or tamarins or saguinus or leontopithecus or squirrel monkey or squirrel monkeys or saimiri or night monkey or night monkeys or owl monkey or owl monkeys or douroucoulis or aotus or spider monkey or spider monkeys or ateles or baboon or baboons or papio or rhesus monkey or macaque or macaca or mulatta or cynomolgus or fascicularis or green monkey or green monkeys or chlorocebus or vervet or vervets or pygerythrus or hominoidea or ape or apes or hylobatidae or gibbon or gibbons or siamang or siamangs or nomascus or symphalangus or hominidae or orangutan or orangutans or pongo or chimpanzee or chimpanzees or pan troglodytes or bonobo or bonobos or pan paniscus or gorilla or gorillas or troglodytes).ti,ab,kf.) not (human/ or (human$ or man or men or woman or women or child or children or patient$).ti,ab,kf.) 4674225

31. 31 or/ 27-30 [Exclusions] 6798658
32. 32 26 not 31 769
33. 33 limit 32 to english language 765
34. 34 limit 33 to yr="2020 -Current" 721
35. 35 remove duplicates from 34 704

WHO COVID-19 Global literature on coronavirus disease (search.bvsalud.org/ global-literatureon-novel-coronavirus-2019-ncov)

Search performed on 5 February 2024. Since June 2023, manual updates to the database have been discontinued. Complete search linked

(ti:(border OR borders OR travel*)) OR (tw:(border* AND (clos* OR restrict* OR control* OR measure*))) OR (tw:((isolat* OR quarantin*) AND (exposed OR suspected OR travel* OR airport* OR border*))) OR (tw:((mobility OR movement*) AND (reduc* OR restrict*) AND travel*)) OR (tw:((questionnaire* or "RT-PCR" or screen* or surveil* or test* or telethermographic* or temperature or "thermal image" or "thermal images" or "thermal imaging" or "thermal scan" or "thermal scans" or "thermal scanning" or thermomet* or thermograph*) AND (traveller* OR entr* OR exit OR border* OR airport*))) OR (tw:(travel AND (measure* OR intervention* OR NPI*))) OR (tw:(travel* AND (restrict* OR reduc* OR control* OR limit* OR lockdown* OR ban*))) OR (tw:(visa OR visas)) (1277)

Filters applied:

Databases: ProQuest Central, medRxiv, WHO COVID, PREPRINT-SSRN, LILACS (Americas), PREPRINT-ARXIV, bioRxiv, Lanzhou University/CNKI, PubMed Central, ELSEVIER, PubMed, WPRIM (Western Pacific)

Language: English

Year: 2022-2024

WHO COVID-19 Global literature on coronavirus disease (search.bvsalud.org/ global-literature- on-novel-coronavirus-2019-ncov)
Strategy:
(ti:(border OR borders OR travel*)) OR (tw:(border* AND (clos* OR restrict* OR control* OR measure*))) OR (tw:((isolat* OR quarantin*) AND (exposed OR suspected OR travel* OR airport* OR border*))) OR (tw:((mobility OR movement*) AND (reduc* OR restrict*) AND travel*)) OR (tw:((questionnaire* or "RT-PCR" or screen* or surveil* or test* or telethermographic* or temperature or "thermal image" or "thermal images" or "thermal imaging" or "thermal scan" or "thermal scans" or "thermal scanning" or thermomet* or thermograph*) AND (traveller* OR entr* OR exit OR border* OR airport*))) OR (tw:(travel AND (measure* OR intervention* OR NPI*))) OR (tw:(travel* AND (restrict* OR reduc* OR control* OR limit* OR lockdown* OR ban*))) OR (tw:(visa OR visas)) (2167)

Filters applied:
Databases: WHO COVID, medRxiv, ELSEVIER, bioRxiv, LILACS, Grey literature, Lanzhou University/ CNKI, WPRIM (Western Pacific), SSRN, ProQuest Central, PREPRINT-SCIELO, PubMed, ArXiv
Language: English
Year: 2020-2022

Cochrane COVID-19 Study Register (COVID-19.cochrane.org)

Search performed on 5 February 2024. The register is no longer updated after 31 January 2024. Complete search linked here.

Filters:

New Studies from date 13 April 2022 to 5 February 2024.

#	Searches	Results
1	(border* AND (close or closed or closing or closure* or restrict*))	179
2	((isolate or isolating or isolation* or quarantin*) AND (travel or traveling or travell* or airport* or border*))	327
3	("reduced mobility" OR "reduced movement" OR "movement reduction" OR "mobility restriction" OR "mobility restrictions" OR "restricted mobility" OR "movement restriction" OR "movement restrictions" OR "restricted movement" or "travel restrictions" or "travel restriction" or "restricted travel" or "restricted traveling" or "retricted travelling" or "reduced travel" or "reduced traveling" or "reduced travelling" or "travel reduction" or "travel reductions")	535
4	((questionnaire* or "RT-PCR" or screen* or surveil* or test* or telethermographic* or temperature or "thermal image" or "thermal imaging" or "thermal scan" or "thermal scans" or "thermal scanning" or thermomet* or thermograph*) AND (traveller* or "port of entry" or "ports of entry" or "point of entry" or "points or entry" or border* or airport*))	470
5	(travel AND (intervention* or NPI*))	305

6	((travel or traveling or travell*) AND (limit* or lockdown* or ban or bans or banning or banned))	493
7	(visa* or "border controls" OR "border control" OR "controlling borders" OR "controlling the border" or "travel measures" or "border measures")	146
8	(border* AND (close or closed or closing or closure* or restrict*)) or ((isolate or isolating or isolation* or quarantin*) and (travel or traveling or travell* or airport* or border*)) or ("reduced mobility" OR "reduced movement" OR "movement reduction" OR "mobility restriction" OR "mobility restrictions" OR "restricted mobility" OR "movement restriction" OR "movement restrictions" OR "restricted movement" or "travel restrictions" or "travel restriction" or "restricted travel" or "restricted traveling" or "retricted travelling" or "reduced travel" or "reduced traveling" or "reduced travelling" or "travel reduction" or "travel reductions") or ((questionnaire* or "RT-PCR" or screen* or surveil* or test* or telethermographic* or temperature or "thermal image" or "thermal imaging" or "thermal scan" or "thermal scans" or "thermal scanning" or thermomet* or thermograph*) and (traveller* or "port of entry" or "ports of entry" or "point of entry" or "points or entry" or border* or airport*)) or (travel AND (intervention* or NPI*)) or ((travel or traveling or travell*) and (limit* or lockdown* or ban or bans or banning or banned)) or (visa* or "border controls" OR "border control" OR "controlling borders" OR "controlling the border" or "travel measures" or "border measures")	1744

Cochrane COVID-19 Study Register (COVID-19.cochrane.org)

1. (border* AND (close or closed or closing or closure* or restrict*)) 245
2. ((isolate or isolating or isolation* or quarantin*) AND (travel or traveling or travell* or airport* or border*)) 1041
3. ("reduced mobility" OR "reduced movement" OR "movement reduction" OR "mobility restriction" OR "mobility restrictions" OR "restricted mobility" OR "movement restriction" OR "movement restrictions" OR "restricted movement" or "travel restrictions" or "travel restriction" or "restricted travel" or "restricted traveling" or "retricted travelling" or "reduced travel" or "reduced traveling" or "reduced travelling" or "travel reduction" or "travel reductions") 757
4. ((questionnaire* or "RT-PCR" or screen* or surveil* or test* or telethermographic* or temperature or "thermal image" or "thermal imaging" or "thermal scan" or "thermal scans" or "thermal scanning" or thermomet* or thermograph*) AND (traveller* or "port of entry" or "ports of entry" or "point of entry" or "points or entry" or border* or airport*)) 653
5. (travel AND (intervention* or NPI*)) 891

6. ((travel or traveling or travell*) AND (limit* or lockdown* or ban or bans or banning or banned)) 983
7. (visa* or "border controls" OR "border control" OR "controlling borders" OR "controlling the border" or "travel measures" or "border measures") 116
8. (border* AND (close or closed or closing or closure* or restrict*)) or ((isolate or isolating or isolation* or quarantin*) and (travel or traveling or travell* or airport* or border*)) or ("reduced mobility" OR "reduced movement" OR "movement reduction" OR "mobility restriction" OR "mobility restrictions" OR "restricted mobility" OR "movement restriction" OR "movement restrictions" OR "restricted movement" or "travel restrictions" or "travel restriction" or "restricted travel" or "restricted traveling" or "retricted travelling" or "reduced travel" or "reduced traveling" or "reduced travelling" or "travel reduction" or "travel reductions") or ((questionnaire* or "RT-PCR" or screen* or surveil* or test* or telethermographic* or temperature or "thermal image" or "thermal imaging" or "thermal scan" or "thermal scans" or "thermal scanning" or thermomet* or thermograph*) and (traveller* or "port of entry" or "ports of entry" or "point of entry" or "points or entry" or border* or airport*)) or (travel AND (intervention* or NPI*)) or ((travel or traveling or travell*) and (limit* or lockdown* or ban or bans or banning or banned)) or (visa* or "border controls" OR "border control" OR "controlling borders" OR "controlling the border" or "travel measures" or "border measures") 2912 references

Appendix 2. List of countries deemed comparable to Canada

This list was provided by the lead author of the previous review (Abou-Setta et al., 2022) and agreed upon with PHAC in May 2022.

Countries similar to Canada:

- Australia
- Austria
- Belgium
- Bulgaria
- Cyprus
- Czech Republic
- Denmark
- Finland
- France
- Germany
- Greece

- Ireland
- Italy
- Japan
- Luxembourg
- New Zealand
- Norway
- Poland
- Spain
- Switzerland
- Netherlands
- UK
- USA

Other countries:

- Afghanistan
- Bahrain
- Brazil
- Burundi
- China
- Dubai
- French Polynesia
- Hong Kong
- India
- Kazakhstan
- Kenya
- Madagascar
- Malta
- Mauritius
- Nepal
- Pakistan
- Qatar

- Russia
- Rwanda
- Singapore
- Sweden*
- South Korea
- South Sudan
- Taiwan
- Thailand
- Tunisia
- Uganda
- Vanuatu
- Vietnam

* Sweden was excluded from the list of countries similar to Canada as their policy towards COVID-19 has been markedly different.