EVIDENCE SYNTHESIS BRIEFING NOTE

TOPIC: ECONOMIC IMPACT OF NON-PHARMACEUTICAL INTERVENTIONS DURING COVID-19

Information finalized as of December 4, 2020.[a] This Briefing Note was completed by the Research, Analysis, and Evaluation Branch (Ministry of Health) based on information provided by members of the COVID-19 Evidence Synthesis Network. Please refer to the Methods section for further information.

- **Purpose**: This note summarizes scientific evidence and jurisdictional experiences on the economic impacts of non-pharmaceutical interventions (NPIs) (lockdown Interventions, micro/targeted interventions, or no intervention) implemented for COVID-19 across Canadian and international jurisdictions.
- **Key Findings**: Modelling studies provide estimates on the economic trade-offs associated with implementing approaches at various levels of intervention or policy stringency. The following study findings describe the economic impacts of NPIs:
  - **Lockdown Interventions**: A modelling study (US) notes that the best outcome is reached when lockdowns last for 30 days and public compliance with COVID-19 physical distancing measures is at least 80%. Another modelling study (British Columbia) recommends implementing an initial lockdown stringency level that reduces the reproduction number close to one, which can be lessened once a vaccination program is underway. It is suggested that maintaining a moderate lockdown level is more effective than one that oscillates between mild and strict lockdown levels. Macro/microeconomic outcomes include:
    - Macroeconomic Outcomes: Six studies report national or state-level economic outcomes from lockdowns in Australia, China, Italy, Switzerland, New York, and San Francisco. For example, the Australian Treasury estimated that the lockdown cost Australia more than CAD $1.14 billion per week. A modelling study estimated the total monthly economic losses in China during the lockdown reached CAD $60 billion.
    - Microeconomic Outcomes: A modelling study (Switzerland) estimated that 31% of jobs have been restricted by the lockdown policy, with the strongest effects in large industries such as hospitality, construction, and arts and entertainment, and among low- and middle-income individuals compared to high-income individuals.
  - **Micro/Targeted Interventions**: The geographical impact of the disease and socio-economic factors can lead to uneven regional economic losses. A modelling study (Italy) suggests adopting geographically tailored policy actions instead of a 'one-rule-fits-all' approach. Some approaches of targeted interventions include travel restrictions (Sweden as compared with Denmark, Finland, Norway, and New Zealand) and school closures (OECD countries).
  - **No Intervention**: In the absence of any interventions (i.e., vaccine or school closure), a study (US) on influenza predicted a 50% attack rate with an economic impact of CAD $224 per capita as loss to society. Moreover, in Nordic countries less stringent lockdowns are not associated with higher quality economic growth.
- **Analysis for Ontario**: Similar to Ontario, many countries have divided their nations into regions, and subregions to implement a range of lockdown strategies (e.g., mandatory proof of negative COVID-19 test before entering a region, closures and limits to mass gatherings, and self-isolation mandates). Many Ontario public health units implemented strategies to enforce and supplement the provincial COVID-19 response framework. No economic impacts were identified.

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

Supporting Evidence

Table 1 below summarizes scientific evidence and jurisdictional experiences on the economic impact of NPIs implemented during the COVID-19 pandemic across Canadian and international jurisdictions (lockdown Interventions, micro/targeted interventions, or no intervention).

Additional details are provided in the Appendix: in Table 2 (research evidence on economic impacts of COVID-19 lockdown interventions), Table 3 (research evidence on the economic impacts of other types of COVID-19 interventions), Table 4 (grey literature findings on economic impacts of NPIs), Table 5 (public health interventions from Canadian provinces), and Table 6 (public health interventions from international jurisdictions), respectively.

Table 1: Summary of Scientific Evidence and Jurisdictional Experiences on the Economic Impacts of NPIs Implemented during COVID-19

Scientific Evidence	• While no systematic reviews were identified, numerous modelling studies provide estimates on the economic impacts of COVID-19 NPIs.[1,2,3,4,5,6,7,8,9,10] Many of these studies analyze trade-offs with stronger or weaker levels of intervention stringency. Definitions of stringency levels vary across studies; however, several refer to the Oxford Response Stringency Index,[b] which collects publicly available information on 18 indicators of government responses. The following studies describe the economic impacts of NPIs: ○ **Lockdown Interventions**: A study on the economic impact of COVID-19 in the US estimated that in terms of the trade-off between compliance with NPIs and duration of lockdown, the best outcome is reached when the lockdown is for 30 days and the public compliance with physical distancing measures is at least 80%.[11] One modelling study in British Columbia concludes that the optimal policy is to adopt an initial lockdown level that reduces the reproduction number of the epidemic to close to one, which is then reduced once a vaccination program is underway. This model also indicates that an oscillating policy of strict and mild shutdowns is less effective than a policy that maintains a moderate shutdown level.[12] Another model (Brazil) demonstrated that governments that chose to preserve the economy by using less severe isolation policies, fatally reached a situation with a high cost in human lives, and still suffered economic losses.[13] There are macro/microeconomic outcomes that are reported to arise from lockdown interventions: ▪ Macroeconomic Outcomes: A study (New York, US) forecasted the effect of the COVID-19 outbreak on the economic output and predicts annualized quarterly growth rate of real gross domestic product (GDP) to be between -3.99 to -4.299% for the first quarter and between -19.79 to -21.67% for the second quarter of 2020.[14] One study reported that the Australian Treasury estimates that the lockdown cost Australia more than CAD $1.14 billion per week.[15] One modelling study (China) estimates the total monthly economic

[b] One study describes the stringency of government-mandated social distancing (SD) measures assessed using an aggregate of the sub-indices C1-C8, E1 and H1-H3 from the University of Oxford Coronavirus Government Response Tracker with 100 being the highest level of stringency. Examples include: New Zealand had the highest level of stringency in its first outbreak in March and May at levels approaching 100. Sweden had the lowest stringency level over the March-May period of between 40 and 50; Norway had stringency levels as high as 80; and, Denmark and Finland had levels, respectively, of approximately 70 and 60. (Gordon, et al., 2020).

	losses in China during the lockdown reached CAD $60 billion.[16] Macroeconomic indicators comparing New Zealand, Greece, Iceland, and Singapore find that the GDP of Iceland and Greece have shown the largest contraction due to the COVID-19 pandemic, with a decrease of approximately 10% in 2020-Q1 compared to 2019-Q4.[17] A modelling study calibrated to the world economy with data from 44 countries estimated that world output fell by 7% at the early stage of the crisis, when only China was under lockdown, and by 23% at the peak of the crisis, when many countries were under a lockdown.[18] This study notes that recovery time is likely to be significantly greater if partial lockdowns persist.[19] A study concluded that government announcements regarding public awareness programs, testing and quarantining policies, and income support packages largely result in positive market returns.[20] ▪ Microeconomic Outcomes: A study (Switzerland) estimates that 31% of jobs have been restricted by the lockdown policy, with the strongest effects in large industries such as hospitality, construction, and arts and entertainment, and among low- and middle-income individuals compared to high-income individuals.[21] A study in Vietnam indicates that 61.6% of respondents reported decreases in their incomes and 28.2% reported that their income deficit was 40% and above.[22] ○ **Micro/Targeted Interventions**: A modelling study in Italy reports that the geographical impact of the disease and socio-economic factors led to uneven regional economic losses and suggests geographically tailor-made policy actions instead of a 'one-rule-fits-all' approach to mobility restrictions.[23] Another modelling study (US) comparing 17 strategies, including a vaccine (i.e., targeted antiviral prophylaxis [TAP]), found the full TAP is the most effective single strategy, reducing the number of cases by 54% at the lowest cost to society (CAD $152 per capita). Pre-vaccination (i.e., with a low-efficacy vaccine) reduces number of cases by 48% and is the second least costly alternative (CAD $168 per capita). Adding school closures to full TAP or pre-vaccination further improves health outcomes but increases total costs to society by approximately CAD $3,240 per capita.[24,c] ▪ Travel Restrictions: A comparison of Sweden with Denmark, Finland, Norway, and New Zealand finds that early imposition of international travel restrictions combined with high levels of government-mandated stringency of physical distancing reduced the per capita cases and per capita fatalities associated with COVID-19.[25] In Nordic countries, less stringent government-mandated physical distancing is not associated with higher quality economic growth.[26] ○ **No Intervention**: In the absence of interventions (i.e., vaccine or school closure), a study (US) on influenza predicts a 50% attack rate with an economic impact of CAD $224 per capita as loss to society.[27] • A cost-effectiveness study comparing Denmark and Sweden suggests that public health interventions for COVID-19 should account for life years saved and not only lost lives. The evidence suggests that strict lockdown costs more than CAD $156,000 per life year saved.[28]
International Scan	• **Lockdown Interventions**: Many countries have divided their nations into regions, and subregions for the implementation of a range of lockdown strategies. Some common interventions seen were mandatory proof of negative COVID-19 test immediately before entering a region, closures and limits to mass gatherings, and self-isolation mandates. Some regions had government involvement in managing or monitored quarantines by providing

[c] The study reported figure of US$127, US$140 and US$2,700. All CAD amounts were calculated using PPPs as published by the OECD for 2019 (1 US dollar [USD] = 1.2 CAD) (OECD, 2019).

quarantine facilities or large fines for breaking quarantine mandates (e.g., Taiwan).[29]
Internationally, two approaches to lockdowns emerged:

- Strict lockdowns are implemented until cases are reduced to, or near, zero, and lifting restrictions with a low threshold to trigger future measures as needed. For example, some public health measures were implemented in Taiwan as soon as cases were beginning to be identified on social media in China, and South Korea recently re-implemented some public health restriction strategies with just 24 cases per day.[30]
- Restrictions are progressively increased as case counts, death counts, and/or hospital utilization increase (e.g., a three-tier alert system localized by postal code in England), and ongoing strategies already in place are extended (e.g., Germany, Netherlands).[31]
- Within these two general types of approaches taken by jurisdictions, there were differences in the specifics of the individual lockdown plans. Italy 'red' zones require online learning for high school and older students, France limits outdoor exercise to three hours, and there was media coverage that Slovakia conducted mandatory mass testing or mandatory strict limits on citizens on October 23-25, 2020 where individuals were not allowed to work unless they had proof of a negative test result or self-isolated for 10 days.
  - Economic Outcomes: An International Monetary Fund (IMF) (October 2020) report analyzed the economic activity of 52 countries finding that despite short-term economic costs, lockdowns may lead to a faster recovery by containing the spread of COVID-19 and reducing the need for voluntary physical distancing, possibly having positive overall effects on the economy.[32] Another IMF report (August 2020) with data from 62 countries notes that workplace closures, stay-at-home orders, and cancellations of events are more effective in flattening COVID-19-related infections but are the costliest in terms of their impact on economic activity. Less costly containment measures, such as international travel restrictions, are nonetheless successful in reducing COVID-19 infections.[33]
    - An analysis of the health-economy trade-off of 38 countries found that countries that suffered the most severe economic downturns (i.e., Peru, Spain, the United Kingdom) are generally among the countries with the highest COVID-19 death rates.[34] Further, countries where the economic impacts have been modest (e.g., Taiwan, South Korea, Lithuania) have kept the death rates low.[35] The economies of the US, Sweden, Denmark and Poland contracted by approximately 8-9%, but the death rates are markedly different: the US and Sweden have recorded five to 10 times more deaths per million than are reported by Denmark and Poland.[36]
    - An OECD report found that the initial direct impact of the shutdowns could be a decline in the level of output of between one-fifth to one-quarter in many economies, with consumers' expenditure potentially dropping by around one-third. The impact of the shutdowns will weaken short-term growth prospects substantially. The scale of the estimated decline in the level of output is equivalent to a decline in annual GDP growth of up to two percentage points for each month that strict containment measures continue. If the shutdown continued for three months, with no offsetting factors, annual GDP growth could be between four to six percentage points lower than it otherwise might have been.[37]
    - According to the World Bank in a report on Asia and the Pacific, lockdown interventions have resulted in most countries experiencing lower levels of GDP, rising unemployment, higher levels of impoverishment, and increasing income inequality.[38] Some countries are more vulnerable to the economic challenges resulting from COVID-19, including those

	implementing more stringent lockdowns and those that are more globally integrated due to their dependence on trade, tourism, and remittances.[39] • A World Bank report on Europe and Central Asia found that NPIs led to approximately a 10% decline in economic activity across the region. On average, countries that implemented NPIs in the early stages of the pandemic appear to have better short-term economic outcomes and lower cumulative mortality, compared with countries that imposed NPIs during the later stages of the pandemic.[40] • A US report that evaluated the effects of economic policies and economic measures identified: 1) microeconomic outcomes include declines in daily credit card spending from mid-March to -30% year-over-year growth rate at the end of March, and has since recovered to slightly above zero percent growth in June 2020. After shelter-in-place orders became widespread in mid-March, the number of employees working fell from about 15 percent below normal conditions to about 55 to 60 percent below normal conditions; and 2) macroeconomic outcomes include OECD estimates that the COVID-19 pandemic and containment measures will decrease US real GDP by 7.3% in 2020 in the absence of a second wave in the fall, or 8.5% if such a wave does occur.[41] • **Micro/Targeted Interventions:** Some jurisdictions have implemented micro/targeted interventions: For example, as of November 30, 2020, South Korea is in their third wave of COVID-19 spread through the Seoul metropolitan area with approximately 24 new cases per day. As a result, they have enacted enhanced quarantine measures and increasing distancing to 1.5 – 2 metres from previous, and these measures are to be evaluated *within a week* to determine if lockdowns should be nationwide.[42] In Scotland, alert levels were created by postal code; the most restrictive (level 4) requires not meeting others in the home but meeting up to six individuals in a public place (not including children under 12) is allowed. Restaurants and pubs are closed, and tourism accommodations are for essential customers only. Travel is restricted so those in level 3 or 4 local authorities do not travel to areas with lower restrictions.[43] ○ School Closures: Information from the OECD on school closures was also identified. There are two implications related to long-term economic costs of school closures in OECD countries: 1) affected students whose schooling has been interrupted by the pandemic face long-term losses in income; and 2) national economies that go forward with a less skilled labour force face lower economic growth which subtracts from the overall welfare of society.[44] • **No Intervention:** No information identified.
Canadian Scan	• **Lockdown Interventions**: During the initial lockdown intervention during the first quarter of 2020, Statistics Canada reported that small firms were among the hardest hit by the COVID-19 pandemic.[45,d] • **Micro/Targeted Interventions**: A report from Ontario Health (Quality) noted that provinces and territories across Canada implemented public health strategies at a provincial level and then additionally by regions that were deemed high risk based on particular indicators (e.g., case counts, hospitalizations and deaths) and required additional measures.[46] A summary of common themes across public health strategies implemented by Canadian jurisdictions includes:[47]

[d] Firms are classified by their employment: small firms have 0 to 99 employees; medium-sized firms, 100 to 499 employees; and large firms, 500 or more employees (Statistics Canada, 2020).

	○ Regional Travel Restrictions: Manitoba and Quebec restrict travel to and from other regions of the province.[48] For example, measures taken in the Northwest Territories include: ▪ Northwest territories restricts travelers to only 4 communities to fulfill a 14-day self-isolation mandate before being allowed to travel to other regions.[49] ▪ As of January 5, 2021 the government will no longer be covering the costs of isolation centre stays related to discretionary or personal travel.[50] ○ Visitor Restrictions to Long-Term Care Homes: Nunavut and Saskatchewan have restricted visitors to long-term care homes.[51] ○ Extension on School Breaks Before or After Christmas Break: Alberta and Manitoba have extended online learning for middle/high school children (grades seven-12).[52] ○ Travel Restrictions: The Atlantic 'bubble' in the eastern Canadian provinces allowed travel within but not beyond provinces within the bubble. Recently, as of November 24, 2020 in Prince Edward Island and November 25, 2020 in Newfoundland and Labrador, with growing case counts, there has been a pause to this bubble as provinces have made the choice to lockdown and implement stricter quarantine measures.[53] ▪ The following measures were taken in British Columbia (details of measures taken by other provinces and territories can be found in Table 5): • On November 10, 2020, two health authorities (Fraser and Vancouver Coastal) had an order from the provincial health officer to prohibit certain activities (e.g., banquet halls from operating).[54] • On November 13, 2020, the above health authorities has additional orders from the provincial health officer to prohibit more activities (e.g., indoor fitness activities and sports).[55] • On November 19, 2020, province-wide restrictions on suspension of all events and gatherings related to social interactions and travel until December 7, 2020.[56] • **No Intervention**: No information identified.
Ontario Scan	• **Lockdown Interventions:** No information identified. • **Micro/Targeted Interventions:** Ontario public health units implemented strategies to enforce and supplement the provincial COVID-19 response framework.[57] Ontario public health units created class-order measures[e] as additions to the measures mandated by the provincial COVID-19 response framework including: ○ Mandating close contacts of positive cases isolated, even if they themselves test negative; ○ Keeping a log of every individual who enters an establishment (e.g., restaurant); and ○ Hand sanitizer be made available at entrances to establishments.[58] • **No Intervention:** No information identified.

[e] Most commonly, public health units created additional policies as section 22 class-orders under the Ontario Health Protection and Promotion Act (Ontario Health [Quality], December 4, 2020).

Methods

Individual peer-reviewed articles and review articles were identified through PubMed, the Cochrane Library, and Google Scholar. Grey literature was identified through Google and relevant government websites. The search was limited to English sources and therefore may not capture the full extent of initiatives in non-English speaking countries. Full-text results extracted were limited to those available through Open Access or studies made available to the Ministry by our partners.

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

- Ontario Health (Quality). Public Health Interventions Targeting the Management of Spread of COVID-19: A Jurisdictional Scan. December 4, 2020
- Evidence Synthesis Unit, Research Analysis and Evaluation Branch, Ministry of Health. December 4, 2020.

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

APPENDIX

Table 2: Economic Impacts of COVID-19 Lockdown Interventions[f]

Jurisdiction	Type of Evidence/ Study	Article	Reported Outcomes of Lockdown Interventions
British Columbia	• Modelling study (pre-print)	Optimal Shutdown Strategies for Covid-19 with Economic and Mortality Costs: BC As a Case Study, November 30, 2020	• **Overview**: The study suggests the optimal policy is to adopt an initial shutdown level (i.e., a significant level of economic shutdown) that will reduce the reproduction number of the epidemic close to one. This level is then reduced once a vaccination program is underway. This model also indicates that an oscillating policy of strict and mild shutdowns is less effective than a policy that maintains a moderate shutdown level.[59] • **Reported Outcomes**: This study provides a perspective on the shutdown approaches taken by governments in British Columbia (BC) and elsewhere. In almost all cases, after a severe initial shutdown, economies were reopened and it was hoped the transmission rate could be controlled through contact tracing as well as individual behaviours (i.e., mask-wearing, washing hands, avoiding crowds, keeping business patrons two metres apart). Unfortunately, these methods do not seem to be as effective as was hoped, and at the time of writing (November 2020) cases are rising dramatically in many jurisdictions, and governments are reimplementing significant shutdown measures. It appears that a slower and more gradual decrease in shutdown level would have led to a smaller overall economic cost of the epidemic.[60] ○ Other costs related to the adoption of economic shutdown measures in BC: The shutdown in BC caused a significant increase in deaths due to drug overdoses. The excess (total overdose deaths over and above the usual average) for March through June 2020 exceeds the total number of COVID-19 deaths for that time period by over 40%. The study suggests the excess was due to such factors as the disruption of regular drug supply chains, border closures, an increasingly toxic drug supply, the reduction in access to harm reduction services as a result of physical distancing protocols, and increased stress resulting from increased isolation and economic uncertainty, etc.[61]
Australia	• Qualitative analysis of government reports	COVID-19: The need for an Australian economic pandemic response	• **Timeline**: March-June: Closed borders, social distancing, closing of non-essential services.[62] • **Reported Outcomes**: The Australian Treasury estimated that the lockdown cost Australia more than CAD $1.14 billion per week.[63,g] ○ GDP: In the first quarter of 2020 there was a 0.3% contraction in GDP, leading to an annual growth rate of only 1.4% in 2020. The effects of COVID-19 restrictions were observed in the second quarter of 2020, with contractions in GDP leading to a negative growth estimate for the year ending June 2020. The Royal Bank of Australia estimated an overall GDP contraction of approximately 6-7% for 2020 with a 5% return in growth over 2021. This growth outcome is highly dependent on the effectiveness of the fiscal response, efforts to mitigate the spread of the virus, and progress in easing restrictions. For instance, the reintroduction of restrictions to reduce virus transmission in Victoria was expected to result in a 2-percentage

[f] The information in this table was compiled by the Evidence Synthesis Unit, RAEB. The information captured in Table 2, Table 3, and Table 4 was identified in PubMed, Google, Google Scholar, medRxiv, and other websites including the IMF, OECD, and the World Bank but not Econolit.

[g] The study reported figures of Australian $1.4 billion. All Canadian Dollar (CAD) amounts were calculated using Purchasing Power Parities (PPPs) as published by the Organisation for Economic Co-operation and Development (OECD) for 2019 (1 Australian dollar [AUS] = 0.816 CAD). PPPs are the rates of currency conversion that eliminate the differences in price levels between countries (OECD, 2019).

Jurisdiction	Type of Evidence/ Study	Article	Reported Outcomes of Lockdown Interventions
			point reduction in national GDP growth in the third quarter. Early estimates suggested Australia's gross debt would reach 40% of GDP; this debt-to-GDP ratio is much lower than that of many other nations.[64] ○ Unemployment: From March to June, the unemployment rate rose by 2.2 percentage points to 7.4%, while the underemployment rate rose 4.9 points to 13.7% in the March to April period, but returned to 11.7% in June. However, the biggest concern was the 2.4% fall in the labour force participation rate in May, indicating that many people did not or could not actively look for work or were not able to work.[65]
Australia	• Modelling study (pre-print)	Health and Economic Effects of COVID-19 Control In Australia: Modelling and Quantifying The Payoffs of Hard Versus Soft Lockdown, September 2, 2020	• **Study design**: Models were used to simulate the effects of different SD and detection strategies on Australian COVID-19 infections and the economy from March to July 2020. Public health and economic outcomes for multiple social distancing levels (i.e., highest level being 100% SD in Australia in April 2020)[h] were evaluated, assessing hard versus soft lockdowns, and for early versus later relaxation of social distancing.[66] ○ Outcomes included economic costs, the timings and magnitudes of observed COVID-19 cases, and cumulative deaths in Australia from March to June 2020.[67] • **Results**: Higher levels of social distancing achieve zero community transmission with 100% probability and lower economic cost while low levels of social distancing result in uncontrolled outbreaks and higher economic costs.[68] ○ Economic costs of high social distancing were CAD $14.2 billion versus CAD $33.6 billion for 0.7 social distancing.[69,i] ○ Early relaxation of SD results in worse public health outcomes and higher economic costs.[70] ○ Better public health outcomes (i.e., reduced COVID-19 fatalities) are positively associated with lower economic costs and higher levels of social distancing; achieving zero community transmission lowers both public health and economy costs compared to allowing community transmission to continue; and early relaxation of social distancing increases both public health and economic costs.[71]
China	• Modelling Study	Assessment of Monthly Economic Losses in Wuhan Under the Lockdown Against Covid-19, July 31, 2020	• **Objective**: The study implemented a compartmental model for the transmission dynamics and health burden assessment to evaluate the health losses, and the direct and indirect economic losses of industries using the Input-Output model.[72] • **Study Design**: Types of data: 1) reported cases of different health endpoints to assess the health burden; 2) business data of transport, logistics and warehousing, postal service, accommodation, food, and beverage service industries to assess the meso-economic losses of industries; and, 3) the supporting data to evaluate the health losses and the meso-economic losses.[73] • **Results**: ○ Health burden caused by the pandemic is estimated to be CAD $1.52 billion and the loss of residents' mental health is evaluated to be CAD $38.8 billion.[74,j]

[h] According to the Oxford Response Stringency Index on 2 April, the severity of policy responses in Australia reached a peak of 73.15; in comparison, China's stringent lockdown policies peaked at 81.02 (Higginson, 2020).

[i] The study reported figures of Australian $17.4 billion and $41.2 billion. All Canadian Dollar (CAD) amounts were calculated using Purchasing Power Parities (PPPs) as published by the Organisation for Economic Co-operation and Development (OECD) for 2019 (1 Australian dollar [AUS] = 0.816 CAD) (OECD, 2019).

[j] The study reported figure of 4.4899 billion Chinese yuan (CNY) and 114.545 billion CNY. All CAD amounts were calculated using PPPs as published by the OECD for 2019 (1 Chinese yuan [CNY] = 0.339 CAD) (OECD, 2010.3399).

Jurisdiction	Type of Evidence/ Study	Article	Reported Outcomes of Lockdown Interventions
			○ Direct Meso-economic losses in transport, logistics, and warehousing, postal service, food, and beverage service industries reach CAD $7.33 billion, and the monthly indirect economic losses of the lockdown for all industries total CAD $12.33 billion. The total monthly economic losses during the lockdown reach CAD $60.01 billion.[75,k] ○ Health Outcomes: The study estimates the lockdown policy reduced COVID-19 infections by >180,000, which saved about 20,000 lives, as well as nearly CAD $10.17 billion in medical costs. Therefore, the lockdown policy in Wuhan has long-term benefits for the society and the total economic losses will be at a controllable level if effective measures are taken to combat COVID-19.[76,l]
Italy	• Modelling Study	After the Lockdown: Simulating Mobility, Public Health and Economic Recovery Scenarios, October 12, 2020.	• **Objective**: This paper estimates the impact that the COVID-19 epidemic and the mobility restriction measures will have on Italy's regional productive systems. It also focuses on the economic consequences of alternative lockdown scenarios.[77] • **Study Assumptions**: Economic losses arise from two main sources: 1) the number of infected people; and 2) the mobility restrictions that have prevented individuals from working.[78] • **Results**: The study suggests that the aggregate reduction of disposable income can vary from 10% to 40%, which is the result of non-linear interactions between mobility policies and infection transmission rates.[79] ○ In addition, different combinations of parameters at the national level correspond to regional losses. However, these effects are shown to depend on the geographical impact of the disease and of the socio-economic structure of each territory.[80] • **Implications of Findings**: ○ Tailored approaches: The findings of this modelling study suggest the adoption of geographically tailor-made policy actions instead of a one-rule-fits-all approach to mobility restrictions.[81]
Switzerland	• Data analysis	A Lockdown Index to Assess the Economic Impact of the Coronavirus, August 28, 2020.	• **Timeline**: March: Closed all educational institutions and all non-essential businesses (i.e., shops, restaurants and bars, entertainment and leisure facilities), and prohibited all public and private events. Public required to engage in social distancing.[82] • **Study Design**: Assessed the heterogeneous consequences of the lockdown policy by computing a lockdown index based on an occupation's dependence on physical proximity to other people and corrected for certain essential sectors being exempt from this policy.[83] • **Outcomes**: The economic consequences of the lockdown policy became immediately apparent, with almost two million workers, or more than every third worker in Switzerland, being put on short-time work[m] within six weeks of the policy's implementation.[84] ○ The analysis revealed that 31% of jobs in Switzerland have been potentially restricted by the lockdown policy, with the strongest effects for the large industries of hospitality, construction, and arts and entertainment. Some regional variation was

[k] The study reported figures of 21.6094 billion CNY, 36.39661994 billion CNY, and 177.0413 billion CNY. All CAD amounts were calculated using PPPs as published by the OECD for 2019 (1 Chinese yuan [CNY] = 0.339 CAD) (OECD, 2019).
[l] The study reported figure of 30 billion CNY. All CAD amounts were calculated using PPPs as published by the OECD for 2019 (1 Chinese yuan [CNY] = 0.339 CAD) (OECD, 2019).
[m] In Switzerland, short-time work is where employees can be asked to reduce their working hours if a business temporarily has too little or no work (Swiss Authorities, n.d.).

Jurisdiction	Type of Evidence/ Study	Article	Reported Outcomes of Lockdown Interventions
			found. Low- and middle-income individuals are considerably more restricted than high-income ones. There were no meaningful differences between men and women or urban and rural areas.[85] ○ The report suggested the lockdown index explains the increase in short-time work and unemployment that took place in regional districts and across industries until the end of April 2020, which explains up to 58% of short-term employment outcomes.[86]
US – New York	• Modelling study	Impact of COVID-19 on Economic Output of the US Outbreak's Epicenter, July 21, 2020	• **Timeline**: First case confirmed March 1, 2020 and case count grew to 416,769 by June 28, 2020. This occurred despite multiple protective measures put in place, including declaring a state of emergency, closing schools, restricting mass gatherings, and issuing stay-at-home orders for the entire New York state.[87] • **Study Design**: Two-step Vector Auto Regression (VAR) model to forecast the effect of the virus outbreak on the economic output of the New York state (i.e., GDP) using data from the Unemployment Insurance Claim series and public transit ridership to indicate economic activity.[88] • **Finding**: The study predicts annualized quarterly growth rate of real GDP to be between -3.99 to -4.299% for the first quarter and between -19.79 to -21.67% for the second quarter of 2020.[89]
US – San Francisco	• Modelling study	Socio-economic impacts of COVID-19 on household consumption and poverty, July 2020	• **Objective**: This study used the San Francisco Bay Area as a case study to estimate the direct impact of lockdown measures (i.e., assuming a shelter-in-place period of three months) on household income, savings, consumption, and poverty.[90] • **Method**: The model assumes two periods: 1) a crisis period during which some individuals experience a drop in income and can use their savings to maintain consumption; and, 2) a recovery period, when households save to replenish their savings.[91] • **Findings**: The poverty rate would temporarily increase from 17.1% to 25.9% in the Bay Area in the absence of social protection, and the lowest income earners would suffer the most.[92] ○ If fully implemented, unemployment insurance and federal funding (i.e., the Coronavirus Aid, Relief, and Economic Security Act) could keep the increase in poverty close to zero and reduce the average recovery time for individuals who suffer an income loss, from 11.8 to 6.7 months. However, certain communities are more affected than the average and could take more than a year to recover.[93]
Vietnam	• Cross-sectional study	Evidence of Covid-19 Impacts on Occupations During the First Vietnamese National Lockdown, 2020	• **Timeline**: 1 April 2020: The first "social isolation" was implemented including strictly enforced contact tracing, quarantine, and the closure of all non-essential businesses for at least two weeks.[94] • **Study Design**: A web-based survey was conducted April 7 to 14, 2020, including 1,423 respondents from 63 cities and provinces in Vietnam.[95] • **Outcomes**: Approximately two-thirds of respondents reported decreases in their income (61.6%), and 28.2% reported that their income deficit was 40% and above. The percentage of women having decreased revenue due to COVID-19 was higher than that of male respondents (65.2% and 54.7%, respectively).[96]
44 countries	• Modelling study	The Economic Cost of COVID Lockdowns: An Out-of-Equilibrium Analysis, June 19, 2020	• **Study Design**: The model used in the study is calibrated to the world economy using input-output data on 56 industries in 44 countries, including all major economies. Within the model, the lockdowns are implemented as partial reductions in the output of some sectors using data on sectoral capacity reductions and replicate the temporal sequence of the lockdowns implemented in different countries.[97]

Jurisdiction	Type of Evidence/ Study	Article	Reported Outcomes of Lockdown Interventions
			• **Findings**: the world output fell by 7% at the early stage of the crisis, when only China was under lockdown, and by 23% at the peak of the crisis, when many countries were under a lockdown. These direct impacts are amplified as the shock reverberates through the world economy because of international trade relations.[98] • Process of economic recovery following the end of the lockdowns: Price flexibility and minor technological adaptations help reduce the time it takes for the economy to recover. The study suggests that the world economy will take about a quarter of the year to move towards the new equilibrium in the optimistic and unlikely scenario of the end of all lockdowns. Recovery time is likely to be significantly greater if partial lockdowns persist.[99]

Table 3: Evidence on the Economic Impacts of Other Types of COVID-19 Interventions[n]

Jurisdiction(s)/Article	Type of Study	Type of Intervention	Findings
United States Epidemiological and Economic Impact of COVID-19 in the US, November 30, 2020	• Modelling study (pre-print)	• This research measures the epidemiological and economic impacts of COVID-19 spread in the US under different mitigation scenarios, which comprise non-pharmaceutical interventions (NPIs) (i.e., social distancing measures, such as stay-home orders, voluntary home isolation of symptomatic individuals, and school closures).[100]	• **Results**: Trade-offs between economic losses and the lives saved and infections averted are non-linear in relation to compliance with social distancing and the duration of lockdown. Sectors that are worst hit are not the labour-intensive sectors, such as agriculture and construction, but professional services, even after teleworking is accounted for.[101] ○ There is also a trade-off between duration of the lockdown and the rate of compliance to NPIs. If people are non-compliant to NPIs, public health policymakers can increase the duration of the lockdown to get the same level of results in terms of infections and deaths averted.[102] ▪ The best outcome is reached when the lockdown lasts for 30 days and the public's compliance rate is at least 80%.[103]
Sweden, Denmark, Finland, Norway, and New Zealand Statistical Analyses of the Public Health and Economic Performance of Nordic Countries in Response to the COVID-19 Pandemic, November 24, 2020	• Statistical analysis (pre-print)	• Compared stringency levels of mandated social distancing (SD) measures (including border closures).[104]	• **Overview**: The analysis used public data on COVID-19 in terms of confirmed cases, fatalities, testing, the stringency of mandated SD measures (including border closures) to determine if there is a statistical difference between the approach taken by Sweden as compared to the approaches used in Denmark, Finland, Norway, and New Zealand.[105] ○ Comparing Levels of Stringency[o] of Government-mandated SD Measures: New Zealand had the highest level of stringency in its first outbreak in March and May at levels approaching 100. By contrast, Sweden had the lowest stringency level over the March-May period of between 40 and 50; Norway had stringency levels as high as 80; and, Denmark and Finland had levels, respectively, of approximately 70 and 60.[106] • **Findings**: 1) An early imposition of international travel restrictions, combined with high levels of government-mandated stringency of SD, reduced the per capita cases and per capita fatalities associated with COVID-19 in the selected countries; and, 2) in Nordic countries, less stringent government-mandated SD has not been associated with higher quality economic growth.[107]
Denmark and Sweden Strict Lockdown Versus Flexible Social Distance Strategy for COVID-19	• Cost-effectiveness analysis	• Compared the costs and effects associated with a strict lockdown (i.e., in Denmark) and a flexible social distancing strategy (i.e., in	• **Design**: Cost-effectiveness analysis using societal data and COVID-19 mortality rates from the public domain from Denmark and Sweden. Expected economic costs were derived from GDP statistics from each country's official statistics bureau and forecasted GDP. The incremental financial costs of the strict lockdown in Sweden and Denmark were calculated using externally available market information. Calculations were

[n] The information in this table was compiled by the Evidence Synthesis Unit, RAEB. The information captured in Table 2, Table 3 and Table 4 was identified in PubMed, Google, Google Scholar, medRxiv and other websites including the IMF, OECD, and World Bank but not Econolit.
[o] In this study, the stringency of government-mandated SD measures are assessed using an aggregate of the sub-indices C1-C8, E1 and H1-H3 from the University of Oxford Coronavirus Government Response Tracker (for details see https://www.bsg.ox.ac.uk/research/researchprojects/coronavirus-government-response-tracker), with 100 being the highest level of stringency (Gordon, et al., 2020).

Jurisdiction(s)/Article	Type of Study	Type of Intervention	Findings
Disease: A Cost-Effectiveness Analysis, September 18, 2020		Sweden) in response to COVID-19.[108]	projected per one million inhabitants.[109] • **Main outcome measure**: Financial costs per life years saved.[110] • **Results**: In Sweden, the number of people who died with COVID-19 was 577 per million inhabitants, resulting in an estimated 6,350 life years lost per million inhabitants. In Denmark, where a strict lockdown strategy was installed for months, the number of people dying with COVID-19 was on average 111 per million, resulting in an estimated 1,216 life years per million inhabitants lost. The incremental costs of strict lockdown to save one life year was CAD $164,742, and higher in most of the sensitivity analyses.[111,p] • **Conclusions:** Comparisons of public health interventions for COVID-19 should account for life years saved and not only lost lives. Strict lockdowns cost more than CAD $156,000 per life year saved.[112,q] ○ The analysis also shows that the more liberal Swedish policy, despite its higher mortality rates, is acceptable in terms of cost-effectiveness and when the absolute number of COVID-19 related deaths is assessed.[113]
77 countries Economic Impact of Government Interventions During the COVID-19 Pandemic: International Evidence from Financial Markets, June 2020	• Empirical analysis	• Government-imposed social distancing	• **Overview**: Daily data collected from 77 countries between January 22 and April 17, 2020 suggests that the announcements of government impositions of social distancing measures adversely impact economic activity and have a direct negative effect on stock market returns. However, they have an indirect positive effect through the reduction in COVID-19 confirmed cases. Government announcements regarding public awareness programs, testing and quarantining policies, and income support packages largely result in positive market returns.[114]
Brazil COVID-ABS: An Agent-Based Model of COVID-19 Epidemic to Simulate Health and Economic Effects of Social Distancing Interventions, Available online July 7, 2020	• Modelling study	• Compared seven different social distancing scenarios	• **Objective**: The study proposes a model that simulates the pandemic dynamics using seven different social distancing scenarios to various epidemiological and economic effects: 1) no interventions; 2) lockdown; 3) conditional lockdown; 4) vertical isolation (i.e., infected people and vulnerable populations [e.g., elderly and people with pre-existent conditions] are kept in social isolation); 5) partial isolation; 6) use of face masks; and 7) use of face masks together with 50% adhesion to social isolation.[115] ○ The COVID-ABS model was implemented in Python programming language with source code that is publicly available.[116] • **Result**: ○ Health Outcomes: The model demonstrated that lockdown and conditional lockdowns were the best at preserving lives. These scenarios present a slower evolution of the epidemic and smaller numbers of infections and deaths. Given the challenges of implementing lockdown policies, the scenario with 50% of social isolation with using

[p] The study reported figure of US$ 137,285. All CAD amounts were calculated using PPPs as published by the OECD for 2019 (1 US dollar [USD] = 1.2 CAD) (OECD, 2019).
[q] The study reported figure of US$ 130,000. All CAD amounts were calculated using PPPs as published by the OECD for 2019 (1 US dollar [USD] = 1.2 CAD) (OECD, 2019).

Jurisdiction(s)/Article	Type of Study	Type of Intervention	Findings
			masks and physical distancing was the best approach in the preservation of lives. On the other hand, the vertical isolation scenario is ineffective and resembles the "do nothing" scenario.[117] ○ Economic Outcomes: The model demonstrated that governments that chose to preserve the economy by using less severe isolation policies, fatally reached a situation with a high cost in human lives, and still suffered economic losses.[118]
Iceland, Greece, New Zealand, and Singapore The COVID-19 Pandemic in Greece, Iceland, New Zealand, and Singapore: Health Policies and Lessons Learned, Available online August 28, 2020	• Document analysis, comparative	• Comparison of medium-level interventions (i.e., self-isolation, closing non-essential business, travel bans, and technological innovations)	• **Interventions for New Zealand, Greece, Iceland and Singapore**: All four countries implemented medium-level interventions (i.e., self-isolation, closing non-essential business, travel bans, and technological innovations) to contain the spread relatively soon after the first case was identified. Containment measures increased in strictness for New Zealand at the peak of daily cases, while Singapore escalated measures as the daily cases began to increase. In all four countries, economic interventions began to be introduced approximately 20 days after the first case was identified. An incremental approach was adopted in each of the four countries as they transitioned from strict to slightly less strict and eventually to no interventions.[119] Details for these and other country-level responses can be found here. Some examples include: ○ Singapore: Singapore implemented hygiene and border control measures swiftly, before focusing on tracing contacts of confirmed cases. In addition, Singapore implemented fines up to $10,000[r] and six months in prison for breaking quarantine. Compared to the other three nations, Singapore has focused on the use of technology to help manage the spread and increase citizens' awareness of crowded places and social distancing measures.[120] ○ Iceland: Iceland never declared a full lockdown. Instead, the number of people able to meet was restricted to a maximum of 20. There was also a focus on containment and protecting health systems before implementing stimulus packages. Iceland created a testing policy for anyone to be tested free of charge.[121] • **Findings**: Each country, with its distinct demographic, epidemiological, socioeconomic profiles, managed to control the pandemic at an early stage in terms of limiting the total number of positive cases. The four countries managed to absorb the health system shock and decrease the case fatality ratio of COVID-19.[122] The pandemic triggered several economic stimulus and relief measures in the four countries; the impact or the economic rebound is yet to be fully observed but the following macroeconomic indicators are reported: ○ Gross Domestic Product: The economies of Iceland and Greece have shown the largest contraction with a decrease of approximately 10% in 2020-Q1 compared to 2019-Q4.[123]

[r] Currencies were not used in the article.

Jurisdiction(s)/Article	Type of Study	Type of Intervention	Findings
			○ Exports & Imports: Exports and imports fell dramatically in New Zealand, Greece, Iceland, and Singapore in the first quarter of 2020.[124] ○ Unemployment Rate: Fluctuations in the unemployment rate were identified in all four countries.[125] ○ Inflation Rate: There were decreases in the inflation rates in all four countries.[126] ○ Exchange Rate and Currency: The local exchange rates per $US in New Zealand, Greece, Iceland, and Singapore have increased dramatically during the lockdown. Government bond yields, both short-term and long-term, continue to drop by the end of July 2020 due to persistent concerns about the COVID-19.[127]
38 countries Which Countries Have Protected Both Health and the Economy in the Pandemic?, September 1, 2020	• Data analysis (Our World in Data)	• Various	• **Economic decline**: This analysis demonstrates the economic decline across 38 countries in the second quarter of 2020 (for which the latest GDP data is available) as compared to the second quarter in 2019.[128] ○ Spain, the UK and Tunisia: The output of the economy was more than 20% smaller than in the same period in 2019. This is four to five times larger than any other quarterly fall on record for these countries.[129] ○ Taiwan: GDP was less than 1% lower than in the same period in 2019.[130] ○ Finland, Lithuania, and South Korea: GDP declines were around 5% or less.[131] • **Health-Economy Trade-off**: Countries that suffered the most severe economic downturns (i.e., Peru, Spain, the UK) are generally among the countries with the highest COVID-19 death rates. Further, countries where the economic impacts have been modest (e.g., Taiwan, South Korea, Lithuania) have kept the death rates low.[132] ○ The economies of the US, Sweden, Denmark and Poland contracted by approximately 8-9%, but the death rates are markedly different: the US and Sweden have recorded five to 10 times more deaths per million than are reported by Denmark and Poland.[133]
United States Economic Evaluation of Influenza Pandemic Mitigation Strategies in the US Using a Stochastic Microsimulation Transmission Model, 2008	• Modelling study	• Comparing 17 strategies, including targeted antiviral prophylaxis (TAP) alone and in combination with school closures as well as pre-vaccination	• **Objective**: To project the potential economic impact of pandemic influenza mitigation strategies from a societal perspective in the US.[134] • **Methods**: A stochastic agent-based model to simulate pandemic influenza in the community comparing 17 strategies, including TAP alone and in combination with school closures as well as pre-vaccination (i.e., with a low-efficacy vaccine).[135] • **No Intervention**: In the absence of an intervention, the study predicts a loss to society of a 50% attack rate with an economic impact of CAD $224 per capita.[136,s] ○ Other Interventions: Full TAP is the most effective single strategy, reducing the number of cases by 54% at the lowest cost to society (CAD $152 per capita). Pre-vaccination reduces number of cases by 48% and is the second least costly alternative (CAD $168 per capita). Adding school closures to full TAP or pre-

[s] The study reported figure of US$187. All CAD amounts were calculated using PPPs as published by the OECD for 2019 (1 US dollar [USD] = 1.2 CAD) (OECD, 2019).

Jurisdiction(s)/Article	Type of Study	Type of Intervention	Findings
			vaccination further improves health outcomes but increases total costs to society by approximately CAD $3,240 per capita.[137,t]

[t] The study reported figure of US$127, US$140 and US$2,700. All CAD amounts were calculated using PPPs as published by the OECD for 2019 (1 US dollar [USD] = 1.2 CAD) (OECD, 2019).

Table 4: Findings from the Grey Literature[u]

Article	Type of Study	Focus	Findings
Canada Economic Impact of the COVID-19 Pandemic on Canadian Businesses Across Firm Size Classes, August 19, 2020	• Report, Statistics Canada	• Impact on businesses	• **Objective**: This Statistics Canada report examines the impact of COVID-19 on the economic activity of Canadian businesses across firm size classes (i.e., small, medium, large).[v] ○ Disruptions due to economic restrictions and social distancing measures are expected to have large negative effects on small and medium-sized firms such as travel- and tourism related industries (e.g., restaurants, accommodation, entertainment).[138] • **Methods**: Two measures of economic activity were analyzed: 1) economic activity (i.e., actual hours worked); and, 2) real output (i.e., GDP).[139] • **Findings**: Hours worked for small firms declined by 9.4% in the first quarter of 2020, compared with an overall decline of 5.6% in the business sector in that quarter. Real output declined by 2.1% in small firms in the first quarter of 2020, while it declined by 1.7% in the business sector in the first quarter. The declines in hours worked and real output among small firms were larger in the service sectors that in the goods sector. [140] • **Conclusion**: Small firms were among the hardest hit by the COVID-19 pandemic for the first quarter of 2020.[141]
52 countries World Economic Outlook, Oct 2020	• Report, International Monetary Fund (IMF)	• Understanding the impact of lockdown on economies	• **Objective**: This IMF report analyzed the economic activity of 52 advanced, emerging market, and developing economies during the first seven months of the pandemic.[142] • **Findings**: By examining the cross-country association between lockdowns and economic activity across a broad sample of countries, the analysis found that countries that endured more stringent lockdowns experienced larger growth declines relative to pre–COVID-19 forecasts, even after controlling for the severity of the local epidemic.[143] ○ Effect of Lockdown and of Voluntary Social Distancing: The adoption of lockdowns (e.g., closing schools and business activities, preventing people from leaving their homes apart from essential reasons) was an important factor in the recession, but voluntary social distancing in response to rising infections also contributed substantially to the economic contraction. The analysis suggests that lockdowns and voluntary social distancing played a near comparable role in driving the economic recession.[144] ○ Easing Lockdowns in High-Infection Periods: Although easing lockdowns can lead to a partial recovery, economic activity is likely to remain subdued until health risks abate. This is true especially if lockdowns are lifted when infections are still relatively high because, in those cases, the impact on mobility appears more modest. The analysis documents that easing lockdowns tends to have a positive effect on mobility, but the impact is weaker than that of tightening lockdowns.

[u] The information in this table was compiled by the Evidence Synthesis Unit, RAEB. The information captured in Table 2, Table 3, and Table 4 was identified in PubMed, Google, Google Scholar, medRxiv and other websites including the IMF, OECD, and the World Bank but not Econolit.
[v] Firms are classified by their employment: small firms have 0 to 99 employees; medium-sized firms, 100 to 499 employees; and large firms, 500 or more employees (Statistics Canada, 2020).

Article	Type of Study	Focus	Findings
			These findings suggest that economies will continue to operate below potential while health risks persist, even if lockdowns are lifted.[145] ○ Supports Needed: Policymakers should be wary of removing policy support too quickly and consider ways to protect the most vulnerable and support economic activity consistent with social distancing. These may include measures to reduce contact intensity and make the workplace safer, for example by promoting contactless payments; facilitating a gradual reallocation of resources toward less-contact-intensive sectors; and enhancing work from home, for example, by improving internet connectivity and supporting investment in information technology.[146] • **Conclusion**: Despite involving short-term economic costs, lockdowns may lead to a faster recovery by containing the spread of the virus and reducing the need for voluntary social distancing, possibly having positive overall effects on the economy.[147]
OECD countries Evaluating the Initial Impact of COVID-19 Containment Measures on Economic Activity, June 2020	• Report, OECD	• Effects of the initial direct impact of shutdowns	• **Objective**: This OECD report provides estimates of the initial direct impact of shutdowns based on an analysis of sectoral output and consumption patterns across countries and an assumption of common effects within each sector and spending category in all countries.[148] • **Findings**: The initial direct impact of the shutdowns could be a decline in the level of output of between one-fifth to one-quarter in many economies, with consumers' expenditure potentially dropping by around one-third. The impact of the shutdowns will weaken short-term growth prospects substantially. The scale of the estimated decline in the level of output is such that it is equivalent to a decline in annual GDP growth of up to two percentage points for each month that strict containment measures continue. If the shutdown continued for three months, with no offsetting factors, annual GDP growth could be between four to six percentage points lower than it otherwise might have been. There are two approaches to evaluating the potential direct impact effects of widespread shutdowns: ○ The Output Approach: This approach identified sectors most directly affected by containment measures including: 1) service sectors (i.e., tourism, hairdressers); 2) retailers (e.g., restaurants, cinemas); 3) non-essential construction work; and, 4) manufacturing sectors (e.g., transport equipment). The affected sectors account for between 30-40% of total output in most economies in which the initial hit to the level of GDP was between 20-25% in many advanced economies. The impact on annual GDP growth would depend on how long these measures remain in place. ○ The Spending Approach: This approach looks at detailed categories of consumer spending most directly affected by containment measures including: 1) decreased spending on clothing and activities involving direct contact between consumers and businesses (e.g., clothing, footwear, household furnishings, package holidays, car purchases, hairdressing); and 2) spending on recreational services (e.g., local travel, restaurants, hotels). The overall direct initial hit to the level of consumer spending could be around one-third in many major advanced economies after the full implementation of confinement measures.[149,w]

[w] The calculations are based on an assumption of an economy-wide reduction in spending, rather than a reduction confined to particular regions.

Article	Type of Study	Focus	Findings
			• **Conclusion**: The implications for annual GDP growth will depend on many factors, including the magnitude and duration of national shutdowns, the extent of reduced demand for goods and services in other parts of the economy, and the speed at which significant fiscal and monetary policy support takes effect.[150]
OECD countries The Economic Impacts of Learning Losses, September 2020	• Report, OECD	• Economic effects of lost learning	• **Objective**: This OECD report suggests plausible ranges for the economic impact of existing and on-going losses in learning based on existing economic research.[151] • **Findings**: There are two implications related to long-term economic costs: 1) affected students whose schooling has been interrupted by the pandemic face long-term losses in income; and, 2) national economies with a less skilled labour force (due to loss of learning) face lower economic growth which subtracts from the overall welfare of society.[152] ○ Based on losses associated with one-third of a year school closure, estimates indicate that current students will suffer 2.6% loss in income across their entire career. The estimated losses for this one-third year closure exceed 3% in US and 5.6% in Singapore.[153] • **Conclusion**: Most of the public and governmental attention has focused on short run issues of unemployment and business closures. However, the economic losses from 1/3 year of learning range from an estimated economic downturn range from CAD $605 billion in South Africa to CAD $18.6 trillion in China. If the disruption turns out to be greater, these losses grow proportionately.[154,x]
Asia and the Pacific Economic Impact of COVID-19 Implications for Health Financing in Asia and Pacific, September 2020	• Discussion paper, World Bank Group	• Economic impacts in Asia and the Pacific	• **Objective**: This report summarizes some of the projected collateral economic damage expected to result from COVID-19 with data sources from the World Bank and IMF.[155] • **Findings**: Lockdown interventions (i.e., closure of schools and nonessential businesses; limitation on retail activities; cross-border travel and trade restrictions; and social distancing mandates for public events) have resulted in most countries experiencing lower levels of GDP, rising unemployment, higher levels of impoverishment, and increasing income inequality.[156] ○ Affect of Lockdowns: Some countries are more vulnerable to the economic challenges resulting from COVID-19, including those implementing more stringent lockdowns and those that are more globally integrated due to their dependence on trade, tourism, and remittances.[157] ○ Declining Revenues: Government revenues have also declined, government borrowing is increasing, and public debt levels are projected to skyrocket globally.[158]
Europe and Central Asia The Sooner, The Better: The Early Economic Impact of Non-Pharmaceutical Interventions During the	• Policy research working paper, World Bank Group	• Early economic impacts of NPIs	• **Objective**: This paper provides estimates of the economic impacts of the NPIs (e.g., lockdowns, social distancing measures, testing and contact tracing) implemented by countries in Europe and Central Asia over the initial stages of the COVID-19 pandemic.[159] • **Findings**: The results suggest that NPIs led to approximately a 10% decline in economic activity across the region. On average, countries that implemented NPIs in the early stages of the pandemic

[x] The study reported figures of US $504 billion and US $15.5 trillion. All Canadian Dollar (CAD) amounts were calculated using Purchasing Power Parities (PPPs) as published by the Organisation for Economic Co-operation and Development (OECD) for 2019 (1 US dollar [USD] = 1.2 CAD). PPPs are the rates of currency conversion that eliminate the differences in price levels between countries (OECD, 2019).

Article	Type of Study	Focus	Findings
COVID-19 Pandemic, May 2020			appear to have better short-term economic outcomes and lower cumulative mortality, compared with countries that imposed NPIs during the later stages of the pandemic.[160]
62 countries The Economic Effects of COVID-19 Containment Measures, August 2020	• Working paper, IMF	• Global economic effects of containment measures	• **Objective**: This paper quantifies the effects of containment measures (e.g., school closures and workplace closures, cancellation of public events, stay-at-home orders) using daily global data on real time containment measures and indicators of economic activity, such as nitrogen dioxide emissions, energy consumption, flights, maritime trade, and mobility indices.[161] • **Findings**: Containment measures have had, on average, very large impacts on NO2 emissions, with the decline in emissions levels equivalent to a loss of about 15 percent in industrial production over the 30-day period following the implementation of the containment measure. Results for other indicators of economic activity suggest that containment measures have had a very large adverse impact on flights worldwide, energy consumption, maritime trade, and retail and transit mobility.[162] ○ Effects among different types of containment measures: Workplace closures, stay-at-home orders, and cancellations of events are of the more effective in flattening COVID-19 related infections but are the costliest in terms of their impact on economic activity. Less costly containment measures, such as international travel restrictions, are nonetheless successful in reducing COVID-19 infections.[163]
United States Evaluating the Effects of the Economic Response to Covid-19, August 2020	• Report, The Council of Economic Advisers	• Effects of economic policies in the US	• **Objective**: This report evaluated the effects of economic policies as well as documenting the impact of social distancing measures (i.e., school closures, bans on group gatherings, restaurant closures) on the US economy.[164] • **Timeline**: March 23: Statewide school closures and restrictions on bars and restaurants had affected over 90% of the US population. March 30: Thirty states had issued stay-at-home orders, with an additional 13 States having issued these orders in parts of the State. Early April: Over 90% of the US population lived in a State that had issued a stay-at-home order.[165] • **Findings**: ○ Microeconomic: Daily credit card spending started plunging in mid-March, bottomed out at -30 percent year-over-year growth rate at the end of March, and has since recovered to slightly above zero percent growth in June 2020. After shelter-in-place orders became widespread in mid-March, the number of employees working fell from about 15 percent below normal conditions to about 55 to 60 percent below normal conditions.[166] ○ Macroeconomic: The OECD estimates that the COVID-19 pandemic and containment measures will decrease US real GDP by 7.3 percent in 2020 in the absence of a second wave in the fall, or 8.5 percent if such a wave does occur.[167]

Table 5: Public Health Interventions from Canadian Provinces[168,y,z]

Provinces across Canada implemented public health strategies at a provincial level and then additionally by regions that were deemed high risk based on particular indicators (e.g., case counts, hospitalizations and deaths) and required additional measures. Policies such as mandatory masking, limits on social gatherings and gatherings in licensed establishments were consistent with current Ontario policies.

Common themes across public health strategies implemented by Canadian provinces include:

- Regional travel restrictions: for example, Manitoba and Quebec restricts travel to and from other regions of the province
- Visitor restrictions to long-term care homes: for example, Nunavut and Saskatchewan have restricted visitors to long-term care homes
- Extension on school breaks before or after Christmas break: Alberta and Manitoba have extended online learning for middle/high school (Grade 7–12) aged children

Additional public health measures that were unique or different than that of the Ontario context is described below in Table 5.

Province or Territory	Detailed Public Health Intervention
British Columbia	• On November 10, 2020, two health authorities (Fraser and Vancouver Coastal) had an order from the provincial health officer to prohibit certain activities (e.g., banquet halls from operating). • On November 13, 2020, the above health authorities has additional orders from the provincial health officer to prohibit more activities (e.g., indoor fitness activities and sports). • On November 19, 2020, province-wide restrictions on suspension of all events and gatherings related to social interactions and travel until December 7, 2020.
Alberta	• On November 24, 2020, Alberta announced mandatory restrictions at multiple geographical levels, all of Alberta, areas that require enhanced public measures, and the Calgary and Edmonton areas. Unique measures that apply to the above areas include: ○ Grade 7–12 at home learning from November 30–January 11, and early childhood services-Grade 6 at home learning after Christmas break to January 11.
Saskatchewan	• On November 19, 2020 the following unique public health measures were implemented province-wide: ○ Visits to long-term and personal care homes suspended except for compassionate reasons, no alcohol sales after 10pm in licensed establishments, entertainment transportation no longer permitted.

[y] The information in this table was compiled by Ontario Health (Quality) in the report Public Health Interventions Targeting the Management of Spread of COVID-19: A Jurisdictional Scan (December 4, 2020). Information about Ontario (i.e., "Unique Public Health Interventions by Ontario Public Health Units" and "Ontario Public Health Units COVID-19 Public Health Interventions") was not included in this briefing note.

[z] Based on the nature of this type of report, the impact of each intervention is not easily discernable. To determine the effectiveness of interventions, the timing of implementation would have to be aligned to the timing of case counts, deaths or hospital utilization increasing or decreasing, which is beyond the scope of this preliminary jurisdictional scan. There are two reports which try and address this completed by Public Health Ontario on community-based public health interventions and lockdown public health measures.

Province or Territory	Detailed Public Health Intervention
	• On November 27, 2020, additional public health measures were implemented province-wide (e.g., restrictions on capacity at restaurants, places of worships, etc.).
Manitoba	• On November 12, 2020, the province entered the critical phase of their provincial response with unique measures including restriction of travel to and from Northern Manitoba. • The five regions of Manitoba have added restrictions in response to outbreaks (e.g., visitor restrictions at long-term care homes) within their own regions. • On December 2, 2020, have announced additional public health measures stating that students in grades 7–12 will have to do remote learning from January 4th- 15th and children in kindergarten to Grade 6 will have the choice to do in-class or remote learning.
Quebec	• The province has individual alert levels by municipality , some points in their restrictions include: ○ Yellow- Alert level 2 (low restrictions) has a maximum of 10 people gathering indoor or outdoor; ○ Orange-alert level 3 travel between regions and cities is not recommended and indoor or outdoor gatherings are limited to 6 people. Places of worship up to 250 people allowed; and ○ Red-alert level 4 (maximum) no visitors or gatherings from another address unless a single person. Not recommended to travel to other zones or outside the province. School classes are now limited to only one cohort and different classes must stay distanced.
New Brunswick	• The province is split into seven zones for individualized response alert levels. As of November 27, 2020 Moncton, Saint John, and Fredericton regions are in orange level and the rest of the province yellow: ○ Orange-level regions are recommended to only travel for essential reasons such as for work, school and medical appointments, public transit must maintain 1 meter distance between riders and while most facilities are allowed to be opened there are restrictions such as gym locker rooms are closed.
Nova Scotia	• Few limits for the majority of the province with gatherings permitted with some guidance about number of individuals with/out distancing required. Back to school plans include mandatory masking and maximum spacing of individuals. • Additional restrictions in place as of November 26, 2020 for Halifax and Hants counties; e.g., limiting groups to five, and closing many services. • Individuals do not have to self-isolate if traveling from another Atlantic Canadian province.
Prince Edward Island	• As of October 1, 2020 PEI is in green level: new normal which includes some restrictions such physical distancing, and cohorts of 50 people at large gatherings. • As of November 24, 2020 the Atlantic bubble for travel has been suspended and a 14 day self-isolation is required upon entry into the province.
Newfoundland and Labrador	• Policies are implemented on a province-wide scale, and as of June 25, 2020 were at Alert level 2 where most facilities are open and gatherings are permitted with few limitations: ○ Restrictions were loosened from the April 30th alert level 4 restrictions. ○ An education re-entry plan was created as of September 3, 2020. ○ As of November 25th, the Atlantic bubble for travel has been suspended and a 14 day self-isolation is required upon entry into the province.
Nunavut	• The province is broken into four sub-regions, with individualized guidance for Sanikiluaq Rankin Inlet, Kivalliq, Baffin and Kitikmeot • Restrictions on gatherings and business that are allowed to operate. • As of November 18, 2020: ○ Travel between regions is restricted to medical emergency only; ○ Schools including Nunavut Arctic college are remote learning and childcare is for essential workers only; and

Province or Territory	Detailed Public Health Intervention
	○ LTC homes are closed to visitors.
Northwest Territories	• Northwest territories restricts travelers to only 4 communities to fulfill a 14-day self-isolation mandate before being allowed to travel to other regions. ○ As of January 5, 2021 the government will no longer be covering the costs of isolation centre stays related to discretionary or personal travel. • Dental services resumed on December 2, 2020. • Exposure notifications listing establishments with positive cases are made public on the government website.
Yukon	• As of August 1, 2020 Yukon is in Phase 3 (new normal) where some gatherings are permitted and all services remain open, with some restrictions such as number of individuals and distance requirements. ○ The region was in phase 0 (strict lockdown), followed by Phase 1 in May, and phase 2 in July, progressively lifting restrictions. The final Phase 4 is expected post-vaccine. • Economic and social supports including paid sick leave rebates for employers and relief funding program for select businesses • International school trips are cancelled, including to Alaska

Table 6: Public Health Interventions from International Jurisdictions[169]

Many countries have divided their nations into regions, and subregions for the implementation of a range of lockdown strategies similar to Ontario. Some common interventions seen were mandatory proof of negative COVID-19 test immediately before entering a region, closures and limits to mass gatherings, and self-isolation mandates. Some regions had government involvement in managing or monitored quarantines by providing quarantine facilities or large fines for breaking quarantine mandates (e.g., Taiwan).

A summary of findings is presented in Table 6; two main approaches to lockdowns emerged:[aa]

- Strict lockdowns until cases were reduced to, or near, zero followed by lifting measures and re-implementation of lockdown measures quickly, as needed. For example, Australia's state of Victoria limited travel to a 5km radius of the home and conducted a testing blitz in hard hit public housing. South Korea recently re-implemented some public health restriction strategies with just 24 cases per day.
- Progressively increasing restrictions as case counts, death counts and/or hospital utilization increased. One example is the recent creation of a three-tier system localized by postal code in England. Germany and the Netherlands have implemented extensions of ongoing strategies as a direct result of decreasing cases observed shortly after the implementation of the current level of restrictions.

Within these two general types of approaches taken by jurisdictions, there were differences in the specifics of the individual lockdown plans. Italy 'red' zones require online learning for high school and older students, France limits outdoor exercise to three hours, and there was media coverage that Slovakia conducted mandatory mass testing or mandatory strict limits on citizens on October 23-25, 2020 where individuals were not allowed to work unless they had proof of a negative test result or self-isolated for 10 days.

Province or Country	Detailed Public Health Intervention
Australia (State of Victoria)	• Certain postal code areas in Melbourne and Mitchell Shire, Victoria were in a strict lockdown for 112 days (e.g., restricting travel outside of the home to a 5 km radius, closing restaurants and retail spaces, mandatory masking outdoors and indoors, a testing blitz in hard hit public housing towers, etc.). This led to a reduction of cases from a peak of more than 700 daily cases in August to 0 active cases and allowed ease of public health measures. • On November 22, 2020, Victoria entered their last-step restrictions which includes masks indoors and allowing venues to reopen.
France	• On October 29, 2020 strict lockdown measures were introduced in metropolitan France and Martinique, where travel outside of the home is restricted to commuting to and from work or school (as well as taking children to school), business trips, medical appointments if it cannot be postponed or done virtually, essential family reasons, individual outdoor exercise within 20km radius and max three hours, and judicial summons. • Shops and services are open however bars, restaurants, cinemas, museums and gyms remain closed.

[aa] The information in this table was compiled by Ontario Health (Quality) in the report Public Health Interventions Targeting the Management of Spread of COVID-19: A Jurisdictional Scan (December 4, 2020). While searching international health authorities, the focus was limited to those countries considered most contextually relevant to the current Ontario context which is currently experiencing the second wave of the COVID-19 pandemic, and therefore this jurisdictional scan is not an exhaustive list and not inclusive of all OECD countries.

Province or Country	Detailed Public Health Intervention
Germany	• Public health measures implemented on November 1, 2020 had a goal of reducing physical contact in the population by 75%. Based on data obtained, the Helmholtz Center for Infection Research has been able to determine that these measures have reduced contacts by only 40%. Therefore, measures are extended, and depending on the state a person resides, some are being further tightened through December. ○ For example: Baden-Wurttemberg is implementing stricter measures and additional guidance for Christmas, Berlin has extended their "partial lockdown" until at least December 2, 2020.
Italy	• Similar to Ontario, Italy has a regional colour-coded (Yellow, Orange and Red) framework that has different public health measures. ○ Yellow Area: Shopping centres closed on weekends and public holidays, online schooling for high schools, bars and restaurants close at 6pm, sport centres are open. ○ Orange Area: Similar measures as the yellow area with the addition of bars and restaurants staying closed, travel in and out from one region or municipality to another is not allowed, amusement arcades, betting rooms are closed. ○ Red Area: Similar measures as the orange area with the addition of sport centres are closed, online schooling for all students except for kindergartens, primary schools and first year of middle schools.
Netherlands	• As of November 19, 2020, lockdown measures have been extended as infections numbers are decreasing and this has been attributed as a direct impact of the measures in place. As such gatherings are limited to 4, closure of restaurants and other places of gathering, funerals limited to 100 people and language around mask use mandatory for individuals over 13yrs except during lessons/lectures. • Children and teenagers *do not* have to stay apart from each other, however students of post-secondary education must (1.5 m.). • Upon a positive COVID-19 test result, all members of a household must stay home. • Public health reminders that everyone to keep a healthy lifestyle to boost the immune system.
Slovak Republic	• As of October 15, 2020, certain lockdown measures have been applied nationally, including dedicated grocery and drugstore hours for seniors over 65 years between 9 – 11 am Monday to Friday, and maximum one person per 15m^2 in a shop and all individuals must have a body temperature of less than 37°Celcius. • Quarantine is to be done in centralized state-run facilities unless a smart phone app is used in which case it can be done at home and mandatory testing for COVID-19.
South Korea	• As of November 30, 2020, South Korea is in their third wave of COVID-19 spread through the Seoul metropolitan area with approximately 24 new cases per day. As a result, they have enacted enhanced quarantine measures and increasing distancing to 1.5 – 2 metres from previous, and these measures are to be evaluated *within a week* to determine if lockdowns should be nationwide.
Taiwan	• Taiwan has put together resources for foreign media outlining what they did and how they were able to control the spread of COVID-19. Some interventions included: ○ Developing a national security program and strengthening epidemiological and surveillance response immediately. Taiwan's response began in December when information about pneumonia cluster in Wuhan China was circulation on social media. ○ Several regulations and government policies amended in response to SARS epidemic in 2003 to allow for fast action, including development of distribution chains. ○ Fines for failure to quarantine up to equivalent of CAD $45,300 and being placed at a designated facility for centralized quarantine. • Closed all levels of schools forcing an extended winter break. Parents and/or grandparents or other caregivers were eligible for family care leave if they had children under 12 years old.
United Kingdom	• Guidance individually developed for England, Wales, Scotland and Northern Ireland: ○ England: On December 2, 2020 a three-tier system for localized alerts was imposed, with regions identified by postal code look up on an NHS app, which also will be used for tracing, symptom check, and self-isolation monitoring.

Province or Country	Detailed Public Health Intervention
	○ Scotland: Alert levels created by postal code, the most restrictive level 4 requires you do not meet others in home but can meet up to six individuals in a public place where children under 12 do not count towards this. Restaurants and pubs are closed, and tourism accommodations are for essential customers only. Travel is restricted so those in level 3 or 4 local authorities do not travel to areas with lower restrictions. ○ Northern Ireland: As of November 27, 2020 there are additional restrictions to the entire regions including no gatherings at places of worship other than funerals and weddings, and wedding are not permitted in venues that can sell alcohol or provide accommodations.

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