Are Policies Alone Effective to Curb the Widespread of Covid-19? A Comparison of the US and Canada.

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Bachelor of Economics,
Covenant University, 2017

A PROJECT SUMBITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN ENVIRONMENTAL ECONOMICS AND MANAGEMENT

in the School of Business and Economics

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ABSTRACT

Rising incidents of covid-19 cases has become a primary concern of the government of the US and Canada. The US has the highest number of covid-19 cases in the world with 16, 549, 366 cases and 454,852 cases recorded in Canada as of December 12. The purpose of this paper is to examine policy effectiveness in curbing the widespread of Covid-19 in the US and Canada from February 1 to October 20. Using an observational study, this paper analyzed thirteen subcategories of policies, four aggregate indices, and social distancing attitudes of the polity used by the government of the US and Canada to reduce the spread of covid-19 in their nations. On April 1, when social distancing compliance and stringency index peaked in both countries, new cases per million and declined in the US and Canada. When economic reopening began in gradual phases in May, stringency index and social distancing compliance declined gradually while new cases per million in the US and Canada started rising on June 1. The results show that policies are effective to curb the widespread Coronavirus disease but there is a long lag period and these policies cannot be relaxed at any point in time if the objective is to contain the virus. Strict policies will be at the expense of hurting the economy. The dilemma facing the regulators is unprecedented. Furthermore, social distancing data show how political beliefs can present itself as a major limitation to the effectiveness of state or federal mandate to curb the widespread of the coronavirus. There is hope that vaccines will put an end to this miserable year.

Key words: Stringency Index; Social Distancing; Coronavirus (SARS-CoV-2 or Covid-19); Government Response; School Closure; New Cases Per Million.

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ACKNOWLEDGEMENTS

I wish to thank Dr. Panagiotis Tsigaris and Dr. Laura Lamb who are my supervisors for the project's conduction. I highly acknowledge their contribution to any success of this project and patient directions during my working time with them. I also would like to thank all the anonymous readers.

DEDICATION

This project is dedicated to my parents, brothers, sister, Heavymetal Family, Igwe, Owaa, Abhi and Mia.

For their countless love, motivation, inspiration and support

INTRODUCTION

In 2019, there were a number of events such as the Amazon forest burning, US-China trade wars, Brexit, and the impeachment of President Donald Trump by the US House (Lindsey, 2019). Meanwhile, the United Nations economic department predicted a 3.2 percentage of world economic growth in 2019 and 3.4 percentage in 2020 (IMF, 2019). However, On December 31st, 2019, the World Health Organization (WHO) was notified of a cluster of pneumonia cases with an unknown cause in Wuhan city, Hubei province of China" (Mishra, 2020). The virus known as Covid-19 or Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-COV-2) can cause severe respiratory illness (Singhal, 2020). The virus is spread by close contact, inhalation, or through respiratory droplets with a minimum incubation period of five to fourteen days (Madjid et al., 2020). The virus spread worldwide as a result of carriers traveling from country to country with or without knowledge of carrying the virus. The World Health Organization declared Covid-19 a world health emergency on January 30 when the virus had been reported in many countries. Moreover, China reported the first death from Covid-19 on January 9, and the Philippine is the first country outside China to report their first death from Covid-19 (Cruz & De Oliveira Dias, 2020). Honk Kong, Taiwan, France, and Iran reported their first death from covid-19 respectively while Italy was the second country to report a large cluster of confirmed cases (Cruz & De Oliveira Dias, 2020). The United States of America reported its first case of the Coronavirus on January 21st and Canada reported its first case on January 25th (Cruz & De Oliveira Dias, 2020). In February, countries like France, Canada, Germany, the US, Italy, UK, Hong Kong, and the Philippines resulted in extreme measures by imposing several policies to protect lives. Some of these policies were; gathering limits, movement restriction, school closure, closure of non-essential services, internal and foreign travel restrictions. There were 82,000 total cases and 2,858

deaths globally as of February 27 but as of today, the world has recorded 60,105,740 cases with 17,137,099 active cases and 1,414,868 deaths (Worldometer, 2020). The United States currently has the highest number of cases in the world with a total of 12,955,007 cases and 265,891 deaths recorded while Canada has recorded a total of 342,444 cases and 11,618 deaths (Worldometer, 2020). The predictions for 2020 show a 4.4 percentage decline in the world economy, 7.1 percent economic decline for Canada and 4.4 percent economic growth for the US (IMF, October 2020). As stated previously, the IMF before Covid was known was predicting a healthy economic growth for the world, Canada and USA. The IMF predicting a V type of recovery for 2021 but will take a few years to get to the steady state level without Covid-19 present.

These are different times that require difficult measures, but the measures taken by several countries have consequences on the economy. The stock market fell initially due to a selloff predicting a global economic recession. The economic downturn resulted in an unprecedented increase in the unemployment rate around the world, due to temporary shutdown of businesses, and supply chain disruptions and other economic and social restrictions.

Public sentiment about such policies plays a major role in the effectiveness of policies. People who view policies as not important or outrageous measures by their leaders are less likely to follow the guidelines or perceive a risk associated with disobedience. Public perception of being infected with the virus is directly inked with their obedience to social distancing rules (De Neys et al., 2020). The president of the US, president Donald Trump made a series of comments about the virus which negatively impacted or presented a new view to the public about the virus most particularly supporters of the Republican party were more likely to disregard the social distancing rule. Some

of the comments made by the president of the US, Donald Trump are; on June 17 he said “the pandemic is fading away and it is going to fade away”, the fourth of July he claimed “ninety-nine percent of Covid-19 cases are totally harmless”, and on the sixth of July he commented that “We now have the lowest mortality rate in the world” (Paz, 2020). Trumps decision to hold political rallies has been linked to over 250 cases per hundred thousand and indirectly over 700 deaths in the US (Bernheim et al., 2020). The case of Canada preaches another story where even if public opinion differs strict fines for the policy disobedience force public with different sentiments to follow the guidelines.

The outbreak of the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-COV-2) also known as Covid-19 has challenged healthcare systems globally with a wavelet effect on every aspect of human life. Movement restriction, quarantine, school closure, and border closure were all policies adopted by various governments to prevent widespread covid-19 cases. Some countries executed these policies with urgency and strict enforcement (e.g. South Korea, Hong Kong, Taiwan) while some delayed implementation and the effects are glaring (e.g., USA, Europe). The early implementation does not necessarily account for the success of these policies neither does early relaxation mean the major cause of a second wave. For example, the US had these policies in motion around the same time as their neighboring countries, but the US still overtook Italy and China to become the country with the highest number of Covid-19 cases. this study aims at comparing policy effectiveness in the US and Canada. The study gives an in-depth analysis of the various policies used by the government of the US and Canada as well as the effect of those policies.

This paper aims at comparing the effectiveness of the policies enacted by the government and health authorities of both countries in preventing the continuous spread of the virus, during the

January 1 to October 20 period. Policies examined include school closure, workplace closure, stay at home requirements, restrictions on internal movement, gathering restrictions. In addition, aggregate indices such as the stringency index, containment health, as well as economic support, government response were also explored. These policies and indices were drawn from Hale et al., (2020) OxCGRT SI version 6. Social distancing data was created using mobile data location pings to calculate distance between people and measure compliance levels across countries from the Institute of Health Metrics and Evaluation (IHME). An observational study approach was utilized, changes in social distancing, aggregate indices and new cases per million were observed. The results show that policies are effective to curb the widespread of the Coronavirus but cannot be relaxed at any point in time which causes a trade-off with the economy growing.

The remainder of this paper is organized as follows. Part 2 provides an insight into the existing literature on the effectiveness of policies, social distancing, and mask use. The methodology of this research is described in part 3. The results and conclusion on policy effectiveness and social distancing in Canada and the US comparison are discussed in part 4 and 5 respectively.

PART TWO

LITERATURE REVIEW

This literature review describes contemporary papers that explore how, and which policies reduced the impact and spread of the Coronavirus (Covid-19). It covers areas such as policy effectiveness, mask use, social distancing benefits, government behavior, the importance of information dissemination on covid-19, and public opinion across more than 20 countries like Italy, the US,

Canada, Korea, Germany, China, Thailand, France, Belgium, Sweden, and United Kingdom. In what follows an annotation of a number of papers are described.

A study conducted by Masters et al., (2020) characterized the social distancing behaviors of and risk perception across different age cohorts in the early phase of the pandemic utilizing an online survey of 713 participants, mostly composed of Caucasian Americans. The results showed a median 32 percent perception of risk. The majority of the U.S. adult population were practicing social distancing while a substantial minority of 35 percent were not. Social distancing was practiced more in older generations than in younger despite risk perception was lower in the older. In a similar study conducted by De Neys et al., (2020) surveys were utilized to obtain responses France, Belgium and Italy. They found that people's moral condemnation of social distancing and their obedience to social distancing rules is linked to their alleged perception of being infected by the virus. It was discovered that those who view the virus as less threatening are more likely to disobey social distancing rules and less likely to condemn such violations.

To estimate the effects of mitigation measures set by the Italian government, Vincentini et al., (2020) used the publicly available data to analyze changes in the growth of occupied beds in the Intensive Care Unit (ICU) between February 19, 2020, and April 9, 2020, post-implementation of mitigating measures. The mitigation measures are; school closure, the lockdown of the hotbed of the outbreak, containment measure, and travel restriction. The research concluded that the mitigation measures were effective in reducing the spread of Coronavirus (Covid-19). A similar study conducted by Da Silva, Tsigaris and Teixeira da Silva, (2020) found that containment policies measured by Hale et al., (2020) OxCGRT SI from the University of Oxford wre effective

in reducing the spread of Covid-19 in Italy between January 1, 2020, and October 13, 2020 but with a significant lag from policies to have an impact.

Abdollahi et al. (2020) used an age-structured agent-based simulation to assess the impact of school closure on the spread of the Coronavirus (Covid-19) in the province of Ontario, Canada. They divided the population into five age groups based on the Canadian census demographics and grouping individuals into various individual compartments; asymptomatic, pre-symptomatic, symptomatic (with either mild, severe, or critical), infected, and incubating. The results concluded that school closure was effective in reducing the spread rate by 7.2-12.7% when increased from 3 to 16 weeks. Another study conducted by Teslya et al. (2020) used a similar method but introduced social distancing and information dissemination into their model. They concluded that information dissemination about the Coronavirus (Covid-19) and government-imposed social distancing rules have been effective in reducing the attack rate of the virus.

Liang Xh et al., (2020) utilized publicly available data to analyze the impact of policies and containment measures imposed by the municipality of Chongqing to prevent and control the widespread of the Coronavirus (Covid-19). They concluded that strict enforcement of policies, containment measures, and social distancing was effective in reducing the spread of the virus and increased detection of incubating cases. A similar study conducted by Lai et al., (2020) examined the effectiveness of implemented policies to reduce the spread of the Coronavirus (Covid-19). Using publicly available data, they concluded that implemented policies led to a 7.5 percent reduction in the spread of cases. Lai et al., (2020) conducted a similar study that evaluated mitigation measures used in countries affected by the virus other than China. They concluded that

the policies were effective in reducing the spread of the Coronavirus (Covid-19) while Honk Kong, South Korea, Australia, Austria, and Switzerland were the most successful countries in the application of adopted policies to mitigate the spread of the Coronavirus (Covid-19).

Kuay et al., (2020) examined containment and mitigation measures adopted by 21 countries that included the U.S.A. and Canada. They utilized a scoping review method and concluded that the initial response of the US was slow that induced the disease rate to increase exponentially by the end of March. Parodi and Liu (2020) examined the importance of moving from containment to mitigation plan in the US. They finalized that the change to mitigation plan would help manage the spread in the face of challenges such as limited hospital supplies and limited available personnel.

Marino et al., (2020) estimated the effects of severe restrictions posed to human mobility and human to human contact to curb the spread of the virus in Italy. They utilized publicly available data with the Markov Chain Monte Carlo (MCMC) parameter estimation approach and Susceptible Exposed Infected Recovered (SEIR) diseases transmission model that included a network that represented the provinces of Italy. The study found that the lockdown measure was effective for reducing the transmission rate in Italy. Chinazzi et al., (2020) studied the effects of travel restrictions in the city of Wuhan, China, and 199 other countries. The study showed that travel restriction reduced international importation of the cases and also the spread of the disease to other mainland cities of china from ground zero.

Karaivanov et al., (2020) studied the effect of mandatory usage of face masks and other policies (non-pharmaceutical) on the spread of the disease in Canada. They utilized a panel data method with publicly available data from March to mid-August. They found that mask usage led to a reduction in the spread of disease in the first few weeks of implementation, and relaxed restrictions on businesses and schools were responsible for growth in the Coronavirus (Covid-19) cases. A similar study conducted by Mohammed et al., (2020) examined public compliance with mask usage and policy change regarding mask usage in Canada. The study found that Canadians have complied with changing policies on mask usage, and usage of face masks has increased drastically in Canada.

Migone (2020) studied the effect of policies aimed at containing the virus from January to June 2020. He analyzed the measures adopted by OECD countries, Some Asian countries, and some countries in Africa based on the availability of data. He found that nations that acted early and proactively were able to reduce the infection rate besides other countries like Belgium and Spain that acted later with strict policies were late to act because the infection rate had increased and the mortality rate per thousand was high. Stephen et al., (2020) conducted a similar study in which he examined the containment strategies for eight highly ranked countries by the Global Health Security (GHS) index between January and July 2020. He found that Australia, South Korea, Finland, Thailand, and Sweden showed exceptional containment measures with proper enforcement while the UK and US showed inadequate containment measures with lack of proper enforcement regardless of their GHS index ranking. Canada ranks just above the US and UK because they couldn't protect their elders in long-term care, insufficient medical personnel besides there was no early warning system that ranks them at that position.

Merkley et al., (2020) examined the elite and public opinion view of the government actions in response to the Coronavirus (Covid-19) pandemic. They utilized quantitative data and a survey administered to 2,499 citizens of Canada from the age of 18 and above. They found that there has been a united front on the Coronavirus (covid-19) between the elite, mass public, and government, unlike the US. Adolph et al., (2020) analyzed the behavior of the republican government in the US. They discovered that the republican government were 42.2 percent not likely to enforce social distancing in the regions compared to their democrat counterparts.

PART 3

METHODOLOGY

AN OBSERVATIONAL STUDY

An attempt to link the influence of social distancing and numerous policies to new cases per million using an observational study. The purpose was to determine how effective policies were in curbing cases of the Coronavirus in the US and Canada. An observational study (also known as Unobtrusive Study) is a non-experimental method whereby a researcher studies a risk factor, diagnostic test, or an intervention method (policies) without imposing on experimental or controlled conditions (McCrindle, 2010). A retrospective (secondary data) observational study was used for this study because I utilized existing data from various sources. A carefully performed observational study is valuable in determining or predicting long term outcomes in a controlled setting (McCrindle, 2010). However, one of the limitations of conducting an observational study is that the ability of an observational study to explore the cause of behavior is limited (McCrindle,

2010). Another limitation is that observational study does not provide one with control over extraneous variables which makes it difficult to achieve cause and effect relationship (McCrindle, 2010). I observed the changes in government policies daily as the confirmed cases of the Coronavirus (covid-19) grew in the two countries. I carefully observed the changes in social distancing compliance and cross matched it with the stringency index and thirteen subcategory policies while utilizing a graph that shows the changes in Stringency Index, new cases per million, and social distancing on a daily basis from February 1 to October 20 in order to detect potential associations.

DATA AND DESCRIPTIVE STATISTICS

Data were obtained from various sources from the first day of February to the twentieth day of October 2020. Social distancing data was extracted online from the Institute of Health Metrics and Evaluation which is a global independent research center in Washington District of Columbia. Aggregate index and subindices data were extrapolated from Oxford Covid-19 government response tracker created by the Blavatnik School of Government. New cases per million were gotten from Our World in data Covid-19 data set by the John Hopkins University (JHU).

Social distancing, new cases per million, and stringency index data were compared using an observational study to determine how effective policies were daily in curbing cases of Covid-19 in the US and Canada.

In what follows an in-depth explanation for each of the policies implemented and aggregate indices

Subindices Breakdown from OXcGRT-20

School Closure (C1)

School Closure (C1) records the closure of schools and universities in different countries either part closure, selective closure, or full closure of learning institutions. The measurement method is

a combination of ordinal scale measurement and binary for geographical scope. The ordinal scale ranges are 0 (no measures), 1 (recommend closing), 2 (require closing) and 3 based on the level of closure while, binary scale ranges between 0 (targeted) and 1 (general) or blank represents no data (Hale et al., 2020).

Workplace Closure (C2)

Workplace Closure (C2) measures the level whereby workplaces or businesses are mandated to close as a result of a policy by the government. It could be selective closure or general closure which leaves only essential services operating at limited capacity with strict guidelines. It ranges between 0 and 3, 0 represents no measures, 1 represents recommend closing, 2 implies require closing in some sectors and 3 denotes extreme measures means require closing all but essential services (Hale et al., 2020).

Cancel Public Events (C3)

Cancel Public Events (C3) records the cancelling of public events such as dinner parties, concerts, revivals, soccer games etc. Governments effort to prevent the widespread of the virus led to implementing a policy which cancelled public events. The levels of implementation are; 0 which represents no measure, 1 represents recommend cancellation, 2 indicates cancelling event in some regions and 3 represents cancel all events generally (Hale et al., 2020).

Restriction on Gatherings (C4)

Gathering restriction or C4 records the cut off number or bans on individual organized or private gatherings. The limitation on functions comprises an ordinal scale measurement and a binary scale measurement for the geographic scope of the policy. The ordinal values of C4 can either be 0 (no restrictions), 1 (gathering limit is above 1000), 2 (gathering limit is less than 1000 but can be greater than 100), 3 (gathering limit is between 11 to 100 people) and 4 (restrictions to less than

ten people). Countries that limit private gathering restrictions to a maximum of 6 people are ranked at level 4. The binary scale measurement for C4 is either 0 (targeted) and 1 (general) (Hale et al., 2020).

Close Public Transport (C5)

The reduction of available routes or full shutdown of public transport is recorded by Close Public Transport (C5). The ordinal values of C5 can either be 0 (no closure), 1 (recommend closing or reduce available buses and route) and 2 (requires closure or prohibit general mass from using them). Countries like Italy, china fully closed their public transport as part of their containment measure while countries like the US, Germany limited the available buses and routes (Hale et al., 2020).

Stay at Home Requirements (C6)

Individuals were required to remain indoors in the homes or confine themselves to their shelter space and only leave for essential trips like grocery shopping, daily exercise. Stay at Home Requirements (C6) records the level at which this home confinement is required. The ordinal values can either be 0 (no measures), 1 (recommend not leaving home), 2 (leave home only for daily exercise or essentials) or 3 (required to not leave home with exceptions to essential supplies and only one person per household is allowed to go) (Hale et al., 2020). It is measured using an ordinal scale and binary on geographical scale measurement (Hale et al., 2020).

Restrictions on Internal Movement (C7)

Controlling the spread of covid-19 required measures including restricting domestic travel or urge the general public from using them. C7 records the level of domestic or internal travel restrictions in different countries (Hale et al., 2020). C7 is measured with an ordinal scale measurement and

ordinal scale measurement. It can carry a value of 0 which means no measures, 1 represents urging people to avoid travel between regional cities and 2 represents internal movement restrictions are in place on a federal level (Hale et al., 2020).

International Travel Control (C8)

This records restriction on international travels. This was a policy adopted by many countries like China, Italy, Canada, Belgium between January to June period. It is measured using ordinal scale measurement only. It can carry a value of either 0 (no measures), 1 (screening arrivals), 2 (quarantine arrivals from certain regions), 3 (ban arrivals from specific regions) or 4 (total border closure) (Hale et al., 2020).

Income Support (E1)

Income Support (E1) records government coverage in terms of salaries or providing direct cash payments, universal basic income, or fifty percent salary payment of people who lose their jobs or cannot work because of the pandemic. Canada provided a percentage of salary payment for people in a form called CERB (Canada Emergency Response Benefit). E1 is measured with an ordinal scale and binary scale for sectoral scope measurement. Ordinal can either be 0 (no measure), 1 (government replaces less than fifty percent of salary loss) or 2(50 percent or more of salary replacement). The binary scale ranges between 0 (formal sector workers only) and 1 (informal and formal sector workers) (Hale et al., 2020).

Debt/Contract Relief for Households (E2)

Government has the power to freeze financial obligations such as utility bill payments, loan repayments, or mortgage payments because of the broad impact of the pandemic across all sectors.

E2 records the extent to which financial obligations have relaxed or frozen. It can carry a ordinal value of either 0 (no measure), 1 (narrow relief) or 2 (wide debt/contract relief) (Hale et al., 2020).

Public Information Campaigns (H1)

A study by Merkley et al., 2020 expatiated on the importance and effects of proper information campaigns about preventive measures on Covid-19. H1 records the presence and level of coordinated public information campaigns. It uses two binary scope measurements on a geographic level. The ordinal value can be 0 (no public campaign), 1 (public officials urging caution about the virus) and 2(coordinated mass information campaigns through social and traditional media) (Hale et al., 2020).

Testing Policy (H2)

The accessibility to testing facilities has been an issue in some countries like Nigeria, Ghana, and the Dominican Republic. H2 records testing level for the virus, who can get tested either based on criteria or the general public can be tested without showing symptoms. It is measured on an ordinal scale only. The minimum level is 0 which implies no measures, level 1 implies testing those that meet a specific requirement, level 2 represents testing those with coronavirus symptoms and the maximum level is three that means open public testing (Hale et al., 2020).

Contact Tracing (H3)

It is vital to trace the steps of a confirmed case of Covid-19 because it can stop a community outbreak in a region. H3 documents the level of contact tracing of infected persons and who they may have come in contact with days before they tested positive for the virus. It is measured on an ordinal scale measurement and can carry a value of either 0 (no contact tracing), 1 (limited tracing) or 2 (comprehensive contact tracing) (Hale et al., 2020).

Aggregate Indices Description

Stringency Index

The Stringency Index is calculated using only the policy indicators C1 – C8 and H1. The value of the index on any given day is the average of nine sub-indices pertaining to the individual policy indicators, each taking a value between 0 and 100. Indicators C1 to C7 and H1 have an additional flag corresponding to whether the policy has been applied locally, in specific areas/circumstances, or generally, nationwide. 0 If the policy is targeted and 1 if general. Note that a policy can only be general if it has a non-zero value, since a zero value corresponds to no measures being taken.

Economic Support

Economic Support (ES) tracks government attempt to keep the economy afloat but does not include support to firms and businesses neither does it account for the value of the economic support. It is calculated by taking the average of the values of the subindices E1, E2, E3 and E4 (Hale et al., 2020).

Containment Health

Containment health (CH) combines various indicators to measure governments' decision between normalizing activities and reducing health risk or mortality rate from the virus. It is measured by taking the average of eight subindices C1, C2, C3, C4, C5, C6, C7, and C8 (Hale et al.,2020).

Government Response

“Government Response tracker provides a structured cross national, cross temporal measure to breakdown how government responses have evolved over a life span of the disease spread” (Hale et. al., 2020). There are measurement difficulties associated with comparing national responses in

a systematic way. Government response is measured by taking the average of C1 to C8, E1 to E4, H1 to H5 and M1. E4, H4, and H5 are fiscal data that which are available for

Aggregate policy formula

$$\boldsymbol{index} = \frac{\mathbf{1}}{\boldsymbol{k}} \sum_{\boldsymbol{j=1}}^{\boldsymbol{k}} \boldsymbol{I_j}$$

K = total sub-indices number

l_j = sub index score of an individual indicator

Table 1 provides a summary of the above subindices policies

CODE	POLICY	POLICY DURATION TILL OCTOBER 20. (CANADA/USA)	FIRST DATE OF ENACTMENT (CANADA/USA)	MAXIMUM VALUES (CANADA/USA)	POSSIBLE VALUES	POLICY AT THE MAXIMUM LEVEL	MEASUREMENT TYPE	ASSIGNED VALUES ON FIRST DAY (CANADA/USA)
C1	Require school closing at all levels	190/203	16-March/5-March	(3/3)	0 - 3	Requires all school to close for in classroom teaching	Ordinal	3/3
C2	Closure of workplace and businesses	188/189	18-March/19-March	(3/3)	0 - 3	Non-essential services were required to close or work from home.	Ordinal	3/3
C3	Cancellation of all public events	194/207	12-March/01-March	(2/2)	0 - 3	Public events were all cancelled (e.g. concerts, parades and marathons)	Ordinal	2/1
C4	Restriction of social gathering number	190/197	16-March/11-March	(4/4)	0 - 4	Restrictions on gathering of less than 6 people.	Ordinal	3/1
C5	Closure of public transport facilities	0/191	DNC/17-March	(0/5)	0 - 2	Reduction of available routes, vehicles and even closure of public transport system.	Ordinal	0/1
C6	Stay at home requirements	192/193	14-March/15-March	(1/2)	0 - 3	Require to not leave home except essential service workers and non-essential workers can leave home for basic necessities	Ordinal	1/2
C7	Domestic travel restrictions	188/194	20-March/14 March	(2/2)	0 - 2	Prevent or require the vast populace from using it	Ordinal	2/1
C8	International travel restriction and border closure	246/235	22-January/ 2-February	(4/3)	0 - 4	Screening but increases to its highest category 2 for Canada on 03/15/2020 and USA on 03/27/2020	Ordinal	1/2
E1	Income support to citizens unemployed and wage support to businesses	193/181	15-March/27-March	(2/2)	0 - 2	Wage subsidy for businesses and unemployment benefits for those who lost their jobs (e.g. CERB and Unemployment income support)		2/2
E2	Debt contract relief	190/181	18-March/27-March	(1/1)	0 - 1	Captures if government is freezing financial obligations of citizens or not.		1/1
H1	Public information campaign	197/192	11-March/16-March	(2/2)	0 - 2	Co-ordinated public campaign on method of spread and safety methods (e.g. through traditional and social media)	Ordinal	2/2
H2	Testing policy	242/208	25-January/28-February	(3/3)	0 - 3	Those who have (a) symptoms after isolating for two weeks, (b) came in contact with some who has had the virus and (c) travelled outside the country.	Ordinal	1/1
H3	Contact tracing	266/247	1-January/21-January	(1/1)	0 - 3	Finding and isolating those who came in contact with a confirmed case of Covid-19		1/1
GR	Government response to Covid-19	266/247	01-Jan/21-Jan	(75/71)	0 – 100	Records stringency of government responses across time		4/4
CH	Containment health	266/247	01-Jan/21-Jan	(75/73)	0 – 100	It combines lockdown restrictions with closure measures such as testing policy and contact tracing.		5/5
ECNS	Economic support	193/181	15-Mar/27-Mar	(75/63)	0 – 100	It combines the measures of income support and debt relief.		50/63

Table 1: Indicator variable breakdown
Source: Hale et. al., 2020.

Table 2 provides an analysis of what the forms the aggregate index

INDICATOR	TYPE	VARIABLE RANGE	VARIABLE INDICATOR
STRINGENCY INDEX	It takes a number between 0 to 100 that reflect the indicators and provides a picture of when a country enforced its strictest measures	0 - 100	C1, C2, C3, C4, C5, C6, C7, C8 & H1
ECONOMIC SUPPORT	It provides a systematic measure to explain governments policies to support citizens and keep their economies afloat	0 - 100	E1, E2, E3 & E4
CONTAINMENT HEALTH	It reflects government actions to contain and prevent the spread of the virus.	0 - 100	C1, C2, C3, C4, C5, C6, C7 & C8
GOVERNMENT RESPONSE	This provides a systematic cross-national, cross-temporal measure to explain how government responses have evolved over the period of the pandemic	0 - 100	C1, C2, C3, C4, C5, C6, C7, C8, E1, E2, E3, E4, H1, H2, H3, H4, H5 & M1

Table 2: Aggregate Indices Breakdown
Source: Hale et. al., 2020.

Table 3 defines the ordinal values of each subindices.

CODE	POLICY	MEANING	ORDINAL VALUE DEFINITION
C1	School closure	Record closings of schools and universities	0 - No measures 1 - recommend closing 2 - Require closing (only some levels or categories, eg just high school, or just public schools) 3 - Require closing all levels No data - blank
C2	Workplace closure	Record closings of workplaces	0 - No measures 1 - recommend closing (or work from home) 2 - require closing (or work from home) for some sectors or categories of workers 3 - require closing (or work from home) all-but-essential workplaces (e.g. grocery stores, doctors)
C3	Cancel public events	Record cancelling public events	0 – no cancellation 1 – recommend cancelling 2 – cancelling events in some regions or limit attendance 3 – cancel all events generally
C4	Restriction of social gathering	Records social gathering limit restrictions	0 – 0 - No restrictions 1 - Restrictions on very large gatherings (the limit is above 1000 people) 2 - Restrictions on gatherings between 101-1000 people 3 - Restrictions on gatherings between 11-100 people 4 - Restrictions on gatherings of 10 people or less
C5	Close public transport	Record closing of public transport	0 - No measures 1 - Recommend closing (or significantly reduce volume/route/means of transport available) 2 - Require closing (or prohibit most citizens from using it)
C6	Stay at home requirements	Records stay at home requirements	0 - No measures 1 - recommend not leaving house 2 - require not leaving house with exceptions for daily exercise, grocery shopping, and 'essential' trips 3 - Require not leaving house with minimal exceptions (e.g. allowed to leave only once a week, or only one person can leave at a time, etc.) No data - blank
C7	Domestic travel restrictions	Records restrictions on internal movement	0 - No measures 1 - Recommend not to travel between regions/cities 2 – internal movement restrictions in place
C8	International travel controls	Records restrictions on international travel	0 – No restrictions 1 – Screening arrivals 2 – Quarantine arrivals from some or all region 3 – ban arrivals from some regions 4 – total border closure
E1	Income support	Records income support to the economy	no income support 1 - government is replacing less than 50% of lost salary (or if a flat sum, it is less than 50% median salary) 2 - government is replacing 50% or more of lost salary (or if a flat sum, it is greater than 50% median salary)
E2	Debt contract relief	Records debt/contract relief for household	0-No 1 - Narrow relief, specific to one kind of contract 2 - broad debt/contract relief

H1	Public information campaigns	Record presence of public information campaign	0 – no public information campaign 1 – public officials urging caution about Covid-19 2 – Co-ordinated public information campaign across traditional and social media
H2	Testing Policy	Records testing about current infection not testing for immunity	0 - no testing policy 1 - only those who both (a) have symptoms AND (b) meet specific criteria (e.g. key workers, admitted to hospital, came into contact with a known case, returned from overseas) 2 - testing of anyone showing COVID-19 symptoms 3 - open public testing (e.g. "drive through" testing available to asymptomatic people) Blank - no data
H3	Contact tracing	Records government policies on contact tracing after identifying a positive subject	0 - no contact tracing 1 - limited contact tracing; not done for all cases 2 - comprehensive contact tracing; done for all identified cases

Table 3: Ordinal Value Breakdown
Source: Hale et. al., 2020.

Social Distancing

In 1963, a cultural anthropologist named Edward Twitchell Hall analyzed proxemics which is the study of human use of space and how it affects their immediate surroundings (Hall et al., 1968). Hall described the interpersonal distances of man in which he expressed social distance as an interaction amongst acquaintances or close relations (Hall et al., 1968). Hall further described social distancing in two forms which are close phase (maintaining four to seven feet apart) and far phase (seven to twelve feet apart) (Hall et al., 1968). However, Social distancing today is one of the primary tools utilized by every government to prevent or reduce the transmission of the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). It is also known as physical distancing, it implies maintaining a safe distance between one person and other people that are not of the same household necessarily a minimum of six feet or two-meter distance (Joakim et al., 2020). Social distancing data is derived through anonymous mobile device location pings and cell phone towers around the world. Anonymous mobile device pings are used to calculate the distance between two approximate pings in a particular area utilizing the cell phone towers (Joakim et al., 2020). This data was extracted from the Institute of Health Metrics and Evaluation (IHME) website and it indicates the percentage of social distancing mandate observed in the two nation. Anonymous mobile pings were utilized in developing the social distance data because of privacy and security reasons (Joakim et al., 2020). Hence, I used social distancing data to show how political beliefs can present itself as a major limitation to the effectiveness of state or federal mandate on social distancing and thirteen subcategories of polices enacted to curb the widespread of the coronavirus. There is a misguided conception that restrict social gathering (C4) and social distancing are the same. Restrict social gathering (C4) sets a limit on the number of people that can converge in a particular place while social distance defines the type of relationship and number

limit of individuals that can be gathered in a particular place while maintaining a two meter distance .The figures were extracted in negative numbers before I multiplied them by -1 to give a positive value to plot the graph.

PART 4

RESULTS

RESULTS: POLICY IMPLICATIONS IN CANADA

It began with the border closure on January 22, Canada imposed international travel restrictions at level 1 which meant arrivals were screened for the virus and urged to self-quarantine for two weeks from the day of arrival into Canada and the general public was urged to not travel from one city to another. Restrictions level were raised to the maximum level which is level 4 on March 18 and that meant total border closure. Flights were not allowed into Canada or road travel from other countries or extremely high-risk countries. Restrictions fell to level 3 on August 13, such that arrivals and travel to high-risk regions of Covid-19 were prohibited and arrivals from such countries were not let into Canada. Canadians were urged to remain at home from the 14th of March as part of the policies to curb the widespread of the Coronavirus (Covid-19) and could only leave the country for valid reasons. Restrictions remain at level 3 till today with plans of border reopening as of November. However, Canada closed all schools for face to face lectures or in classroom attendance and set a limit on social gathering on the 16th of March. Schools reopened partially with strict guideline policies on the 8th of September. The restrictions reached a maximum level of 3 for both C1 and C4 as shown in Figure 1, indicating the closing of Schools and the cancelling of events. C1 was relaxed to level 2 on September 8 with many schools opening. High schools have reopened with severe restrictions, but universities are partially open to classes

that require face to face lecture or lab studies only providing government reopening policies are strictly followed. Social distancing measures and social gathering restrictions have remained at the maximum level (level 4) since March 24.

Two days after the school closure mandate, Canada ordered all workplaces to close on March 18 except for essential services such as grocery stores, gas stations, and convenience stores. Some restaurants were closed while some were allowed to remain open in certain provinces with strict employee social distancing restrictions, compulsory face masks and for takeout only no dine-ins allowed. The restrictions started at the maximum level which is level 3 on March 18 and reduced to level 2 on June 22 as shown in Figure 1. Businesses reopened with social distancing restrictions, maximum occupancy limit, compulsory face mask rule while restaurants were allowed to operate at 50 percent dine-in capacity. Moreover, Canada canceled all public events which required mass gathering on March 12 as illustrated in Figure 5. Sports events, concerts, and cinemas were all closed but some public events were allowed to occur with limited gathering numbers which meant that the level of restriction was at level 2 and not the maximum level of 3. Restrictions on public events haven't been eased in Canada and remain at the same level. In addition, the public transport system of Canada never shut down as indicated by C5 with a constant policy level of zero.

Also, Canada introduced an income support policy (E1) with various funding methods on March 15th, to assist individuals as well as businesses who had a loss of income as a result of Covid-19 at the maximum level which is level 2. Income support came in form of CERB (Canada Emergency Response Benefit "2000 Canadian dollars") for individuals or households who had lost income and CEWB (Canada Emergency Wage Benefit) for businesses to cover wages since they could not operate at maximum capacity. Income support has remained at level 2 to date, as shown in Figure 1. The economic impact of Covid-19 on household and individual income led to the government

of Canada enacting a debt/contract relief policy. It began on March 18 at the maximum possible level, freezing financial obligations of citizens such as health coverage fee for internationals or non-permanent residence, mortgage allowance to support mortgage payers, and debts to the government were frozen or contracts renegotiated, as illustrated in Figure 1. Furthermore, informing the public of the basic methods of protecting themselves from the virus. The maximum level of this policy is level 2, where all forms of traditional and social media are utilized to spread awareness to every area in a country. The maximum level of this policy was set in Canada on March 11 with aim of preventing the spread of the virus and what to do in the case of a possibility where individual suspects he or she may contact have the virus. This is policy remains at the maximum level to date, as exhibited in Figure 1. Hence, testing level stared at level 1 in Canada on January 24, which there was selective testing or groups where individuals had to fall into before they could be tested. March 9, the Covid-19 virus had started spreading rapidly as confirmed cases grew to a total of 62 cases across Canada and this led to testing policy level to be raised to level 2 to curb the spread before the cases grew out of control or before Canada has to switch to damage control. As of March 19, cases had grown exponentially across Canada to a total of 690 cases and testing policy was raised to the maximum level where there was open testing for individuals who feared they had the virus or are experiencing symptoms. Level 3 led to the detection of many infected persons, quarantine of many people but cases still grew at an exponential rate across Canada, and testing policy remained at the maximum level to avoid a second wave that can cripple the entire economy, as shown in Figure 1. Finally, contact tracing for the possibility of infected persons from a confirmed case started at level 1 from January 1, increased to the maximum level that is level 2 when confirmed cases surpassed 100,000 cases. It was found that some cases had a bit of connection either patient x had come in contact with patient y at a particular spot or public

place which could potentially mean many more may have been infected. It has since remained at the maximum level to date because of the fear of a massive second wave just like Germany or England, as illustrated in Figure 1.

Figure 1 displays a graphical summary of the above-mentioned policies.

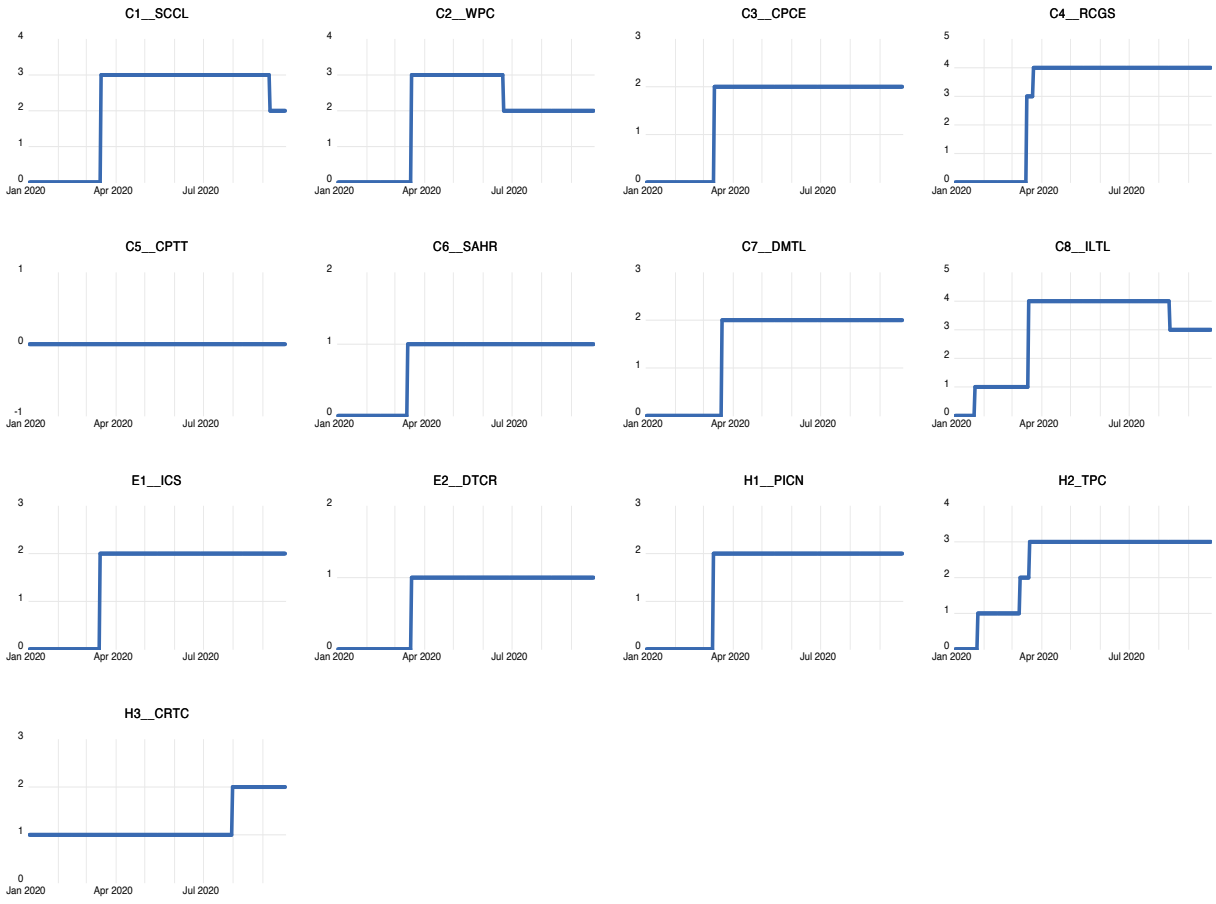

Figure 1: Canada Policy Implementation Level (C1 to H3)
Source: Hale et. al., 2020.

RESULTS: AGGREGATE INDICES IN CANADA

The Stringency Index (SI) records a level between 0 and 100, representing the strength of several policies in Aggregate as described in Table 2. January 22 marked the beginning of the government measures at level 3 when cases were zero as shown in Figure 2. The stringency index in Canada rose to level 44 on March 16 as new daily cases had become 60, cases rose above 100 on March 17 and on March 18, the stringency index rose to 61 as total cases of the virus was at 569 active cases. Stringency Index (SI) increased to 71 on March 20, when new cases were 156 and total cases had become 846 active cases across Canada. March 23 recorded a change to what was the strongest measure to prevent the widespread of the virus at a level of 73 as total cases across Canada had grown over 1000 active cases. By September 9th, the number of new cases dropped at an arithmetic rate and the stringency index reduced to level 61, as economic restoration began. Since the break of the virus in Wuhan China, various governments responded minimally, Canadian health containment (CH) was at level 5 from January 1 till January 25 when a case had been discovered and health containment rose to level 10. On March 18, total cases surpassed 200, the government responded by raising the containment level to 61 while enforcing strict policies to protect lives and prevent the virus from spreading. When the cases surpassed 1000, the government raised health containment measures to level 75 on the 1st of April with even stricter policies such as compulsory face masks, limited capacity, and closure of non-essential services. Health containment measures reduced from time to time as activities resumed, businesses reopened, and health containment reduced to level 68, as shown in Figure 2.

At the beginning of the year government response indictor was at a level of 4 since in many countries the virus had not gotten into their atmosphere. The Canadian government responses increased to level 8 on January 25 after an active case was confirmed in a man in Toronto, Canada

who had just returned from Beijing. As cases soared, government response increased exponentially and hit its all-time highest response on April 1 with 8,536 total cases confirmed and 96 deaths. Government response maintained a steady level at 72 from the 11th of May till the 21st of June and increased to level 73 on July 31st as cases had grown to over 115,000 while 8,929 were confirmed dead. September 8th marked a new level of government response at level 69 with reduced restrictions and return of economic activities, as illustrated in Figure 2

Finally, from January 1 to March 14, the economic support index was at a zero score. However, on March 15 it rose to an index score of 50 as E1 was at 2 and E2 at 0. When total cases had grown to over 500 in Canada, the lockdown had begun, businesses had closed, and many individuals were out of a job, economic support increased to its highest score of 75 while E1, as well as E2, were set at the maximum level. The economic support index has remained at an index score of 75 to date, as illustrated in Figure 2.

Figure 2 shows a summary over time of these aggregate policies indices

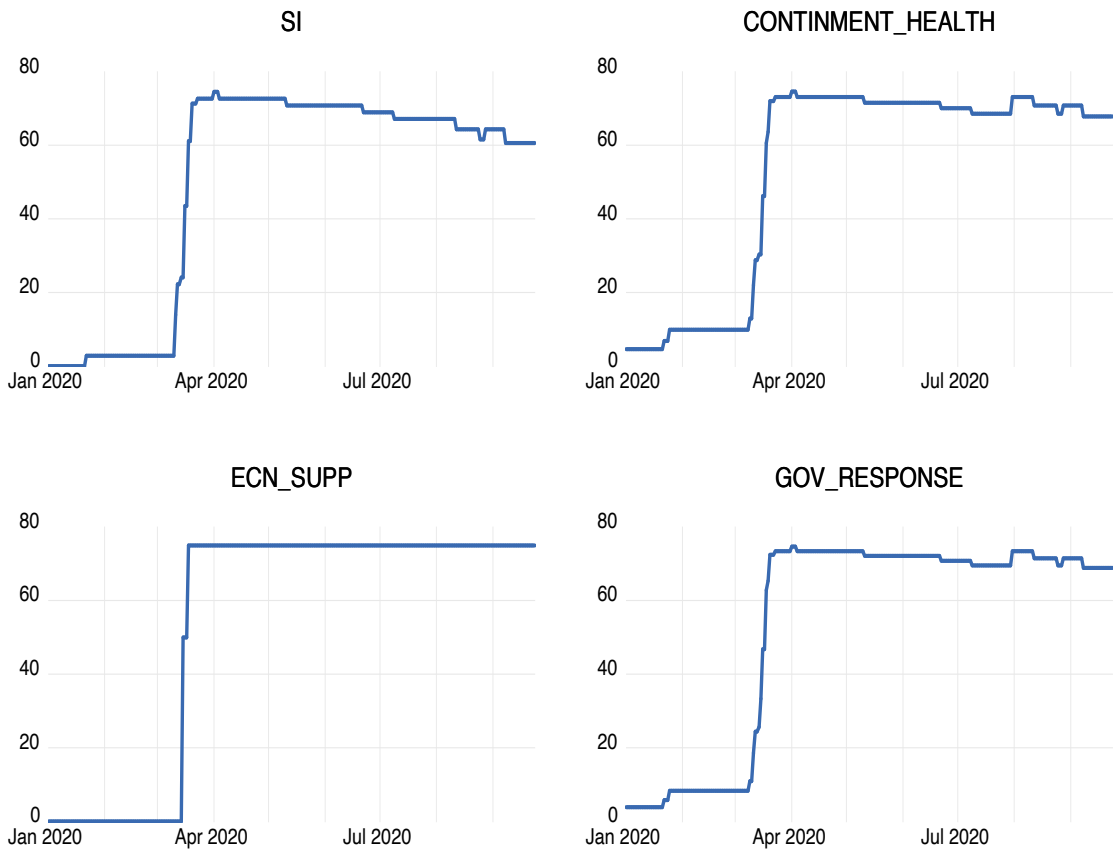

Figure 2: Aggregate Indices Level for Canada
Source: Hale et. al., 2020.

RESULTS: POLICIES IN THE USA

The US had its first case before Canada on January 19 and School closure (C1) started at level 3 on March 5 after there had been 159 cases. It began at the maximum level and unlike Canada that later relaxed C1 the United States maintained the policy at the maximum level after clusters of cases began rising again. Schools reopened with approval and maximum safety protocols implemented in September. So far, many cases have been linked to institutions reopening, as shown in Figure 3. Furthermore, on March 19 workplace closure was set in motion at a maximum level allowing only essential services to remain working and all others had to work from home. This policy relaxed to level 2 on June 15, allowing restaurants and other businesses to operate at a

certain capacity level, and the maximum limit per space was based on size (e.g. restaurants could only sit guests at 50 percent capacity), as exhibited in Figure 3. Sports events, concerts, and cinemas were all closed but some public events were allowed to occur with limited gathering numbers. Restrictions started at level 1 on March 1st, increased to level 2 on March 12 but never reached maximum level of restriction. Part of the public believes inefficient restrictions were what caused the death rate from Covid-19 to grow at a geometric rate. In addition, March 11 marked the beginning of the policy at level 1 but that was only for a day as the policy restriction was elevated to level two the next day meaning people could gather in hundreds but not exceed 1000, as illustrated in Figure 3. After 9 days, 14,250 confirmed cases, and 150 deaths the policy was elevated to its maximum level on March 21st. The policy remained at the maximum level until September 8 when it was reduced to a level 3 and has remained at level 3 till today, as illustrated in Figure 3. Political rallies have however disregarded this policy restriction. Government reduced available bus routes, the number of buses, and the volume of buses by setting restrictions at level 1 on March 17th. Closure of public transport never got to the maximum level of restriction in the United States but remained at level 1 till date, as shown in Figure 3. Furthermore, the United States imposed international travel restrictions at level 2 on the 2nd of February, which meant arrivals were screened for the virus and urged to self-quarantine for two weeks from the day of arrival into the US. Restrictions level were raised to the maximum level which is level 3 and that meant arrival from some regions were banned. Flights from some regions or road travel from other countries or extremely high-risk countries. Restrictions remained at level 3 but never got to the maximum level like Canada. Domestic travel Restrictions began at level 1on March 14 and were raised to the maximum level which is level 2 on March 19. It has remained at level 2 since that date till September 24, as illustrated in Figure 3. Hours later the US ordered its residents to remain at home

and only step out for essential reasons which meant a stay-at-home requirement policy was in immediate effect. The US started by setting it at level 2 on March 15, this level was the maximum level the policy ever got to and could also account for the disparities in cases. On July 20, the policy reduced restrictions to level 1 even though they recorded over 300,000 cases and 130,000 deaths, as exhibited in Figure 3.

Also, Income Support (E1) began on the 27th of March at the maximum level which is level 2 that provided more than 50 percent of income loss to households and businesses by the government to cover loss as a result of the pandemic. Income support remains at the maximum level till the most recent date of the data available and available to those covered by employment insurance. The government of the US offered additional assistance to residents through debt or contract relief policy. March 27, this policy was put in motion at level 1 which meant narrow relief to one specific kind of contract or one category. This policy remained at level 1 and never got to the maximum level. Some scholars believe that a massive information campaign is beneficial to reducing the widespread of Covid-19. The maximum level of public information campaign is level 2 where all forms of traditional and social media are utilized to spread awareness to every area in a country. The maximum level of this policy was set in the US on March 16th to prevent the spread of the virus and what to do in the case of a possibility where individual suspects he or she may contact have the virus. This is policy remains at the maximum level till the last day of data collection September 24, 2020, as illustrated in Figure 3.

Finally, the testing level and contact tracing started at level 1 in the US on February 28 and January 21 respectively. March 4, the Covid-19 virus had started spreading rapidly as confirmed cases grew to a total of 125 cases across the United States with 9 deaths registered and this led to testing policy level to be raised to level 2 to curb the spread before the cases grew out of control. As of

March 14, cases had grown exponentially across the United States to a total of 2174 cases and testing policy was raised to the maximum level where there was open testing for individuals who feared they had the virus or are experiencing symptoms. Level 3 led to the detection of many infected persons, quarantine of many people but still, cases still grew at an exponential rate, and testing policy remained at a maximum level while contact tracing remained at level 1 all through the period covered in this study, as shown in Figure 3.

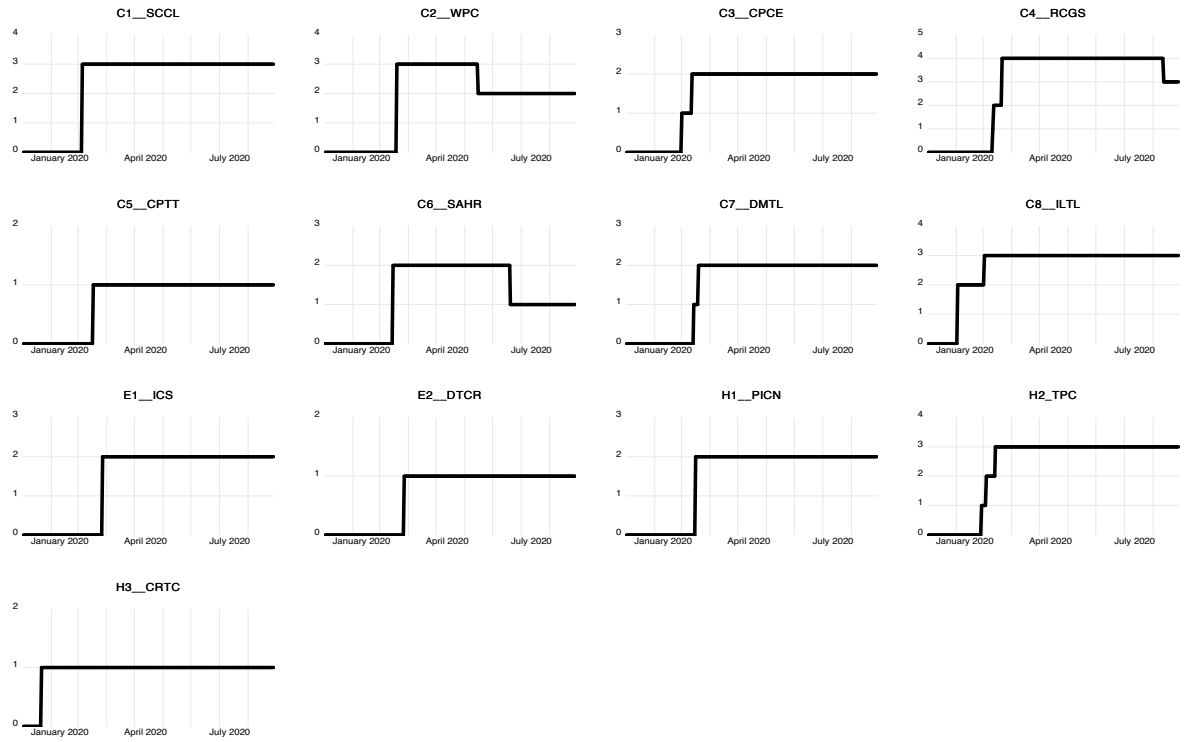

Figure 3:USA Policy level implementation (C1 to H3)
Source: Hale et. al., 2020.

RESULTS: AGGREGATE INDICES OVERTIME FOR THE USA

February 2 marked the United States stringency score at 6 and confirmed cases were 8 with zero confirmed deaths. It remained at level 6 till February 29 before a constant daily increase as cases

doubled on daily basis as well. Stringency score increased to 55 on March 17, confirmed cases were 4661 and confirmed deaths were at 85. Stringency increased to 73 on March 21st, active cases had become 19,624 and deaths had more than tripled to a total of 260 deaths. This stringency level wasn't enough to slow down the confirmed cases or death total has confirmed cases grew over 300,000 and deaths 0ver 100,000. On June 15, stringency reduced to 69 but the death rate or confirmed cases continued rising and then stringency reduced to 67 on 20th July. The death rate was over 195,000 and confirmed cases over 600,000 before stringency reduced to 63 on 12th of September to allow schools reopen with strict measures as well as firms for economic recovery, as exhibited in Figure 4. Moreover, the first attempt by the US government to contain the virus was ranked at 5 on January 21, there was no real threat from developing cases or deaths since there was only one case. When cases started growing exponentially, containment health rank increased to 27 on March 5th but cases had grown over hundreds and deaths in double-figure. When confirmed cases surpassed 15,000 and deaths in the hundreds, the containment health index score rose to its highest score ever with an index score of 73 on March 21st. Policy levels were not enough to curb the widespread of the virus as cases surged over 600,000 while deaths were almost 200,000 but amidst these prevalent issues, the containment health index still reduced to 65 on September 12 for the reason of reopening the economy, as shown in Figure 4. Unlike Canada, Government response began on the 21st of January with an index score of 4 and rose to 62 on March 21st while cases were above 19,624 with deaths at 260. As cases soared, government response increased exponentially and hit its all-time highest response at 71 on March 27 with 85,991 total cases confirmed and 1296 deaths, as illustrated in Figure 4. Government response maintained a steady level at 71 from 27th of March till the 14th of June and decreased to level 69 on June 15th as cases had grown over 2 million while 115,732 were confirmed dead. September 12 marked a new level

of government response at level 63 with reduced restrictions and return of economic activities, as illustrated in Figure 4.

Finally, From January 1 to March 26, the economic support index was at a zero score. However, on March 27 it rose to an index score of 63 as E1 was at 2 and E2 at 1. When total cases had grown to over 12,000 in the US, the lockdown had begun, businesses had closed, and many individuals were out of a job, economic support remained the same even though cases and death tripled, as shown in Figure 4.

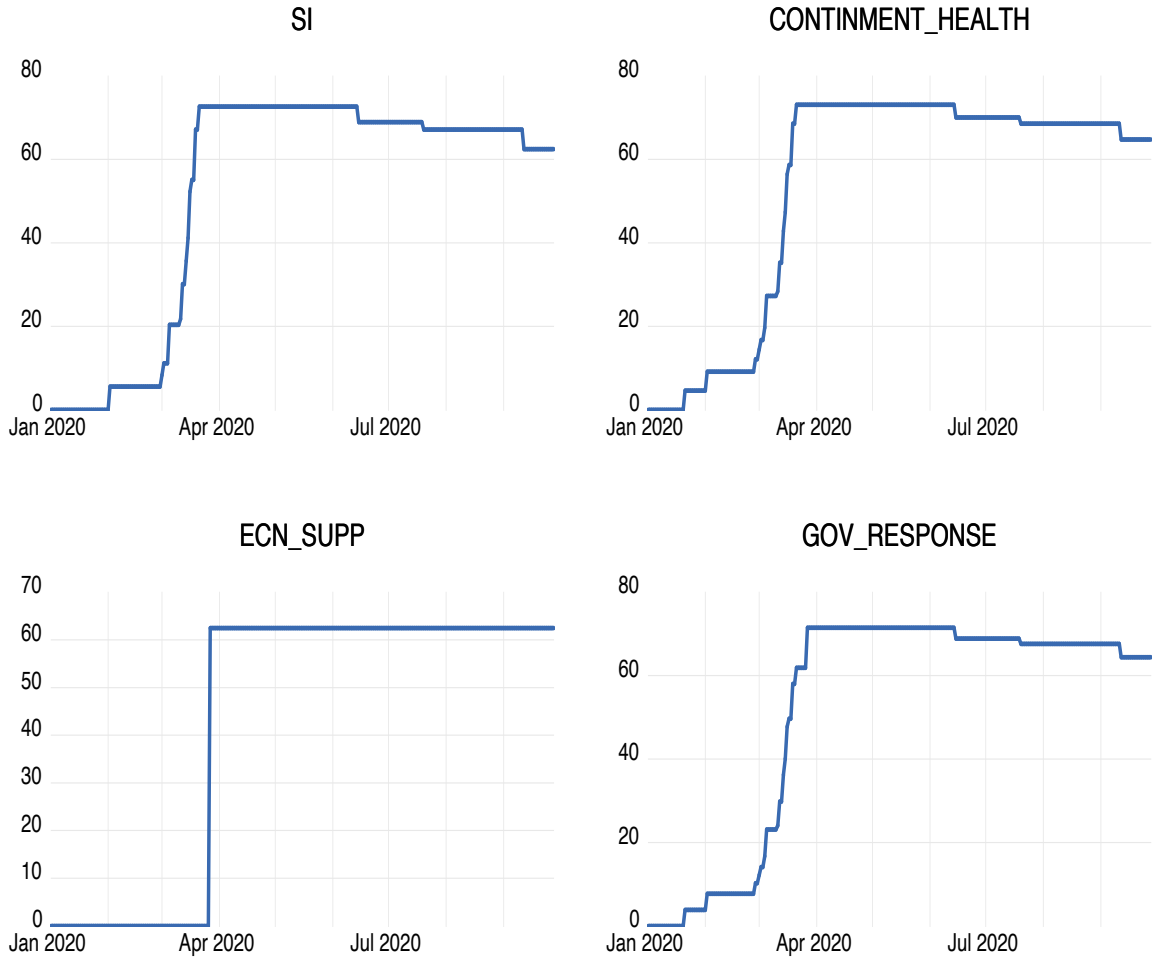

Figure 4:US Aggregate Policy levels
Source: Hale et. al., 2020.

RESULTS: COMPARING THE INITIATIVES OF THE TWO NATIONS

Table 4 shows the differences between the highest and lowest policy attainment levels for both countries as well as date of enactment for the highest policies. In the US, School closure (C1), restrict social gathering (C4), Domestic travel restrictions (C7), International travel restrictions (C8), and Testing Policy (H2) were all policies that were implemented earlier in the US before Canada while workplace closure (C2), Stay at home requirements (C6), Income support (E1), Debt Contract Relief (E2), Public information campaign(H1) and contact tracing(H3) were implemented earlier in Canada.

The US significantly reduced the availability of public transport or urged residents not to use them which ranked their close public transport at level 1 and it was implemented on March 17 while Canada never reduced or urged residents to avoid using public transport. Cancel all public events (C3) is the one policy that was implemented simultaneously on March 12 in both nations, as shown in Table 4. The average response time difference between one country implementing one policy and the other responding is 6 days.

Policy	Date of Maximum Level Enactment (Canada)	Date of Maximum Level Enactment (USA)	Highest Level (Canada)	Highest Level (USA)	Lowest Level in September (Canada)	Lowest Level in September (USA)
C1	16th of March	5TH of March	3	3	2	3
C2	18th of March	19th of March	3	3	2	2
C3	12th of March	12th of March	2	2	2	2
C4	23rd of March	21st of March	4	4	4	3
C5		17th of March	0	1	0	1
C6	14th of March	15th of March	1	2	1	1
C7	20th of March	19th of March	2	2	2	2
C8	18th of March	2nd of March	4	3	3	3
E1	14th of March	27th of March	2	2	2	2
E2	18th of March	27th of March	1	1	1	1

H1	11th of March	16th of March	2	2	2	2
H2	19th of March	14th of March	3	3	3	3
H3	1st of January	21st of January	2	1	2	1

Table 4:Policy difference table
Source: Hale et. al., 2020.

RESULTS: SOCIAL DISTANCING DATA FOR CANADA

Figure 5 illustrates the association between new cases per million of Covid-19, the stringency index and Social distance adherence in Canada for the period February 1 to October 20. This year has been a turbulent year for the world with the imminent shutdown of activities worldwide, widespread of the virus and population loss caused by deaths from Covid-19. New cases per million is plotted on the primary y axis, while social distancing and the stringency index on the secondary y axis.

The stringency index in Canada was recorded at an index level of 3 and social distancing became a policy that was been enforced in early February. Social distancing compliance spiked to 8 percent, while stringency index maintained a steady state and new cases per million was at zero. All three variables maintained an upward trend until March when there were large changes in all variables. Social distancing peaked to its highest compliance rate of 56% in April at the same period stringency peaked to 75 and new cases per million rose to 44.327. Social distance compliance maintained a trend of remaining above the 50 percent compliance range. When compliance to social distance measures began decreasing the number of new cases per million spiked to 73.128 new cases per million. If social distance compliance had been maintained at its peak percentage compliance, it appears that new cases per million would have declined in a trend until it hit zero but a fall in compliance percentage appears to have led to an increase in new cases per million. Canada reopened their economy in June with new more lenient Covid-19 guidelines and restrictions for both household and firms. Post economic reopening, a second wave of the deadly virus began spreading, the stringency index had reached its lowest level since April at an index level of 61, social distance compliance percentage gradually decreased to 31 percent and new cases per million increased to hit its peak of 125 new cases per million in the second wave on October 13. Do the relationships between these three variables point towards a need for tighter restrictions or a fated second lockdown?

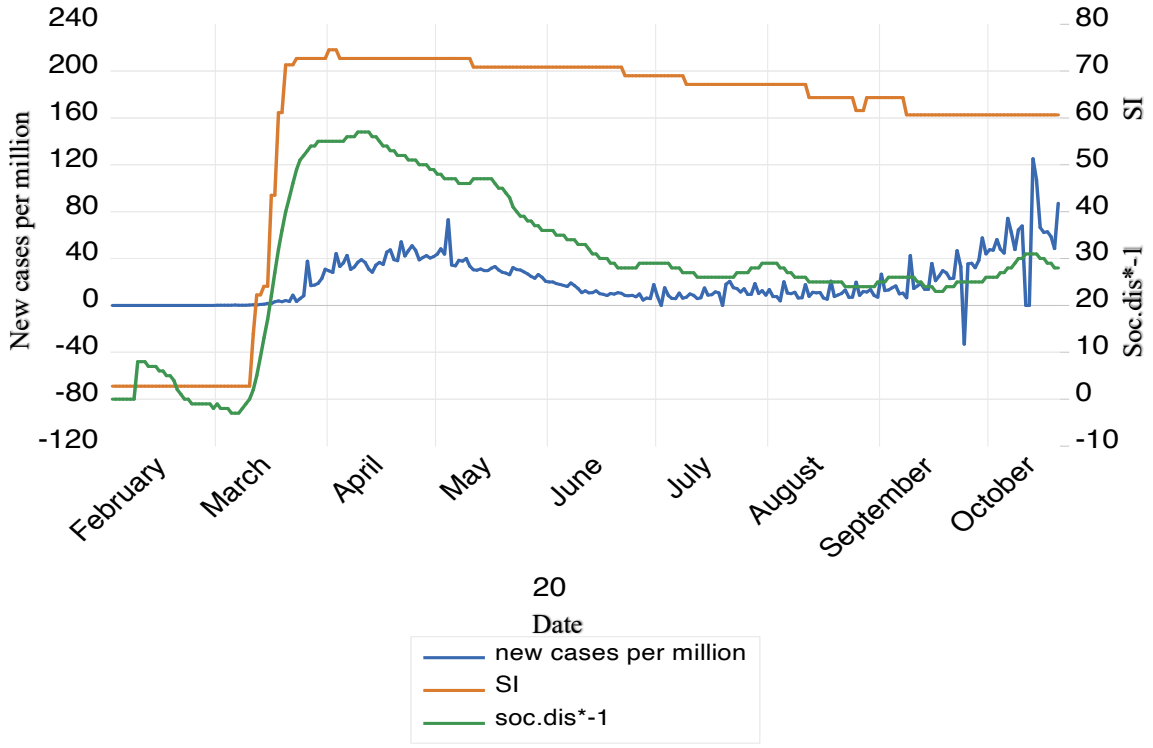

Figure 5:New Cases Per Million, Stringency Index and Social Distance in Canada
Source: IHME, 2020; Hale et al., 2020; JHU, 2020.

SOCIAL DISTANCING RESULTS FOR USA

Figure 6 illustrates the association between the stringency Index, Social distancing compliance and New cases per million of Covid-19 in the US for the period of February 1 to October 20. The US overtook several countries to become the leading country in number of cases and deaths as a result of Covid-19. New cases per million is plotted on the primary y axis, while social distance compliance and stringency index are on the secondary y axis.

Social distancing kicked off earlier in all states of the US before Canada enacted the six feet distancing policy across all their provinces. Social distancing compliance percentage started with a zero percent compliance rate when new cases per million in the US below 1, and Stringency index was at a steady state of 6in February. March 13 marked a turning point; social distance

compliance percentage and Stringency index began moving in an upward trend as well as new case per million grew at an exponential rate on daily basis. Social distance compliance levels increased to 49 percent, Stringency index was at its peak level of 73, and new cases per million at 50.746 cases per million on March 27. Social distance compliance peaked on April 1, at a compliance level of 52 percent while stringency index and maintained a steady state index of 73 and new cases per million began a downward trend on April 11. This trend essentially suggests that social distancing compliance can effectively reduce the wide spread of Covid-19. If social distance was maintained at 52 percent the graph of new cases per million will continue in a downward trend till it becomes zero. Social distance compliance and the stringency index followed a downward trend because of economic reopening, political affairs and attitudes in the US. When social distance compliance fell below 30 percent, new cases per million of Covid-19 rose drastically and hit its peak of 232.415 new cases per million in the United States on July 17. New cases per million fell, social distance measure compliance and stringency Index continued in the downward trend. A second spike in cases per million meant a third wave, new cases per million hit 212.252 while Social distancing kept falling and the stringency index increased on October 17.

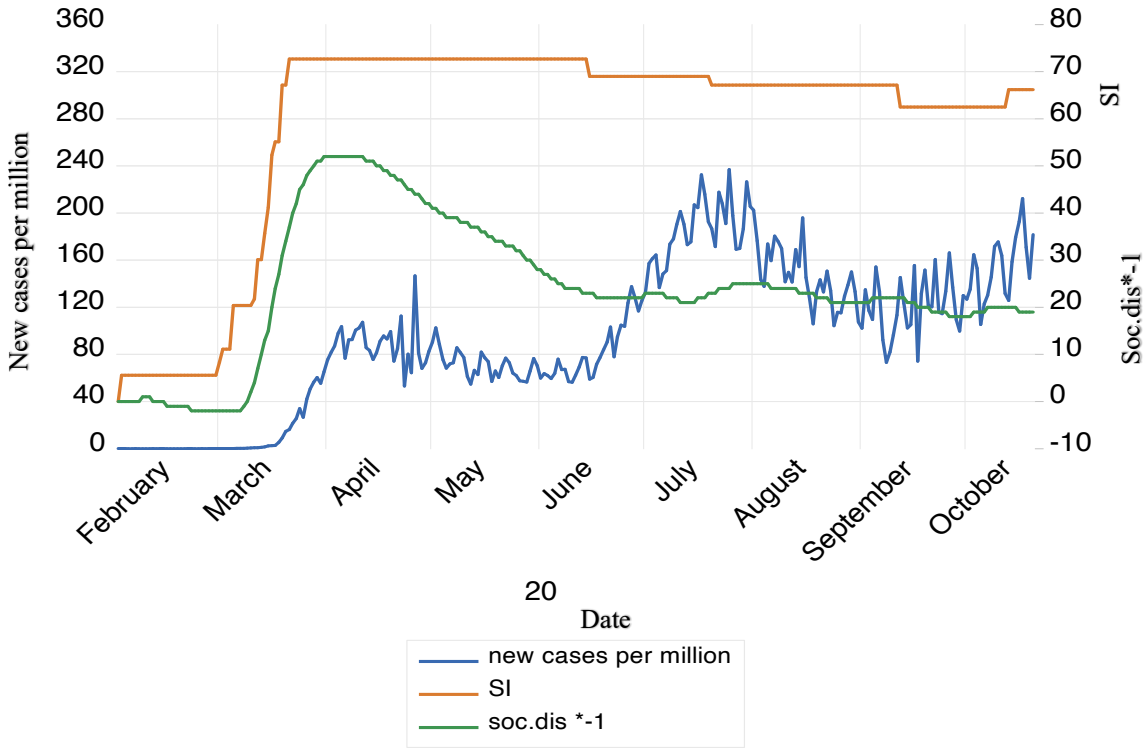

Figure 6:New Cases Per Million, Stringency Index and Social Distance in US
Source: IHME, 2020; Hale et al., 2020; JHU, 2020

RESULTS: COMPARISON BETWEEN US AND CANADA

Several similarities can be found for both countries apart from the pre-existing fact that they are neighboring countries. Social distancing in Canada and the US started at the same time on February 8 and within the same range of compliance. New cases per million was in the range of 0 to 1 for the period of February 1 to March 15 for both countries as well as Stringency Index for Canada and US. The upward trend of new cases per million and social distance compliance started in the month of March.

However, the stringency index peak point for the US was earlier than that of Canada, yet there were stricter measures in Canada than in the US which gave Canada a higher stringency index of

75 while the US was 73. The social distance compliance percentage in Canada was higher than it was in the US, and that is a major factor that narrates the high disparity in new cases per million between both countries and the three peak points of new cases per million in the February to October period. The United States has the highest new cases per million of Covid-19 in the world while Canada ranked number 31 in the world as of November 24 (Worldometer, 2020).

The high disparity in new cases per million and death rate between both countries can be explained by certain factors. The differences can be accounted by the following two factors: long standing issues with health care and political factors. In Canada, health care is free for all except international students or work permit holders who are covered for a fee of 75 dollars a month while in the US healthcare is not free and the issue of no care coverage that is easily affordable by the lower-class income population. Nearly 30 million people in the US are without health coverage of any form (Sommers, 2020). Political factors are one of the major factors that contributed to the large difference gap between both countries. The Black Lives Matter protest that began in May and spread across all cities and the world was another major cause. People gathered in protest of illegal treatment of black people by institutions ignoring major policies that were put in place to prevent the widespread of the virus as well as failure of political institutions to resolve the matter with swift response. Cases from the protest were not reasons for the cause of the spike but inadequate policy enforcement. Inadequate policy enforcement was captured to be delayed or prominent in states controlled by Republican government especially social distancing measures which are critical to stop the wide spread of the Virus. An empirical study conducted by Adolph et al., (2020), they discovered that republican states were slower to adopt social distancing policies and republican governors are 42.2 percent less likely to mandate social distancing than their

democratic counterparts. Bernheim et al., (2020) examined the effects of disregarding warnings made to the republican party against holding rallies which has led to 332 case per-hundred thousand residents which meant an increase in cases by over 30,000 and more than 700 deaths. This essentially displayed the effect of leadership behavior in slowing the growth of the virus and which the opposing party (democratic party) has condemned.

PART 5

CONCLUSION

This study is conducted to provide an analysis and comparison of polices and their effectiveness in curbing the widespread of the coronavirus in the US and Canada. It also provides an insight into the extent to which policies were implemented in both countries and the effects of relaxation of policies. According to the results from the observation of the data, policy implementation without strict enforcement is not sufficient enough to curb the widespread of Covid-19. The analysis of this study indicated that both countries implemented similar policies but the enforcement level across all institutions explains the difference in why cases in the US more than the cases in Canada are. Social distance compliance and gathering limit are not strictly enforced in the US while in Canada violation of Social distancing rule or gathering limit carries a fine of 2000 dollars. Some factors are essential and account for the wide gap in new cases per million. The study concludes that policies are enough to curb the widespread of the coronavirus (covid-19) but these policies cannot be relaxed at any point in time in both nations. The factor of the population cannot be a reason for the high number of cases in the US when comparing both countries against the rest of the world because I have examined daily new cases per million people which controls for

population Canada has less cases per million than the US and China has less than 10 cases per million people.

Factors that can explain these large differences are the degree of stringency of policies between the two nations, differences in social distancing compliance, the health care systems and political factors.

The study has its limitations even though the results of our observation meet our expectations. The availability of data and observation study contribute to the limitation of this study. Social distancing data is not available to the general public and the period of availability. Social distancing data was available from February to October 20 and that limited the study to a period of 9 months. Social distancing data relies on mobile device location as a proxy and may not represent people's definite location accurately. I have also considered that not all percentage of the population uses a mobile phone especially amongst the population that is 60 years and above. Also, people can turn off their mobile phones and move around. Moreover, I am not concerned with the small bias this will cause in this study. The limitations of the OxCGRT-20 dataset can also be considered as limitations of this study. The oxCGRT-20 dataset is a data set collected manually by a group of people by observing governmental publications and news channels to gather data about policies from C1 to H3. The indexes and reality might be different in situations such as implementation date of policies, what level policies started, or errors in recording caused by the language barrier. The Stringency Index points were evaluated on specific criteria. Furthermore, some extra measures have been used by the government of Canada and the US that were not considered or included in this study such as economic factors. In this study, data regarding the virus spread are official data. Future research can explore the effects of early implementation or delayed implementation of policies on reducing the widespread of covid-19 in the US and Canada.

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