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The Economic Impact of COVID-19 in Canada: A Health Economist's Perspective

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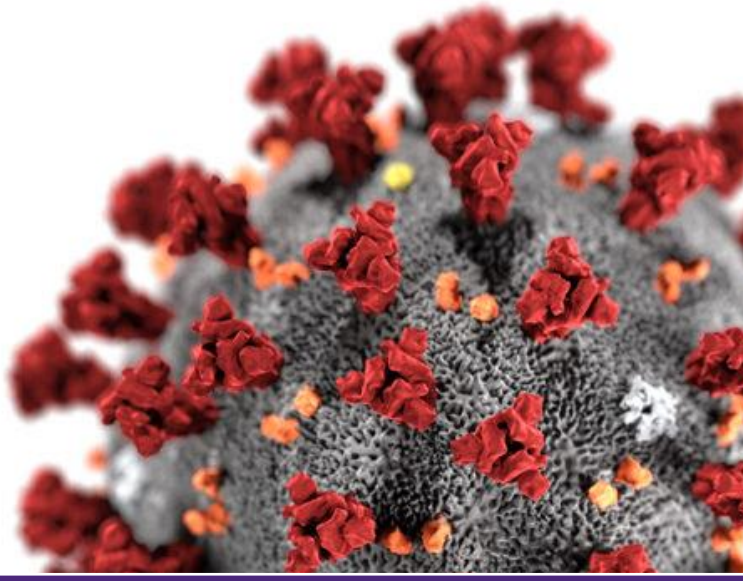

Purple Squirrel Economics

Montreal – Toronto – Vancouver – New York – Boston

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Executive Summary

The Canadian population and all levels of its government are facing difficult times with the rapid spread of a novel Coronavirus, COVID-19. The virus has already significantly impacted patient lives, while at the same time harnessed destructive potential for global trade and employment. The purpose of this analysis was to improve our understanding of the impact of potential strategies to face COVID-19 in Canada; and to better understand the respective costs of such measures.

This analysis demonstrates that the benefit of a short-term economic lockdown can outweigh the potential cost of massive contamination, especially if healthcare systems were to become overloaded. Therefore, a balanced strategy that incorporates a short-term lockdown and social distancing approach, in order to limit the spread and ensure a flattening of the contamination curve, is a crucial step in minimizing the potential costs of the pandemic.

Background

The COVID-19 pandemic was certainly unexpected by most and took many nations by surprise. While Canada's preparedness and relatively quick provincial and federal reactions to the potential threat likely delayed the local spread of the pandemic, the disease is expected to remain an important economic and social disruptor for several months to come. While many clinical guidelines and related publications have recently dominated the news, very little evidence is currently available informing the potential impact of COVID-19 in terms of healthcare and economic costs.

The purpose of this document is to provide a health economist's perspective on the potential costs of the pandemic by weighing the trade-offs generated by potential strategies that can be adopted in Canada to help maximize positive outcomes. It must be noted that the results of this analysis are speculative in nature, since the pandemic is still accelerating in Canada, and the outcomes will depend on many variables whose true values are currently unknown.

In this analysis, the aim was to understand the potential healthcare and productivity costs of the COVID-19 pandemic by comparing the cost per patient, the cost of different contamination scenarios, and the potential economic costs of the only currently available "cure" (i.e., social distancing). The economic impact discussed in this white paper will include direct medical costs, productivity costs (i.e., indirect costs), and the potential short-term cost of the economic disruption that ensues.

Methods

To generate the required data and understand the cost and potential national strategies, a Monte Carlo Markov Chain (MCMC) model was created to simulate the propagation of the disease in the Canadian population. Several variables were key to the projections, including the R naught (Zhang S. et al. 2020), the impact of social distancing (Broderick M.P. et al. 2008), the isolation of patients (self quarantine or hospital isolation), and the isolation of the general population (stay at home policy). Additionally, the delay in implementation and policy aggressiveness of social distancing, isolation of patients, and isolation of the general population policies was used as a variable in the model.

The model is probabilistic in nature, and is based on estimates from 10,000 iterations for the population contamination uptake and all other variables. The source of unit costs is primarily based on Ontario Case Costing Initiative (OCCI) values, using specific coronavirus and respiratory failure codes. The COVID-19 patients' costs were therefore estimated based on existing codes for similar complications, and were not based on actual COVID-19 patients, since this data was unavailable at the point of writing. Additionally, Statistics Canada data was used to inform the income and natural life expectancy inputs. The probabilities of being hospitalized, requiring intensive care and experiencing mortality were based on the most recent American data (MMWR, March 18, 2020). An increase in mortality was assumed to simulate the potential impact of a healthcare system

overload by using the upper 95% confidence intervals of the mortality rates.

It is important to note that this analysis only estimates direct (medical costs) and indirect costs (productivity) and does not account for intangible costs, such as the value of life or societal benefits generated by the non-working population (volunteering, family ties, etc.), and results can therefore be considered as conservative estimates.

Analysis

Firstly, assessing the medical and productivity loss costs of COVID-19 patients is important in understanding the potential population costs of the pandemic. The comparison of a normal hospital capacity scenario vs. a healthcare system overload scenario demonstrates that a healthcare system overload would be more expensive, but not significantly since a system overload means patients cannot access the treatment they need. However, a healthcare system overload would result in a significant increase of mortality events.

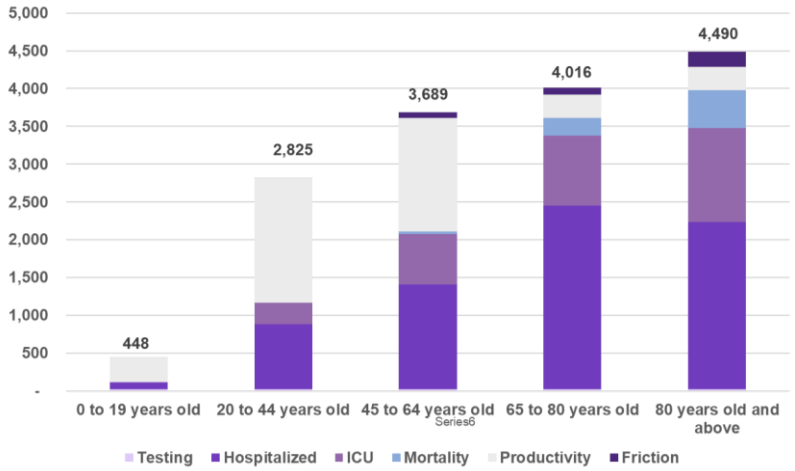
Table 1. Estimated cost per COVID-19 patient

	Normal scenario		Healthcare system overload scenario	
	Incidence in %	Cost per patient	Incidence in %	Cost per patient
Hospitalized	18.7%	1,129	18.0%	1,087
ICU	4.6%	469	3.7%	377
Mortality	0.6%	61	2.0%	204
Friction	0.6%	43	2.0%	170
Productivity	85.6%	1,115	83.2%	1,069
Testing	100.0%	25	100.0%	25
Total		**2,844**		**2,933**

Another important factor that should be considered is the age-stratified costs, since age is significantly associated with the COVID-19 outcomes and costs. The following figure shows that higher costs are associated with patients aged 45 and above, with those above 80 years of age having the highest cost; largely due to the high mortality rate for this age group. When considering the direct (i.e., medical-related) costs only, the 80+ population have the highest cost. The population between 20 and 65 also have a relatively high cost, however, their cost is mostly attributed to indirect (productivity) costs as opposed to direct medical costs (unlike the older age groups).

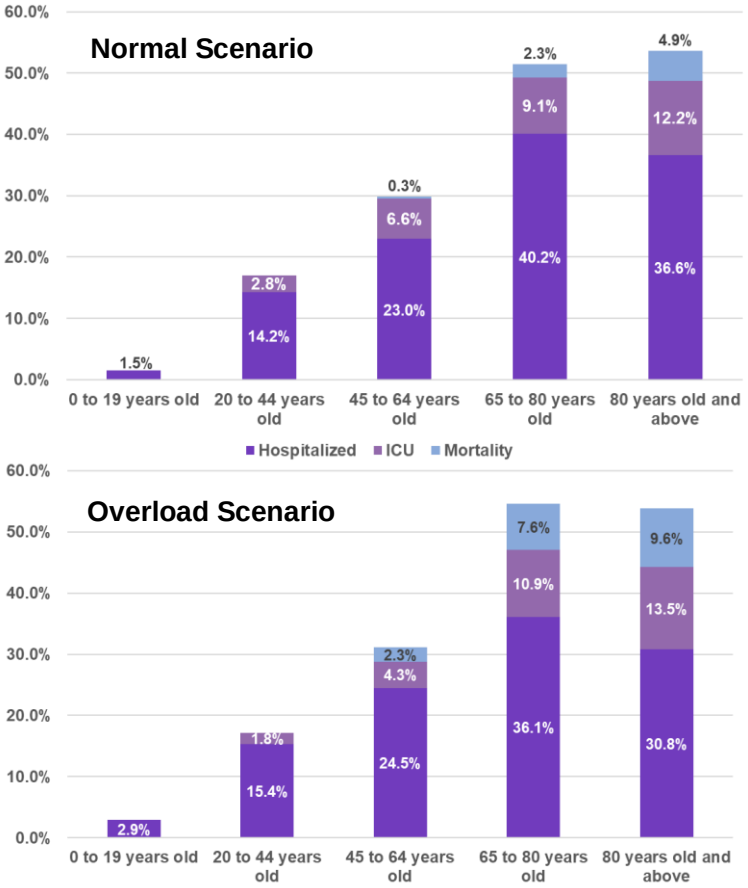
In addition to costs, it is also crucial to understand the rate of important health events in the population. The following figure presents the rate of events in a cumulative format for presentation purposes, but it should be noted that a patient can be in all categories,

Figure 1. Estimated cost per COVID-19 patient per age group for the Normal Scenario



as the events are not mutually exclusive. Here, the older age groups are associated with significantly higher event rates (hospitalizations, ICU visits, and mortality events) relative to the younger age groups.

Figure 2. Cumulative event rate per COVID-19 patient



Finally, estimated outcomes for different population contamination levels were assessed (presented below). The Council of Economic Advisers was projecting influenza pandemic scenarios at a rate of 20 to 30% (CEA, September 2019). Canadian Federal Health Minister Patty Hajdu mentioned that without proper disease control, the virus could affect 30 to 70% of the population (Adrian Wyld, March 12, 2020). Since it is difficult to determine how many Canadians will be infected by the disease, the above mentioned values were used to assess a range of contamination levels between each scenario (normal hospital capacity vs. healthcare system overload). Table 2 presents the costs and impacts of the different contamination rates for both scenarios. The lower bound of cost presented represents the direct costs identified in Table 1, while the upper bound represents the sum of direct costs and the potential long term productivity lost from mortality.

Table 2. Canadian population outcome scenarios

Contamination level in the population	Normal scenario			Healthcare system overload scenario		
	Mortality	Life years lost	Total costs in billion$	Mortality	Life years lost	Total costs in billion$
5%	11,368	27,284	5.39 - 19.56	37,895	306,535	5.56 - 75.59
20%	45,474	109,137	21.55 - 78.23	151,579	1,226,140	22.23 - 302.34
30%	68,211	163,706	32.33 - 117.34	227,369	1,839,210	33.34 - 453.52
50%	113,684	272,843	53.89 - 195.57	378,948	3,065,350	55.57 - 755.86
70%	159,158	381,980	75.44 - 273.8	530,527	4,291,490	77.8 - 1058.21

It is also critical to determine the potential cost of social distancing, especially considering that it is the only “cure” currently available that is being widely used on a global scale. Using preliminary data from China for February 2020, on the disruption of the economy, and applying that to Canadian data (Statistics Canada), a one-month economic lockdown was estimated to cost 24B$, a two-month lockdown would cost 57B$ and a three-month lockdown would cost 90B$; without considering the company closures and bankruptcy, which would certainly affect future economic recovery and growth.

It must be noted that these estimates are speculative and are presented to show an order of magnitude, rather than be used as an accurate point estimate. The most important aspect for the recovery will be the labor market, and the expression “Will there be a job to go back to” will become key to a quick recovery, and will justify strong and rapid business support during the lock-down.

Discussion

The current COVID-19 pandemic has enormous economic and social disruption capacity and could leave a lasting mark on Canadian economic and financial health if not approached properly. Therefore, it is critical to better understand the costs associated with the propagation of the pandemic, as well as the cost of the current “cure” of social distancing and economic shutdown. There are important limitations due to the unavailability of data that must be noted for this analysis, including the use of Chinese retail and manufacturing data, utilization of various cost codes, and the use of American COVID-19 mortality data.

Healthcare costs alone do not represent the only consequence of COVID-19, therefore the scenarios included the long-term productivity losses caused by mortality which present very high costs compared to a short-term lockdown. However, a prolonged lockdown could cause severe business closures that are not accounted for here and could change the balance of benefits and costs. When considering the potential costs for society with the different levels of potential contamination (Table 2), it is easily understood why the Canadian provinces are putting massive efforts into enforcing social distancing and short-term lockdown. If governments are able to maintain a low contamination rate by using social distancing and short-term economic lockdown (1 to 2 months), the long-term benefit of such policies will far outweigh the cost of an uncontained pandemic and its associated consequences.

Among the variables that were included in the analysis, the proper isolation of the sick or potentially sick population (unsurprisingly) seemed to have the greatest impact on the propagation of the disease. Since the number of sick or potentially sick people is still relatively small at the time of writing, this option

is not very costly and would be quite effective in preventing COVID-19 propagation. Another potentially effective strategy could involve isolation of the elderly population at risk. While this option is less effective than a full economic lockdown, it would have far less of a short-term economic impact than isolating the population as a whole. A full economic lockdown on top of patient isolation and social distancing will help halt disease spread but would have the largest economic costs, while social distancing on its own can only do so much, as it will not halt the spread of the virus without the isolation of the at-risk population. The isolation of the at-risk population on its own, while being the most economically and socially viable option, would help prevent healthcare system overcrowding and would avoid a long-term economic shutdown. However, a full lockdown approach is the only strategy that can lead to a complete halt of COVID-19 propagation, if this is still possible. Therefore, if the goal of the policy is to halt the virus, an economic shutdown will be needed. If the goal is to delay the contamination, then isolating the at-risk population seems to be a more economically viable option if a short-term shutdown was insufficient.

An important consideration is that while the at-risk population in Canada is less likely to be actively employed, the economic impact of their isolation (or mortality) is large. In an economy where demand and consumption are the main economic drivers, a reduction of the demand by an important subsegment of the population will undoubtedly have an impact. The consumption of the at-risk population is a revenue for many people in the economy. Therefore, assuming that the isolation or loss of an at-risk person would have a low economic impact is, at best, an economic fallacy.

On a different note, the reader must be reminded that the impact of COVID-19 spread, especially for medical personnel, is amplified by the lack of medical supplies and equipment largely due to resulting inefficiencies and bottlenecks in the supply chain (among other causes). This can result in reduced testing abilities and unavailability of other medical equipment, in addition to medical therapies. Canada's healthcare sector has largely relied on other countries for their medical materials for too long, and this dependency has been amplified in the recent years. In times of crisis such as the COVID-19 outbreak, the enormous potentially destructive impact of relying on these countries for medical material have become apparent. In such times, the countries supplying medical materials will certainly (and rightly) prioritize their own population over Canada's, and this is a risk that the Canadian population should not be exposed to so significantly. Therefore, a re-emphasis of Canada's industrial policy is needed to ensure that the necessary medical material and pharmaceuticals are manufactured in Canada and that their raw materials are sourced in Canada as much as possible. While this would likely increase the cost of some medical commodities, it would have the added benefits of creating a new local economy sector and would reduce our dependency on other countries for critical materials.

Since the labor market will be the key here to maintain economic confidence and recover quickly, a very aggressive business support, including the cancellation of corporate tax for 2019 in order to use the surplus to help companies survive, on top of rent relief and salary support, could be required. To help support consumer confidence, relieving some of their monthly expenses, such as an electricity and water rebate, and a rent relief program, could improve market confidence and the willingness to consume.

As a closing statement, the idea of imposing reparations on China for having caused the disease has been discussed recently. Reparations would be futile and could not possibly come close to covering the significant extent of the damage caused by COVID-19. However, requesting that countries with direct relationships with Canada (whether through direct flights or trading) impose extremely strict laws against so-called wet markets, which have an extremely high risk of spreading zoonotic diseases, could have a substantial impact on the prevention of future pandemics. Canada and other countries should at least cease to allow direct flights to countries that cannot enforce these minimal public health laws. A united front from the affected countries could create an incentive large enough for the countries with such wet markets to adjust their internal policies in order to avoid the resurgence of another coronavirus, or worse.

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Purple Squirrel Economics (PSE) includes around 35 health economists, writers, analysts, and market access professionals offering evidence generation, economic modelling, outcomes research, value communications, and market access strategy across therapeutic areas.

With a strategic senior team in the US, and Canada, we offer globally informed expertise, as reflected in our recent submissions to NICE, SMC, CADTH, PBAC, HAS, and IQWIG and responses to ICER (US).

We focus on:

- Health economic analyses: Economic models, indirect treatment comparison, population-matching, and statistical analysis in healthcare.
- Curated evidence generation: Systematic Literature reviews and targeted reviews presented on continuously updated platforms.
- Value communications including medical writing and from Early Value Frameworks to full global value dossiers, Academy of Managed Care Pharmacy dossiers, and local HTA submissions.

About the Author

Dr Tremblay is an applied economist specializing in health economic studies and health technology assessments with over 12 years of experience in the pharmaceutical industry and consulting.

His primary focus is on cost-effectiveness analysis and comparative effectiveness research for drugs and medical technologies. He has produced over 130 health economic and health technology assessment analyses and completed over 60 economic submissions to payers in 40 different countries.

Gabriel has a doctorate in Business Administration specialized in healthcare decision making for health technology assessment from BSI Luxembourg and Lyon University, a masters in health economics from HEC Montreal, and a BA in economics from Laval University.

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