COVID-19
Lessons We Should Have Learned
COLLECTED ESSAYS

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Essay Five

Lockdown: A Final Assessment

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Executive Summary

Economy wide COVID-19 lockdown policies, which included stay-at-home orders, school and business closures, along with mask and other non-pharmaceutical interventions, were a radical and untried social policy. Over the two years that followed the initial declaration of a pandemic an exceptional amount of research was done on all things related to COVID-19, and this included the costs and benefits of lockdowns.

The benefits of lockdowns were originally expressed in terms of mitigating the rush to hospitals and preventing the health system from being overrun. Later many thought that the virus might actually be eliminated by lockdowns (so-called "zero-COVID"). Initial benefit estimates were based on simple models that predicted the number of hospitalizations and deaths without lockdowns. Initial estimates of the costs of the lockdowns were based only on lost GDP from reduced labor-force participation. This led to grossly inaccurate cost/benefit estimates.
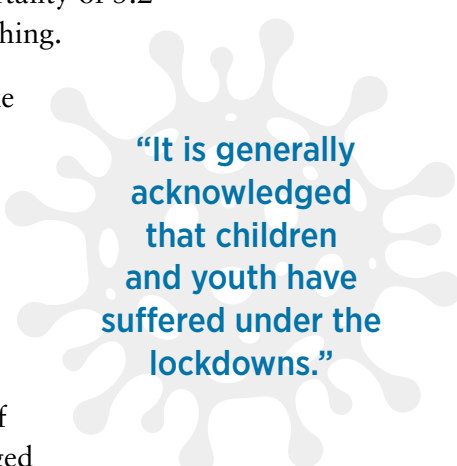
Examining the research over the past two years reveals several robust and clear findings:

1. Epidemiological models that do not include human behaviour changes in response to a novel virus drastically over-estimate the number of hospitalizations and deaths. All of the early models made death predictions that were off by factors of 10 or more. The infamous Imperial College of London model, led by Neil Ferguson, predicted that with

full lockdowns in place there would be 132,687 COVID-19 deaths in Canada by July 30, 2020; in fact, by that date there were 9,019 actual deaths.

2. Changes in people's behaviour in response to the arrival of the virus were immediate, and around the world and in every country infected by COVID-19 changes in behaviour meant that an endemic state was reached in the spring of 2020.

3. Behaviour effects were not limited to acting cautiously. Other behaviour changes including incomplete compliance with mandates—and compliance levels varied over the course of the pandemic. These changes in behaviour meant that deaths and hospitalizations were not substantially different in jurisdictions with different degrees of lockdown when other factors were controlled for.

4. Ultimately, estimates of the benefit of lockdowns in terms of lives saved were made based on data. Analysts used many different procedures in an attempt to identify the causal effect of lockdowns. Over and over, findings showed only small positive effects on death rates. The most recent and thorough meta-analysis found that after combining all lockdown effects there was only an average reduction in mortality of 3.2 percent. All of the lockdown efforts amounted to almost nothing.

5. The costs of lockdown go far beyond the lost GDP. In areas like worldwide food insecurity, international trade reductions, reduced travel, increased domestic violence, increased drug/alcohol/mental health issues, and employment disruptions, we are only aware of the costs and no estimates have yet been made of the level of these costs. Much work has been done on the effect lockdowns have had on children's physical well-being, lost education, early development, IQ, and social abilities. Again, no widespread estimates of the actual size of these losses have been made, but it is generally acknowledged that children and youth have suffered under the lockdowns.

> **"It is generally acknowledged that children and youth have suffered under the lockdowns."**

6. Lockdowns created collateral deaths. Behaviour changes in the face of COVID-19 and lockdowns included forms of self-protection that often ended up increasing mortality. These behaviour changes included missing regular medical checkups out of fear of contracting the disease. Estimates in the US show that there were 171,000 excess non-COVID-19 deaths through to the end of 2021. By that time the US had recorded 825,929 COVID-19 deaths. However, if lockdowns only reduce deaths by 3.2 percent, then only 27,303 lives were saved by lockdowns. Just on collateral deaths alone the cost/benefit ratio of lockdown is 171,000/27,303 = 6.26.

Widespread, economy-wide lockdown policies were a disaster. They had only marginal effects on the ultimate number of deaths, but imposed enormous costs.

I. Introduction

The logical foundation behind COVID-19 lockdowns was that no disease could be transmitted if personal contact was eliminated; therefore, transmission could be mitigated if personal contact was reduced.[1] Reducing transmission meant that lockdown could "bend the curve" of COVID-19 cases, prevent the hospital system from being overwhelmed, and lower overall mortality.[2] Unfortunately, this logic breaks down when applied to *reduced* contact among the general population. Reduced contact does not necessarily reduce general infection and subsequent death—despite the intuition of the inference. Once a disease like COVID-19 is in the general population, many factors interrupt the premise of lockdowns.

Faith in lockdowns also rests on the belief that they worked; that is, that the various forms of NPIs altered the course of COVID-19 and reduced mortality. This belief has been fostered by claims that lockdowns were built on "science," and "modeling." It was further supported by constant government and media appeals to a correlation: deaths rose, restrictions were put in place, and deaths subsequently fell. Whether deaths would have fallen without the restrictions was not addressed in political or public health news conferences.

In the spring of 2021 I wrote a critical assessment of the literature examining the costs and benefits of lockdown (Allen 2022). That exercise critiqued the use of epidemiological models to create counterfactual predictions on the number of deaths with and without lockdowns, and the misuse of value of statistical life (VSL) calculations. It then reviewed all of the cost/benefit studies I could find at the time, mostly in chronological order. Finally, after a review of early attempts to grapple with the costs of lockdowns, I used Professor Caplan's (2020) proposed alternative methodology based on a willingness-to-pay thought experiment to provide an estimate of the costs of lockdown for the first year of the pandemic.[3]

"Once a disease like COVID-19 is in the general population, many factors interrupt the premise of lockdowns."

I drew several conclusions. First, simple epidemiological SIR models were inappropriate to estimate counterfactuals.[4] Often parameter values were assumed too high, but most importantly, they did not account for endogenous changes in behaviour as individuals naturally responded to the risks posed by the virus. In practice, many people self-protected regardless of lockdown mandates, and many others ignored the restrictions. These models led to extraordinary predictions of COVID-19 deaths in a short period of time.
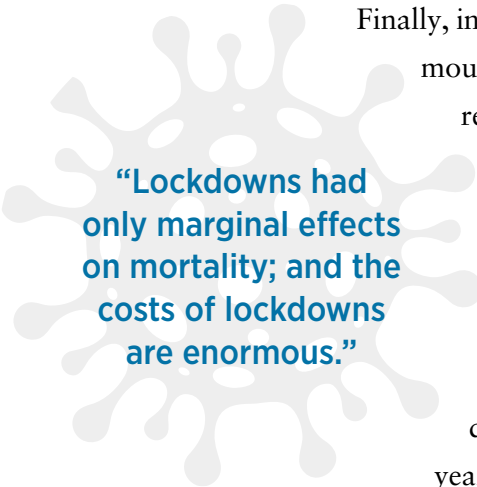
Second, over the course of 2020 to the summer of 2021, the empirical work estimating the effect of lockdowns on deaths, hospitalizations, and cases became increasingly sophisticated. Analysts made less use of models to generate counterfactuals and gave more attention to empirical methods that exploited quasi-natural experiments, instrumental variables (to avoid endogeneity issues), and difference-in-difference estimations (in which different groups are tracked as they go through some event) to see if there was evidence of a causal relationship between lockdowns and outcomes. I summarized these findings thus:

> A reasonable conclusion to draw from the sum of lockdown findings on mortality is that a small reduction (benefit) cannot be ruled out for early and light levels of lockdown restrictions. There is almost no consistent evidence that strong levels of lockdown have a beneficial effect, and given the large levels of statistical noise in most studies, a zero (or even negative) effect cannot be ruled out. Maybe lockdowns have a marginal effect, but maybe they do not; a reasonable range of the decline in COVID-19 mortality is 0–20%. (Allen, 2022: 15)

"Lockdowns had only marginal effects on mortality; and the costs of lockdowns are enormous."

Finally, in terms of estimated costs, the early evidence was that these were enormous and that individual categories of costs (e.g., lost years of life due to reduced education) alone swamped any gain the lockdowns provided. Using the Caplan method, a reasonable estimate of the cost/benefit ratio in Canada was 141 for the first year of the pandemic.[5] This means that the costs were 141 times greater than the benefits.

In this short article I update these findings based on research that has come out over the past year. The recent studies vary in quality, design, and outcome, but the bottom line is that the conclusions of last year remain the same. Models that fail to account for human behaviour should not be used for public health policy; lockdowns had only marginal effects on mortality; and the costs of lockdowns are enormous. Lockdowns as a COVID-19 policy choice is a no-brainer: they should not have been used.

II. Update on Models

Theoretical research on the COVID-19 pandemic demonstrated a clear distinction between epidemiologists and economists: the latter included equations that took some account of endogenous human response to the virus. Without such an adjustment the basic SIR models performed terribly; with the adjustment there is remarkable improvement. These new models are known as BSIR models, where the "B" stands for "behavioural." Such adjustments can take a number of forms: simply make the transmission rate of the virus depend on various human or environmental characteristics; include some form of "demand" behavior where responses change over time depending on the viral threat; or include time varying parameters that model self-protective behaviour.[6]
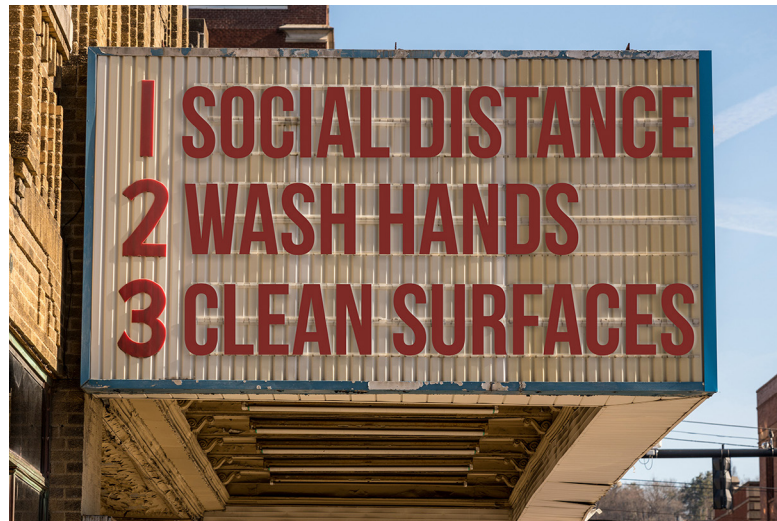
The BSIR models help explain one of the early empirical findings over the first wave of the pandemic. Atkeson, Kopeky, and Zha (2020) showed that once a country reached 25 COVID-19 deaths, then within 30 days the death rate growth falls to zero and the reproduction number becomes 1. According to these models, initially the entire population is susceptible to the novel virus and infections explode. This is followed by behaviour reactions that reduce infections until a "behavioural" endemic state is reached.[7] However, as these same authors explain in Atkeson, Kopeky, and Zha (2021), as the pandemic evolved, the behavioural responses also changed. Therefore, such models must contain dynamic behavioural functions to explain subsequent waves.

"Individuals behaved in a way that maintained a zero growth rate in infections and deaths."
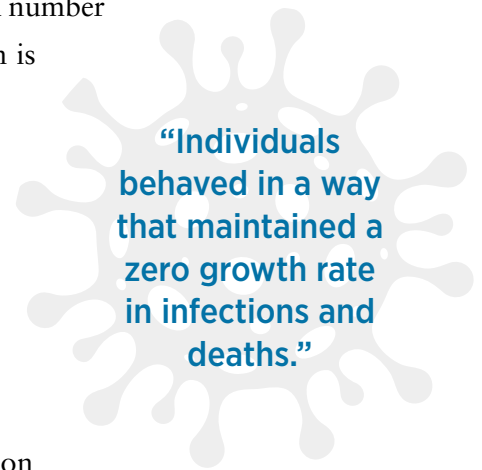
Figure 1, produced with Our World in Data, shows the reproduction number across the world over the course of the past two years. Until February of 2021 we see the Atkeson, Kopeky, and Zha (2020) finding: an initial high reproduction number followed by a quick leveling at 1. This can be thought of as a behavioural endemic state of the virus during the alpha variant; that is, individuals behaved in a way that maintained a zero growth rate in infections and deaths. However, as subsequent waves arrived, the figure shows there was increased variance in the reproduction number. The reproduction number still averaged around 1, but there

Figure 1: World Reproduction Number during the Pandemic

Estimate of the effective reproduction rate (R) of COVID-19

The reproduction rate represents the average number of new infections caused by a single infected individual. If the rate is greater than 1, the infection is able to spread in the population. If it is below 1, the number of cases occurring

Our World in Data

Source: Arroyo-Marioli, Bullano, Kucinskas, and Rondón-Moreno (2021).

were periods of significant growth in infections and deaths as individuals responded to vaccines, new variants of reduced lethalness, and increased knowledge of actual risks.

In a highly aggregated model, Droste and Stock (2021: 354-355) show that including endogenous variables that change over time significantly improves the ability to explain the progression of the virus over 2021/2022. Changes in rates of vaccination, treatment, and knowledge of protection; differences in variant transmissibility and lethalness; and pandemic fatigue led to changes in behaviour (especially among some age cohorts) that led to different levels of infections and deaths compared to the first wave. Droste and Stock find that over time there was less behavioural response, and infer that because of this "... exogenous actions to reduce activity (such as lock-downs) are likely to have only a limited effect on reducing contagion and spread" (2021: 355).
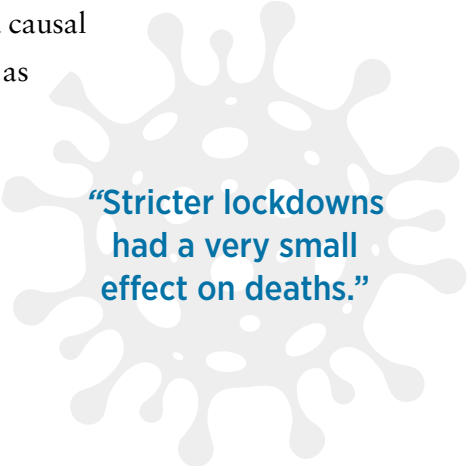
III. Update on Empirical Work

Since the publication of my paper there have been two published meta-analyses of lockdown effectiveness. The first, however, by Johanna et al. (2020), is based on 14 studies retrieved on June 8, 2020. Of these studies, 10 were based on simple SIR models which we know over-estimate the

counterfactual number of deaths. Three of the others were simple before/after time-series studies, which also overestimate the effect of lockdowns because there is no control group.[8] This leaves the Herby et al. (May 2022) meta-analysis, which is an updated version of their January 2022 paper, as the only recent major survey of the empirical literature. In addition to this paper, there is a "final report card" by Kerpen, Moore, and Mulligan (2022) which ranks US state performance over the course of the pandemic.

The Herby et al. meta-analysis

A meta-analysis is a method of statistically combining results from multiple similar studies that address the same question. Such an analysis provides a pooled estimate that is less biased and more precise than any given individual study. As such, a meta-analysis goes beyond the narrative synthesis of a typical literature review.

Herby et al. (May 2022) examine 22 studies. They made the important selection criteria that only difference-in-difference (DnD) studies were to be examined. In the absence of a "lockdown random control trial," such studies are likely the best method of determining a causal effect of lockdowns on mortality. A DnD study tracks different groups as they go through some event. In this case, all individuals experienced the pandemic, but only some under lockdown. The DnD methodology can calculate the *marginal* effect of the treatment (lockdown). Herby et al. (May 2022) are able to examine the effect of lockdowns, stay-at-home orders, and other specific forms of NPIs. It is a substantial and important contribution, but here I will focus only on a few of their findings.

"Stricter lockdowns had a very small effect on deaths."

The first results examine the relationship between lockdown stringency and mortality.[9] They summarize their findings:

> … the studies find that lockdowns, on average, have reduced COVID-19 mortality rates by 3.2%... To put the estimate in perspective, there were 188,542 registered COVID-19 deaths in Europe and 128,063 COVID-19 deaths in United States by June 30, 2020. Thus, the 3.2% PWA [precision weighted average] … corresponds to 6,000... avoided deaths in Europe and 4,000... avoided deaths in the United States. In comparison, there are approximately 72,000 flu deaths in Europe and 38,000 flu deaths in the United States each year. (Herby et al., May 2022: 40)

Given that they are examining the *marginal* effect of lockdowns, this finding means that *stricter* lockdowns had a very small effect on deaths.[10] Herby et al. (May 2022) find similar results with respect to shelter-in-place orders (SIPOs):

... SIPOs have reduced COVID-19 mortality by 2.0% (precision weighted average)... To put these numbers into perspective... the reduction of 2.0% PWA... corresponds to approximately 4,000... avoided deaths in Europe and 3,000... avoided deaths in the United States... (p. 43)

Herby et al. (May 2022) then examine a series of different non-pharmaceutical interventions: business closures, school closures, limited gatherings, travel restrictions, mask mandates, and "other NPIs." They conclude:[11]

The central precision-weighted average... is small for most NPIs and even positive for limiting gatherings. Only mask mandates seem to have a notable effect on mortality rates but note that the estimate is based on just three studies... The precision-weighted averages are generally robust to the sensitivity analyses... (2022: 56)

Combining all of the various types of lockdown effects, Herby et al. find an average lockdown effect on mortality of 10.7 percent with a range of 0.7 to 16.0 percent. When they weight by quality of study, *the average lockdown effect is just a 3.2* percent *reduction in mortality*. Lockdowns "at least in the spring of 2020 — had little to no effect on COVID-19 mortality" (May 2022: 58).[12]

Final report card

Kerpen, Moore, and Mulligan (2022) exploit the fact that the US federation allowed the 50 states the freedom to respond differently to the pandemic. Their report mostly ranked the performance of the 50 states on economic, education, and mortality scores. They also combined these outcome measures and discussed the relationship between the three. There was considerable variation across the states, and using the combined scores, Utah, Nebraska, and Vermont scored A+, with Montana, South Dakota, and Florida following. New York, DC, and New Jersey received an F-, with New Mexico, California, and Illinois not far behind with F grades.

Of interest here is the relationship between restrictions and mortality. Kerpen, Moore, Mulligan (2022) conclude:

> There is no clear pattern in which states had high and low mortality, although we note one major study from Rand Corporation researchers found that lockdowns increased all-cause mortality to a statistically significant extent. (p. 13)

> Excluding the geographically unusual cases of Hawaii and Alaska to focus on the continental U.S., there is no apparent relationship between reduced economic activity during the pandemic and our composite mortality measure. (p. 18)

> Unsurprisingly, there was a strong relationship between the states that had poor economic performance and closed schools — the lockdown states. (p. 20)

In other words, Kerpen, Moore, and Mulligan find little in the US data to suggest that lockdowns made any difference to COVID-19 mortality.

IV. Update on Costs

As I noted in my earlier paper (Allen 2022), it will take years before there is a full accounting of the costs of lockdowns. Various reviews (e.g., Onyeaka et al., 2021) highlight the far ranging impact on worldwide food security, international trade, education, hospitality, travel, domestic violence, drug and alcohol abuse, mental health, and unemployment. However, actual estimates of most of these costs are still not available.

"Kerpen, Moore, and Mulligan find little in the US data to suggest that lockdowns made any difference to COVID-19 mortality."

Much work has been done on children in terms of their education, the effect of school closures, and stay-at-home orders. These include studies on exercise and well-being (Oliveira et al., 2022), psychological well-being (Christner et al., 2021), sleep patterns (Cerasuolo et al. 2021), and learning outcomes (Deoni et al., 2021). One of the more disturbing findings has been the negative consequences on early child development. Babies born during the pandemic have scored lower on gross and fine motor skills, had developmental delays, and fared much worse on tests of intelligence (Moyer, 2022).[13] It is tragically ironic that children were least likely to suffer from the COVID-19 disease, but the most likely to suffer from the COVID-19 response. Again, actual estimates of these costs are not yet available.

Peltzman-effect deaths

In 1975 economics professor Sam Peltzman published an analysis of highway automobile safety regulations, arguing that efforts to increase safety were often undone by changes in behaviour induced by those same regulations. Imposing the wearing of seat belts increased the safety of the driver, which led him to drive less safely, which increased the chance of an accident. Driver deaths may go up or down depending on which effect is bigger, but pedestrians, cyclists, and passenger deaths are all expected to increase.

> **"Many people sacrificed regular medical treatment out of fear of contracting COVID-19 in, or on their way to, hospitals."**

With COVID-19 the so-called Peltzman effect can work a number of ways. For example, vaccines and masking might make people feel safer and subsequently engage in more intimate human interactions leading to more infections. Of course, the Peltzman effect works in the other direction, too: when situations are considered dangerous, self-protection leads to changes in behaviour that mitigate the danger. But these forms of self-protection may also increase risk of death. As is well known, throughout the pandemic, and especially in its early phase, many people sacrificed regular medical treatment out of fear of contracting COVID-19 in, or on their way to, hospitals. Failure to receive proper and regular medical attention then led to future excess deaths.

Williams et al. (2021) was the first paper to estimate Peltzman-effect deaths resulting from lockdowns. The authors compared "excess" deaths in England and Wales with their five-year average as their measure of mortality. They used a two-stage estimation procedure to break down excess deaths into those attributed to COVID-19 directly, and those attributed to lockdowns. In the first stage they used data on all-cause mortality in the five years prior to the pandemic to estimate a counterfactual mortality for 2020. They then exploited the imposition of lockdowns in a second stage regression to decompose the two causes of death. They found that COVID-19 excess deaths were 63 percent of excess mortality, and that lockdowns *increased* all-cause mortality; that is, there were substantial Peltzman-effect deaths, and these deaths offset any lives saved from lockdowns. They conclude:

the first national lockdown in England and Wales *had a net mortality increasing effect.* We postulate that this is likely a function of both low efficacy in the lockdown meeting its intended aim, combined with the presence of the Peltzman offsetting effect. (2021: 6995)

Mulligan and Arnott (2022) provide another report on Peltzman-effect deaths, or what they call "collateral damage." Unlike the Williams et al. paper, this study directly examines CDC data on nine cause-of-death categories (including COVID-19). Like the Williams et al. paper it uses past data from 1999 to 2019 to estimate expected excess deaths during the pandemic. From April 2020 to December 2021 excess deaths for those 18–64 were up about 26 percent compared to 18 percent for those over 65. Excess deaths due to drugs, alcohol, homicide, and traffic accidents were significantly up for those under 65. Mulligan and Arnott (2022) suggest that the collateral increase in excess deaths could be caused by a number of factors: increased use of alcohol and tobacco, increased weight gain from staying at home, and reduction in cancer screening. They conclude:

> Summing our estimates across causes and age groups, we estimate 171,000 excess non-Covid deaths through the end of 2021... For the European Union as a whole, the estimate is near-identical at 64 non-Covid excess deaths per 100K. In contrast, the estimate for Sweden is -33, meaning that non-Covid causes of death were somewhat low during the pandemic. We suspect that some of the international differences are due to the standard used to designate a death as Covid, but perhaps also Sweden's result is related to minimizing the disruption of its citizens' normal lifestyles. (2022: 13)

For the moment, suppose we ignore all of the costs of lockdown except the Peltzman-effect or collateral lockdown deaths and conduct a simple cost/benefit calculation. Herby et al.'s meta-analysis indicates that lockdowns had little effect on COVID-19 mortality: a 3.2 percent reduction. As of December 2021 the United States recorded 825,929 COVID-19 deaths. Without lockdowns then, the death toll would have been 853,232 (825,929/0.968). Therefore, lockdowns had the benefit of saving 27,303 lives. However, Mulligan and Arnott (2022) found 171,000 excess non-COVID deaths. Lockdowns in the US directly killed more than six times the number of people they saved!

Thus, before lockdown costs in terms of lost education, reductions in mental health, lost economic activity, lost civil liberties, and the like are even considered, lockdowns perversely led to an increase in mortality. Sadly, these excess deaths fell mostly on younger people who were generally not in harm's way from COVID-19.

V. Conclusion

This overview of the updated COVID-19 lockdown literature reinforces my conclusion from last year (Allen 2021). If anything, lockdown policies look to have been an even greater disaster than I had first calculated. These policies provided only tiny benefits, yet imposed extraordinary costs. It is hard to imagine any other peacetime policy in living memory that comes close to being such a tragic failure. If lockdowns are ever again contemplated when COVID-19 makes its next return, it will not be because of the "science."

Endnotes

1   For the purpose of this update I will define "lockdown" as any government restriction made to reduce COVID-19 transmission. This includes business closures, stay-at-home orders, school restrictions, mask and distancing mandates, and other non-pharmaceutical Interventions (NPIs).

2   Often lockdowns evolved into a means of achieving "zero COVID," and some have suggested that it will become a routine way of life as future viruses arrive. As of June 8, 2022, the BC government web page has a message from Provincial Health Officer Dr. Bonnie Henry that states: "Some people are asking when we will see masks mandated in B.C. The answer is that they already are. The mandate to use masks appropriately is a cornerstone of businesses' and organizations' COVID-19 safety plans, and is embedded in our health-care facilities' operational policies and restart protocols in other public institutions.... The orders we have in place now complement our clear and expressed expectation that people will wear masks in indoor public places like shopping malls, stores, on ferries and transit."

3   See Allen (2022), pp. 18-20, for a discussion of how I applied the Caplan method.

4   "SIR" stands for Susceptible, Infectious, and Recovered.

5   Based on different assumptions Allen (2022) estimated the cost/benefit ratios ranged from 1.19 to 7355.

6   See Chernozhukov, Hiroyuki and Schrimpf (2021); Eichenbaum, Sergio and Trabandt (2021); Gupta, Simon, and Wing (2020); and Droste and Stock (2021), for examples of BSIR approaches.

7   This is akin to a biological "herd immunity," but the viral spread is limited by behaviour, not natural immunity.

8   Such interrupted time-series studies follow a single group through the imposition of a lockdown, and ignore changes in behaviour caused by the viral threat. Therefore, any behaviour change is attributed to the lockdown only.

9   Stringency is based on the OxCGRT stringency index of Oxford University's Blavatnik School of Government, Hale et al. (2021).

10 As of June 12, 2022, Canada had experienced 41,585 Covid-19 deaths according to Our World in Data. Based on the Herby et al. estimate, lockdowns in Canada reduced deaths by only 1,330.

11 They find that limiting gatherings was counterproductive and actually increased mortality by 5.9 percent. This is consistent with findings by Mulligan (2021) who found that private homes were often less safe than schools and work places where various protocols were in place. It also makes the closing of churches a more egregious violation of Canadian charter rights.

12 This is in line with the findings of my own earlier study. Indeed, they state: "Overall, we believe that Allen (2022) is correct, when he concludes, 'The ineffectiveness [of lockdowns] stemmed from individual changes in behavior: either non-compliance or behavior that mimicked lockdowns.'"

13 Early studies on masking children focused on oxygen levels, and generally found no limitations. However, later studies (e.g., Stajduhar et al.) have found that face coverings in children "led to a profound deficit in face perception abilities."

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Acknowledgments

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