**Supplementary Expert Report on the COVID Epidemic Response in Alberta, Canada**

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In this affidavit, I provide responses to the reports in support of Alberta’s lockdown policies provided by government experts. While the government experts address many topics related to my expert report, I note at the outset one overarching issue that the government experts did not address. In particular, nowhere do the government experts provide the government’s formal analysis of the marginal benefits and harms of the various lockdown policies – business closures, stay-at-home orders, restrictions on social interactions, etc. – that it has imposed. The government experts provide their views and analyses on the benefits of these policies in terms of reduced COVID-19 disease spread, and they discuss a process of decision making in emergency situations that they say permits to – in effect – not conduct or provide such an analysis. But they do not provide any formal analyses of the harms of these policies, many of which I documented with reference to the scientific literature in my expert report. This insufficient consideration of a policy’s harms violates a basic principle of public health, which I outlined in my expert report and which the government experts did not contest.

In what follows, I organize by responses to the government experts on nine topics:

(1) The errors in PCR testing render them unfit for public health decision making;

(2) On the futility of contact tracing to control disease spread;

(3) The scientific evidence indicates asymptomatic and pre-symptomatic individuals spread the disease inefficiently;

(4) There is no established causal link between lockdown policies and COVID-19 case growth and mortality rate;

(5) The decoupling of cases and deaths despite the spread of variants versions of the virus;

(6) No consideration of harms of lockdown restrictions;

(7) The existence of lingering symptoms after recovery from covid infection (long covid) do not make lockdown a wise policy;

(8) Response to Criticism of the Great Barrington Declaration

(9) Problematic analysis of the possibility of herd immunity.

1. ***The Errors in PCR Testing Render them Unfit for Public Health Decision Making***

This section is in response to *Dr. Nathan Zelyas* affidavit. In my initial report, I explained that the test on which Canada bases its count of COVID infections – the RT-PCR test for the presence of the SARS-CoV-2 virus – will often generate a positive result even when an individual is not infectious (that is, does not pose a danger of infecting other people). [[1]](#footnote-1) The difficulty is that the RT-PCR test as implmented permits too many doubling cycles of viral particles before declaring a negative test. The functional false positive rate (by which I mean that the test resturns a positive result even though the patient from whom the nasopharyngeal sample was drawn is not infectious) increases with the number of cycles (known as a Ct value) required to produce a positive result. As I stated in my report, according to a careful study published in *Eurosurveillance* (a top journal in the field of epidemiology), if 27 cycles are needed for a positive test, the false positive rate is 34%; if 32 cycles are needed for a positive test, the false positive rate is 72%, and if 37 cycles are need for a positive test, the false positive rate is 92%.[[2]](#footnote-2) If more than 40 cycles are needed for a positive test, the functional false positive rate is nearly 100%. Many laboratories in Canada run the RT-PCR test up to 45 cycles, so false positive results are not just a theoretical possibility.

Since I wrote my report last January, scientists have written many papers that confirm my conclusions on this point. Of particular interest is a Canadian report by Dr. Jared Bullard, which found that – in their samples drawn from Manitoba, Canada – only 44% of adult patients with a positive RT-PCR test had nasopharyngeal samples that were positive in a viral culture analysis. The analogous numbers were only 19% for children less than 10, and 23% for children between 11 and 17.[[3]](#footnote-3) Another report from Johns Hopkins University found a qualitatively similar result and concluded that “the use of Ct values and clinical symptoms provides a more accurate assessment of the potential for infectious virus shedding."[[4]](#footnote-4)

This error in the test is a major problem with Alberta’s epidemic policy making because it relies on the accuracy of the RT-PCR tests to determine whether an individual is infected with the virus. The PCR test’s inaccuracies imply Alberta’s epidemic planning does not reflect the risk of community spread of the virus because a high case count or positivity rate may be due instead to functional false positive outcomes. Given this scientific evidence, it is certain that Canadian provinces are imposing sharp lockdowns – along with their attendant costs– even when the risk of community spread of COVID-19 does not warrant it.

Dr. Zelyas states in his report that different laboratories have different settings on their implementation of the PCR test that are difficult to standardize across laboratories, so that Ct value from a single laboratory should not be compared against a result from another laboratory. Additionally, he writes that viral culture analysis is expensive and time consuming and should not be used without an RT-PCR result alongside it. In his response, Dr. Zelyas concedes the problem that I identified with the RT-PCR tests (that is, a positive test result very often does not correspond to a patient is who is infectious or pose a risk of spreading the virus to others).

Surprisingly, Dr. Zelyas does not dispute any of these points. Instead, he assert that the RT-PCR test is a “gold standard” test for checking for the presence of SARS-CoV-2 virus – a fact not in dispute. The important question is not whether RT-PCR is a “gold standard” test for viral presence, but rather whether it is a gold standard test for determining whether a patient is infectious, which it is not. Rather, the gold standard test for infectivity involves checking whether a sample taken from the nasopharynx of a patient can infect, in vitro, a cell culture. Infectious samples are known as “culture positive”, while non-infectious samples are known as “culture negative”. From an epidemiological point of view, infectivity measurement is more important than a measurement of whether the virus is present, since it is possible for a patient to have non-viable viral fragments present, a positive PCR test, and yet not be infectious.

The relevant question then, is whether the RT-PCR test is sufficiently accurate to use as a tool to decide whether to sharply curtail the normal activities of people living in Alberta, imposing untold harm on them related to the lockdown. None of the Respondents’ affiants provide any argument or analysis in support of an affirmative answer to that question. Instead, they provide details about standardization procedures that the province uses to correct for other problems in the province’s case estimates that my original declaration did not discuss. None of these standardization procedures fixes the problem of functional false positives.

Dr. Zelyas asserts that it is inappropriate for laboratires to use or report Ct values because the RT-PCR test is a qualitative test and because of difficulties in calibrating the results across laboratories. However, there is no reason provided that such calibration could not occur within laboratories and be used as a basis for decision making, as is recommended in the literature on PCR testing. This is not responsive, since the number of cycles to achieve a positive result is a readily available (though unreported) output of the RT-PCR test currently in use in clinical laboratories throughout Canada. It is suggested that a patient should only be counted as a case if the RT-PCR test result indicates that the patient is very likely infectious, and not counted otherwise.

Although the Respondents’ affiants do not address the topic, there are simple alternative tracking methods available – using existing technology – that would yield more accurate information about disease risk. In particular, Canadian provinces could premise epidemic policy making on the number of cycles necessary to achieve a positive RT-PCR test result (a number already produced by the PCR test, but not used by Canadian policy makers in decision making about lockdowns). If Ct values are considered, two PCR tests on the same patient, taken 24 hours apart and analyzed at the same laboratory, could indicate whether viral load is increasing or stangant in a patient – a better indication of whether the patient is infectious or not than a single PCR test.

There is support for this approach from even pro-lockdown scientists, like Harvard University epidemiology professor Marc Lipsitch, who recently wrote:[[5]](#footnote-5)

“Our findings suggest that instead of discarding individual Ct values from positive specimens, incorporation of viral loads into public health data streams offers a new approach for real-time resource allocation and assessment of outbreak mitigation strategies, even where repeat incidence data is not available. Ct values or similar viral load data should be regularly reported to public health officials by testing centers and incorporated into monitoring programs.”

Since my expert report, the World Health Organization on January 13th, 2021, issued a technical report that supports the points made in that report.[[6]](#footnote-6) The report emphasizes two things. First, it points out that a positive COVID test does not necessarily mean that someone has any capacity of infecting someone else with the virus. Therefore, it instructs laboratories to report the replication number, as I suggested. And second, the WHO warns against relying on a single test for patients without considering clinical COVID-19 symptoms, as Alberta does. There is no mention in the Respondents’ affidavits that a positive case (patient) must be assessed clinically after diagnosis with Covid based on that positive test. Alberta decision making about the lockdowns is thus not aligned with WHO guidelines for using the PCR test data.

Such information is critical to inform good decision making and good public health policy in terms of the risk that a person who tests positive presents to the public, and in balancing the costs and benefits of making public health orders based on that information. Some of the factors that determines what special measures Alberta public health deems necessary to reduce the threat of Covid include the total number of cases, and the test positivity rate and trend. Without knowing the Ct value of those positive tests, it is impossible to determine whether the proportion of people in the population who are at risk of spreading the disease is increasing or decreasing. Faulty case counts that do not correct for this issue with Ct values do not reflect the risk that the identified cases pose to the population, and thus cannot provide a scientific basis for drastic public health orders (such as lockdown orders) that violate basic civil liberties.

Dr. Zelyas in effect argues that it is good public health practice to ignore the errors of the PCR test because it is in the interest of Canadian public health to identify every single person virally infected person and quarantine them, whether or not they pose any risk whatsoever in spreading the virus. The assertion that we need to capture every case, regardless of the risk that the person is false, as there are harms to lockdown actions that are taken upon the false premise that every PCR positive case poses a risk of infection spread, when the scientific evidence suggest otherwise.

1. ***On the Futility of Contact Tracing to Control Disease Spread***

Dr. Zelyas explains that Alberta relies on contact tracing programs as a means to control the spread of COVID-19 disease. Contact tracing programs require people who have been identified as COVID-19 cases to divulge to public health officials all the people with whom they have been in contact with during their illness, as well as all the locations they may have visited. Health officials have asked Canadians to install a phone application that aids in contact tracing by providing officials information about the locations where a person has frequented.

Despite extensive expenditures devoted to these efforts, there has been no demonstration that contact tracing programs in Canada have contributed to limiting disease spread. Alberta has not provided any data to illustrate the effectiveness of contact tracing. Rather, news reports suggest that contact tracing programs have been overwhelmed throughout Canada whenever COVID-19 case frequency starts to rise.[[7]](#footnote-7), [[8]](#footnote-8),[[9]](#footnote-9),[[10]](#footnote-10) Canadian researchers who have examined the topic concluded that Canadians were wary of the COVID Alert app because they do not believe that their privacy will be protected.[[11]](#footnote-11) The failure of contact tracing programs to control disease spread is not unique to Canada; a recent government report in the UK concluded that there was no clear evidence that it had accomplished much, despite an expenditure of 37 billion pounds over a two year span.[[12]](#footnote-12)

The futility of contact tracing to control COVID-19 disease spread is entirely predictable. While contact tracing is a useful public health technique for diseases where the location of disease spread is readily identifiable (e.g. sexually transmitted diseases), it is less efficacious for diseases like COVID-19, where the moment of disease transmission is harder to identify. This is especially true since a large fraction of COVID-19 cases involve no symptoms at all. Though asymptomatic disease spread is much less efficient than symptomatic disease spread, it does occur (0.7% of the time in intimate household settings), and it renders contact tracing efforts less likely to succeed. Errors in the PCR testing, which render it unable to distinguish a COVID-19 patient who is highly infectious from a patient who has recovered from the disease, still has non-infectious viral fragments detectable, and is no longer a threat to spread the disease, also make contact tracing efforts less likely to succeed. When contact tracers are overwhelmed, delays in identifying, contacting, and testing contacts makes it more likely that contacts will be found long after they pose any risk of disease spread. Finally, from a privacy point of view, the reluctance of Canadians (and others) to cooperate with contact tracers is entirely understandable – there is little to no private benefit derived by the infected patient from reporting on their friends, family, churches, or favorite restaurants, and there is some possible social harm from the unwanted attention and privacy violations inherent in contact tracing. I discuss many of these issues in a paper entitled “On the Futility of Contact Tracing”, that I published in September of last year.[[13]](#footnote-13)

1. ***Scientific Evidence Indicates Asymptomatic and Pre-symptomatic Individuals Spread the Disease Inefficiently***

In my original expert report, I provided evidence from a large meta-analysis of within household spread of the virus, from an infected person to someone else living in the same home, where none of the safeguards that restaurants recommended by the CDC are typically applied. This study represents the most comprehensive survey of the vast empirical literature on asymptomatic spread; because it focuses on a single setting (household transmission), it is not subject to the same problems that other studies on this topic might have. The primary result is that symptomatic patients passed on the disease to household members in 18% of instances, while asymptomatic and pre-symptomatic patients passed on the disease to household members in 0.7% of instances.[[14]](#footnote-14) Kindrachuk does not address this evidence on the relatively low risk of asymptomatic disease spread drawn from real-world transmission data and focuses instead on modeling studies that require a substantial number of unverifiable assumptions. In particular, these models often make the *assumption* that lockdowns actually work in reducing interactions between individuals in ways that reduce disease transmission risk. It is inappropriate to then conclude from such modeling studies that lockdowns work in a way predicted by the model. The Respondents’ affidavits provide no evidence that they have conducted any validation exercises which would suggest that the models on which they rely to infer the efficacy of church closures have actually match real-world evidence I provided from the scientific literature of low levels of asymptomatic spread. Many of the studies cited by Kindrachuk were taken into consideration within the large meta-analysis, which ultimately found, after analyzing 54 studies (including Kindrachuk’s cited studies and others) a very low chance of asymptomatic and pre-symptomatic disease spread.

One clear implication of the small likelihood of asymptomatic and pre-symptomatic disease spread and a higher likelihood of symptomatic spread is that the Respondents have available a simple policy that would have similar infection control properties but with substantially lower harms.

There is at least one prominent real world study that some – including Respondent experts -- have used to argue that asymptomatic disease spread is common. A recently published meta-analytic study by Qiu et al. (2021) distinguishes the likelihood of disease spread by a pre-symptomatic individual from the an asymptomatic but not pre-symptomatic individual.[[15]](#footnote-15) A primary finding of this study is that, while asymptomatic but not pre-symptomatic individuals are exceedingly unlikely to spread the disease, individuals who are not symptomatic now, but will eventually develop symptoms, are efficient at infecting others in their pre-symptomatic state. One problematic interpretation of this result is that relative efficiency of disease spread by pre-symptomatic individuals militates in favor of lockdown policies and mass asymptomatic testing. This interpretation is incorrect.

Distinguishing between an infected individual who will eventually develop symptoms and an infected individual who will never develop symptoms is practically impossible without the passage of time. Infected individuals who will develop symptoms tend to do so within a very short interval (two to three days) after first becoming infected. Meanwhile, infected individuals who never develop symptoms may test positive with the PCR test for the virus for an extended period of time. These two groups of observationally identical individuals are mixed in the population in some unknown frequency that may change over time. Given this information constraint, from a policy point of view, the relevant question is how likely it is that an infected individual without symptoms (whether pre-symptomatic or purely asymptomatic) will spread the disease to close contacts. For the purpose of answering this crucial policy question, the Madewell et al. (2020) study provides an answer (less than 0.7% secondary attack rate in household settings), while the Qiu et al. (2021) study does not. Additionally, unlike the Madewell et al. (2020) study, the Qiu et al. (2021) study does not concentrate its focus on a homogenous environment (households), which makes the results it reports harder to interpret.

*Notably*, *this* evidence on the relatively low risk of asymptomatic disease spread drawn from real-world transmission data *is not so much disputed, as ignored.* Instead, *those who insist on a relationship between infected people who show no symptoms and significant Covid spread,* tend to rely on modeling studies that require a substantial number of unverifiable assumptions.

1. ***There is no established causal link between lockdown policies and COVID-19 case growth* *and mortality rate***

The Respondents’ arguments are all premised on the assertion that lockdown policies, such as prohibitions on gatherings, in-person worship and non-essential business closures, etc. work to reduce the risk of COVID-19 infection in the community. Much of the evidence they refer to in their affidavits/reports is based on modeling studies, which as noted in the original expert report, have a poor track record.

Now, however, there has emerged a growing peer-reviewed empirical literature that demonstrates the futility of lockdowns to control COVID case growth over a long period of time. This may be illustrated by describing one peer-reviewed study recently published in the *European Journal of Clinical Investigation*, of which I am a co-author. This study compares the effectiveness of mandatory lockdown orders (stay-at-home orders and forced business closures) versus less restrictive policies adopted by ten European and Asian countries on case growth in Spring 2020.[[16]](#footnote-16) This study re-analyzes and revises the results from an earlier study by using countries that did not introduce mandatory stay-at-home orders and business closures over this period (like Sweden and South Korea) as a comparison with countries that did.[[17]](#footnote-17) The main conclusion arising from this analysis is that “While small benefits cannot be excluded, [my co-authors and I] do not find significant benefits on case growth of more restrictive NPIs. Similar reductions in case growth may be achievable with less restrictive interventions.”

Other peer-reviews papers, using different methodologies, and different comparison countries and regions, confirm this finding.[[18]](#footnote-18),[[19]](#footnote-19), [[20]](#footnote-20) Another peer-reviewed study evaluating the efficacy of lockdowns was published in the prestigious journal, *Scientific Reports*. The analysis considers the effects of non-pharmaceutical interventions such as those imposed in Canada on COVID-19 related mortality in 87 regions around the world. The primary finding is that in the vast majority of cases there is no detectable effect of lockdowns on COVID mortality. The authors conclude that “With our results, we were not able to explain if COVID-19 mortality is reduced by staying at home in ~ 98% of the comparisons after epidemiological weeks 9 to 34.” Earlier work[[21]](#footnote-21), which used modeling methodologies that held as a fixed assumption that lockdowns reduce disease spread to conclude that lockdowns were effective, have been criticized on methodological grounds.[[22]](#footnote-22) The observational data analyses cited here do not suffer from this methodological flaw.

Evidence that lockdowns do not reduce transmission or prevent death comes from a case study contrasting COVID results in California (which has implemented extended lockdowns, including mandatory stay-at-home orders, curfews, school, church, and business closures, among other strategies at various points during the epidemic), and Florida which is demographically similar to California, but has not implemented harsh lockdown since May 2020 (and entirely lifted lockdowns in September 2020).

Through March 28th, 2021, 8.9% of all Californians have been identified as COVID cases – 3.6 million cases.[[23]](#footnote-23) Since most infections are not recognized as cases, a much larger fraction of the population has been infected with COVID.[[24]](#footnote-24) Through March 31st, nearly 58,000 people have died in California with COVID.[[25]](#footnote-25) In sharp contrast with California, Florida partially lifted its lockdown in May 2020[[26]](#footnote-26) and then further relaxed restrictions in September 2020.[[27]](#footnote-27) Most Florida schools and universities have been open for in-person instruction since the fall, normal human activities – sports, church-going, visits to the park – occur with regularity, and businesses have been open for in-person activities.[[28]](#footnote-28) Local ordinances can recommend masks and social distancing and impose indoor capacity limitations but cannot mandate closures, as is the case in California. Disneyworld in Orlando, Florida has been open since July.[[29]](#footnote-29) At the same time, Florida increased testing and protection of its nursing homes to reduce the risk of COVID among its most vulnerable residents.

Despite the dramatically different policies, the infection control results to date in Florida look remarkably similar to California's, and in some ways better. Through March 28th, 2021, 9.5% of Floridians have been identified as COVID cases.[[30]](#footnote-30) Once we account for the fact that Florida has the fifth oldest population in the country and California the seventh youngest,[[31]](#footnote-31) the death rates with COVID through March 2021 are lower in Florida than they are in California. In fact, the COVID mortality rate for *both* the under-65 population and the over-65 population are lower in Florida than in California.

The Respondents in their affidavits/reports seem to think of lockdowns as the only possible way to protect the population from exposure to COVID risk. In reality, the California lockdowns and elsewhere have served to protect only a portion of the population – the rich. Data from L.A. County, where a large fraction of COVID cases in California has occurred, put this fact in stark relief.[[32]](#footnote-32) Through June 29th, in the wealthiest parts of L.A. county (with less than 10% poverty), the age-adjusted death rate with COVID-19 was 128 people per 100,000 population. As we look in poorer and poorer areas, the death rate mounts; areas with more than 30% poverty have faced a death rate of 416 people per 100,000 population – more than three times as many deaths. Hispanics in L.A. have borne the worst of the pandemic, with a death rate of 366 per 100,000 people. By contrast, black, Asian, and white residents have experienced 215, 162, and 125 deaths per 100k residents, respectively. The California and Canadian[[33]](#footnote-33) lockdowns are a form of trickle-down epidemiology. In Florida, by contrast, there is little difference between races in COVID-related death rates throughout the epidemic, with the Hispanic population dying at lower rates than the white population.[[34]](#footnote-34)

1. ***The Decoupling of Cases and Deaths Despite The Spread of Variants Versions of the Virus***

Alberta has had tremendous success with its vaccine rollout. As of July 30th, 2021, 55% of Alberta’s population is fully vaccinated, which provides substantial protection against hospitalization and death from COVID. Furthermore, Alberta has prioritized its older population for vaccination so that over 85% of the vulnerable elderly had received at least one dose. Vaccination access for the elderly started in mid-to-late-February in Alberta. Fortunately, this was in time for the third wave of cases in Alberta, which began in mid-March 2021 and has recently subsided.

The fruit of this success is a decoupling of cases and deaths, despite the spread of variant versions of the virus throughout Canada. In the figures below, I plot data from Alberta public health on daily diagnosed COVID cases from January 2020 to July 2021. The second wave of cases (after the first wave in March 2020) started in September 2020, peaked in January 2021, and subsided by Februar 2021. The third wave of cases began in March 2021, peaked in late April/May 2021, and subsided by July 2021. The figure below that plots death with COVID per day. During the second wave, in a largely unvaccinated population, deaths rose proportionally with cases with a lag of two- to three- weeks, just as they had during the first wave of cases in March 2020.





However, during the third wave, cases and deaths decoupled. Though cases rose sharply during the third wave, deaths did not rise as sharply as cases. This is because such a large fraction of the elderly population had received their first dose of the vaccine. These results show that at this point, the elderly population is much less susceptible to poor outcomes from COVID infection than they once were.

When the elderly population in Alberta is fully vaccinated, the decoupling of cases and deaths will be near complete. This decoupling also occurred, for instance, in Sweden, which started its vaccination campaign in late December 2020. While avoiding stringent lockdown measures, Sweden deployed an [imperfect](https://www.aftonbladet.se/debatt/a/bnnEQd/lat-ingen-over-60-ar-jobba-utanfor-hemmet) focused protection strategy through most of the pandemic, but that changed with the vaccine. As an EU member, its vaccine deliveries were slower than in the US, but Sweden was strict in providing its few available vaccine doses to care home residents, older adults, and front-line health care workers.

Like Canada, Sweden had a sizeable second COVID wave, lasting between September 2020 and February 2021, shown in the figure immediately below. Sweden had a third COVID wave that started in February 2021 and has only recently subsided.



The Swedish vaccination campaign got off to a slow start along with the rest of the European Union. By the end of March 2021, it had vaccinated only 7% of the population but had focused nearly every dose on its elderly population. Sweden was strict in providing its few available vaccine doses to care home residents, older adults, and front-line health care workers. To illustrate how serious the Swedes were, a local government employee [was fired](http://www.upplandsvasby.se/arkiv/nyheter/2021-03-05-socialchefen-underrattad-om-avsked-efter-utredning-om-otillaten-vaccinfortur.html) for skipping the vaccine queue.

Despite this slow vaccine rollout, Sweden had substantially fewer COVID-associated hospitalizations and deaths during that third wave than would be expected from the amplitude of the wave (which matched in size the amplitude of Sweden's second wave). This figure immediately below tracks deaths per capita in Sweden over the second and third waves. The cause of this successful decoupling of cases and deaths is Sweden's focused deployment of the vaccine, just as they were in Canada. These outcomes during the Swedish third wave thus provide a reliable guide to what Canada and Alberta should expect in the coming months now that they have achieved focused protection.

Because of the success of the vaccination campaign in Alberta, COVID poses no real or imminent serious threat to the population's health and the situation is clearly no longer an emergency, even for previously vulnerable older adults.

1. ***No Consideration of Harms of Lockdown Restrictions***

Although a fundamental principle of public health requires that officials conduct a careful consideration of *both the costs and benefits* before imposing any policy, the Respondents’ affidavits do not show any evidence that Alberta has conducted a rigorous evaluation of the lockdown policies it has adopted. It is clear from the Respondents’ affidavits that the Province has worked to quantify the purported public health benefit from its lockdown policy (though this analysis has its problems that are addressed in the original expert report and here). However, it is striking that there is no discussion whatsoever of the collateral harms from these forced closures.

Instead, the Respondents have offered the testimony of an expert (Long) who discusses at length the emergency response system that Alberta has put in place to address emergencies that may afflict the province. None of this testimony shows evidence that the province considered the collateral harms of the lockdown policies at all in its decision making, certainly not in any formal way akin to the analysis of COVID risk.

In my original expert report, I discussed some of the scientific evidence documenting lockdown harms, including physical harms from delayed medical care and psychological harms from the lockdowns themselves and harms associated with the closure of schools, so I will not repeat this evidence here. Policies enacted without a careful consideration of *both* its costs and benefits cannot possibly be construed to have a rational basis.

1. ***The Existence of Lingering Symptoms after Recovery from COVID Infection (Long COVID) Do Not Make Lockdown a Wise Policy***

Some analysts and politicians have used the possibility that a fraction of patients who recover from COVID infection will experience lingering symptoms to justify lockdown measures. Long COVID, as this phenomenon is called, includes a complex set of clinical outcomes with a poorly understood link to acute COVID infection.[[35]](#footnote-35) One cross-sectional study found that about 30% of recovered COVID patients reported at least one symptom months after recovery, with fatigue and anosmia (loss of sense of smell) by far the most common.[[36]](#footnote-36) A separate study with a more convincing longitudinal methodology, by contrast, concluded that 2.3% of patients experienced such symptoms 3 months after recovery.[[37]](#footnote-37) Patients who suffered a more severe acute course of COVID, including hospitalization, were more likely to report lingering symptoms after recovery.[[38]](#footnote-38) A study on children who recovered from COVID found the same rate of long COVID symptoms as a control group of children who had no serological evidence of prior COVID infection.[[39]](#footnote-39) Some analysts have noted the similarity between “long COVID” symptoms and other functional somatic syndromes that sometimes occur after other viral infections and other triggers (and sometimes with no identifiable etiology.[[40]](#footnote-40)

To summarize, long COVID symptoms do occur in a minority of patients who recover from COVID, and pose a real burden on patients who suffer from it. However, this fact does not alter the logic of my argument that the success of the vaccine rollout in Alberta should end the state of emergency. A vaccinated individual has a near zero liklihood of having a severe course of the disease resulting in hosptalization, and hence much less likely to suffer from long COVID. In fact, one study by Yale University researchers concluded that vaccine administration itself eases the symptoms of long COVID.[[41]](#footnote-41) The successful vaccine roll out in Alberta addresses the problem of long COVID, just as it addresses the problems of COVID associated mortality.

1. ***Response to Criticism of the Great Barrington Declaration***

Dr. Hinshaw criticizes the Great Barrington Declaration (hereafter, GBD) [[42]](#footnote-42) in her affidavit. The logic of the GBD is that the return to normal life will improve health and other outcomes for the non-vulnerable by reducing lockdown harms, while focused protection policies will protect the vulnerable. The aim of focused protection is to minimize overall mortality from *both* COVID-19 *and* other diseases by balancing the need to protect high-risk individuals from COVID-19 while reducing the harm that lockdowns have had on other aspects of medical care and public health.  The GBD represents a return to standard public health practices, which acknowledge that human health requires more than just infection control and is instead concerned with the health and well-being of populations in a much broader way.[[43]](#footnote-43)

Dr. Hinshaw writes skeptically about the possibility of protecting vulnerable people (the elderly primarily, but also others with certain chronic conditions for whom COVID-19 infection poses a high mortality risk) from infection without lockdowns. She argues that the only way to protect the vulnerable is to reduce community disease spread. In particular, she argues that focused protection of the vulnerable – as described in the Great Barrington Declaration – is impossible without lockdown. She mischaracterizes focused protections as requiring a complete segregation of vulnerable and non-vulnerable populations, when what is necessary are policies that reduce the probability that infected people will have extended contact with vulnerable people in a context where the spread of the disease is likely. The former is impossible, while the latter is certainly possible, especially since the leading meta-analysis study discussed above shows that asymptomatic spread is exceedingly rare. There are several other major problems with Dr. Hinshaw’s argument.

As we have seen, there is good theoretical and empirical evidence that lockdowns do not and cannot control community spread of the disease over an extended period of time. Even if lockdowns slow the spread, vulnerable people will ultimately be infected. The best example of success of the Focused Protection approach is in Florida, which, as discussed above, has reduced its death and case count without lockdown, and has fared better than California (with some of the harshest lockdown restrictions in the US) in terms of its overall Covid death rate accounting for age.[[44]](#footnote-44)

Focused protection is possible as long as public health experts deeply understand the particular living circumstances of the vulnerable and are creative in designing effective interventions based on that understanding. Empirical evidence from around the world shows that focused protection of nursing homes is possible. During the first wave of the epidemic, there was an unfortunately high rate of exposure of nursing home residents to COVID-19 infections – a failure of focused protection. In the US, nearly half of all COVID-19 deaths occurred in nursing home settings, fueled by policies – famously adopted by New York state – that sent elderly COVID-19 infected patients back to nursing homes that could not effectively quarantine them.[[45]](#footnote-45) The same was true in in Canada. The proportion of COVID-19 deaths in nursing homes dropped sharply during the second wave of COVID-19 infections over the summer as these facilities adopted better policies to protect their elderly residents.[[46]](#footnote-46)

A strategy of focused protection involves a suite of policies that protect people who are particularly vulnerable (e.g. the elderly) from COVID-19 infection. Those strategies have been discussed thoroughly in my previous report.

Finally, and most importantly, the vaccines make it relatively simple to implement a policy of focused protection. By prioritizing the older, most vulnerable, population for vaccination, it is possible to provide focused protection, even without adopting any of the policy suggestions outlined above. Certainly, no lockdown is necessary for reducing hospitalization and deaths from COVID, as long as the older population is prioritized for vaccination. As I have shown above, the effective roll-out of the vaccine in Alberta has decoupled cases from hospitalizations and deaths; Alberta has successfully achieved focused protection.

1. ***Problematic Analysis of the Possibility of Herd Immunity***

Kindrachuk provides a misleading analysis of the role that herd immunity plays in the control of the epidemic. Herd immunity – also known as endemic equilibrium – occurs when enough people have immunity so that most infected people cannot find new uninfected people to infect, leading to the end of the epidemic.[[47]](#footnote-47) This means that the epidemic will end before everyone is infected, although it will continue in endemic form with low rates of infections.  Sooner or later, herd immunity will be reached either through natural infection or through a combination of vaccinations and natural infection. Since worldwide zero COVID is impossible, herd immunity is the endpoint of this epidemic regardless of whether we choose lockdowns or focused protection to address it.

Kindrachuk cites the experience of Manaus, Brazil to assert that herd immunity cannot be achieved. The basic fact cited is that Manaus has experienced two very large epidemic waves, and that high levels of population immunity achieved during the first wave did not protect the population from a large second epidemic wave. The major problem with this reasoning is that it is based on a single, flawed, seroprevalence study conducted in Manaus in the middle of 2020. The 76% estimate was not based on a random survey, but on blood donors, who are a very select group of people in the developing world. Moreover, the seroprevalence among the blood donors was 52%, which was adjusted upwards based on questionable mathematical modelling of the waning of anti-bodies. Hence, we do not really know the level of immunity in Manaus from earlier this year.

Apart from this factual problem, there are several other explanations for the Manaus, Brazil experience that Kindrachuk does not consider, and would need to be ruled out from a scientific point of view before accepting the proposition that herd immunity failed in Brazil. First, residential segregation in Manaus (along socio-economic lines) could lead to a separation in the peaks of epidemics occurring in different communities. An unfortunate feature of the reporting of figures during this pandemic has been the misleading aggregation of data from different geographical locations. For instance, the impression of a bigger ‘second wave’ occurring within the same jurisdiction, may be due to a bigger area being affected during the second wave compared to the first. But even within the same location, residential and socio-economic segregation can create the conditions for a second wave to occur more or less independently of the first.

Second, the herd immunity threshold is not a single constant that is known in the literature, but instead is likely to vary substantially from place to place and by season of the year since interaction patterns between people – and disease contagion risk – vary along these dimensions. The herd immunity thresholds differ sharply by location and time, depending upon factors such as population density, living arrangements, social interactions, climate, season and hygiene. It is not a universal constant determined by biological characteristics of the virus alone. One cannot learn much about herd immunity thresholds in Alberta from the experience of Manaus, Brazil.

Third, based on a location (Manaus, Brazil) with a largely uncontrolled epidemic, it is impossible to conclude that lockdowns are a good strategy to control the epidemic. It is scientifically unconvincing to attempt to make inferences about the efficacy of lockdowns from one single location where lockdowns were not implemented. A similar serosurvey conducted in the Dharavi slums in Mumbai, India,– the focus of an intense lockdown through May and only limited reopening in June, 2020 – [found](https://www.bbc.com/news/world-asia-india-53576653) a seroprevalence of 57% in early July, 2020.[[48]](#footnote-48) One of the researchers who conducted the study conveyed the hypothesis to me that the lockdown may have intensified the spread of the disease in the densely packed region by forcing residents to spend long days in packed rooms with poor ventilation. Similarly, [nearly 40%](https://andina.pe/Ingles/noticia-peru-nearly-4-million-people-may-already-have-had-covid19-in-lima-metropolitan-area-827959.aspx) of the population of Lima, Peru has SARS-CoV-2 specific antibodies, despite one of the longest lasting and harshest lockdown policies in the world.[[49]](#footnote-49)

Fourth, the experience of Manaus, Brazil does not rule out the possibility of replacing Alberta lockdowns with a policy of focused protection with good results. Manaus, Brazil did not adopt a focused protection strategy. As expected with a largely uncontrolled epidemic, the seroprevalence was roughly equal across the age-distribution in Manaus, which makes it similar to lockdown countries like Spain.[[50]](#footnote-50) As a contrast, in Sweden seroprevalence (which adopted something more akin to a focused protection strategy) was more than twice as high among ages 20-64 compared to those over 65, belying the assertion that focused protection is impossible.

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