Commentary

Rethinking lockdowns: The risks and trade-offs of public health measures to prevent COVID-19 infections

Ari Joffe

Early in the COVID-19 pandemic, there was contagion of fear and lock-down policies across the world. Modeling in March (based on inaccurate disease estimates) suggested there could be 510,000 deaths in Great Britain and 2.2 million deaths in the US by mid-April, with cases surpassing intensive care demand by 30 times. Non-pharmaceutical interventions spread to around 80 percent of OECD (Organisation for Economic Co-operation and Development) countries within a two-week period in March 2020, mainly predicted by prior adoptions of a policy among spatially proximate countries.

Most countries in the world implemented lockdowns, restricting their population's movements, work, education, gatherings, and general activities in attempt to reduce transmission and thus 'flatten the curve' of COVID-19 cases. Cognitive biases largely drove the response,[1] and resulted in the triumph of groupthink (the desire for harmony and conformity prevailed, and we became less willing to alter our course of action). My own cognitive

biases made me (like others) focus on controlling one disease, COVID-19, to the exclusion of important broader considerations discussed below; thus, I was an initial proponent of lockdowns (see Kumar et al. 2020).

Better information emerges

As the pandemic progressed, better information emerged that should alleviate much of the fear.

First, the difference between the case fatality rate and the infection fatality rate is important. Early estimates were based on the case fatality rate, the deaths in confirmed diagnoses of COVID-19. This is a gross over-estimate of death rates, as most infections (at all ages) are mild or asymptomatic and were not detected. According to a study by John Ioannidis (2020), the median infection fatality rate – based on detection of antibody (seroprevalence) in populations – in those infected with SARS-CoV-2 is 0.23 percent, and for those under 70 years old, is 0.05 percent.[2] Thus, usually 99.95 percent of people age less than 70 infected with SARS-CoV-2 survive.

Second, determining who is at highest risk of severe outcomes is important. By far the most important risk factor is older age. The risk of death from infection in children is 100 to 1000 times lower than in those over 80 years. In Canada, the risk of death from infection for those less than 65 years is 100 times lower than for those equal to or greater than 65 years. Other risk factors include several chronic diseases and obesity (comorbidities); however, these have only a moderate effect on outcome. For people under age 50 the infection fatality rate is less than 0.01 percent and for those age 50-64 is less than 0.15 percent. About 80 percent of deaths from COVID-19 in Canada during the first wave occurred in nursing homes, where elderly people were not adequately protected from infection. Overall, less than 10 percent of the population is at high-risk, accounting for more than 90 percent of potential deaths from COVID-19.

Third, having an exit strategy from lockdowns is important. The only exit considered was to achieve herd immunity, either naturally or artificially by vaccine. Natural herd immunity occurs after enough people are exposed and develop immunity to SARS-CoV-2 to keep transmission in the population at a low level. Before we had vaccines, we had to deal with recurrent waves several years apart of infections like measles, mumps, and rubella, as new cohorts of children were added by births until herd immunity in the young waned. Given that people have different connectivity and social mixing, for example, roughly 80 percent of SARS-CoV-2 infections come from just around 10 percent of infected people (Meyerowitz et al. 2020), this would likely require up to 40 percent of the population to be infected. Waves of lockdowns prevent this from occurring. If immunity only lasts many months, COVID-19 will become an annual occurrence.

Vaccine induced herd immunity means that if 60-70 percent of the random population develop (lasting) immunity from vaccination, transmission in the population will be kept at a low level. Promising safe and effective vaccines are beginning rollouts in some developed countries. However, the long-term safety, efficacy in high-risk populations (especially the elderly with comorbidities), efficacy at preventing upper respiratory tract SARS-CoV-2 infection (necessary to prevent transmission and thus for herd immunity), ability to be produced at scale to vaccinate entire populations, and capacity to be delivered equitably to the entire human population in the near future, all remain to be seen. Several considerations, discussed below, suggest we should not just lock down and wait.

Collateral effects of lockdowns

Public health leaders are medical experts and are necessary advisors in formulating a response to the pandemic. However, their expertise is not sufficient to make policy decisions. There are trade-offs to any decision made, and preventing COVID-19 cases, deaths, and overwhelmed hospital capacity are not the only factors to consider. Unfortunately, the response perspective of controlling a single disease has had devastating, often unequally distributed, collateral effects.

Lockdowns have put many sustainable development goals out of reach. In many parts of the world there have been interruptions in childhood vaccinations, education, detection and treatment of infectious diseases (for example, tuberculosis, malaria, and HIV), and prevention of under 5-year-old and maternal mortality, projected to cost many millions of lives in the coming years. These interruptions in economic activity and supply chains are estimated to cause more than 83 million people to become food insecure, and over 70 million people to enter severe poverty (living on less than US$1.90/day), both likely to cost many more millions of lives in the coming years. Violence against women, including intimate partner violence, female genital mutilation, and child marriage are projected to also increase by many millions of cases.

In high-income countries other collateral damage from lockdowns is occurring. Fear of attending hospitals resulted in 50 percent declines in visits for heart attacks and strokes, meaning missed opportunity for time-critical treatments. 'Non-urgent' surgery and cancer diagnosis/treatment were delayed, with backlogs that will take years of catch-up and untold effects on prognoses. Of excess mortality during the pandemic, 20-50 percent has not been due to COVID-19 (see Kontis et al. 2020; Docherty et all 2020; and Postill et al 2020); much of that excess is likely attributable to these collateral effects. An unexplained increase in deaths of people with dementia in the US and UK also likely arose from deterioration due to loneliness. Over time, suicide, depression, alcohol use disorder, childhood trauma due to domestic violence, changes in marital status, and social isolation are projected to cause millions

of years of life lost in Canada alone.

The focus on raw numbers of cases and deaths from COVID-19 has distorted our perspective. For example, COVID-19 was the cause of 5.96 percent of all deaths in Canada during the first six months of the pandemic, meaning that more than 94 percent of all deaths had not been called to our attention. In 2018, there were 777 deaths/day in Canada. The global picture is even more serious, with 160,000 deaths/day globally in 2019. Many of these global deaths are preventable with appropriate action, for example childhood pneumonia (2200 deaths/day) and diarrhea (1462 deaths/day), malaria (1100 deaths/day), tuberculosis (4100 deaths/day), and tobacco use (21,900 deaths/day). Some of these deaths are potentially preventable but we as a society have decided we are willing to accept them in trade-off for our freedom and wellbeing, including motor vehicle deaths (3700 deaths/day) and dietary risks (30,000 deaths/day).

Cost-benefit analysis: The false dichotomy

To compare outcomes of policies we need a common metric we can use to weigh trade-offs and make best decisions. The public health policy goal is to maximize the sum of years lived by the population, weighted by the health quality of those years (i.e., Quality Adjusted Life Years, QALY) or the wellbeing quality of those years (i.e., Wellbeing Years, WELLBY, about 6 WELLBY = 1 QALY). Here we compare the cost and benefit of lockdown policy using the common metric of QALY.

The benefit of lockdowns is to save lives potentially lost to COVID-19. A *maximum* benefit calculation of potentially prevented COVID-19 deaths is this: (less than 40 percent of the population infected to natural herd immunity) X (less than 0.23 percent infection fatality rate) X (7.8 billion people) X (less than 70 percent of deaths can be prevented with lockdown) is equal to or less than 5.02 million lives. Given the age distribution of deaths from COVID-19, each death has cost the loss of about 5 QALY; thus, lockdowns might save up to 25.12 million QALY (see Table 1).

Yet we also need to consider the costs of lockdown. According to the Canadian Medical Association President's letter, "The strength of the economy should not come at the expense of Canadians' lives" (Collins 2020). An opinion piece by the Scientific Advisory Group on COVID-19 lead in Alberta wrote that a "circuit-breaker" lockdown would "strike a balance between the need to save lives and to limit the impact on our economy" and "no one wants to sacrifice our elderly or kill the economy" (Saxinger 2020). Unfortunately, this frame of the trade-offs demonstrates a misunderstanding, a false dichotomy. We must consider the benefit and cost using a common metric. We are comparing COVID-19 deaths vs. economic recession deaths, lives versus lives, as the economy is not simply about wealth, but about lives.

Government spending on health care, education, roads, sanitation, housing, nutrition, vaccines, safety, social security nets, clean energy, and other services determine the population well-being and life-expectancy. Government spending on all of these things, and not just on health care, have a strong historical long-run relation with life expectancy. If the public system is forced to spend less on our future, there are statistical lives lost; people will die in the years to come. Similarly, decisions about what resources to apply to maintain public health from government services (e.g., treatment of cancer, heart disease, etc.) are based on research regarding how much health and life these expenditures can buy.

The lockdowns caused an economic recession in Canada and for much of the world. Canada's Chief Medical Officer of Health Theresa Tam wrote that "the extensive slowdown in the Canadian economy [was] as a result of public health emergency measures" (Chief Public Health Officer of Canada 2020). The severity of mandated lockdowns was directly linked with the severity of the economic collapse; these were direct commands to halt work, restrict travel, restrict the number of people inside dwellings, close factory floors, stay at home, etc. A minimum cost calculation of the recession's effect on reducing government spending on the determinants of population wellbeing and lifespan is this: (at least US$50 trillion GDP loss globally) X (around 40 percent of GDP from government expenditures) ÷ (less than US$80,000/

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QALY) is equal to or greater than 250 million QALY lost in the years to come. Already the cost-benefit balance comes out about 10 times against lockdowns (see Table 1).

A similar rough calculation for Canada puts the cost-benefit balance at about 17 times against lockdowns. It is important to point out that population mortality sometimes paradoxically decreases in the short-term during a recession, particularly if short-term government spending increases, even though the long-run negative association with shortened lifespan still holds. In addition, the US$80,000 cost per QALY is high; for example, the Patented Medicine Prices Review Board had used $30,000 per QALY for estimating the opportunity cost of adopting new medicines within Canada's public health care systems, and this estimate would make the cost-benefit balance over 2.6 times higher against lockdowns (Paulden et al. 2019).

Of note, this calculation does not include a number of factors on the benefits and costs of the lockdown. On the former, this includes reductions in the

Table 1: Calculations in the cost-benefit balance globally and for Canada based on Quality Adjusted Life Years (QALY)

Global	Maximum Benefit	Minimum Cost	Comment
COVID-19 deaths	25.12 million QALY	–	Assumptions for the calculation were (multiply each of these to obtain the result): 1. Up to 40 percent of the population would be infected until natural herd immunity is reached. 2. The world population is 7.8 billion people. 3. The infection fatality rate is 0.23 percent. 4. Lockdowns can prevent 70 percent of the deaths from COVID-19. 5. Each death from COVID-19 results in the loss of 5 QALY.
Economic Recession	–	250 million QALY	Assumptions for the calculation were (multiply 1 and 2, and divide by 3 to obtain the result): 1. The recession this year is ~6 percent of GDP, and it will take five to 10 years to catch up to pre-pandemic GDP projections: at least US$50 trillion GDP loss globally. 2. Government expenditure accounts for 40 percent of GDP. These government expenditures determine future public health (i.e., population wellbeing and lifespan). 3. Government spending of US$80,000 will save 1 QALY.
Balance	–	Cost **~10x** more than benefit	Some factors were not included, likely to result in even higher cost than benefit: 1. Benefits: long-COVID incidence and effects on quality of life; and overwhelmed health care systems if illness exceeds capacity (despite attempts to increase capacity). 2. Costs: collateral effects on world food insecurity, poverty, and interrupted health care; effects of loneliness and unemployment on lifespan and chronic diseases; and effects of interrupted education on determining children's future earnings, health, and lifespan.

Canada	Maximum Benefit	Minimum Cost	Comment
COVID-19 deaths	121,040 QALY	–	Assumptions for the calculation were the same as above, with the Canadian population of 37.59 million.
Economic Recession	–	2.05 million QALY	Assumptions for the calculation were the same as above, and that the Canadian GDP loss is 6 percent in 2020, with catch up to pre-pandemic projections over the next 5 to 10 years: about 25 percent of current GDP loss ($1.64 trillion X 0.25 = $410 billion).
Balance	–	Cost **~17x** more than benefit	The same factors were not included as above.

incidence of long-COVID and the prevention of overwhelmed health care systems. Yet that must in turn be weighed against the other lockdown costs not included in this calculation, including the major collateral effects on millions of people discussed above. In addition, the effects of many millions of people experiencing unemployment, loneliness, and life stresses are important, as these are among the top risk factors for early mortality, reduced lifespan, chronic diseases, poor wellbeing, and suicide. The effects on children (particularly in the early years of life) from adverse life experiences (e.g., family financial crisis and violence, loneliness, hunger, inactivity) and disrupted education, will have permanent profound impacts on their future quality of life, educational achievement, earning potential, lifespan, and health care utilization.

Various cost-benefit analyses from different countries, including some of these costs, have consistently estimated the cost in lives from lockdowns to be at least five to 10 times higher than the benefit, and likely far higher.[3]

What should we do?

We must take an 'effortful pause' from our cognitive biases and calibrate our response to the risks and trade-offs discussed above. To do otherwise risks only magnifying the many costs outlined above. A recalibrated response might involve the following:

1. Educate the public and policy-makers on the risks and trade-offs involved. Alleviate unreasonable fear with accurate information.

2. Focus on cost-benefit analysis. Repeated or prolonged lockdowns cannot be based on COVID-19 numbers alone.

3. Focus on protecting people at high risk: people hospitalized or in nursing homes (e.g., universal masking in hospitals reduced transmission markedly), in crowded conditions (e.g., homeless shelters, prisons, large gatherings), and equal to and greater than 70 years old (especially with multiple severe comorbidities). Do not lock down everyone, regardless of their individual risk.

4. Keep schools open: children have very low morbidity and mortality from COVID-19, and (especially those 10 years old and younger) are less likely to be infected by SARS-CoV-2 and have a low likelihood to be the source of transmission of SARS-CoV-2.

5. Consider increasing health care surge capacity if forecasting, accurately calibrated repeatedly to real-time data (up to now, forecasting, even short-term, has repeatedly failed), suggests it is needed. With universal masking in hospitals, asymptomatic health care workers can continue to work.

The decision to adopt repeated or prolonged lockdown measures cannot be based on COVID-19 numbers alone. Instead, we need to better recognize the risks and trade-offs inherent in our public health measures against COVID. We cannot attempt to avoid every (or even most) case(s) of COVID-19, as this will cost far more harm than benefit. But what we can do is open up society with the more modest restrictions outlined above, with a particular emphasis on protecting high-risk people, keeping schools open, and increasing our health care surge capacity.

About the author

Ari R. Joffe MD, FRCPC is a specialist in pediatrics, pediatric infectious diseases, and pediatric critical care medicine. He has been at the University of Alberta and Stollery Children's Hospital since finishing training in 1995, and is now a Clinical Professor in the Department of Pediatrics, and an adjunct Clinical Professor at the John Dossetor Health Ethics Centre. He is the medical clinical research lead in the Pediatric Intensive Care Unit, having published many research papers on the long-term outcomes (and their potentially modifiable risk factors) after complex therapies in critically ill children, and participated in many multicenter randomized trials of novel therapies in critically ill children. He was recently found to be one of the ten most influential researchers in the field of pediatric critical care, putting the Stollery Children's Hospital among the ten most influential centers in the research field.

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Endnotes

1   The cognitive biases include at least: a. Identifiable lives bias: we ignored hidden 'statistical deaths' at the population level, and we prioritized efforts to save lives from a known cause even if more lives would be saved through alternative responses; b. present bias: we preferred immediate benefits to even larger benefits in the future; c. availability bias: the proximity and vividness of COVID-19 deaths captured our attention; d. anchoring bias: we adhered to our initial hypothesis, and disregarded evidence that disproved our favorite theory; and e. escalation of commitment bias: we invested more resources over time into a set course of action despite evidence of probably better options.

2   I consider the Ioannidis study to be the most reliable estimate; as explained in it, other higher estimates are based on flawed meta-analysis methodology. Yet, as he goes on to say, "The infection fatality rate is not a fixed physical constant and it can vary substantially across locations, depending on the population structure, the case-mix of infected and deceased individuals and other, local factors" (Ioannidis 2020, 7). Even the infection fatality rate of 0.23 percent is likely an over-estimate, as some people never develop detectable antibody to the virus, and some lose detectable antibody within months of infection.

3   Many more references for the content in this commentary can be found in Joffe (2020).

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