**Expert Report on the COVID-19 Epidemic Response in Quebec, Canada**

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December 18th 2020.

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RE: Expert Report Covid-19 – Province of Quebec

You have mandated me on November 5th 2020 to prepare an expert report in the fields of medicine, infectiology, health economics and public health in relation to an legal procedure to be filed in court.

You will find below the responses to the questions that you have put forward to me.

## A. Does Covid-19 pose a real or imminent serious threat to the health of the population?

The mortality danger from COVID-19 infection varies substantially by age and a few chronic disease indicators.[1] For a majority of the population, including the vast majority of children and young adults, COVID-19 infection poses less of a mortality risk than seasonal influenza. By contrast, for older populations – especially those with severe comorbid chronic conditions – COVID-19 infection does pose a high risk of mortality, on the order of a 5% mortality rate.

The best evidence on the infection fatality rate from SARS-CoV-12 infection (that is, the fraction of infected people who die due to the infection) comes from seroprevalence studies. The definition of seroprevalence of COVID -19 is the fraction of people within a population who have specific antibodies against SARS-CoV-2 in their bloodstream. Seroprevalence studies provide better evidence on the total number of people who have been infected than do case reports or a positive reverse transcriptase- polymerase chain reaction (RT-PCR) test counts; these both miss infected people who are not identified by the public health authorities or do not volunteer for RT- PCR testing. Because they ignore unreported cases in the denominator, fatality rate estimates based on case reports or positive test counts are substantially biased upwards.

According to a meta- analysis [2] by Dr. John Ioannidis of every seroprevalence study conducted

[1] Public Health England (2020) Disparities in the Risk and Outcomes of COVID-19. August 2020. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/908434/Disparities_in_the_risk_and_outcomes_of_COVID_August_2020_update.pdf

[2] John P.A. Ioannidis , *The Infection Fatality Rate of COVID- 19 Inferred from Seroprevalence Data*, Bulletin of the World Health Organization BLT 20.265892.

with a supporting scientific paper (74 estimates from 61 studies and 51 different localities around the world), the median infection survival rate from COVID-19 infection is 99.77%. For COVID-19 patients under 70, the meta- analysis finds an infection survival rate of 99.95%. A newly released meta-analysis[3] by scientists independent of Dr. Ioannidis' group, reaches qualitatively similar conclusions.

A recent CDC report[4] found that there were between six and 24 times more SARS-CoV-2 infections than cases reported between March and May 2020. This study is based on serological analysis of blood samples incidentally collected by commercial laboratories in 10 cities nationwide. Although the CDC does not provide the infection fatality rate estimate implied by their seroprevalence studies, in contrast to the study by Dr. Ioannidis above.

In September 2020, the CDC updated its current best estimate of the infection fatality ratio- the ratio of deaths to the total number of people infected- for various age groups.[5] The CDC estimates that the infection fatality ratio for people ages 0-19 years is .00003, meaning infected children have a 99.997% survival after infection. The CDC's best estimate of the infection fatality rate for people aged 20-49 years is .0002, meaning that young adults have a 99.98% survival following infection. The CDC's best estimate of the infection fatality rate for people age 50-69 years is .005, meaning this age group has a 99.5% survival. The CDC's best estimate of infection fatality rate for people ages 70+ years is .054, meaning seniors have a 94.6% survival.

The mortality risk for those infected with SARS-CoV-2 is not the same for all patients. Older patients are at higher risk of death if infected, while younger patients face a vanishingly small risk. The best advice on age-specific infection fatality rates comes again from seroprevalence studies. Three such studies (of which I am currently aware) provide age-specific infection fatality rate estimates. The CDC's current best estimates are that the symptomatic fatality rate from COVID- 19 among patients less than 50 years old is 0.05%, or 5 in 10,000; 0.2% for patients between ages 50 and 64; and 1.3% for patients 65 and above. The infection fatality rates are lower than these numbers since only a fraction of patients are symptomatic.

A study of the seroprevalence of COVID-19 in Geneva, Switzerland (published in the *Lancet*)[6] provides a detailed age break down of the infection survival rate in a preprint companion paper[7] 99.9984% for patients 5 to 9 years old; 99.99968% for patients 10 to 19 years old; 99.991% for patients 20 to 49 years old; 99.86% for patients 50 to 64 years old; and 94.6% for patients aged over 65 years.

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[3] Andrew T. Levin, et al., *Assessing the Age Specificity of Infection Fatality Rate for COVID- 19: Meta-Analysis & Public Policy Implications* (Aug. 14,2020)MEDRXIV, http://bit.ly/3gplolV.

[4] Fiona P. Havers, et al., *Seroprevalence of Antibodies to SARS-CoV-2 in 10 Sites in the United States, March 23-May 12, 2020* (Jul. 21, 2020) JAMA INTERN MED., https://bit.ly/3goZUgy.

[5] COVID- 19 Pandemic Planning Scenarios, Centers for Disease Control and Prevention, https://www.cdc.gov/coronavirus/2019-ncov/hep/planning-scenarios.html.

[6] Silvia Stringhini, et al., *Seroprevalence of Anti-SARS-CoV-2 lgG Antibodies in Geneva, Switzerland (SEROCoV-POP): A Population Based Study* (June 11,2020) THE LANCET, https://bit.ly/3187S13.

[7] Francisco Perez-Saez, et al. *Serology- Informed Estimates of SARS-COV-2 Infection Fatality Risk in Geneva, Switzerland* (June 15,2020) OSF PREPRINTS, http://osf.io/wdbpe/.

I estimated the age-specific infection fatality rates from the Santa Clara County seroprevalence study[8] data (for which I am the senior investigator). The infection survival is 100% among people between 0 and 19 years (there were no deaths in Santa Clara in that age range up to that date); 99.987% for people between 20 and 39 years; 99.84% for people between 40 and 69 years; and 98.7% for people above 70 years. In fact, in all of California[9] up through August 20, there have been only two deaths among COVID-19 patients below age 18. 74.2% of all COVID-19 related deaths occurred in patients 65 and older.

While I am not aware of a serosurvey available for Quebec, it is clear that the age gradient in COVID-19 mortality found everywhere else applies. Population fatality rate estimates[10] are available at the Institut national de santé publique du Québec.[11] For those aged 90 and up, the population mortality rate from COVID-19 was 2.8% for women and 2.4% for men. For those 80-89, the population mortality rate from COVID-19 was 0.8% for women and 1.1% for men, For those 70-79, the population mortality rate from COVID-19 was 0.15% for women and 0.21% for men. For those 60-69, the population mortality rate was 0.03% for women and 0.047% for men. The population fatality rate declines from there for those under 60, with no COVID-19 deaths whatsoever for people 29 and under.[12]

In addition to the risk posed by old age, COVID-19 infection poses an elevated mortality risk for people with certain chronic conditions, like diabetes. We now have good evidence on the relative risk posed by the incidence of chronic conditions, so we know that among common conditions, age is the single most important risk factor. For instance, a 65-year-old obese individual has about the same COVID-19 mortality risk conditional upon infection as a 70-year-old non-obese individual.

In summary, Covid-19 does not pose a real or imminent serious threat to the health of the population in general but only to the health of a specific part of the population – the elderly and a limited number of people with certain chronic conditions. Age is the single most important risk factor, with a worldwide 99.95% infection survival rate for people under 70 and 95% infection survival rate for people aged 70 years or more.

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[8] Eran Bendavid, et al., *COVID- 19 Antibody Seroprevalence in Santa Clara County, California* (April 30,2020) MEDRXIV, https://bit.ly/2EuLIFK.

[9] COVID- 19, *Cases and Deaths Associated with COVID-19 by Age Group in California* (Aug. 20,2020) CAL. DEPT. OF PUB. HEALTH, https://bit.ly/31inK9q [accessed Aug. 22,2020].

[10] Public Health England (2020) Disparities in the Risk and Outcomes of COVID-19. August 2020. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/908434/Disparities_in_the_risk_and_outcomes_of_COVID_August_2020_update.pdf

[11] INSPQ (2020) Données COVID-19 par âge et sexe au Québec. https://www.inspq.qc.ca/covid-19/donnees/age-sexe

[12] The population fatality rate is an underestimate of the infection fatality rate. The denominator in these calculations include the entire population of Quebec, not just those infected with the SARS-CoV-2 virus. I included these to provide evidence from Quebec regarding the age-gradient in COVID-19 fatality risk.

## B. What are the principles govern good health policy and public health practice?

The principles of good public health[13] and health policy[14] practice predate the epidemic. While the topic is voluminous, there are a few principles that are particularly relevant to COVID-19 policy making, and include the following guidelines for decision makers:

- Consider both the costs *and* benefits of alternative policies, choosing policies that appropriately balance the two.
- Account for uncertainty in the projected costs and benefits of policy options.
- Account for the strength of the scientific evidence.
- Be constrained in policy making by democratic norms and ethical principles.
- Choose policies that treat people in society equitably, and in particular eschew policies that disproportionately favor richer members of society over poorer members.

Sound health policy decision making requires a careful evaluation of both the costs and benefits over both the long and short term. The nature of these costs and benefits considered should be broadly considered, including physical costs (such as enhanced risk of mortality and morbidity from all sources), psychological harms (such as increased rates of depression and suicidality), as well as the economic damage (such as increased joblessness, closed businesses, and reduced income).

The costs and benefits of every potential policy involves some degree of uncertainty, including lockdowns. In the face of uncertainty, public health decision making should be based on the best available evidence regarding the most likely outcomes once a policy is introduced. Public health decision making should eschew decision making based on worst-case or best-case assumptions about the outcomes that may happen if alternate policies are adopted. It is particularly bad practice to make decisions that assume worst case scenarios regarding the costs of a policy and best-case scenarios regarding the benefits of a policy, or vice versa. So, for instance, it is poor public health practice to assume that lockdowns, if implemented will have a dramatic effect on disease transmission and mortality with no consideration of the harms associated with lockdowns.[15]

In addition to the costs and benefits, public health policy must consider the strength of the scientific evidence regarding the measure in achieving the aims it proposes. Of course, without solid scientific evidence in favor of a policy – especially one with enormous costs – its imposition by a government on a population would be unethical. The greater the potential harms from the policy on some part of the population, the greater the evidentiary standard required to

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[13] Public Health Leadership Society (2002) Principles of the Ethical Practice of Public Health. American Public Health Association. https://www.apha.org/-/media/files/pdf/membergroups/ethics/ethics_brochure.ashx

[14] Bhattacharya J, Hyde T, Tu P. Health Economics, London: Palgrave-MacMillan, (2013).

[15] In Quebec, unfortunately, the national director of public health, Dr. Horacio Arruda, has explicitly adopted the view that planning should consider only the worst case scenario regarding disease spread. See Assemblee Nationale du Quebec (2020) Conférence de presse de M. François Legault, premier ministre et Mme Danielle McCann, ministre de la Santé et des Services sociaux. March 23, 2020. http://www.assnat.qc.ca/fr/actualites-salle-presse/conferences-points-presse/ConferencePointPresse-58419.html

establish its necessity.

There are other ethical norms and standards as well to which public health decision making should abide. Public health decision-makers must limit themselves to interventions that respect human rights, broadly considered. Among the rights that public health decisions should not violate in a democratic society, include the right to free speech and assembly, the right to the protection of property, the right to high quality education for children, the right to health care, the right to pursue a healthy life, and the right to worship. Any restriction on these rights must be proportionate, temporary, and tailored to be minimally invasive to achieve a legitimate goal of the government.

In a democratic society, measures taken by the government, must respect the law. The constitution is the test of the legality of decisions made by a democratic government. There must be a rational link between the measures taken and the goals that the government has. Preferred measures must are those that least infringe upon liberties and freedoms of citizens. This is the fundamental difference between a free society and a dictatorship. This must not be seen as a negative limit on the government to act to "save lives", but as our basic understanding of the clear and undeniable benefits of freedoms and liberties on all aspects of human life.

Finally, equity is a key principle of public health. Public health officials must consider whether the harms of a policy like lockdowns fall disproportionately on the poor, on minority populations, or on others who are of low socio-economic status. Similarly, policies that accrue benefits disproportionately to the rich, to majority populations, and to people of high socio-economic status should be redesigned to rather promote equity in public health decision making.

In summary, sound public health practice adheres to key principles aimed at grounding policy in good science, respecting human rights and democratic norms, appropriately accounting for costs and benefits of policies and uncertainty in outcomes, treating people equitably, as well as other principles not discussed here.

**C. Are the lockdowns (including, but not limited to, shelter-in-place orders and forced quarantines, business, cultural, sports and religious service restrictions and closures, restrictions on in-person schooling, restrictions on private gatherings, travel restrictions across provinces, restrictions on children playing together and scholastic sport, and the arbitrary designation of businesses into 'essential' and 'non-essential') necessary to maintain and enhance the health and well-being of the general population?**

Since the available epidemiological literature often tends to group many of the items in the list above under the moniker of "lockdown" or "non-pharmaceutical intervention (NPI)" we will consider the evidence related to the items together based on the criteria for good public health practice we discussed above.

**Theoretical Considerations.** The theoretical models used to justify lockdowns – compartmental or SEIR models – do not predict a decrease in the total number of infected people but rather a

shift in the timing of infections.

Compartmental models work by envisioning a population exposed to a new pathogen like the SARS-CoV-2 virus. In the simplest versions of these models, everyone in the population are initially susceptible to infection. The epidemic starts with one person being infected and in turn infecting other people in the pool of susceptible people. Many infected people recover from the disease and – because of immunity induced by infection – are no longer susceptible. Over time, the population of susceptible people diminishes to the point where a newly infected person infects one or fewer people, and the epidemic declines.

In models like this, which are in common use to forecast the COVID-19 epidemic, lockdowns play a role of dampening the number of interactions between susceptible people and infected people, slowing the growth of the epidemic. However, unless the number of infections are reduced to zero – a result clearly not in evidence in the COVID-19 epidemic – the disease continues to spread in the population.

The clear theoretical implication from these models is that lockdowns delay infections into the future, rather than prevent them from occurring altogether.[16] But society-wide lockdowns are not a tool of disease eradication, and in fact have never in history eradicated a disease. This benefit – a theoretical delay in the incidence of cases – should be counted against the harms from lockdowns, some of which are described below.

What is the evidence that these theoretical models provide accurate forecasts of the future path of the pandemic? Unfortunately, their track record is poor. According to a comprehensive evaluation of the performance of these models by an international group of statisticians and mathematicians, their poor performance stems from a wide variety of problems, including: [17]

> Poor data input, wrong modeling assumptions, high sensitivity of estimates, lack of incorporation of epidemiological features, poor past evidence on effects of available interventions, lack of transparency, errors, lack of determinacy, looking at only one or a few dimensions of the problem at hand, lack of expertise in crucial disciplines, groupthink and bandwagon effects and selective reporting are some of the causes of these failures.

Given this poor track record in prediction, extreme caution should be exercised by public health decision makers in using compartment models to forecast the future direction of the pandemic and in predicting the effects of policy interventions such as lockdowns on COVID-19 outcomes such as mortality and hospitalization.[18]

**Empirical Literature on Lockdown Benefits.** In the case of lockdowns and social distancing interventions, there is no existing randomized study – the gold standard study type in clinical

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[16] Chikina M and Pegden W (2020) A Call to Honesty in Pandemic Modeling. *Medium*. https://medium.com/@wpegden/a-call-to-honesty-in-pandemic-modeling-5c156686a64b

[17] Ioannidis JPA, Cripps S, Tanner MA. Forecasting for COVID-19 has failed. Int J Forecast. 2020 Aug 25. doi: 10.1016/j.ijforecast.2020.08.004. Epub ahead of print. PMID: 32863495; PMCID: PMC7447267.

[18] Chin V, Ioannidis J, Tanner M, Cripps S. (2020) Effects of Non-Pharmaceutical Interventions on COVID-19: A Tale of Three Models. medRxiv. https://www.medrxiv.org/content/10.1101/2020.07.22.20160341v2

therapeutics and public health interventions – that has evaluated the efficacy or costs of these measures. Scientific experts have argued for the necessity and feasibility of such randomized evaluation of restricting schools, universities, and workplaces, banning public gatherings, and the like.[19] If one were to view these lockdowns and activity restrictions as a medical intervention, it would be unethical to implement them in the absence of randomized evidence in support of their efficacy.

In the absence of such evidence, scientists and public health officials tend to rely on studies that are less rigorous than randomized trials in establishing causal links between the intervention and outcomes, including event studies and other observational studies. In the case of the lockdowns, the evidence from these sources is decidedly mixed. Evidence from the draconian lockdown order in China – including home and centralized quarantine, severe travel restrictions, cordon sanitaire, mandated centralized symptom reporting, and other interventions inconsistent with democratic norms – suggests that lockdowns can "temporarily" reduce spread of the virus.[20] Evidence from the early days of the epidemic (March and early April 2020) in the US found that states that imposed strict stay-at-home orders had a slower growth in the epidemic that states that did not over that short period of time.[21]

The problem with these event studies is that they cannot be used to forecast the effect of imposing less strict lockdowns (such as restrictions on businesses and gatherings). Focused as they are on quarantine or stay-at-home orders and the draconian policies imposed during the early epidemic in China, they represent a best case for the effectiveness of lockdowns. More importantly, they only measure the effect of lockdown on the speed of disease spread in the short run and should not be used to forecast the effect of lockdown on long run epidemic outcomes, since the theoretical literature strongly cautions against it. Recall that in those models, lockdowns push cases into the future; they do not prevent them altogether.

In fact, there are many possible reasons why the number of cases might change over time outside of lockdowns, and these should be accounted for in any accurate estimation of lockdown effects. Perhaps most importantly, these simple event studies do not account for the environmental, epidemiological, and economic factors that impact disease spread, imputing changes in the track of the epidemic almost entirely to policy interventions. There are many possible reasons why the number of cases might change over time outside of lockdowns, and these should be accounted for in any accurate estimation of lockdown effects. For instance, there is evidence that COVID-

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[19] Cristea, I. A., Naudet, F., & Ioannidis, J. P. A. (2020). Preserving equipoise and performing randomized trials for COVID-19 social distancing interventions. *Epidemiology and Psychiatric Sciences*. https://doi.org/10.1017/S2045796020000992

[20] Pan A, Liu L, Wang C, et al. Association of Public Health Interventions With the Epidemiology of the COVID-19 Outbreak in Wuhan, China. *JAMA*. 2020;323(19):1915–1923. doi:10.1001/jama.2020.6130

[21] Mark N Lurie, Joe Silva, Rachel R Yorlets, Jun Tao, Philip A Chan, Coronavirus Disease 2019 Epidemic Doubling Time in the United States Before and During Stay-at-Home Restrictions, The Journal of Infectious Diseases, Volume 222, Issue 10, 15 November 2020, Pages 1601–1606, https://doi.org/10.1093/infdis/jiaa491; The article also had a correction appended. Mark N Lurie, Joe Silva, Rachel R Yorlets, Jun Tao, Philip A Chan, Corrigendum to: COVID-19 Epidemic Doubling Time in the United States Before and During Stay-at-Home Restrictions, The Journal of Infectious Diseases, Volume 222, Issue 10, 15 November 2020, Page 1758, https://doi.org/10.1093/infdis/jiaa506

19 infection rates are increased during cold weather seasons.[22, 23] It is striking that the recent sharp rise in COVID-19 cases in California corresponds with colder weather, despite the continuing lockdowns. Even authors who favor lockdowns as a policy option in summarizing this evidence agree that seasonality plays an important role in case spread:[24]

> "A convincing argument that weather influences COVID-19 can be formulated in three parts: (1) experiment data suggest SARS-CoV-2 persistence on surfaces or in the air is sensitive to temperature, humidity, and ultraviolet light; (2) other environmentally sensitive respiratory viruses are seasonal, and more common in winter; and therefore, (3) climatic effects could be protective over space (hot, dry places might have less transmission) and time (summer might see reduced transmission compared to winter)."

This is not to say that other factors play no role, but rather that seasonality should be accounted for in any analysis of case spread. Studies decomposing lockdown effects should also account for the fact that, even in the absence of policy interventions, people change their behavior to protect themselves from disease risk if they perceive the danger from infection to be high.[25]

The best studies, which account for environmental, epidemiological, and economic factors alongside policy interventions conclude that the mortality from COVID-19 infection in different regions is not primarily driven by policy decisions like lockdowns, but rather by other factors specific to each region.[26] A comprehensive international cross-country study, analyzing data from the first 8 months of the pandemic, concluded that:[27]

> Countries that already experienced a stagnation or regression of life expectancy, with high income and non-communicable disease rates, had the highest price to pay. This burden was not alleviated by more stringent public decisions. Inherent factors have predetermined the Covid-19 mortality: understanding them may improve prevention strategies by increasing population resilience through better physical fitness and immunity.

In other words, countries that had a population predisposed to poor COVID-19 infection outcomes, including countries that had an older population or a more obese population, tended to

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[22] Araujo MB and Naimi B (2020) Spread of SARS-CoV-2 Coronavirus Likely Constrained by Climate. medRxiv. https://www.medrxiv.org/content/10.1101/2020.03.12.20034728v3.article-info

[23] Sajadi, Mohammad M. and Habibzadeh, Parham and Vintzileos, Augustin and Shokouhi, Shervin and Miralles-Wilhelm, Fernando and Amoroso, Anthony, Temperature, Humidity and Latitude Analysis to Predict Potential Spread and Seasonality for COVID-19 (March 5, 2020). Available at SSRN: https://ssrn.com/abstract=3550308 or http://dx.doi.org/10.2139/ssrn.3550308

[24] Carson CJ, Gomez ACR, Shweta B, and Ryan SJ (2020) "Misconceptions about Weather and Seasonality Must not Misguide COVID-19 Response" Nature Communications 11: 4312. https://doi.org/10.1038/s41467-020-18150-z

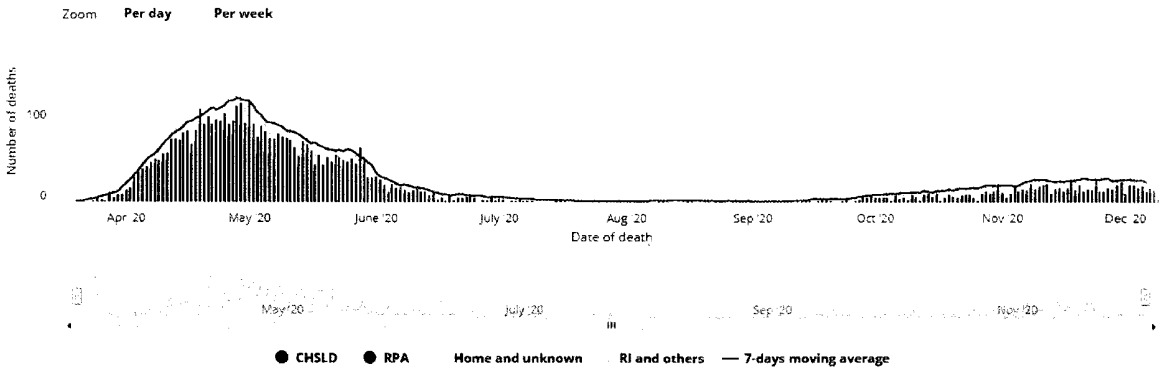
[25] Yoo BK, Kasajima M, Bhattacharya J. (2020) "Public Avoidance and the Epidemiology of novel H1N1 Influenza A." National Bureau of Economic Research Working Paper #15752. DOI 10.3386/w15752. https://www.nber.org/papers/w15752

[26] Atkeson A, Kopecky K, Zha T. (2020) "Four Stylized Facts about COVID-19" National Bureau of Economic Research Working Paper #27719. DOI 10.3386/w27719. https://www.nber.org/papers/w27719

[27] De Larochelambert Q, Marc A, Antero J, Le Bourg E, and Toussaint JF. (2020) Covid-19 Mortality: A Matter of Vulnerability Among Nations Facing Limited Margins of Adaptation. Front. Public Health, 19 November 2020 | https://doi.org/10.3389/fpubh.2020.604339

have worse outcomes irrespective of whatever lockdown policies they implemented.

It is striking that Quebec has seen a surge in COVID-19 cases and deaths since October, despite maintaining its strict lockdown throughout the summer. The continuing lockdowns and activity restrictions very clearly did not prevent the second wave, and indeed the lockdowns during the first wave likely increased the size of this second wave relative to what it otherwise would have been.[28]




## D. What are the harms of lockdowns and governmental actions aiming to slow down the propagation of the disease on the health of the population?

While the evidence on the benefits of lockdowns in equivocal, the harms of the lockdown are manifold and devastating. The effects on the health of populations, in particular, warrants careful attention, since they can be compared directly against the harms from COVID-19 infection. The COVID-19 lockdowns have often featured the cessation of elective and other medical services to keep hospital and health care systems available for COVID-19 patients. Naturally, patients who skip medical services will suffer adverse health consequences as a result. The empirical evidence support these ideas includes documentation for plummeting childhood vaccination rates[29], worse cardiovascular disease outcomes (in part because patients delayed necessary

[28] Quebec Public Health (2020) Data on COVID-19 in Quebec. https://www.quebec.ca/en/health/health-issues/a-z/2019-coronavirus/situation-coronavirus-in-quebec/#c75848 (accessed 10 Dec. 2020)
[29] CDC (2020) Effects of the COVID-19 Pandemic on Routine Pediatric Vaccine Ordering and Administration — United States, 2020. MMWR. 69(19): 591-3. https://www.cdc.gov/mmwr/volumes/69/wr/mm6919e2.htm

cardiac care)[30], less cancer screening[31], and deteriorating mental health[32], to name a few.

In addition to the physical health harms from lockdown, there has been immense psychological harm. The social isolation induced by lockdown has led to a sharp rise in opioid and drug-related overdoses[33], similar to the "deaths of despair" that occurred in the wake of the 2008 Great Recession.[34] Social isolation of the elderly has contributed to a sharp rise in dementia-related deaths around the country.[35] For children, the cessation of in-person schooling since the spring has led to "catastrophic" learning losses[36], with severe projected adverse consequences for affected students' life spans.[37] According to a US CDC estimate, one in four young adults seriously considered suicide this past June.[38] Among 25 to 44-year olds, the US CDC reports a 26% increase in excess all-cause mortality relative to past years, though fewer than 5% of 2020 deaths have been due to COVID-19.[39, 40]

While the lockdowns result in direct harms for the health of populations where they are implemented, they also have devastating indirect consequences as a result of a collapse in worldwide economic outcomes, with a particularly large and negative effect on poor countries.[41] This economic harm translates directly into health harm, as large populations are no longer able

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[30] Ball S, Banerjee A, Berry C, et alMonitoring indirect impact of COVID-19 pandemic on services for cardiovascular diseases in the UKHeart Published Online First: 05 October 2020. doi: 10.1136/heartjnl-2020-317870

[31] Rutter MD, Brookes M, Lee TJ, et alImpact of the COVID-19 pandemic on UK endoscopic activity and cancer detection: a National Endoscopy Database AnalysisGut Published Online First: 20 July 2020. doi: 10.1136/gutjnl-2020-322179

[32] Vizard T, Davis J, White E, Beynon B (2020) Coronavirus and depression in adults, Great Britain: June 2020. Office for National Statistics, UK. https://www.ons.gov.uk/peoplepopulationandcommunity/wellbeing/articles/coronavirusanddepressioninadultsgreatbritain/june2020

[33] American Medical Association (2020) Issue Brief: Reports of Increases in Opioid- and Other Drug Related Overdose and Other Concerns During COVID Pandemic. AMA Advocacy Resource Center. Oct. 31, 2020. https://www.ama-assn.org/system/files/2020-11/issue-brief-increases-in-opioid-related-overdose.pdf

[34] Deaton A and Case A (2020) Deaths of Despair and the Future of Capitalism. Princeton University Press. March 17, 2020.

[35] Alzheimer's Impact Movement (2020) The 2020 COVID-19 Pandemic and Dementia: Deaths Above Average. https://www.scribd.com/document/483085777/Dementia-Deaths-Above-Average-State-by-State-Table

[36] Center for Research on Education Outcomes (2020) Estimates of Learning Loss in the 2019-2020 School Year. CREO Stanford University. October 2020. https://credo.stanford.edu/sites/g/files/sbiybj6481/f/short_brief_on_learning_loss_final_v.3.pdf

[37] Christakis DA, Van Cleve W, Zimmerman FJ. Estimation of US Children's Educational Attainment and Years of Life Lost Associated With Primary School Closures During the Coronavirus Disease 2019 Pandemic. JAMA Netw Open. 2020;3(11):e2028786. doi:10.1001/jamanetworkopen.2020.28786

[38] Czeisler MÉ , Lane RI, Petrosky E, et al. Mental Health, Substance Use, and Suicidal Ideation During the COVID-19 Pandemic — United States, June 24–30, 2020. MMWR Morb Mortal Wkly Rep 2020;69:1049–1057. DOI: http://dx.doi.org/10.15585/mmwr.mm6932a1

[39] Rossen LM, Branum AM, Ahmad FB, Sutton P, Anderson RN. Excess Deaths Associated with COVID-19, by Age and Race and Ethnicity — United States, January 26–October 3, 2020. MMWR Morb Mortal Wkly Rep 2020;69:1522–1527. DOI: http://dx.doi.org/10.15585/mmwr.mm6942e2

[40] CDC (2020) Provisional COVID-19 Death Counts by Sex, Age, and State. https://data.cdc.gov/NCHS/Provisional-COVID-19-Death-Counts-by-Sex-Age-and-S/9bhg-hcku

[41] Bhattacharya J and Packalen M (2020) Focused COVID-19 Restrictions will Save Lives in Poor Countries. Financial Post. July 3, 2020. https://financialpost.com/opinion/focused-covid-19-restrictions-will-save-lives-in-poor-countries

to feed themselves due to poverty. The UN estimates that an additional 130 million poor people will be at risk of starvation as a consequence of the economic collapse caused by the lockdowns – predicting a famine of "biblical" proportions.[42] Estimates suggest that an additional 400,000 people will die from inadequate tuberculosis treatment as a consequence of diversion of resources away from TB identification and treatment.[43] Vaccination campaigns in rich and poor countries that address diseases like diphtheria and polio have been suspended due to the lockdowns.[44] According to a recent editorial in the journal *Nature*, the COVID-19 focus is "fuelling a resurgence of AIDS, malaria, and tuberculosis" around the world.[45]

### E. Are the harms of the lockdowns equitably distributed?

The harms of lockdown are unequally distributed. In the US, for instance, economists have found that only 37% of jobs in the US can be performed wholly on-line, and high-paying jobs are overrepresented among that set.[46] By declaring janitors, store clerks, meat packers, postal workers, and other blue-collar workers as "essential" workers in most states, regardless of whether they qualify as high COVID mortality risk, the lockdowns have failed to shield the vulnerable in these occupations. The same is true in Canada as well. Canada has the highest unemployment rate in the G7.[47] The impact of this unemployment has fallen most severely on younger and less well-educated workers.[48]

The economic dislocation from the lockdowns has increased the number of households where young adults who have lost their jobs co-reside with vulnerable older parents[49], which may increase the risk of COVID-related death.[50] Lockdowns thus fail the test of imposing costs and conferring benefits equitably.[51]

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[42] Dowsett C (2020) As famines of 'biblical proportion' loom, Security Council urged to 'act fast'. UN News. April 21, 2020. https://news.un.org/en/story/2020/04/1062272

[43] McKie R (2020) Covid set to cause 400,000 surge in TB deaths as medics diverted. The Guardian. Nov. 8, 2020. https://www.theguardian.com/world/2020/nov/08/covid-set-to-cause-400000-surge-in-tb-deaths-as-medics-diverted

[44] GAVI (2020) At least 80 million children at risk of disease as COVID-19 disrupts vaccination efforts, warn Gavi, WHO and UNICEF. May 22, 2020. https://www.gavi.org/news/media-room/least-80-million-children-risk-disease-covid-19-disrupts-vaccination-efforts

[45] Nature (2020) How to stop COVID-19 fuelling a resurgence of AIDS, malaria and tuberculosis. Nature 584: 169. August 12, 2020. doi: https://doi.org/10.1038/d41586-020-02334-0

[46] Dingel JI and Neiman B (2020) How Many Jobs Can Be Done at Home? National Bureau of Economic Research Working Paper #26948. April 2020

[47] Goldsetein L (2020) We're Number One! Highest Unemployment Rate in the G7. Toronto Sun. Sept. 30, 2020. https://torontosun.com/opinion/columnists/goldstein-were-number-one-highest-unemployment-rate-in-the-g7

[48] Beland LP, Brodeur A, Mikola D, and Wright T. (2020) Here's how the coronavirus is affecting Canada's labour market. The Conversation. May 13, 2020. https://theconversation.com/heres-how-the-coronavirus-is-affecting-canadas-labour-market-137749

[49] Evandrou M, Falkingham J, Qin M, and Vlachantoni A (2020) Changing Living Arrangements, Family Dynamics and Stress During Lockdown: Evidence from Four Birth Cohorts in the UK. University of Southampton Eprint Soton. https://eprints.soton.ac.uk/443865/1/family_dynamics_during_covid_19_final.pdf

[50] Fenoll AA & Grossbard S (2020) Intergenerational residence patterns and Covid-19 fatalities in the EU and the US, Economics & Human Biology, 39. https://doi.org/10.1016/j.ehb.2020.100934.

[51] Kulldorff M and Gupta S. (2020) Canada's COVID-19 strategy is an assault on the working class. Toronto Sun. Nov. 29, 2020. https://torontosun.com/opinion/columnists/opinion-canadas-covid-19-strategy-is-an-assault-on-the-working-class

### F. What is the magnitude of the risk children pose in disease spread? Is there any rationale for lockdown related restrictions on children?

The overwhelming weight of scientific data suggests that the risk of transmission of the virus from younger people aged 18 and below to older people is small or negligible, and the risk of transmission from people 18 to 25 to older people is small relative to the risk of transmission from people older than 25 to others older than 25.

The most important evidence on childhood spread of the disease comes from a study conducted in Iceland and published in the New England Journal of Medicine[52]. The data for this study come from Iceland's systematic screening of its population to check for the distribution of the virus in the community. This is the most important study on this topic because it is the only one that definitively establishes the direction of spread of virus from contact to contact. The study reports on both a population-representative sample and a sample of people who were tested because of the presence of symptoms consistent with COVID-19 infection. The study team isolated SARS-CoV-2 virus samples from every positive case, sequenced the genome of the virus for every case and tracked the mutation patterns in the virus. This analysis, along with contact tracing data, allowed the study team to identify definitively who passed the virus to whom. There have been hundreds of minor mutations of the virus identified, which typically do not alter the function of the virus much, but which provide a unique fingerprint, of sorts, that makes it possible to tell whether two patients could possibly have passed the virus to one another. From this analysis, the senior author of the study, Dr. Kari Stefansson, concluded[53] that "[E]ven if children do get infected, they are less likely to transmit the disease to others than adults. We have not found a single instance of a child infecting parents. There is amazing diversity in the way in which we react to the virus."

Though the Iceland survey is the only definitive study, there are a number of others that use contact tracing methods to investigate the role of children in disease spread. The bulk of such studies conclude that children play a small role, consistent with the Iceland data. A French study[54], conducted by scientists at the L'Institut Pasteur, examined data from late April 2020 on schoolteachers, students, and their parents in Crepy-en-Valois in France. The schools in France were closed from the end of January on, at first because of a February holiday and then the late February lockdown. The authors found three cases among kids in January using antibody tests but found no evidence of virus spread to other children or teachers from those early cases. Any spread between the end of January and the end of April (when the authors collected samples) must have occurred during the lockdown. The kids who tested antibody positive at the end of April, because of the circumstances of the lockdown, must have become positive from a source

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[52] Daniel F. Gudbjartsson, Ph.D., Agnar Helgason, Ph.D., et al., *Spread of SARS-CoV-2 in the Icelandic Population,* The New England Journal of Medicine, https://www.nejm.org/doi/full/10.1056/NEJMoa2006100 (June 11, 2020).
[53] Roger Highfield, *Coronavirus: Hunting Down COVID-10,* Science Museum Group, https://www.sciencemuseumgroup.org.uk/blog/hunting-down-covid-19/ (April 27, 2020).
[54] Arnaud Fontanet, MD, DrPH, Rebecca Grant, et al., *SARS-CoV-2 Infection in Primary Schools in Northern France: A Retrospective Cohort Study in an Area of High Transmission,* Institut Pasteur, https://www.pasteur.fr/fr/file/35404/download (last visited July 9, 2020).

other than their school. The main contacts of the young children were their parents, of whom 61% were positive, which is consistent with parent to child spread. Also consistent is the fact that only 6.9% of parents tested positive in April for the virus among the children who were antibody negative. The authors' main conclusion[55] from these facts is that parents were the source of infections in school children; children were not the source. This finding mirrors the conclusion from the Icelandic study that the disease spreads less easily from children to adults than it does from adults to adults.

Researchers in Ireland conducted a similar study[56] which analyzed 1,160 children and adults in Ireland who were physically present in a school at some time between March 1st and March 13th where a COVID-19 case was identified. (Schools were closed in Ireland on March 12th). The authors found 3 children (all between 10 and 15 years old) and 3 adults who had COVID-19 infections. Their study followed students and families after the school closures to see if there was any evidence of disease spread from these identified cases. All six patients had confirmed cases of COVID-19 disease but were found to have contracted the virus from contacts outside of the school setting. Despite identifying a total of 722 contacts, the study authors reported finding no instance of an infected child infecting another child. The infected adults, by contrast, had many fewer contacts – 102 – but did pass on the infection to a few adult contacts. This, despite the fact, that the infected children engaged in "music lessons (woodwind instruments) and choir practice, both of which are high-risk activities for transmission." *Ibid*

A report[57] by the ministry of health in the Netherlands, based on contact tracing data, finds almost no disease spread by infected patients 20 years and under at all, and only limited spread by adults 20-25 to others outside their own age category. The authors of the study concluded: "Data from the Netherlands also confirms the current understanding: that children play a minor role in the spread of the novel coronavirus. The virus is mainly spread between adults and from adult family members to children. The spread of COVID-19 among children or from children to adults is less common."

A German[58] study reports a strikingly similar finding on the likelihood of pediatric disease spread. The German Society for Pediatric Infectious Diseases collected on all children and adolescents admitted to a hospital for COVID-19 treatment between mid-March and early May 2020 – 128 patients in all, admitted to 66 different hospitals. The authors were able to find the source of infection for 38% of these patients, which turned out to be a parent 85% of the time. Though the authors document a limitation of small sample size, they conclude that "In contrast to other epidemic viral respiratory infections, the primary source of infection with SARS-CoV-2 appears not to be other children." The authors reported a single death among these 128 pediatric

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[55] *COVID-19 In Primary Schools: No Significant Transmission among Children or From Students to Teachers,* Institut Pasteur, https://www.pasteur.fr/en/press-area/press-documents/covid-19-primary-schools-no-significant-transmission-among-children-students-teachers (June 23, 2020).

[56] Laura Heavey, Geraldine Casey, et al., *No Evidence of Secondary Transmission of COVID-19 from Children Attending School in Ireland, 2020,* Eurosurveillance, https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2020.25.21.2000903#html_fulltext (May 28, 2020).

[57] *Children and COVID-19,* National Institute for Public Health and the Environment, https://www.rivm.nl/en/novel-coronavirus-covid-19/children-and-covid-19 (July 2, 2020).

[58] Armann, J. P., Diffloth, N., Simon, A., Doenhardt, M., Hufnagel, M., Trotter, A., Schneider, D., Hübner, J., & Berner, R. (2020). Hospital Admission in Children and Adolescents With COVID-19. Deutsches Arzteblatt international, 117(21), 373–374. https://doi.org/10.3238/arztebl.2020.0373

patients.

One of the largest studies in the world on coronavirus in schools, carried out in 100 institutions in the UK, recently confirmed that "there is very little evidence that the virus is transmitted" in schools.[59] Indeed, the president of the Royal College of Pediatrics and Child Health and a member of the government advisory group Sage confirmed that "there is very little evidence that the virus is transmitted in schools" based on this extensive study.

A study of 23 family disease clusters in Greece, published on Aug. 7th in the *Journal of Medical Virology*, found that in 91% of the clusters, an adult was the first person to be infected. Their contact tracing effort attempted to clarify the direction of disease spread by careful questioning about the relative timing of the development of symptoms. They found no evidence of either child-to-adult spread, or even child-to-child. They concluded that "[w]hile children become infected by SARS-CoV-2, they do not appear to transmit infection to others. Furthermore, children more frequently have an asymptomatic or mild course compared to adults."[60]

A study by the Federal Office of Public Health of Switzerland analyzed 793 cases reported by Swiss doctors in late July 2020.[61] The reports included the place where each patient most likely contracted the infection. The most common source of infection was at home, with 27.2% tracing their disease there. School, by contrast, consisted of only 0.3% of the infections; only two of the 793 cases could be tracked to a school. There are some limitations though of this study: first, it is a contact tracing study without genetic sequencing verification so the usual caveat applies; and second, the report provides no details about the age of the cases, so it is not possible to separately glean the disease acquisition frequencies for children and adults; and third, only summer schools were in session during this time period. Nevertheless, the results strongly suggest that schools are a minor source of community spread of the infection.

A recent South Korean contact tracing study[62] was cited in the New York Times as providing evidence that "Older Children Spread the Coronavirus Just as Much as Adults." Contrary to the interpretation of the NYT headline, the pattern of evidence reported in the study does not imply that older children spread the corona virus as much as adults. A follow-on paper on South Korean case study, reanalyzing the same data set, the same patients, and published in the *Archives of Disease in Childhood*, clarified the direction of transmission of disease by focusing only on cases without "shared exposure" to a positive case.[63] The idea in this reanalysis paper is to exclude from consideration situations where two people who are infected share a third contact

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[59] Sian Griffiths, *Pupils pose little risk of spreading COVID*, The Sunday Times (Aug. 9, 2020), available at https://www.thetimes.co.uk/article/pupils-pose-no-risk-of-spreading-covid-27q6zfd9l.

[60] Helena C. Maltezou Rengina Vorou Kalliopi Papadima, et al. (2020) "Transmission dynamics of SARS-CoV-2 within families with children in Greece: a study of 23 clusters" Journal of Medical Virology, https://doi.org/10.1002/jmv.26394 (accessed August 12, 2020).

[61] Office fédéral de la santé publique OFSP (2020) "Rectificatif : les lieux de contamination sont les contextes familiaux et non les boîtes de nuit" Aug. 2, 2020. available at https://www.bag.admin.ch/bag/fr/home/das-bag/aktuell/news/news-02-08-2020.html

[62] Park YJ, Choe YJ, Park O, Park SY, Kim YM, Kim J, et al. "Contact tracing during coronavirus disease outbreak, South Korea, 2020," *Emerg Infect Dis.* (Oct. 2020), available at https://doi.org/10.3201/eid2610.201315 (accessed online July 27, 2020),

[63] Kim J, Choe YJ, Lee J, et al., *Role of children in household transmission of COVID-19*, ARCHIVES OF DISEASE IN CHILDHOOD (August 7, 2020), available at doi: 10.1136/archdischild-2020-319910

who is also infected, since it is possible that third contact infected both the original two people. Using this method, the authors found a single case (out of 107 pediatric index cases and 248 household members who also tested positive) of a child passing on the disease to another household member – another child. They find no instances of a child passing the disease to an adult.

This reanalysis of the South Korean paper is instructive, and the lesson should be clear. Correlation studies and anecdotes that do not distinguish the direction of spread of disease provide no information whatsoever about the safety (or lack thereof) of school reopening. In every single instance, when a more careful analysis that identifies the direction of spread (such as this South Korean study) is conducted, the analysis finds that children pose a negligible risk of spreading the disease to adults, both at school and at home.

There are other contact tracing-based studies that have attempted to reach conclusions about the role of children in spreading the epidemic that suffer from the same problem as the original South Korean study referenced above. For instance, a pre-print study from the Italian province of Trento[64] reported on 2,812 cases who reported 6,690 contacts. Though there were only 14 children among these cases, the authors nevertheless conclude that they transmitted the disease at a high rate, infecting 11 of their 49 contacts, nearly all within the same household. This represents only a small fraction of cases and contacts that the authors analyzed, so numerically it is incorrect to conclude that children played a key role in the spread of the epidemic. Furthermore, unlike the Icelandic study, the Italian study cannot distinguish a child infecting a contact from the contact infecting the child. To my knowledge, nearly every contact-tracing based study of the role of children in the epidemic – with the Icelandic study and reanalysis of the South Korean study cited above as notable exceptions – suffers from this same problem.

A recent report, published in the *Journal of Pediatrics* and entitled "Pediatric SARS-CoV-2: Clinical Presentation, Infectivity, and Immune Responses", measured the concentration of the SARS-CoV-2 virus in the nasopharynx of children who showed symptoms consistent with COVID-19 infection.[65] The report found that the viral load in pediatric patients with symptoms (typically mild symptoms) was higher than adult hospitalized patients with severe COVID-19 disease. This is consistent with reports from earlier in the epidemic, which found similarly high viral loads in children.[66] Many news media reports of the *Journal of Pediatrics* study extrapolated beyond the results of the study, with alarming headlines saying that children are "silent spreaders" of SARS-CoV-2.[67]

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[64] Pirous Fateh-Moghadam, Laura Battisti, Silvia Molinaro, Steno Fontanari, Gabriele Dallago, Nancy Binkin, Mariagrazia Zuccali (2020) "Contact tracing during Phase I of the COVID-19 pandemic in the Province of Trento, Italy: key findings and recommendations" medRxiv preprint, DOI: https://doi.org/10.1101/2020.07.16.20127357. (accessed online Aug. 6, 2020)

[65] Lael Yonker et al. (2020) "Pediatric SARS-CoV-2: Clinical Presentation, Infectivity, and Immune Responses." *The Journal of Pediatrics* DOI: 10.1016/j.jpeds.2020.08.037 https://www.jpeds.com/article/S0022-3476(20)31023-4/fulltext

[66] Terry C Jones et al. (2020) "An Analysis of SARS-CoV-2 Viral Load by Patient Age" medRxiv. doi:https://doi.org/10.1101/2020.06.08.20125484. https://www.medrxiv.org/content/10.1101/2020.06.08.20125484v1

[67] Science Daily (2020) "Researchers show children are silent spreaders of virus that causes COVID-19" Press release, August 20, 2020. https://www.sciencedaily.com/releases/2020/08/200820102442.htm

These media reports are misleading because the presence of virus in the nasopharynx is not synonymous with the transmissibility of the virus. The PCR test which checks for the presence of the virus registers false-positive results in the presence of non-viable, non-infectious, viral particles.[68,69,70] So even a high viral load is not evidence of infectivity.[71] The *Journal of Pediatrics* study itself appropriately lists the fact that their study does not assess the transmissibility of the virus as a limitation of the study. The only way to check for infectivity is to conduct a careful study of actual transmission of the virus, of the sort reported in the Icelandic contact tracing/viral mutation analysis referenced earlier.[72]

Another approach to this topic involves analyzing the effect of actual school closures on the spread of the epidemic within a country. If children play a role as a key vector of the epidemic, then one would expect that countries that closed schools would see a significant effect of this policy on disease spread. In fact, the opposite is the case. Studies from around the world that have examined school closures (including Japan[73], New South Wales[74], and Sweden/Finland[75]) find little or no effect of school closure on disease spread. The studies encompass closures of both elementary schools and high schools. A study[76] analyzing the Swedish experience concluded that there was there was no additional risk to elderly people cohabiting with school age children up to age 16, despite the fact that Swedish schools were kept open throughout the epidemic. A systematic review of this evidence[77] concluded that even though it may be possible for children to be infected with the virus and even transmit it, "[o]pening up schools and kindergartens is unlikely to impact COVID-19 mortality rates in older people."

One purported counterexample to this evidence that has received widespread attention involves

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[68] Kucirka LM, Lauer SA, Laeyendecker O, et al. (2020) Variation in False-Negative Rate of Reverse Transcriptase Polymerase Chain Reaction–Based SARS-CoV-2 Tests by Time Since Exposure. *Annals of Internal Medicine.* https://doi.org/10.7326/M20-1495

[69] Lan L, Xu D, Ye G, et al. (2020) Positive RT-PCR Test Results in Patients Recovered From COVID-19. JAMA. 2020;323(15):1502–1503. doi:10.1001/jama.2020.2783

[70] Cohen AN, Kessel B (2020) False positives in reverse transcription PCR testing for SARS-CoV-2. medRxiv 2020.04.26.20080911; doi: https://doi.org/10.1101/2020.04.26.20080911. Accessed 7/22/2020.

[71] Gavin Joynt and William Wu (2020) "Understanding COVID-19: what does viral RNA load really mean?" Lancet Infectious Diseases 20(6): P635-6. DOI:https://doi.org/10.1016/S1473-3099(20)30237-1 https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(20)30237-1/fulltext

[72] Daniel F. Gudbjartsson, Ph.D., Agnar Helgason, Ph.D., et al., Spread of SARS-CoV-2 in the Icelandic Population, The New England Journal of Medicine, https://www.nejm.org/doi/full/10.1056/NEJMoa2006100 (June 11, 2020).

[73] Kentaro Iwata, Asako Doi, and Chisato Miyakoshi (2020) "Was school closure effective in mitigating coronavirus disease 2019 (COVID-19)? Time series analysis using Bayesian inference" *International Journal of Infectious Diseases.* DOI: https://doi.org/10.1016/j.ijid.2020.07.052 (accessed online Aug. 6, 2020).

[74] Kristine Macartney, Helen Quinn, Alexis Pillsbury, et al. (2020) "Transmission of SARS-CoV-2 in Australian Educational Settings: A Prospective Cohort Study" *The Lancet Child & Adolescent Health.* DOI: https://doi.org/10.1016/S2352-4642(20)30251-0 (accessed online Aug. 6, 2020)

[75] Public Health Agency of Sweden (2020) "COVID-19 in Schoolchildren: A Comparison between Finland and Sweden" https://www.folkhalsomyndigheten.se/contentassets/c1b78bffbfde4a7899eb0d8ffdb57b09/covid-19-school-aged-children.pdf (accessed online Aug. 6, 2020)

[76] Brandén, Maria; Aradhya, Siddartha; Kolk, Martin; Härkönen, Juho; Drefahl, Sven; Malmberg, Bo; et al. (2020): Residential Context and COVID-19 Mortality among the Elderly in Stockholm: A population-based, observational study. Stockholm Research Reports in Demography. Preprint. https://doi.org/10.17045/sthlmuni.12612947.v1 (accessed online Aug. 6, 2020)

[77] Jonas Ludvigsson (2020) "Children are Unlikely to be the Main Drivers of the COVID-19 Pandemic – A Systematic Review" *Acta Paediatrica,* DOI: 10.1111/apa.15371 (accessed online Aug. 6, 2020).

the reopening of schools in Israel in the early summer.[78] While the Israeli opening of schools is cited as a counterexample to the many other studies showing the negligible risk of transmitting COVID-19 by children, the Israeli reports suggest it was a unique circumstance, with children crowded into a small closed space and few precautions taken against disease spread. The New York Times story cited above provides an illustrative anecdote of symptomatic teachers passing the virus to their students. And the primary source of disease spread at the Gymnasia Rehavia high school was a single symptomatic teacher infecting colleagues and students. Additionally, an analysis of cell-phone mobility data, conducted by Dr. Scott Atlas, shows that by the end of May, Israel had returned to pre-pandemic norms.[79] Contemporary reports, which emphasize the success of Israel in controlling the epidemic, suggest that Israelis reduced adherence to other mitigation measures as well. The cases that arose in Israeli schools are more likely a reflection of pre-existing community spread of the virus, rather than as a cause.

Thus, with no careful study to back it, and several lines of evidence that complicate any causal inference, the role of school opening in the resurgence of COVID-19 cases in Israel is not established. If there is a lesson to be learned, it is that schools can be opened safely for in-person learning if reasonable precautions – specific to the circumstances of each school – are taken. In the Israeli case, as with much of the anecdotal evidence cited, no viral sequencing analysis was conducted to verify the direction of disease spread. A report in *Science* emphasizes that no causal connection should be inferred from the correlation between Israeli school openings and the rise in cases there: "In Israel, infections among children increased steadily after schools opened. That paralleled a rise in cases nationwide, but it's not clear whether the country's rising caseload contributed to the increase within schools or vice versa."

Another purported counter example comes from the experience with the epidemic at an overnight camp in Georgia.[80] The summer camp anecdote is no analogy for schools. There, the kids were older, they slept together in crowded cabins, and engaged in lots of singing and screaming. Many of the children who developed symptoms did so within two days of arriving at the camp. Since the time between viral exposure and symptom development is typically longer than two days, this suggests strongly that many of the children in the camp were infected prior to their arrival at the camp. Some developed cases more than two weeks after leaving the camp. Since symptom development – if it happens at all – is typically within two weeks of infection, this leaves open the possibility that the campers were exposed at home. Since this outbreak corresponds to a time when community spread was common in Georgia, these are not just theoretical possibilities, and indeed likely. Finally, as with many of the correlational contact tracing studies, there is no indication of whether the transmission was from staff to student, or student to student.

In sharp contrast with the Georgia summer camp report, a large study of 1,900 children attending an urban summer schools in Barcelona, Spain over a five-week period found only 39 new index

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[78] Isabel Kershner and Pan Belluck (2020) "When COVID Subsided, Israel Reopened Its Schools. It Didn't Go Well." New York Times. Aug. 4, 2020. https://www.nytimes.com/2020/08/04/world/middleeast/coronavirus-israel-schools-reopen.html (Accessed online Aug. 6, 2020)

[79] Personal communication.

[80] Caitlin McGabe, *Latest Research Points to Children Carrying, Transmitting Coronavirus*, THE WALL STREET JOURNAL (Aug. 9, 2020), available at https://www.wsj.com/articles/latest-research-points-to-children-carrying-transmitting-coronavirus-11596978001?st=4rrxzoyo0jou5ns&reflink=article_email_share.

cases (30 pediatric).[81] The setting was chosen because the investigators viewed it as a model for what to expect from school openings in the fall. These kids had 253 contacts in total, of whom, only 12 developed an infection – a secondary attack rate of 4.7%. The low secondary attack rate was similar for children of all ages attending the programs, ranging up to 17 years-old. The investigators attributed the success in controlling the spread of the disease to frequent hand washing by the children and to organizing the children into "bubbles" so that the kids interacted with the same group of children all day long.

A recent and comprehensive official report by Public Health England of the role of English schools, which were reopened on June 1, 2020 despite high community case numbers, in spreading the pandemic.[82] The author of this report found that cases and outbreaks were "uncommon across all educational settings" and that "[s]taff members had an increased risk of SARS-CoV-2 infections compared to students in any educational setting, and the majority of cases linked to outbreaks were in staff." In response to this study, UK education minister Gavin Williamson said "The latest research, which is expected to be published later this year – one of the largest studies on the coronavirus in schools in the world – makes it clear there is little evidence that the virus is transmitted at school."[83]

The overwhelming bulk of scientific studies that have examined the topic – including the best studies, which take pains to distinguish correlation from causation – find that children play a limited role in spreading COVID-19 infection to adults and that children themselves face minimal risk of poor outcomes if they should become infected.

In summary, Canadian responses to the epidemic have included many limits on the activities of children, including but not limited to closures of schools, limitations to in class teaching, suspension or limits of sports and activities, and restricted contact with friends. Given the evidence cited here, these policies are inconsistent with the principle that public health decisions must be grounded in good scientific evidence.

### G. Do Restrictions on the Activities of Young Adults Play an Important Role in Disease Spread? Do Young adults face particular harms from the lockdown restrictions?

Unlike children, young adults who are infected – especially early in infection – spread disease as efficiently older adults. However, they are harmed by infection much less than older adults. Young adults face a very low mortality risk from COVID-19 infection – an infection survival

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[81] Oriel Guell (2020) *Major coronavirus study in Spanish summer camps shows low transmission among children.* El Pais. (Aug. 26, 2020) available at https://english.elpais.com/society/2020-08-26/major-coronavirus-study-in-spanish-summer-camps-shows-low-transmission-among-children.html

[82] Sharif Ismail et al. (2020) "SARS-CoV-2 infection and transmission in educational settings: cross-sectional analysis of clusters and outbreaks in England" Public Health England, Aug. 12, 2020 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/911267/School_Outbreaks_Analysis.pdf

[83] Peter Walker (2020) "Little Evidence COVID Spreads in Schools, says Gavin Williamson" *The Guardian*, Aug. 10, 2020. https://www.theguardian.com/world/2020/aug/10/little-evidence-covid-spreads-in-schools-says-gavin-williamson

rate of 99.98% for people aged 20-49, according the US CDC.[84]

By contrast, young adults face enormous harm from lockdowns. Indicators of psychological harm have also increased sharply in prevalence in this group. According to a US CDC survey, one in four young adults aged 18 to 24 years seriously considered suicide.[85] Other harms include lost educational opportunities with colleges and universities shutting down or providing only online classes and catastrophically high unemployment and economic dislocation.[86] Ironically, the lockdowns themselves have thus increased the risk of COVID-19 faced by older populations by increasing the number of households where young adults who have lost their jobs co-reside with vulnerable older parents[87], which increases the risk of COVID-related death.[88]

For young adults then, the harms from lockdowns are substantially greater than the harms from COVID. Viewed as a medical treatment, lockdowns imposed on younger populations violates the ethical principle that medical actions should do no harm to the patient. Unlike, chemotherapy for cancer, which induces a short-term harm to a patient in exchange for a potential longer-term benefit, lockdowns cause long lasting harm to young adults with little to no long-lasting benefit.

### H. Can religious services be held safely? Are there particular benefits that derive from communal singing?

Religious activity is essential to a meaningful life for many Canadians, and the free exercise of religion is guaranteed by the country's constitution. Because assembly for religious practice is so important to so many, rather than recommending that religious assembly be canceled during the pandemic, the World Health Organization has provided guidance for religious assembly in the context of COVID-19.[89] The US CDC provides similar guidance and is instructive in the North American context.

The CDC guidance for communities of faith starts by recognizing the particular importance that religious communities should be permitted to gather for worship.[90] The CDC document cites the

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[84] COVID- 19 Pandemic Planning Scenarios, Centers for Disease Control and Prevention, https://www.cdc.gov/coronavirus/2019-ncov/hep/planning-scenarios.html.

[85] Czeisler MÉ , Lane RI, Petrosky E, et al. Mental Health, Substance Use, and Suicidal Ideation During the COVID-19 Pandemic — United States, June 24–30, 2020. MMWR Morb Mortal Wkly Rep 2020;69:1049–1057. DOI: http://dx.doi.org/10.15585/mmwr.mm6932a1external icon

[86] Sharp A. (2020) Youth unemployment rate spikes amid pandemic. Canada's National Observer. May 8, 2020. https://www.nationalobserver.com/2020/05/08/news/youth-unemployment-rate-spikes-amid-pandemic

[87] Evandrou M, Falkingham J, Qin M, and Vlachantoni A (2020) Changing Living Arrangements, Family Dynamics and Stress During Lockdown: Evidence from Four Birth Cohorts in the UK. University of Southampton Eprint Soton. https://eprints.soton.ac.uk/443865/1/family_dynamics_during_covid_19_final.pdf

[88] Fenoll AA & Grossbard S (2020) Intergenerational residence patterns and Covid-19 fatalities in the EU and the US, Economics & Human Biology, 39. https://doi.org/10.1016/j.ehb.2020.100934.

[89] World Health Organization (2020) Practical Considerations and Recommendations for Religious Leaders and Faith-Based Communities in the Context of COVID-19. https://www.who.int/publications/i/item/practical-considerations-and-recommendations-for-religious-leaders-and-faith-based-communities-in-the-context-of-covid-19

[90] US Centers for Disease Control (2020) Considerations for Communities of Faith. https://www.cdc.gov/coronavirus/2019-ncov/community/faith-based.html

First Amendment right to the free exercise of religion, and reminds state and local authorities to account for this right in decision making about permitting religious communities to meet. Similar guarantees are present in the Canadian constitution, as these involve fundamental human rights. The recommendations in the CDC guidance include: (1) communication with local public health authorities regarding in person service plans; (2) protection for staff who are at higher risk for severe illness, including older staff members and those with underlying medical conditions; (3) encouragement of the congregation and staff to engage in hygienic hand washing practices; (4) encourage the congregation and staff to wear masks when social distancing is difficult, (5) promote six-foot social distancing during worship and reduce physical contact (shaking hands, hugging); (6) disinfection and cleaning of the worship space before and after each service; (7) minimize sharing of worship materials and shared food; (8) encourage staff and congregants with symptoms consistent with COVID-19 infection or at high mortality risk given infection (e.g. elderly congregants and those with relevant comorbid conditions) to stay home; and (9) post signs and messages to communicate information about practices that can lead to disease spread. The CDC document is pointedly silent on singing during worship and does not make any explicit recommendations regarding communal singing. These guidelines require social distancing, which can reduce the likelihood of disease spread, but do not require – as Quebec does[91] -- a limitation to a fixed number of people in a service regardless of the size of the church, which has no scientific justification.

By following these guidelines, churches, mosques, synagogues, and other religious assemblies can safely hold indoor worship services, with minimal effect on the spread of COVID-19 disease.

Against the cost of a marginal increase in disease spread (a harm that can be mitigated by following safety protocols), should be considered the overwhelming evidence that church attendance provides psychological benefits for attendees. A comprehensive meta-analysis of the literature found evidence of improved mental health from religiosity (typically defined to encompass church attendance).[92] This is consistent with the broader literature on the psychological benefits of membership in voluntary associations as way to alleviate psychological distress.[93] The evidence suggesting psychological benefits of church attendance (including reductions in rates of depression) are particularly strong for adolescents.[94] Church attendance reduces stress and allostatic load (a term indicating stress endured over a long period of time),[95] which can cause both psychological and physical harms, including higher incidence of chronic

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[91] Gloutnay F. (2020) Quebec government limits churches to 50 people, 25 in riskier regions. Catholic News Service. Sept. 22, 2020. https://www.catholicnews.com/quebec-government-limits-churches-to-50-people-25-in-riskier-regions/

[92] Hackney, C. H., & Sanders, G. S. (2003). Religiosity and Mental Health: A Meta-Analysis of Recent Studies. Journal for the Scientific Study of Religion, 42(1), 43–55. https://doi.org/10.1111/1468-5906.t01-1-00160

[93] Rietschlin, J. (1998). Voluntary Association Membership and Psychological Distress. Journal of Health and Social Behavior, 39(4), 348–355. https://doi.org/10.2307/2676343

[94] Demir, M., & Urberg, K. A. (2004). Church attendance and well-being among adolescents. Journal of Beliefs and Values, 25(1), 63–68. https://doi.org/10.1080/1361767042000198951

[95] Bruce, M. A., Martins, D., Duru, K., Beech, B. M., Sims, M., Harawa, N., Vargas, R., Kermah, D., Nicholas, S. B., Brown, A., & Norris, K. C. (2017). Church attendance, allostatic load and mortality in middle aged adults. PLOS ONE, 12(5), e0177618. https://doi.org/10.1371/journal.pone.0177618

disease and higher mortality.[96] There is also evidence in the medical literature regarding the particular psychological benefits provided by communal singing in the process of worship.[97,] Communal singing provides a sense of belonging and connectedness that is crucially important in the life of many believers, with measurable effects on mental health.[98,99,100]

Of course, the spiritual benefits of in-person religious observance are personal to every member of the religious communities and should not be discounted even if they are not discretely measurable in terms of health benefits. For many believers, faith provides purpose in life.

## I. Can restaurants and bars be opened safely to customers? Are there particular benefits that derive from eating in community?

Quebec is the home to a vibrant restaurant and food service industry, including world-class eateries, bars, and cafes. It is an important industry that provides entrepreneurial and employment opportunities that benefit the people of Quebec in many ways, including providing psychologically important opportunities to eat together with friends and family. These facilities remain closed throughout Quebec despite the reservations of Quebec' public health director, Dr. Horacio Arruda, who cites evidence that restaurants are not a major source of COVID-19 disease spread in Quebec.[101] These closure orders are not scientifically justified.

If restaurants, bars, etc. adhere to basic safety protocols promulgated by public health agencies throughout Canada (the protocols in Alberta are a typical example[102]), they can operate with in person service safely. The recommendations include the following (among other items not listed here): (1) discourage patrons from congregating together while waiting for seating; (2) limit party size at tables and require a 2 meter distance between each dining party; (3) provide for physical barriers between tables when 2 meter distance is impossible; (4) use contactless payments and avoid cash payments where possible; (5) clean menus between uses or use paper

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[96] Juster, R. P., McEwen, B. S., & Lupien, S. J. (2010). Allostatic load biomarkers of chronic stress and impact on health and cognition. In Neuroscience and Biobehavioral Reviews (Vol. 35, Issue 1, pp. 2–16). Pergamon. https://doi.org/10.1016/j.neubiorev.2009.10.002

[97] Shakespeare T & Whieldon A (2017) Sing Your Heart Out: community singing as part of mental health recovery. *Medical Humanities*, 44(3) http://dx.doi.org/10.1136/medhum-2017-011195

[98] Clift S , Hancox G , Morrison I , et al . Choral singing and psychological wellbeing: quantitative and qualitative findings from english choirs in a cross-national survey. *J Applied Arts & Health* 2010;1:19–34.doi:10.1386/jaah.1.1.19/1

[99] Clift S , Morrison I . Group singing fosters mental health and wellbeing: findings from the East Kent 'singing for health' network project. *Mental Health and Social Inclusion* 2011;15:88–97.doi:10.1108/20428301111140930

[100] Livesey L , Morrison I , Clift S , et al . Benefits of choral singing for social and mental wellbeing: qualitative findings from a cross-national survey of choir members. *J Public Ment Health* 2012;11:10–26.doi:10.1108/17465721211207275

[101] Silva V (2020) Quebec's Top Doctor Wasn't the One Behind Restaurant Closures. Dec. 10, 2020. https://montreal.eater.com/2020/12/10/22167312/arruda-didnt-recommend-restaurants-close-coronavirus-pandemic-quebec

[102] Alberta Public Health (2020) COVID-19 Information: Guidance for restaurants, cafes, pubs, and bars. September 2020.

menus; (6) avoid singing, or provide physical distancing between singers and patrons; (7) all employees must wear acceptable face covering at all times; (8) frequent sanitizing of surfaces, (9) encourage symptom checking of potential patrons and do not serve patrons who have symptoms consistent with COVID-19 disease.

In New York City, where a similar set of recommendations were in place for restaurants and bars restaurants which were permitted to operate for in-person dining (until a new closure order[103] was put in place effective Dec. 14, 2020), a detailed contact tracing report found that restaurants and bars in New York City only account for 1.4% of the COVID spread. In that study, private gatherings at home account for 74% of the COVID spread.[104]

This finding should not be surprising. The scientific evidence now strongly suggests that COVID-19 infected individuals who are asymptomatic (that is, show no symptoms of a respiratory infection) are more than an order of magnitude less likely spread the disease to even close contacts than symptomatic COVID-19 patients. Requiring a check of potential patrons for symptoms consistent with COVID-19 disease, permitting only people without symptoms to enter the premises and dine indoors, thus suffices to sharply curb the probability of disease spread during the in-person dining experience. A meta-analysis of 54 studies from around the world found that within households – where none of the safeguards that restaurants are required to apply are typically applied – symptomatic patients passed on the disease to household members in 18% of instances, while asymptomatic patients passed on the disease to household members in 0.7% of instances.[105] A large study of 10 million residents of Wuhan, China, all tested for the presence of the virus, found a total of 300 total cases, all asymptomatic. A comprehensive contact tracing effort identified 1,174 close contacts of these patients, none of whom tested positive for the virus.[106] This is consistent with a vanishingly low level of asymptomatic spread of the disease. While theoretical modeling work from earlier in the epidemic (including some of my own published research[107]) predicts some level of asymptomatic disease spread, the empirical evidence at this point later in the epidemic strongly shows very little evidence that this is an important empirical reality. So as long as restaurants follow guidelines to exclude potential symptomatic diners, in-person dining can occur safely.

Against these data regarding the negligible risks of COVID-19 transmission in indoor dining (in a restaurant following guidelines) should be considered the substantial evidence that social eating provides significant and tangible psychological and physiological benefits for diners that are lost through the imposition of such scientifically and epidemiologically unjustified blanket and untargeted bans. Those who eat socially more often feel happier and are more satisfied with life, are more trusting of others, are more engaged with their local communities, and have more

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[103] Klein C. (2020) New York City Indoor Dining Will Shut Down Again. *Intelligencer*. Dec. 11, 2020. https://nymag.com/intelligencer/2020/12/new-york-city-indoor-dining-to-shut-down-again-over-covid-19.html

[104] Adams E and Warerkar T (2020) Restaurants and Bars Account for 1.4 Percent of COVID-19 Spread in New York. Dec. 11, 2020. https://ny.eater.com/2020/12/11/22169841/restaurants-and-bars-coronavirus-spread-data-new-york

[105] (Madewell ZJ, Yang Y, Longini IM, Halloran ME, Dean NE. Household Transmission of SARS-CoV-2: A Systematic Review and Meta-analysis. *JAMA Netw Open*. 2020;3(12):e2031756. doi:10.1001/jamanetworkopen.2020.31756)

[106] (Cao, S., Gan, Y., Wang, C. et al. Post-lockdown SARS-CoV-2 nucleic acid screening in nearly ten million residents of Wuhan, China. *Nat Commun* 11, 5917 (2020). https://doi.org/10.1038/s41467-020-19802-w)

[107] (Peirlinck et al., *op cit.*)

friends they can depend on for support; path analysis suggests that the causal connection runs from eating together to bondedness rather than the other way around.[108] Dining together reduces people's perceptions of inequality and contributes to a view of those of different races, genders and socioeconomic backgrounds as more equal than in other social scenarios.[109] And a comprehensive survey of 17,612 men and 19,581 women over the age of 65 found that eating alone has been linked to a higher incidence of depression among adults, particularly those who live alone.[110] Eliminating the possibility of indoor dining, no matter the precautions taken, reduces or eliminates these important benefits.

**J. Can gyms, martial arts studios, and other venues offering opportunities for physical activities open with minimal risk of disease spread? Are there particular benefits to health that derive from access to such facilities?**

Gyms, martial arts studios, dance studios, and other venues offering opportunities physical activities are important to many Canadians as a way of staying physically fit and healthy. Despite the importance of these venues to public health, in much of Canada, Quebec included, the lockdown orders have ordered them to stay closed for extended periods during the past months. These orders are unjustified.

First, though Quebec premier Francois Legault has asserted that opening gyms poses particular risk to disease spread, to my knowledge the public health authorities in Quebec have provided no studies – based on contact tracing or other data – to document this statement in Quebec.[111] There is one report of a "super-spreader" event that occurred in a gym in Ontario in October.[112] In that case, there was a spinning class, with stationary bicycles with wheels that in theory could aerosolize the virus. If that is true, the right remedy is to limit indoor spin classes or require physical barriers between bicycles, not to shutter gyms and fitness venues altogether. In the CBC story reporting on this event cited one infectious disease expert who admitted that gyms are not high-risk environments:

> Dr. Ilan Schwartz, an infectious disease expert with the University of Alberta, said spin classes may pose more risk than other group settings because of the bikes themselves. In theory, the rapidly spinning wheels could aerosolize droplets by flinging them farther distances.

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[108] (Dunbar, *Breaking Bread: the Functions of Social Eating, Adaptive Human Behavior and Physiology* (*available at* https://link.springer.com/article/10.1007/s40750-017-0061-4)).

[109] (Julier, *Eating Together: Food, Friendship and Inequality*, The University of Illinois Press (2014)).

[110] Tani, et al, *Eating alone and depression in older men and women by cohabitation status: the JAGES longitudinal survey, Age Ageing* 44(6) 1019-1026 (2015) (*available at* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4621239/).

[111] Laframboise K (2020) Quebec gym owners, clients who flout COVID-19 red zone rules will face fines: Legault. *Global News*. October 27, 2020. https://globalnews.ca/news/7425270/quebec-gyms-coronavirus-red-zones-fines/

[112] Zuber MC. (2020) Heavier breathing, spewing droplets, poor ventilation add to gyms' superspreading risk. CBC. October 15, 2020. https://www.cbc.ca/news/health/gyms-superspreading-events-covid-19-1.5763297

> "I haven't seen any studies of this, but theoretically it makes sense," he said.
>
> "I think going to the gym isn't necessarily high-risk, unless individuals are close together and there's poor ventilation. But there might be specific circumstances that could make it higher-risk, where something with fast, moving parts [or] a rapidly moving fan can generate aerosols as well."

Compared with this sort of anecdotal evidence, there are more systematic data from other localities that suggest that physical fitness centers play a limited role in disease spread.[113] In a sophisticated study published in *Nature* analyzing the relationship between mobility of populations, super-spreader events and disease risk, the authors conclude that restricting occupancy in public venues is the best approach to limiting the risk of disease spread, while lockdowns aimed at general mobility restrictions work less well.[114] They find that fitness centers do not pose a very high risk of disease spread relative to other public venues.

Second, guidelines disseminated by public health agencies around Canada provide discrete steps that fitness centers can take to reduce the risk of spread of the disease at these centers.[115] These steps include physical distancing requirements, physical barriers, ventilation requirements, symptom checking, cleaning requirements, and face masks when physical distancing is impossible. Given the findings in the scientific literature, these requirements – if implemented appropriately – are sufficient to limit the probability of disease spread at fitness centers.

Third, closing fitness centers reduces the ability of the population to engage in activities that maintain physical fitness, and thus increase the risk of poor outcomes if a COVID-19 infection were to occur. For example, obesity is a risk factor for mortality from COVID-19 infection. Regular exercise is essential for patients with type 2 diabetes[116] or cardiovascular disease[117] to maintain their health. Exercise also provides people with anxiety, depression, and stress-related disorders with an important avenue to address these problems.[118, 119] The negligible benefits of closing fitness centers in terms of slowing disease spread should be balanced against the health

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[113] UK Office for National Statistics (2020) Which occupations have the highest potential exposure to the coronavirus (COVID-19)? May 11, 2020. https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/articles/whichoccupationshavethehighestpotentialexposuretothecoronaviruscovid19/2020-05-11

[114] Chang S, Pierson E, Koh PW, Gerardin J, Redbird B, Grusky D, Leskovec J. Mobility network models of COVID-19 explain inequities and inform reopening. Nature. 2020 Nov 10. doi: 10.1038/s41586-020-2923-3. Epub ahead of print. PMID: 33171481.

[115] Government of Canada (2020) Community-based measures to mitigate the spread of coronavirus disease (COVID-19) in Canada. October 15, 2020. https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/health-professionals/public-health-measures-mitigate-covid-19.html#_Community_gathering_spaces

[116] Kirwan JP, Sacks J, Nieuwoudt S. The essential role of exercise in the management of type 2 diabetes. Cleve Clin J Med. 2017 Jul;84(7 Suppl 1):S15-S21. doi: 10.3949/ccjm.84.s1.03. PMID: 28708479; PMCID: PMC5846677.

[117] Nystoriak MA and Bhatnagar A (2020) Cardiovascular Effects and Benefits of Exercise. Front. Cardiovasc. Med., 28 September 2018 | https://doi.org/10.3389/fcvm.2018.00135

[118] Craft, Lynette L., and Frank M. Perna. "The Benefits of Exercise for the Clinically Depressed." Primary care companion to the Journal of clinical psychiatry vol. 6,3 (2004): 104-111. doi:10.4088/pcc.v06n0301

[119] Stubbs B, Vancampfort D, Rosenbaum S, Firth J, Cosco T, Veronese N, Salum GA, Schuch FB. An examination of the anxiolytic effects of exercise for people with anxiety and stress-related disorders: A meta-analysis. Psychiatry Res. 2017 Mar;249:102-108. doi: 10.1016/j.psychres.2016.12.020. Epub 2017 Jan 6. PMID: 28088704.

benefits of these centers for people who frequent them.

In summary, if fitness centers take standard precautions as recommended by Canadian public health agencies (symptom checking, good ventilation, physical barriers, etc.) the risk of COVID-19 disease spread from their operation is small. The most comprehensive studies confirm that fitness centers play a small role in disease spread. And finally, there are considerable harms to health – both physical and psychological health – from reducing the availability of venues for physical fitness for the population.

**K. Do other measures exist that would achieve the goal of the government to protect the population from the Covid-19, but that would have less or no impairments on the freedoms and liberties of the population? If yes, what are they?**

Yes. The Great Barrington Declaration, of which I am a primary coauthor, describes an alternate policy of focused protection. This policy would lead to less COVID-related death and less non-COVID related deaths than the current government policy. The coauthors of the Declaration include Prof. Martin Kulldorff of Harvard University and Prof. Sunetra Gupta of Oxford University. Over 12,000 epidemiologists and public health professionals, and 35,000 medical professionals have co-signed the declaration. The text of the Great Barrington Declaration is copied immediately below.[120]

> "As infectious disease epidemiologists and public health scientists we have grave concerns about the damaging physical and mental health impacts of the prevailing COVID-19 policies and recommend an approach we call Focused Protection.
>
> Coming from both the left and right, and around the world, we have devoted our careers to protecting people. Current lockdown policies are producing devastating effects on short and long-term public health. The results (to name a few) include lower childhood vaccination rates, worsening cardiovascular disease outcomes, fewer cancer screenings and deteriorating mental health – leading to greater excess mortality in years to come, with the working class and younger members of society carrying the heaviest burden. Keeping students out of school is a grave injustice.
>
> Keeping these measures in place until a vaccine is available will cause irreparable damage, with the underprivileged disproportionately harmed.
>
> Fortunately, our understanding of the virus is growing. We know that vulnerability to death from COVID-19 is more than a thousand-fold higher in the old and infirm than the young. Indeed, for children, COVID-19 is less dangerous than many other harms, including influenza.

[120] Bhattacharya J, Gupta S, Kulldorff M (2020) Great Barrington Declaration. https://gbdeclaration.org

As immunity builds in the population, the risk of infection to all – including the vulnerable – falls. We know that all populations will eventually reach herd immunity – i.e. the point at which the rate of new infections is stable – and that this can be assisted by (but is not dependent upon) a vaccine. Our goal should therefore be to minimize mortality and social harm until we reach herd immunity.

The most compassionate approach that balances the risks and benefits of reaching herd immunity, is to allow those who are at minimal risk of death to live their lives normally to build up immunity to the virus through natural infection, while better protecting those who are at highest risk. We call this Focused Protection.

Adopting measures to protect the vulnerable should be the central aim of public health responses to COVID-19. By way of example, nursing homes should use staff with acquired immunity and perform frequent PCR testing of other staff and all visitors. Staff rotation should be minimized. Retired people living at home should have groceries and other essentials delivered to their home. When possible, they should meet family members outside rather than inside. A comprehensive and detailed list of measures, including approaches to multi-generational households, can be implemented, and is well within the scope and capability of public health professionals.

Those who are not vulnerable should immediately be allowed to resume life as normal. Simple hygiene measures, such as hand washing and staying home when sick should be practiced by everyone to reduce the herd immunity threshold. Schools and universities should be open for in-person teaching. Extracurricular activities, such as sports, should be resumed. Young low-risk adults should work normally, rather than from home. Restaurants and other businesses should open. Arts, music, sport and other cultural activities should resume. People who are more at risk may participate if they wish, while society as a whole enjoys the protection conferred upon the vulnerable by those who have built up herd immunity."

The Great Barrington Declaration provides concrete suggestions for a strategy of focused protection. This includes a (non-comprehensive) suite of policies aimed at protecting people who are particularly vulnerable (e.g. the elderly) to mortality from COVID-19 infection. These policies differ depending on the particular living situation of vulnerable people. The current policies have failed to protect the vulnerable, as is evidence by the large fraction of the COVID-19 deaths among the elderly in Canada. There have been many unnecessary deaths, and especially among the urban working class and poor.[121] Concrete examples of these failures include:

[121] Kulldorff M and Gupta S (2020) Canada's COVID-19 strategy is an assault on the working class. Toronto Sun. Nov. 29, 2020. https://torontosun.com/opinion/columnists/opinion-canadas-covid-19-strategy-is-an-assault-on-the-working-class

- Requiring older "essential" workers and members of the working class that cannot afford not to work to be put in work situations where they may be exposed to the virus.

- Failure to protect nursing home residents from exposure to the virus from staff members, visitors, and other residents.[122]

- No provision for elderly people living in multi-generational homes to be shielded should a family member be exposed to the virus.

Focused protection of the vulnerable provides a better alternative to lockdown to protect the vulnerable. Below, in Section M, I outline ideas for focused protection.

In summary, the Great Barrington Declaration offers a policy alternative to lockdowns that reduces COVID-19 related mortality among the vulnerable via overwhelm resources devoted focused protection where they live. For the non-vulnerable, the lifting of lockdowns provides an enormous benefit for physical and psychological health – including mortality risk – that offsets the harm from potential COVID-19 infection.

## L. Is there immunity obtained after being infected and cured from Covid-19?

Yes. The scientific evidence is overwhelming that there is lasting immunity after SARS-CoV-2 infection among people who recover from the infection.

First, SARS-CoV-2 is a coronavirus and humans been exposed to coronaviruses for millenia. Immunologists reviewing this evidence of immunity after coronavirus infection argue that we should use this knowledge to set prior expectations about human immune response to SARS-CoV-2 infection, and these priors suggest a robust and long-lasting immune response. In the *Journal of Immunology*, immunologist Nicole Baumgarth and her colleagues write:[123]

> "[W]e argue that the normal cadence by which we discuss science with our colleagues failed to properly convey likelihoods of the immune response to SARS-CoV-2 to the public and the media. As a result, biologically implausible outcomes were given equal weight as the principles set by decades of viral immunology. Unsurprisingly, questionable results and alarmist news media articles have filled the void. We suggest an emphasis on setting expectations based on prior findings while avoiding the overused approach of assuming nothing. After reviewing Ab-mediated immunity after coronavirus and other acute viral infections, we posit that, with few exceptions, the development of protective humoral immunity of more than a year is the norm. Immunity to SARS-CoV-2 is likely to follow

[122] Kwiatkowski M, Nadolny TL, Priest J, Stucka M (2020) 'A National Disgrace': 40,600 deaths tied to US Nursing Homes. USA Today. June 1, 2020. https://www.usatoday.com/story/news/investigations/2020/06/01/coronavirus-nursing-home-deaths-top-40-600/5273075002/

[123] Baumgarth N, Nikolich-Zugich J, Lee FEH, Bhattacharya D. (2020) Antibody Responses to SARS-CoV-2: Let's Stick to Known Knowns.

the same pattern."

The direct evidence in favor of a robust and long-lasting immune response is also overwhelming. In a paper published in the journal *Immunity*, immunologist Deepta Bhattacharya (no relation) and his colleagues show that recovered COVID-19 patients show "durable antibody production for at least 5-7 months after infection."[124] Several other studies, published in prominent immunology journals, confirm this report and show that the vast majority of people who are infected produce specific antibodies in response to the infection, which confer immunity or substantial protection against reinfection.[125, 126]

Over time, as is the normal course of an infection, the specific antibodies to SARS-CoV-2 infection fade. The immune memory persists in dormant or resting cells, called memory cells, who do not actively secrete antibodies, but nevertheless continue to provide lasting protection against SARS-CoV-2 infection. This is entirely consistent with a typical immune response to a challenge by a virus like SARS-CoV-2. Viral infections are most often addressed through CD8 T cells, which do not produce antibody, but rather directly eliminate virus-infected cells to shortcut viral replication. Indeed, SARS-CoV-2 specific CD4 and CD8 T cells have been detected in convalescent patients.[127]

This T-cell mediated immunity is also long lasting. A preprint study released last month documents this fact, and the title of the piece summarizes its result: "Robust SARS-CoV-2 specific T-cell Immunity is Maintained at Six Months Following Primary Infection."[128] Another pre-print released last month identifies long-lasting protection after SARS-CoV-2 infection from memory B-cells, which can produce specific antibodies in response to reinfection by the virus.[129]

Finally, it is apparently the case that many individuals who have not been infected by SARS-CoV-2 possess T-cells that recognize it and can neutralize cells infected by the virus. The hypothesized mechanism involves infection by other coronaviruses, which share some molecular structural properties with SARS-CoV-2. A separate study published in Nature found both CD4 and CD8 T cells which provide recognize (and hence attack) regions of the SARS-CoV-2 virus in both convalescent patients and patients who had previously been infected with other coronaviruses including SARS-CoV-1, seventeen years after infection.[130] Summarizing this evidence, Francis Collins (Director of the National Institutes of Health) writes:

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[124] Ripperger TJ et al. (2020) Orthogonal SARS-CoV-2 Serological Assays Enable Surveillance of Low-Prevalence Communities and Reveal Durable Humoral Immunity. *Immunity* 53, 925–933. Nov. 17, 2020. https://doi.org/10.1016/j.immuni.2020.10.004

[125] Ni, Ling, et al. (2020) "Detection of SARS-CoV-2-specific humoral and cellular immunity in COVID-19 convalescent individuals." *Immunity*. https://doi.org/10.1016/j.immuni.2020.04.023

[126] Moderbacher CR et al. "Antigen-specific adaptive immunity to SARS-CoV-2 in acute COVID-19 and associations with age and disease severity." Cell 183.4 (2020): 996-1012. DOI:https://doi.org/10.1016/j.cell.2020.09.038

[127] *Ibid.*

[128] Zuo J et al. (2020) Robust SARS-CoV-2-specific T-cell immunity is maintained at 6 months following primary infection. medRxiv. doi: https://doi.org/10.1101/2020.11.01.362319

[129] Dan JM et al. (2020) Immunological memory to SARS-CoV-2 assessed for greater than six months after infection. medRxiv. doi: https://doi.org/10.1101/2020.11.15.383323

[130] Le Bert, N., Tan, A.T., Kunasegaran, K. et al. (2020) SARS-CoV-2-specific T cell immunity in cases of COVID-19 and SARS, and uninfected controls. Nature 584, 457–462. https://doi.org/10.1038/s41586-020-2550-z

> Much of the study on the immune response to SARS-CoV-2, the novel coronavirus that causes COVID-19, has focused on the production of antibodies. But, in fact, immune cells known as memory T cells also play an important role in the ability of our immune systems to protect us against many viral infections, including—it now appears—COVID-19...This might potentially explain why some people seem to fend off the virus and may be less susceptible to becoming severely ill with COVID-19.

All these conclusions are well reflected in the fact that that despite millions of people infected worldwide to date after 10 months living with the virus, we have seen only a handful of patients who re-tested positive after being discharged, all of whom showed no evidence of being contagious and all presented milder symptoms. In a fascinating study of an outbreak of SARS-CoV-2 in a tightly packed fishery vessel where 85% of the crew became infected, all of crew who had previously been infected escaped reinfection.[131] The scientific evidence thus strongly suggests that recovery from SARS-Cov-2 infection will provide lasting protection against reinfection, either complete immunity or protection that makes a severe reinfection extremely unlikely.

### M. What is herd immunity? What is the most effective way to reduce harm until endemic equilibrium?

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/pandemic. This means that the epidemic/pandemic will end before everyone is infected, although it will continue in endemic form with low rates of infections. Herd immunity is a scientifically proven phenomenon. Sooner or later, herd immunity will be reached either through natural infection or through a combination of vaccinations and natural infection.

To protect the vulnerable elderly living in nursing homes and other care settings, a focused protection strategy would include frequent testing of nursing home staff members that are not already immune, testing of visitors, and less staff rotation so that residents only interact with a limited number of staff people. COVID-19 infected individuals, in hospital, should not be sent to nursing homes, and all new residents should be tested. Sequestering of care home residents who have COVID-19 is also important.

To protect older people living at home, during high transmission times, older people should be offered home delivery of groceries and other essentials. When seeing friends and relatives, it is best to do it outdoors. Testing should be available for relatives and friends who want to visit. Free N95 masks should be provided for when they cannot avoid potential exposure.

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[131] Addetia A, Crawford KHD, Dingens A, Zhu H, Roychoudhury P, Huang ML, Jerome KR, Bloom JD, Greninger AL. Neutralizing Antibodies Correlate with Protection from SARS-CoV-2 in Humans during a Fishery Vessel Outbreak with a High Attack Rate. J Clin Microbiol. 2020 Oct 21;58(11):e02107-20. doi: 10.1128/JCM.02107-20. PMID: 32826322; PMCID: PMC7587101.

Focused protection requires protecting protect older people still in the work force. People in their 60s are at somewhat high risk, and many are still in the workforce. Those that can work from home should be allowed to do so. For example, teachers in their 60s could teach online courses, or help fellow teachers with grading exams, essays and homework. Those that cannot work from home should be funded to take a 3 to 6-month sabbatical. In addition, workplace disability laws should require employers to provide reasonable accommodations to protect high COVID19 risk workers without losing their jobs.

Focused protection also requires protecting elderly people living in multigenerational homes. University closures and the economic displacement caused by lockdowns has led millions of young adults to live with older parents, increasing regular close interactions across generations. We know that older people living with working-age adults have higher COVID-19 risk than older people living with other older people. There is no further excess risk if also living with children though. This is the toughest challenge, and family specific solutions must be found. If the working-age household members can work from home, they can isolate together. If that is not possible, the older family member might temporarily be able to live with an older friend or sibling, with whom they can self-isolate together during the height of community transmission. As a last resort, empty hotel rooms could be used for temporary housing.

Focused protection also requires guarding younger people with chronic conditions like diabetes, severe asthma, or obesity that place them at higher mortality risk should they become infected. The focused protection plan for these individuals is the same as that for the elderly and will vary depending upon their living circumstance.

The imminent deployment of an effective SARS-CoV-2 vaccine – if people who are most vulnerable are prioritized for inoculation -- offers an opportunity for near perfect focused protection. For this population, the harms from COVID-19 infection are far greater than the possible harms from vaccination.

Effective focused protection reduces the number of people who will need hospitalization for COVID-19 infection, since hospitalization risk, like mortality risk, rises sharply with patient age.[132] Thus, if effective focused protection is implemented, the probability of overcrowded hospital systems is greatly reduced.[133]

Lockdowns actually extend the time that vulnerable are at risk of infection, by delaying infections into the future, lockdowns delay the establishment of herd immunity in a population. Focused protection of the vulnerable is possible but without an effective vaccination campaign, requires vigilance which cannot be maintained forever.

In summary, replacing a lockdown policy with a policy of focused protection of the vulnerable would greatly reduce the lockdown harms for less vulnerable populations, while protecting the vulnerable from COVID-19 risk. The concrete suggestions outlined here are not comprehensive, and with the advent of a safe and effective vaccine in December 2020, there should be no

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[132] US Centers for Disease Control (2020) COVID-19 Hospitalization and Death by Age. Aug. 18, 2020. https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/hospitalization-death-by-age.html

[133] Chikina M, Pegden W. Modeling strict age-targeted mitigation strategies for COVID-19. PLoS One. 2020 Jul 24;15(7):e0236237. doi: 10.1371/journal.pone.0236237. PMID: 32706809; PMCID: PMC7380601.

controversy over whether this policy is possible. It is a failure of public health officials in Quebec that they have not engaged in developing strategies like those listed here. Reducing the risk of harm to the vulnerable and non-vulnerable alike from infectious (COVID-19 related) and non-infectious (lockdown related) causes should be the goal of public health policy. An aim that focuses solely on slowing disease spread – lockdown – ultimately increases both COVID-19 related and lockdown harms relative to a policy of focused protection.

### N. How to you explain that there were more deaths in March and April 2020 than now? What has changed?

COVID-19 case fatality rates have been dropping steadily since the disease emerged. Peer-reviewed studies document these trends.[134] One study in England found that "30-day mortality peaked for people admitted to critical care in early April. There was subsequently a sustained decrease in mortality risk until the end of the study period" in late June. This trend was found for people of all age groups, and survived adjustment for patient characteristics, which strongly suggests an improvement in treatment and patient management as the cause.[135]

Ventilator protocols which were used during the early days of the epidemic were too aggressive, with physicians too quick to place patients on mechanical ventilation. In those early days, nearly 90% of all COVID-19 patients on mechanical ventilation died. New discoveries about the use of histamine blockers in conjunction with ventilators contribute to improved survival of hospitalized COVID-19 patients.[136, 137] Separately, there were particular problems in the care of elderly COVID-19 patients in state run nursing homes in Quebec during the early days of the epidemic, where some COVID-19 patients were neglected and died from thirst and hunger.[138] Quebec also did very poorly because the government failed to protect the vulnerable population in the CHSLD by sending COVID infected patients to nursing homes that were unable to isolate them from the rest of the population, greatly increasing patient mortality.[139]

Addressing this neglect certainly contributed to improved outcomes in Quebec. The discovery that a deadly immune over-reaction to SARS-CoV-2 infection in some patients could be

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[134] Brumfiel G. (2020) Studies Point To Big Drop In COVID-19 Death Rates. NPR. October 20, 2020. https://www.npr.org/sections/health-shots/2020/10/20/925441975/studies-point-to-big-drop-in-covid-19-death-rates

[135] Dennis JM, McGovern AP, Vollmer SJ, Mateen BA. Improving Survival of Critical Care Patients With Coronavirus Disease 2019 in England: A National Cohort Study, March to June 2020. Crit Care Med. 2020 Oct 26. doi: 10.1097/CCM.0000000000004747. Epub ahead of print. PMID: 33105150.

[136] Hogan Ii RB, Hogan Iii RB, Cannon T, Rappai M, Studdard J, Paul D, Dooley TP. Dual-histamine receptor blockade with cetirizine - famotidine reduces pulmonary symptoms in COVID-19 patients. Pulm Pharmacol Ther. 2020 Aug;63:101942. doi: 10.1016/j.pupt.2020.101942. Epub 2020 Aug 29. PMID: 32871242; PMCID: PMC7455799.

[137] Janowitz T, Gablenz E, Pattinson D, Wang TC, Conigliaro J, Tracey K, Tuveson D. Famotidine use and quantitative symptom tracking for COVID-19 in non-hospitalised patients: a case series. Gut. 2020 Sep;69(9):1592-1597. doi: 10.1136/gutjnl-2020-321852. Epub 2020 Jun 4. PMID: 32499303; PMCID: PMC7299656.

[138] Richer J. (2020) Aînés affamés et déshydratés: «ils ont crevé de faim». Journal de Montreal. April 23, 2020. https://www.journaldemontreal.com/2020/04/23/aines-affames-et-deshydrates

[139] Quebec Ombudsman (2020) COVID-19 in CHSLDs during the first wave of the pandemic. Learning from the crisis and moving to uphold the rights and dignity of CHSLD residents. Dec. 10, 2020. https://protecteurducitoyen.qc.ca/sites/default/files/pdf/rapports_speciaux/progress-report-chslds-covid-19.pdf

modulated by dexamethasone has greatly improved patient outcomes.[140, 141] There has also been an improved understanding of the pathophysiological reasons why some patients progress to more severe outcomes from SARS-CoV-2 infection, while others do not.[142] So, the improvements in outcomes for COVID-19 patients derive from multiple sources. In summary, COVID-19 infection is less deadly than it was when it arrived in North America in winter 2020.

### O. What are RT-PCR tests? Are they useful knowing that Quebec is using a cycle threshold of 45 cycles?

The RT-PCR test for the SARS-CoV-2 virus is at the heart of the testing system adopted by Canada. The RT-PCR tests, as used in most laboratories in Quebec, likely registers a positive test result even for non-infectious viral fragments. The RT-PCR test amplifies the virus – if present – by a process of repeated doubling the concentration of viral genetic material. If the viral load is small, many doublings are required before it is possible to detect the virus.

The problem arises from the fact that the implementation of the RT-PCR test for COVID-19 requires that clinical laboratories decide in advance how many doubling of the genetic material they will require before deciding that a sample is negative for the presence of the virus. This threshold, known as the "cycle time" of the test, determines both the rate at which a positive test result will be returned when the original sample does not include viral concentrations in sufficient amount to be infectious (hereafter, the functional false positive rate), and the rate at which a negative test result will be returned when the original sample does include viral concentrations in sufficient amount to be infectious (hereafter, the functional false negative rate).

A higher cycle time threshold – requiring more doublings before declaring a negative test result – increases the functional false positive rate of the RT-PCR test because even if a non-infectious viral load is present in the sample obtained from the patient, a large number of permitted doublings could amplify whatever is present such that the test result is positive.

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[140] RECOVERY Collaborative Group, Horby P, Lim WS, Emberson JR, Mafham M, Bell JL, Linsell L, Staplin N, Brightling C, Ustianowski A, Elmahi E, Prudon B, Green C, Felton T, Chadwick D, Rege K, Fegan C, Chappell LC, Faust SN, Jaki T, Jeffery K, Montgomery A, Rowan K, Juszczak E, Baillie JK, Haynes R, Landray MJ. Dexamethasone in Hospitalized Patients with Covid-19 - Preliminary Report. N Engl J Med. 2020 Jul 17:NEJMoa2021436. doi: 10.1056/NEJMoa2021436. Epub ahead of print. PMID: 32678530; PMCID: PMC7383595.

[141] Tomazini BM, Maia IS, Cavalcanti AB, Berwanger O, Rosa RG, Veiga VC, Avezum A, Lopes RD, Bueno FR, Silva MVAO, Baldassare FP, Costa ELV, Moura RAB, Honorato MO, Costa AN, Damiani LP, Lisboa T, Kawano-Dourado L, Zampieri FG, Olivato GB, Righy C, Amendola CP, Roepke RML, Freitas DHM, Forte DN, Freitas FGR, Fernandes CCF, Melro LMG, Junior GFS, Morais DC, Zung S, Machado FR, Azevedo LCP; COALITION COVID-19 Brazil III Investigators. Effect of Dexamethasone on Days Alive and Ventilator-Free in Patients With Moderate or Severe Acute Respiratory Distress Syndrome and COVID-19: The CoDEX Randomized Clinical Trial. JAMA. 2020 Oct 6;324(13):1307-1316. doi: 10.1001/jama.2020.17021. PMID: 32876695; PMCID: PMC7489411.

[142] McCullough, Peter A et al. "Pathophysiological Basis and Rationale for Early Outpatient Treatment of SARS-CoV-2 (COVID-19) Infection." The American journal of medicine, S0002-9343(20)30673-2. 7 Aug. 2020, doi:10.1016/j.amjmed.2020.07.003

The RT-PCR test is commonly known in the scientific literature as the gold standard to check for the presence of the SARS-CoV-2 virus. This is true, but beside the point. 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 millions of people living in Quebec, imposing untold harm on them related to the lockdown, and the unfortunate answer is no.

A systematic review of the literature on cycle time thresholds for the SARS-CoV-2 RT-PCR tests (encompassing 25 different published studies on the topic) concludes that "A binary Yes/No approach to the interpretation of RT-PCR unvalidated against viral culture will result in false positives with segregation of large numbers of people who are no longer infectious and hence not a threat to public health." [143] Scientific evidence that the test on which the California Blueprint for reopening is based – 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). The difficulty is that the RT-PCR test permits too many doubling cycles of viral particles before declaring a negative test. The functional false positive rate increases with the number of cycles (known as a Ct value) required to produce a positive result.

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%.[144] If more than 40 cycles are needed for a positive test, the functional false-positive rate is nearly 100%.

This error in the test is a major problem for Quebec, since the public health authority tracks cases per capita and percent positivity of test results to measure the spread of the disease in the population. Both of these measures depend on the accuracy of the RT-PCR tests to determine whether an individual is infected with the virus. The PCR test's inaccuracies imply that the criteria for reopening do 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

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[143] (T. Jefferson, et al., *Viral Cultures for COVID-19 Infectivity Assessment – A Systematic Review (Update 3)* (Sept. 3, 2020), medRxiv, https://www.medrxiv.org/content/10.1101/2020.08.04.20167932v3.full.pdf.)

[144] Singanayagam A, Patel M, Charlett A, Lopez Bernal J, Saliba V, Ellis J, et al. Duration of infectiousness and correlation with RT-PCR cycle threshold values in cases of COVID-19, England, January to May 2020. Eurosurveillance. 2020;25(32):2001483. 2020

scientific evidence, it is certain that lockdowns are being imposed – along with their attendant costs– even when the risk of community spread of COVID-19 does not warrant it.

In summary, the scientific literature establishes the importance of cycle time thresholds in interpreting RT-PCR SARS-CoV-2 results to establish the infectivity of the samples;[145] A reliance on a test that is run for 45 cycles – a procedure that is recommended by the National Institute of Public Health in Quebec and followed by the Public Health Laboratory of Quebec[146] – is certain to produce a very large proportion of false positive outcomes. Lockdowns that are imposed on the basis of case counts derived from PCR tests will be only marginally related to the threat posed by the spread of the SARS-CoV-2 virus.

**P. What do you think about the strategy to wait for a vaccine to be given to the whole population in order to mitigate the propagation of the virus?**

Though the lockdowns should have been abandoned much earlier, with the advent of several new vaccines the end is finally at hand. The imminent dissemination of several safe and effective vaccines can provide a path out of this situation within the next two months, but only if we understand their proper use and avoid some dangerous pitfalls. The release of an extremely positive report on the new Pfizer mRNA vaccine suggests that we now have a vaccine that can end the epidemic quickly.[147] The Great Barrington Declaration, provides the key idea of avoiding pitfalls: focused protection of people who face a high risk of mortality should they become infected by COVID-19.

While some have criticized the focused protection ideas that are at the heart of the Great Barrington Declaration as infeasible, with the vaccine imminently available, this criticism is no longer viable. There are 2.4 million people living in Canada who are 75+ years old and hence at higher risk for mortality from SARS-CoV-2 infection.[148] The Canadian government has finalized agreements so that there are enough doses for at least 2 million people by the end of March 2021.[149]

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[145] Rita Jaafar, Sarah Aherfi, Nathalie Wurtz, Clio Grimaldier, Thuan Van Hoang, Philippe Colson, Didier Raoult, Bernard La Scola, Correlation Between 3790 Quantitative Polymerase Chain Reaction–Positives Samples and Positive Cell Cultures, Including 1941 Severe Acute Respiratory Syndrome Coronavirus 2 Isolates, Clinical Infectious Diseases, , ciaa1491, https://doi.org/10.1093/cid/ciaa1491

[146] Désautels L (2020) Rechece du SARS-CoV-2 par RT-PCR avec detection en temps reel. Version 3. Laboratoire de Sante Publique du Quebec. https://inspq.qc.ca/sites/default/files/demandes_acces/pr-bm-131.pdf

[147] Polack FP, Thomas SJ, Kitchin N, Absalon J, Gurtman A, Lockhart S, Perez JL, Pérez Marc G, Moreira ED, Zerbini C, Bailey R, Swanson KA, Roychoudhury S, Koury K, Li P, Kalina WV, Cooper D, Frenck RW Jr, Hammitt LL, Türeci Ö, Nell H, Schaefer A, Ünal S, Tresnan DB, Mather S, Dormitzer PR, Şahin U, Jansen KU, Gruber WC; C4591001 Clinical Trial Group. Safety and Efficacy of the BNT162b2 mRNA Covid-19 Vaccine. N Engl J Med. 2020 Dec 10. doi: 10.1056/NEJMoa2034577. Epub ahead of print. PMID: 33301246.

[148] Statistics Canada (2020) Demographic Estimates by Age and Sex, Provinces and Territories. July 1, 2020. https://www150.statcan.gc.ca/n1/pub/71-607-x/71-607-x2020018-eng.htm

[149] Nassar HM (2020) Canada to Begin Receiving COVID-19 Vaccines This Month. City News. Dec. 7, 2020. https://montreal.citynews.ca/2020/12/07/canada-begin-receiving-covid-19-vaccines-december/

The vaccine trial data suggest that inoculation provides no additional protection for people who previously had COVID-19 infection.[150] This result is not surprising since natural immunity after recovery is known to be robust.[151,152,153] Not vaccinating the recovered will preserve doses for the vulnerable and still susceptible.

With a 90%+ efficacy rate in protecting against COVID-19 symptoms, we will achieve near-perfect focused protection. At that point, the lockdown should end immediately and forever. For the rest of the population, and for the poor in particular, the lockdowns harms far outstrip the harms from natural infection. [154]

An alternate plan envisions near-universal vaccination before a resumption of normal life. Logistically, this plan is challenging, as it may take until late 2021 to secure enough doses for the whole Canadian population.[155] This strategy will inflict six months or more of continuing lockdown harms. There are other problems. The vaccine trials did not include children, so we do not know if it is safe to vaccinate them.

A second alternate plan envisions mandatory vaccination for the entire Canadian population with severe limitations imposed on activities by non-vaccinated citizens (ie going to work, theaters, cinemas). This plan is unethical and unneeded. The new vaccine has some side common effects after injection (including short-term pain at the injection site, fever, fatigue, and headache) as well as some uncommon serious adverse events. Vaccinating the entire population will undoubtedly lead to substantial number of people to experience these negative consequences. Against these negative consequences should be weighed the benefits of preventing COVID-19 infection. For the vulnerable, it is ethical to recommend vaccination since the balance of vaccine benefits and harms militates strongly in favor of vaccination – for them, the mortality risk from COVID-19 infection is high. For the rest of the population, and for children in particular,

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[150] Polack FP, Thomas SJ, Kitchin N, Absalon J, Gurtman A, Lockhart S, Perez JL, Pérez Marc G, Moreira ED, Zerbini C, Bailey R, Swanson KA, Roychoudhury S, Koury K, Li P, Kalina WV, Cooper D, Frenck RW Jr, Hammitt LL, Türeci Ö, Nell H, Schaefer A, Ünal S, Tresnan DB, Mather S, Dormitzer PR, Şahin U, Jansen KU, Gruber WC; C4591001 Clinical Trial Group. Safety and Efficacy of the BNT162b2 mRNA Covid-19 Vaccine. N Engl J Med. 2020 Dec 10. doi: 10.1056/NEJMoa2034577. Epub ahead of print. PMID: 33301246. https://www.nejm.org/doi/full/10.1056/NEJMoa2034577

[151] Ni, Ling, et al. (2020) "Detection of SARS-CoV-2-specific humoral and cellular immunity in COVID-19 convalescent individuals." *Immunity*. https://doi.org/10.1016/j.immuni.2020.04.023

[152] Moderbacher CR et al. "Antigen-specific adaptive immunity to SARS-CoV-2 in acute COVID-19 and associations with age and disease severity." Cell 183.4 (2020): 996-1012. DOI:https://doi.org/10.1016/j.cell.2020.09.038

[153] Zuo J et al. (2020) Robust SARS-CoV-2-specific T-cell immunity is maintained at 6 months following primary infection. medRxiv. doi: https://doi.org/10.1101/2020.11.01.362319

[154] Broadbent A, Walker D, Chalkdou K, Sullivan R, and Glassman A. (2020) Lockdown is not egalitarian: the costs fall on the global poor. Lancet 396(10243):P21-22. July 4, 2020. DOI:https://doi.org/10.1016/S0140-6736(20)31422-7

[155] Higgins-Dunn N (2020) Trump Covid vaccine chief Slaoui says everyone in U.S. could be immunized by June. CNBC. Dec. 1, 2020. https://www.cnbc.com/2020/12/01/trump-covid-vaccine-chief-says-everyone-in-us-could-be-immunized-by-june.html

vaccination may not provide a net private benefit. For this reason, the World Health Organization recommends against mandatory COVID-19 vaccination.[156]

Focused protection is the best strategy for using the vaccine. A combination of vaccine-induced immunity among the vulnerable and natural-immunity among the non-vulnerable will provide a solid wall of protection against a repeat of the epidemic in 2021. For the vulnerable, the vaccine will protect against COVID, and for the non-vulnerable, the end of the epidemic will end lockdown harms.

**Q. Does Covid-19 infection commonly lead to longer term extra-respiratory consequences? If yes, of what nature and what degree?**

It is true that non-lethal extra-respiratory consequences of COVID-19 infection are possible and have been reported in the literature.[157] Among the extra-respiratory consequences that have been reported include myocarditis, clotting irregularities, and a poorly-defined group of non-specific symptoms (e.g. extended periods of fatigue, muscle aches, and difficulty concentrating) dubbed "long-COVID."[158]

The literature on this subject is still in its infancy and there is little that is firmly known about the frequency, severity, and duration of extra-respiratory consequences of COVID-19 infection. The US Centers for Disease Control website provides some guidance that provides this context:[159]

> While most persons with COVID-19 recover and return to normal health, some patients can have symptoms that can last for weeks or even months after recovery from acute illness. Even people who are not hospitalized and who have mild illness can experience persistent or late symptoms. Multi-year studies are underway to further investigate. CDC continues to work to identify how common these symptoms are, who is most likely to get them, and whether these symptoms eventually resolve... More serious long-term complications appear to be less common but have been reported...The long-term significance of these effects is not yet known. CDC will continue actively investigation and provide updates as new data emerge, which can inform COVID-19 clinical care as well as the public health response to COVID-19.

A recently released "living review" of the literature on the long-term consequences of COVID-19 infection comprehensively surveys the rapidly growing literature on this subject, with a focus on higher quality studies with at least 100 participants. The conclusion from this review is that

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[156] Reuters (2020) WHO does not envisage COVID-19 vaccines being made mandatory. Dec. 7, 2020. https://news.yahoo.com/does-not-envisage-covid-19-175726903.html

[157] Carfì A, Bernabei R, Landi F, for the Gemelli Against COVID-19 Post-Acute Care Study Group. Persistent Symptoms in Patients After Acute COVID-19. *JAMA*. 2020;324(6):603–605. doi:10.1001/jama.2020.12603

[158] Mahase E. Covid-19: What do we know about "long covid"? BMJ. 2020 Jul 14;370:m2815. doi: 10.1136/bmj.m2815. PMID: 32665317.

[159] CDC (2020) Long-Term Effects of COVID-19. https://www.cdc.gov/coronavirus/2019-ncov/long-term-effects.html (accessed Dec. 7, 2020)

the scientific literature on the subject is of uniformly poor quality, with a specific problem of not providing any guidance on how common or long-lasting are the extra-respiratory of COVID-19 infection:[160]

> The quality of evidence was low, with a high risk of bias and heterogeneity in prevalence. The incorporated studies demonstrated limited external validity, a lack of control subjects, and inconsistent data collection methods. Few studies were conducted in primary care, no studies focused solely on children, and no studies were set in low- and middle-income countries... Our findings suggest that long covid is a complex, heterogeneous condition; however, the limited evidence base currently precludes a precise definition of its symptoms and prevalence.

Even if much more were known about these conditions, and it was established that the long-term effects of COVID-19 infection were common and severe, a policy of lockdown would not be justified. The premise that lockdowns prevent COVID-19 infections in the long run – is not true and runs counter to both theoretical analyses and empirical analyses of the effect of lockdowns, as I describe in Section C.

In summary, much of what is known about these extra-respiratory consequences of COVID-19 infection is speculative and under active study by the scientific community. By contrast, the lockdown harms documented below are already occurring, of a large magnitude, and subject to much less uncertainty.

I remain available to answer any other further question that the court or yourselves might entertain in the future regarding this report.

I remain very respectfully yours,

Dr. Jay Bhattacharya

[160] Michelen M et al. (2020) Characterizing long-term covid-19: a rapid living systematic review. medRxiv. https://www.medrxiv.org/content/10.1101/2020.12.08.20246025v1

**COSIGNERS FORMS IN THEIR SPECIFIC FIELD OF EXPERTISE**

**AND**

**DECLARATIONS**

## COSIGNER DECLARATION

I have read Dr. Jay Bhattacharya's above report relating to Covid-19 and the Province of Quebec and I agree with the content of the said report and the conclusions that he is drawing.

Signed on December 20th 2020,

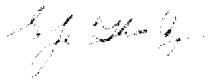
Ronald B. Brown, PH.D.

Dr. Ronald B. Brown

## COSIGNER DECLARATION

I have read Dr. Jay Bhattacharya's above report relating to Covid-19 and the Province of Quebec and I agree with the content of the said report and the conclusions that he is drawing.

Signed on December 21st 2020,

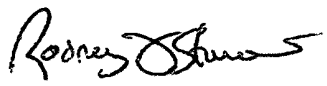


Dr. Simon Thornley

## COSIGNER DECLARATION

I have read Dr. Jay Bhattacharya's above report relating to Covid-19 and the Province of Quebec and I agree with the content of the said report and the conclusions that he is drawing.

Signed on December 19 2020,



Dr. Rodney Sturdivant

## COSIGNER DECLARATION

I have read Dr. Jay Bhattacharya's above report relating to Covid-19 and the Province of Quebec and I agree with the content of the said report and the conclusions that he is drawing.

Signed on December 6th 2020,

Dr. Roger Hodkinson

**MODEL ESTABLISHED BY THE MINISTER OF JUSTICE**

Declaration regarding the carrying out of
the mission of an expert
(article 235 C.C.P.)

I declare that I will carry out my mission as an expert with objectivity, impartiality and rigour. To enlighten the court in making its decision, I will give my opinion on the basis of my qualifications concerning the points submitted to me, taking into account the facts relating to the dispute or, if my services are required as a court bailiff, I will make an ascertainment describing the materials facts or situation of which I have personal knowledge.

I will, on request, provide the court and the parties with details on my professional qualifications, the progress of my work and, if applicable, the instructions received from a party. I will also comply with the time limits given to me and, if necessary, request the directives from the court that are necessary to carry out my mission.

Dr. Jay Bhattacharya, M.D., Ph.D.
Signature

Professor of Medicine, Stanford University
Title

December 18th 2020

**MODEL ESTABLISHED BY THE MINISTER OF JUSTICE**

Declaration regarding the carrying out of
the mission of an expert
(article 235 C.C.P.)

I declare that I will carry out my mission as an expert with objectivity, impartiality and rigour. To enlighten the court in making its decision, I will give my opinion on the basis of my qualifications concerning the points submitted to me, taking into account the facts relating to the dispute or, if my services are required as a court bailiff, I will make an ascertainment describing the materials facts or situation of which I have personal knowledge.

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Ronald B. Brown, PH.D.
Dr. Ronald B. Brown
Signature

Doctoral Candidate, University of Waterloo, School of Public Health and Health Systems
Title

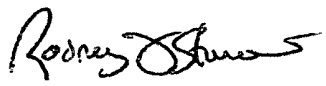
December 20th 2020

**MODEL ESTABLISHED BY THE MINISTER OF JUSTICE**

Declaration regarding the carrying out of
the mission of an expert
(article 235 C.C.P.)

I declare that I will carry out my mission as an expert with objectivity, impartiality and rigour. To enlighten the court in making its decision, I will give my opinion on the basis of my qualifications concerning the points submitted to me, taking into account the facts relating to the dispute or, if my services are required as a court bailiff, I will make an ascertainment describing the materials facts or situation of which I have personal knowledge.

I will, on request, provide the court and the parties with details on my professional qualifications, the progress of my work and, if applicable, the instructions received from a party. I will also comply with the time limits given to me and, if necessary, request the directives from the court that are necessary to carry out my mission.



Dr. Rodney Sturdivant
Signature

Director of the Statistical Consulting Center
and Associate Professor of Statistics, Baylor University

Title
December 19th 2020

**MODEL ESTABLISHED BY THE MINISTER OF JUSTICE**

Declaration regarding the carrying out of
the mission of an expert
(article 235 C.C.P.)

I declare that I will carry out my mission as an expert with objectivity, impartiality and rigour. To enlighten the court in making its decision, I will give my opinion on the basis of my qualifications concerning the points submitted to me, taking into account the facts relating to the dispute or, if my services are required as a court bailiff, I will make an ascertainment describing the materials facts or situation of which I have personal knowledge.

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Dr. Simon Thornley
Signature

Senior Lecturer in Section of Epidemiology and Biostatistics, University of Auckland__
Title
December 21st 2020

## MODEL ESTABLISHED BY THE MINISTER OF JUSTICE

Declaration regarding the carrying out of
the mission of an expert
(article 235 C.C.P.)

I declare that I will carry out my mission as an expert with objectivity, impartiality and rigour. To enlighten the court in making its decision, I will give my opinion on the basis of my qualifications concerning the points submitted to me, taking into account the facts relating to the dispute or, if my services are required as a court bailiff, I will make an ascertainment describing the materials facts or situation of which I have personal knowledge.

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Dr. Roger Hodkinson
Signature

MEDICAL DIRECTOR, WESTERN MEDICAL ASSESSMENTS CORP.
EDMONTON, ALBERTA
Title

December 18th 2020

# CURRICULUM VITAE

**JAY BHATTACHARYA**

**JAY BHATTACHARYA, M.D., Ph.D.** **December 2020**

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**RESEARCH INTERESTS**

Health economics, health policy, and outcomes research

**A. ACADEMIC HISTORY:**

| | | |
|---|---|---|
| Stanford University | A.M., A.B. | 1990 |
| Stanford University School of Medicine | M.D. | 1997 |
| Stanford University Department of Economics | Ph.D. | 2000 |

**B. EMPLOYMENT HISTORY:**

| | |
|---|---|
| 2001 – present | Professor (Assistant to Full), Stanford University Department of Medicine, Department of Economics (by courtesy) and Department of Health Research and Policy (by courtesy) |
| 2013 – present | Senior Fellow, Stanford Institute for Economic Policy Research |
| 2014 – present | Senior Fellow Stanford Freeman Spogli Institute |
| 2007 – present | Research Associate, Sphere Institute / Acumen LLC |
| 2002 – present | FRF to Research Associate, National Bureau of Economic Research |
| 2006 – 2008 | Research Fellow, Hoover Institution |
| 1998 – 2001 | Economist (Associate to Full), RAND Corporation |
| 1998 – 2001 | Visiting Assistant Professor, UCLA Department of Economics |

**C. SCHOLARLY PUBLICATIONS:**

PEER-REVIEWED ARTICLES (139 total)

1. Yoshikawa A, Vogt W.B., Hahn J., **Bhattacharya J.**, "Toward the Establishment and Promotion of Health Economics Research in Japan," *Japanese Journal of Health Economics and Policy* 1(1):29-45, (1994).
2. Vogt WB, **Bhattacharya J**, Kupor S, Yoshikawa A, Nakahara T, "The Role of Diagnostic Technology in Competition among Japanese Hospitals," *International Journal of Technology Management, Series on Management of Technology in Health Care*, 11(1):93-105 (1995).
3. **Bhattacharya J**, Vogt WB, Yoshikawa A, Nakahara T, "The Utilization of Outpatient Medical Services in Japan," *Journal of Human Resources*, 31(2): 450-76, (1996).
4. Vogt WB, Kupor S, **Bhattacharya J**, Yoshikwawa A, Nakahara T, "Technology and

Staffing in Japanese University Hospitals: Government vs. Private," *International Journal of Technology Assessment in Health Care*, 12(1): 93-103, (1996).

5. Sturm R, Gresenz C, Sherbourne C, **Bhattacharya J**, Farley D, Young AS, Klap R, Minnium K, Burnham MA, and Wells KB. "The Design of Healthcare for Communities: A Study of Health Care Delivery for Alcohol, Drug Abuse, and Mental Health Conditions." *Inquiry* 36(2):221-33 (1999).
6. Goldman D, **Bhattacharya J**, Joyce G, D'Amato R, Bozette S, Shapiro M, Liebowitz A. "The Impact of State Policy on the Costs of HIV Infection", *Medical Care Research and Review* 58(1):31-53 (2001). See comments *Medical Care Research and Review* 58(4):497-498 (2001).
7. Schoenbaum M, Spranca M, Elliot M, **Bhattacharya J**, Short PF. "Health Plan Choice and Information about Out-of-Pocket Costs: An Experimental Analysis" *Inquiry* 38(1):35-48 (2001).
8. Reville R, **Bhattacharya J**, and Sager L. "New Methods and Data Sources for Measuring the Economic Consequences of Workplace Injuries," *American Journal of Industrial Medicine* 40(4):452-63 (2001).
9. Goldman D, **Bhattacharya J**, McCaffrey D, Duan N, Leibowitz A, Morton S. "The Effect of Insurance on Mortality in an HIV+ Population in Care," *JASA* 96(455):883-894, (2001). See comments "The Effect of Insurance on Mortality in an HIV+ Population in Care," *JASA* 97(460):1218 (2002).
10. Su C, **Bhattacharya J**, and Wang CC, "Role of Neck Surgery in Conjunction with Radiation in Regional Control of Node-Positive Cancer of the Oropharynx" *American Journal of Clinical Oncology* 25(2):109-16. (2002).
11. DeLeire T, **Bhattacharya J**, and MaCurdy T. "Comparing Measures of Overtime Across BLS Surveys." *Industrial Relations* 41(2):362-369 (2002).
12. Studdert D, **Bhattacharya J**, Warren B, Schoenbaum M, Escarce JJ. "Personal Choices of Health Plans by Managed Care Experts." *Medical Care* 40(5):375-86 (2002).
13. **Bhattacharya J**, Schoenbaum M, and Sood N. "Optimal Contributions to Flexible Spending Accounts for Medical Care." *Economics Letters* 76(1):129-135 (2002).
14. Reville R, Neuhauser F, **Bhattacharya J**, and Martin C, "Comparing Severity of Impairment for Different Permanent Upper Extremity Musculo-Skeletal Injuries" *Journal of Occupational Rehabilitation* 12(3):205-21 (2002).
15. Lakdawalla D., Goldman D, **Bhattacharya J**, Hurd M, Joyce G, and Panis C., "Forecasting the Nursing Home Population", *Medical Care* 41(1):8-20 (2003) See comments "Forecasting the Nursing Home Population," *Medical Care* 41(1):28-31 (2003).
16. **Bhattacharya J**, Deleire T, Haider S, Currie J. "Heat or Eat? Cold-Weather Shocks and Nutrition in Poor American Families," *American Journal of Public Health* 93(7):1149-1154 (2003).
17. **Bhattacharya J** and Vogt W. "A Simple Model of Pharmaceutical Price

Dynamics." *Journal of Law and Economics* 46:599-626 (2003).

18. **Bhattacharya J**, Goldman D, Sood N. "The Link Between Public and Private Insurance and HIV-Related Mortality," *Journal of Health Economics* 22:1105-1122 (2003).
19. Lakdawalla D, **Bhattacharya J**, and Goldman D. "Are the Young Becoming More Disabled?" *Health Affairs* 23(1):168-176 (2004).
20. **Bhattacharya J**, Currie J, and Haider S. "Poverty, Food Insecurity, and Nutritional Outcomes in Children and Adults," *Journal of Health Economics* 23(4):839-862 (2004).
21. Yoo BK, **Bhattacharya J**, McDonald K and Garber A. "Impacts of Informal Caregiver Availability on Long-term Care Expenditures in OECD Countries," *Health Services Research* 39(6 Pt 2):1971-92 (2004).
22. **Bhattacharya J**, Goldman D, and Sood N. "Price Regulation in Secondary Insurance Markets" *Journal of Risk and Insurance* 72(4):61-75 (2005).
23. **Bhattacharya J**. "Specialty Selection and Lifetime Returns to Specialization Within Medicine" *Journal of Human Resources* 40(1):115-143 (2005).
24. Lakdawalla D, Philipson T, **Bhattacharya J**, "Welfare-Enhancing Technological Change and the Growth of Obesity," *American Economics Review* (Papers and Proceedings) 95(2): 253-257 (2005).
25. **Bhattacharya J,** Shang B, Su CK, Goldman D "Technological Advance in Cancer and the Future of Medical Care Expenditures by the Elderly," *Health Affairs.* [Web Exclusive 10.1377/hlthaff.w5.r5-r17] 26 September (2005).
26. Goldman DP, Shang B, **Bhattacharya J**, Garber AM, Hurd M, Joyce GF, Lakdawalla D, Panis C, Shekelle P, "Consequences Of Health Trends And Medical Innovation For The Future Elderly," *Health Affairs.* [Web Exclusive 10.1377/hlthaff.w5.r53-r66] 26 September (2005).
27. **Bhattacharya J** and Lakdawalla D, "The Labor Market Value of Health Improvements" *The Forum for Health Economics and Health Policy.* Forum: Biomedical Research and the Economy: Article 2 http://www..bepress.fhep/biomedical_research/2 (2005).
28. **Bhattacharya J** and Lakdawalla D, "Does Medicare Benefit the Poor?" *Journal of Public Economics* 90(1-2):277-92 (2006).
29. **Bhattacharya J**, Goldman D, McCaffrey D, "Estimating Probit Models with Endogenous Covariates," *Statistics in Medicine* 25(3):389-413 (2006).
30. **Bhattacharya J**, Currie J, and Haider S, "Breakfast of Champions? The Nutritional Effects of the School Breakfast Program," *Journal of Human Resources* (2006) 41(3):445-466.
31. **Bhattacharya J** and Sood N, "Health Insurance and the Obesity Externality" *Advances In Health Economics And Health Services Research* 17:279-318 (2007).
32. Shetty K and **Bhattacharya J,** "The Impact of the 2003 ACGME Work Hours Regulations" *Annals of Internal Medicine* 147: 73-80 (2007). See comment "A

Response to Dr. Puhan" *Annals of Internal Medicine* 148(6): 482 (2008).

33. **Bhattacharya J** and Shang B, "Model Based Survey Design Using Logits: Estimating Lost Statistical Power from Random Alternative Sampling" *Survey Research Methods* 1(3):145-154 (2007).
34. **Bhattacharya J**, Choudhry K, and Lakdawalla D, "Chronic Disease and Trends in Severe Disability in Working Age Populations" *Medical Care* 46(1):92-100 (2008).
35. **Bhattacharya J**, Shaikh A, Vytlacil E, "Treatment Effect Bounds under Monotonicity Assumptions: An Application to Swan-Ganz Catheterization" *American Economic Review (Papers and Proceedings)* 98(2): 351–56 (2008).
36. Shetty K, Vogt WB, and **Bhattacharya J,** "Hormone Replacement Therapy and Cardiovascular Health in the US." *Medical Care* 47(5):600-606 (2009).
37. **Bhattacharya J** and Bundorf K, "The Incidence of the Healthcare Costs of Obesity" *Journal of Health Economics* 28(3):649-658 (2009)
38. Bendavid E and **Bhattacharya J,** "PEPFAR in Africa: An Evaluation of Outcomes" *Annals of Internal Medicine* 150(10):688-695 (2009)
39. Nukols T, **Bhattacharya J**, Wolman DM, Ulmer C, Escarce JJ, "Cost Implications of Reductions to Resident Physician Work Hours and Workloads for Resident Physicians," *New England Journal of Medicine* 360(21):2202-15 (2009).
40. **Bhattacharya J** and Isen A, "On Inferring Demand for Health Care in the Presence of Anchoring and Selection Biases," *Forum for Health Economics & Policy*: 12(2) (Health Economics), Article 6. http://www.bepress.com/fhep/12/2/6 (2009)
41. **Bhattacharya J**, Goldman D, and Sood N, "Market Evidence of Misperceived Prices and Mistaken Mortality Risks," *Journal of Economic Behavior and Organization* 72(1):451-462 (2009)
42. Seabury S, **Bhattacharya J**, Neuhauser F, Reville R, "Using Empirical Data on Earnings Losses to Improve Permanent Disability Ratings in Workers' Compensation," *Journal of Risk and Insurance* 77(1):231-260 (2010).
43. Kautz T, Bendavid E, **Bhattacharya J**, Miller NG, "AIDS and Declining Support for Dependent Elderly People in Africa: Retrospective Analysis Using Demographic and Health Surveys" *British Medical Journal* 340:c2841 doi:10.1136 (2010)
44. Patel CJ, **Bhattacharya J**, Butte AJ, "An Environment-Wide Association Study (EWAS) on Type 2 Diabetes Mellitus," *PLoS ONE* 5(5): e10746. doi:10.1371/journal.pone.0010746 (2010)
45. Yoo BK, **Bhattacharya J**, Fiscella K, Bennett NM, Szilagyi P, "Effects of Mass Media Coverage on Timing and Annual Receipt of Influenza Vaccination among Medicare Elderly" *Health Services Research* 45(5 Pt 1):1287-309. (2010)
46. Bendavid E, Leroux E, **Bhattacharya J**, Smith N, and Miller G, "The Role of Drug Prices and Foreign Assistance in Expanding HIV Treatment in Africa" *British Medical Journal* 341:c6218 (2010)

47. Shetty K, Deleire T, White C, and **Bhattacharya J,** ``Changes in Hospitalization Rates Following Smoking Bans,'' *Journal of Policy Analysis and Management* 30(1):6-28 (2011)
48. **Bhattacharya J** and Sood N, "Who Pays for Obesity*?" Journal of Economic Perspectives* 25(1):139-58 (2011)
49. Liu V, Weill D, **Bhattacharya J,** "Racial Differences in Survival Following Lung Transplantation" *Archives of Surgery* 146(3):286-293 (2011)
50. Liu V, **Bhattacharya J**, Weill D, Hlatky M, "Persistent Racial Disparities in Survival Following Heart Transplantation" *Circulation* 123:1642-1649 (2011)
51. **Bhattacharya J** and Packalen M "Opportunities And Benefits As Determinants Of The Direction Of Scientific Research"' *Journal of Health Economics* (2011) 30(4):603-15
52. Atella V, **Bhattacharya J**, Carbonari L, "Pharmaceutical Price Controls and Minimum Efficacy Regulation: Evidence from the US and Italy," *Health Services Research* (2012) 47(1 Pt 1):293-308.
53. **Bhattacharya J**, Shaikh AM, and Vytlacil E, "Treatment Effect Bounds: An Application to Swan-Ganz Catheterization," *Journal of Econometrics* (2012) 168(2): 223-243.
54. **Bhattacharya J** and Packalen M, "The *Other* Ex-Ante Moral Hazard in Health"' *Journal of Health Economics* (2012) 31(1):135-46
55. Smith-Spangler C, **Bhattacharya J**, and Goldhaber-Fiebert JD, "Diabetes, Its Treatment, and Catastrophic Medical Spending in 35 Developing Countries" *Diabetes Care* (2012) 35(2):319-26
56. Arroyo A, Wang E, Saynina O, **Bhattacharya J**, Wise P, "The Association Between Insurance Status and Emergency Department Disposition of Injured California Children" *Academic Emergency Medicine* (2012) 19: 541–551.
57. **Bhattacharya J** and Vogt WB, "Do Instrumental Variables Belong in Propensity Scores?" *International Journal of Statistics & Economics* 9(A12) (2012)
58. Goldhaber-Fiebert JD, Rubinfeld RE, **Bhattacharya J**, Robinson TN, Wise PH, "The Utility of Childhood and Adolescent Obesity Assessment in Relation to Adult Health" *Medical Decision Making* (2012) 33(2):163-75.
59. Bendavid E, Holmes CB, **Bhattacharya J**, Miller G, "HIV Development Assistance and Adult Mortality in Africa" *JAMA* 2012;307(19):2060-2067.
60. Perlroth DJ, **Bhattacharya J**, Goldman DP, Garber AM," An economic analysis of conservative management versus active treatment for men with localized prostate cancer," *J Natl Cancer Inst Monogr.* 2012(45):250-7.
61. **Bhattacharya J**, Gathmann C, Miller NG, "The Gorbachev Anti-Alcohol Campaign and Russia's Mortality Crisis," *American Economic Journals: Applied Economics* (2013) 5(2):232-60.
62. Erickson K, Tan K, Winkelmayer W, Chertow G, **Bhattacharya J**, "Variation in Nephrologist Visits to Patients on Hemodialysis across Dialysis Facilities and Geographic Locations." *Clinical Journal of the American Society of Nephrology* (2013): 987-994 doi:10.2215/CJN.10171012

63. Bundorf K, Mata R, Schoenbaum M, **Bhattacharya J**, "Are Prescription Drug Insurance Choices Consistent with Expected Utility Theory?" *Health Psychology* (2013) *32*(9), 986.
64. Basu S, Seligman H, **Bhattacharya J,** "Nutritional policy changes in the Supplemental Nutrition Assistance Program: A microsimulation and cost-effectiveness analysis" *Medical Decision Making* (2013) *33*(7), 937-948.
65. Nguyen C, Hernandez-Boussard T., Davies SM, **Bhattacharya J**, Khosla RM, Curtin CM, "Cleft Palate Surgery: An Evaluation of Length of Stay, Complications, and Costs by Hospital Type," *The Cleft Palate-Craniofacial Journal.* (2013)
66. Austin D, Luan A, Wang L, **Bhattacharya J,** "Small Increases to Employer Premiums Could Shift Millions of People to the Exchanges and Add Billions of Dollars to Federal Outlays" *Health Affairs* 32.9 (2013): 1531-1537.
67. Bendavid E and **Bhattacharya J**, "The Relationship of Health Aid to Population Health Improvements" *JAMA Internal Medicine* Jun;174(6):881-7. doi: 10.1001/jamainternmed.2014.292. (2014) PMID: 24756557
68. Erickson K, Winkelmayer W, Chertow G, **Bhattacharya J** "Physician Visits and 30-day Hospital Readmissions in Patients Receiving Hemodialysis." *Journal of the American Society of Nephrology* Sep;25(9):2079-87. doi: 10.1681/ASN.2013080879 (2014) PMID: 2481216.
69. Patel RB, Mathur MB, Gould M, Uyeki TM, **Bhattacharya J**, Xiao Y, Khazeni N "Demographic and Clinical Predictors of Mortality from Highly Pathogenic Avian Influenza A (H5N1) Virus Infection: CART Analysis of International Cases." PLoS One Mar 25;9(3):e91630. doi: 10.1371/journal.pone.0091630. eCollection 2014. PMID: 24667532 (2014).
70. Basu S, Seligman H, Gardner C, and **Bhattacharya J**, "Ending SNAP subsidies for sugar-sweetened beverages could reduce obesity and type 2 diabetes" *Health Affairs* Jun;33(6):1032-9. doi: 10.1377/hlthaff.2013.1246 (2014) PMID: 24889953
71. Jena AB, Schoemaker L, and **Bhattacharya J**, "Exposing Physicians to Reduced Residency Work Hours Did Not Adversely Affect Patient Outcomes After Residency" *Health Affairs* 33:1832-1840 (2014)
72. Mathur MB, Patel RB, Gould M, Uyeki TM, **Bhattacharya J**, Xiao Y, Gillaspie Y, Khazeni N, "Global Seasonal Patterns in Human HPAI H5N1 Infection: Analysis of International Cases" *PLoS ONE* Sep 12;9(9):e106171. doi: 10.1371/journal.pone.0106171. eCollection 2014. PMID: 25215608 (2014)
73. **Bhattacharya J**, Vogt WB. "Employment and Adverse Selection in Health Insurance." *Forum for Health Economics and Policy* 17(1):79-104. DOI: 10.1515/fhep-2013-0017 (2014)
74. Erickson KF, Winkelmayer WC, Chertow GM, and **Bhattacharya J**. "Medicare Reimbursement Reform for Provider Visits and Health Outcomes in Patients on Hemodialysis." *Forum for Health Economics and Policy* 17(1):53-77 (2014)
75. Park MD, **Bhattacharya J**, Park KT. "Differences in healthcare expenditures for inflammatory bowel disease by insurance status, income, and clinical care setting." PeerJ. Sep 23;2:e587. doi: 10.7717/peerj.587 PMID: 25279267 (2014)
76. Erickson KF, Mell MW, Winkelmayer WC, Chertow GM, and **Bhattacharya J** "Provider Visit Frequency and Vascular Access Interventions in Hemodialysis"

*Clinical Journal of the American Society of Nephrology* (2015) 10(2):269-77. doi: 10.2215/CJN.05540614. PMID: 25587105

77. Chicklis C, MaCurdy T, **Bhattacharya J**, Shafrin J, Zaidi S, and Rogers D "Regional Growth in Medicare Spending, 1992-2010." *Health Services Research* (2015) 50(5):1574-88. doi: 10.1111/1475-6773.12287 PMID: 25676603
78. Romley JA, Axeen S, Lakdawalla DN, Chernew ME, **Bhattacharya J**, and Goldman DP. "The Relationship between Commercial Health Care Prices and Medicare Spending and Utilization." Health Services Research (2015) 50(3):883-96. doi: 10.1111/1475-6773.12262. PMID: 25429755
79. Gidwani R and **Bhattacharya J** "CMS Reimbursement Reform and the Incidence of Hospital-Acquired Pulmonary Embolism or Deep Vein Thrombosis." *Journal of General Internal Medicine* 30(5):588-596 (2015)
80. Erickson KF, Mell MW, Winkelmayer WC, Chertow GM, and **Bhattacharya J** "Provider Visits and Early Vascular Access Placement in Maintenance Hemodialysis." *Journal of the American Society of Nephrology* 26(8):1990-7 doi:10.1681/ASN.2014050464 (2015) PMID: 25452668
81. Goldhaber-Fiebert JD, Studdert DM, Farid MS, **Bhattacharya J** "Will Divestment from Employment-Based Health Insurance Save Employers Money? The Case of State and Local Governments." *Journal of Empirical Legal Studies* 12(3): 343-394 (2015) DOI: 10.1111/jels.12076
82. Alsan M, Schoemaker L, Eggleston K, Kammili N, Kolli P, **Bhattacharya J**. "Out-of-pocket health expenditures and antimicrobial resistance in low- and middle-income countries" *Lancet Infectious Disease* (2015) 15(10):1203-1210
83. Wang L, Haberland C, Thurm C, **Bhattacharya J**, Park KT. "Health Outcomes in US Children with Abdominal Pain at Major Emergency Departments Associated with Race and Socioeconomic Status" *PLoS One* 10(8): e0132758 DOI: 10.1371/journal.pone.0132758 (2015)
84. Patel MI, **Bhattacharya J**, Asch SM, Kahn J "Acceptance of Advance Directives and Palliative Care Referral for Veterans with Advanced Cancer: A Retrospective Analysis." *The American Journal of Hospice & Palliative Care* DOI:10.1177/1049909115595216 (2015).
85. Jena AB, Schoemaker L, **Bhattacharya J**, Seabury SA (2015) Physician spending and subsequent risk of malpractice claims: observational study. *BMJ* 2015;351:h5516 doi: 10.1136/bmj.h5516. PMID: 26538498 See also: Jena AB, Schoemaker L, Bhattacharya J, Seabury SA. "Authors' reply to Barbieri and Kovarik, Mariani, and Waxman and Kanzaria." *BMJ*. 2015 351:h6774. doi: 10.1136/bmj.h6774 (2015). PMID: 26668033
86. Richman I, Asch SM, **Bhattacharya J**, Owens DK. "Colorectal Cancer Screening in the Era of the Affordable Care Act" *Journal of General Internal Medicine* (2016) 31(3):315-20. doi: 10.1007/s11606-015-3504-2. PMID: 26349953
87. Mooney JJ, **Bhattacharya J**, and Dhillon GS Effect of Transplant Center Volume on Cost and Readmissions in Medicare Lung Transplant Recipients, *Annals of the American Thoracic Society* 13(7):1034-41. doi: 10.1513/AnnalsATS.201601-017OC (2016). PMID: 27064753

88. Hurley MP, Schoemaker L, Morton JM, Wren SM, Vogt WB, Watanabe S, Yoshikawa A, **Bhattacharya J**. "Geographic variation in surgical outcomes and cost between the United States and Japan." *Am J Manag Care*. 22(9):600-7 (2016) PMID: 27662222
89. Erickson KF, Winkelmayer WC, Chertow GM, **Bhattacharya J**. "Hemodialysis Hospitalizations and Readmissions: The Effects of Payment Reform." *Am J Kidney Dis*. 2016 Nov 14. pii: S0272-6386(16)30524-8. doi: 10.1053/j.ajkd.2016.08.033. (2016) PMID: 27856087
90. Richman I, Asch SM, Bendavid E, **Bhattacharya J**, Owens DK. "Breast Density Notification Legislation and Breast Cancer Stage at Diagnosis: Early Evidence from the SEER Registry." *J Gen Intern Med*. 32(6):603-609 (2017) doi: 10.1007/s11606-016-3904-y. PMID: 27844260
91. Erickson KF, Zheng Y, Winkelmayer WC, Ho V, **Bhattacharya J**, Chertow GM. "Consolidation in the Dialysis Industry, Patient Choice, and Local Market Competition."*Clin J Am Soc Nephrol*. 12(3):536-545 (2017) doi: 10.2215/CJN.06340616 PMID: 27831510
92. Erickson KF, Winkelmayer WC, Chertow GM, **Bhattacharya J**. "Effects of physician payment reform on provision of home dialysis." *Am J Manag Care* 22(6):e215-23. (2016) PMID: 27355909
93. Eneriz-Wiemer M, Saynina O, Sundaram V, Lee HC, **Bhattacharya J**, Sanders LM. "Parent Language: A Predictor for Neurodevelopmental Follow-up Care Among Infants With Very Low Birth Weight." *Acad Pediatr*. 16(7):645-52. doi: 10.1016/j.acap.2016.04.004. (2016) PMID: 27130810
94. Chen B, Jalal H, Hashimoto H, Suen SC, Eggleston K, Hurley M, Schoemaker L, and **Bhattacharya J**. "Forecasting Trends in Disability in a Super-Aging Society: Adapting the Future Elderly Model to Japan," *Journal of the Economics of Ageing* 8 (2016): 42-51.
95. Liu VX, Fielding-Singh V, Greene JD, Baker JM, Iwashyna TJ, **Bhattacharya J**, Escobar GJ. "The Timing of Early Antibiotics and Hospital Mortality in Sepsis" *Am J Respir Crit Care Med*. (2017) 196(7):856-863. doi: 10.1164/rccm.201609-1848OC PMID: 28345952
96. Shaw JG, Farid M, Noel-Miller C, Joseph N, Houser A, Asch SA, **Bhattacharya J**, Flowers L. "Social Isolation and Medicare Spending: Among Older Adults, Objective Social Isolation Increases Expenditures while Loneliness Does Not" *J of Aging and Health* 29(7):1119-1143 (2017)
97. Tran EMT, **Bhattacharya J**, Pershing S. "Self-Reported Receipt of Dilated Fundus Examinations Among Patients with Diabetes: Medical Expenditure Panel Survey, 2002-2013" *American Journal of Ophthalmology* 179:18-24 (2017) doi: 10.1016/j.ajo.2017.04.009 PMID: 28455116
98. Lin E, Cheng XS, Chin KK, Zubair T, Chertow GM, Bendavid E, Bhattacharya J. "Home Dialysis in the Prospective Payment System Era" J Am Soc Nephrol 28(10):2993-3004. doi: 10.1681/ASN.2017010041. Epub 2017 May 10. (2017) PMID: 28490435

99. Hakim I, Hathi S, Nair A, Narula T, **Bhattacharya J**. "Electronic health records and the frequency of diagnostic test orders" *Am J Manag Care*. 23(1):e16-e23. (2017) PMID: 28141935
100. Pollom EL, Wang G, Harris JP, Koong AC, Bendavid E, **Bhattacharya J**, Chang DT. "The Impact of Intensity Modulated Radiation Therapy on Hospitalization Outcomes in the SEER-Medicare Population With Anal Squamous Cell Carcinoma" *Int J Radiat Oncol Biol Phys.* 98(1):177-185. doi: 10.1016/j.ijrobp.2017.01.006. PMID: 28258896 (2017)
101. Kwong JZ, Weng Y, Finnegan M, Schaffer R, Remington A, Curtin C, McDonald KM, **Bhattacharya J**, Hernandez-Boussard T. "Effect of Medicare's Nonpayment Policy on Surgical Site Infections Following Orthopedic Procedures" *Infect Control Hosp Epidemiol.* 38(7):817-822 doi: 10.1017/ice.2017.86. (2017) PMID: 28487001
102. Chen SP, **Bhattacharya J**, Pershing S. "Vision Loss and Cognition in the US Population of Older Adults, *JAMA Ophthalmology* 135(9):963-970 (2017) DOI: 10.1001/jamaophthalmol.2017.2838 PMID: 28817745 PMCID: PMC5710542
103. Lin E, MaCurdy M, **Bhattacharya J** "MACRA and its Implications for Nephrology" *Journal of American Society of Nephrology* (2017) 28(9):2590-2596. doi: 10.1681/ASN.2017040407
104. Sandhu AT, Heidenreich PA, **Bhattacharya J**, and Bundorf MK "Cardiovascular Testing and Clinical Outcomes in Emergency Department Patients with Chest Pain" *JAMA Internal Medicine* (2017) 177(8):1175-1182 PMID: 28654959 PMCID: PMC5710427 doi:10.1001/jamainternmed.2017.2432
105. Mooney JJ, Hedlin H, Mohabir P, **Bhattacharya J**, & Dhillon GS. "Racial and ethnic disparities in lung transplant listing and waitlist outcomes." *The Journal of Heart and Lung Transplantation*, *37*(3), 394–400. doi:10.1016/j.healun.2017.09.017 (2017)
106. Packalen M and **Bhattacharya J** (2017) "Neophilia Ranking of Scientific Journals" *Scientometrics* 110(1):43-64 PMID: 28713181 PMCID: PMC5506293 doi: 10.1007/s11192-016-2157-1
107. Garber AM, Azad TD, Dixit A, Farid M, Sung E, Vail D, **Bhattacharya J** "Medicare savings from conservative management of low back pain" *American Journal of Managed Care* 24(10):e332-e337. (2018)
108. Patel MI, Sundaram V, Desai M, Periyakoil VS, Kahn JS, **Bhattacharya J**, Asch SM, Milstein A, and Bundorf MK. "Effect of a Lay Health Worker Intervention on Goals-of-Care Documentation and on Health Care Use, Costs, and Satisfaction Among Patients with Cancer: A Randomized Clinical Trial." *JAMA Oncol.* 4(10):1359-1366. doi: 10.1001/jamaoncol.2018.2446. (2018)
109. Erickson KF, Winkelmayer WC, Ho V, **Bhattacharya J**, Chertow GM "Market Competition and Health Outcomes in Hemodialysis" *Health Services Research* 53(5):3680-3703. doi: 10.1111/1475-6773.12835. Epub 2018 Feb 22. (2018)
110. Yu JX, Oliver M, Lin J, Chang M, Limketkai BN, Soetikno R, **Bhattacharya J**, Kaltenbach T. Patients Prescribed Direct-Acting Oral Anticoagulants Have Low Risk of Postpolypectomy Complications. *Clinical Gastroenterology and*

*Hepatology*. https://doi.org/10.1016/J.CGH.2018.11.051 17(10 2000-2007.e3 (2018) PMID: 30503964. PMCID: PMC6541555

111. Patel CJ, **Bhattacharya J**, Ioannidis J, & Bendavid E. "Systematic identification of correlates of HIV infection." *AIDS, 32*(7):933-943. (2018)
112. McKenzie RB, Sanders L, Bhattacharya J, Bundorf MK "Health Care System Factors Associated with Transition Preparation in Youth with Special Health Care Needs" Population Health Management 22(1):63-73. doi: 10.1089/pop.2018.0027. Epub 2018 Jun 29 (2019)
113. Erickson KF, Winkelmayer WC, Ho V, Bhattacharya J, Chertow GM "Market Consolidation and Mortality in Patients Initiating Hemodialysis" *Value in Health.* 22(1):69-76. doi: 10.1016/j.jval.2018.06.008. Epub 2018 Jul 27. (2019)
114. Curto V, Einav L, Finkelstein A, Levin J, & **Bhattacharya J**. "Health Care Spending and Utilization in Public and Private Medicare." *American Economic Journal: Applied Economics*, 11(2), 302–332. https://doi.org/10.1257/app.20170295 (2019)
115. Mooney JJ, **Bhattacharya J**, and Dhillon GS "Effect of Broader Geographic Sharing of Donor Lungs on Lung Transplant Waitlist Outcomes" *Journal of Heart and Lung Transplantation* 38(2):136-144. doi: 10.1016/j.healun.2018.09.007. Epub 2018 Sep 14. (2019)
116. Azad, T., Vail, D., Bentley, J., Han, S., Suarez, P., Varshneya, K., Mittal V, Desai M, **Bhattacharya J**, and Ratliff, J. "Initial Provider Specialty is Associated with Long-term Opiate Use in Patients with Newly Diagnosed Low Back and Lower Extremity Pain." Spine 44(3):211-218. doi: 10.1097/BRS.0000000000002840. (2019)
117. Patel MI, Moore D, **Bhattacharya J**, Milstein A, & Coker TR "Perspectives of Health Care Payer Organizations on Cancer Care Delivery Redesign: A National Study" *Journal of Oncology Practice* 15:1, e46-e55 (2019)
118. Lin E, **Bhattacharya J**, & Chertow GM "Prior Hospitalization Burden and the Relatedness of 30-Day Readmissions in Patients Receiving Hemodialysis." *Journal of the American Society of Nephrology, 30*(2), 323–335. https://doi.org/10.1681/asn.2018080858 (2019)
119. Packalen M, & **Bhattacharya J**. "Age and the Trying Out of New Ideas." *Journal of Human Capital*, 13(2), 341–373. https://doi.org/10.1086/703160 (2019)
120. Patel MI, Ramirez D, Agajanian R, Agajanian H, **Bhattacharya J**, & Bundorf KM "Lay Health Worker-Led Cancer Symptom Screening Intervention and the Effect on Patient-Reported Satisfaction, Health Status, Health Care Use, and Total Costs: Results From a Tri-Part Collaboration." *Journal of Oncology Practice*, https://doi.org/10.1200/JOP.19.00152 (2019)
121. Sandhu AT, Kohsaka S, **Bhattacharya J**, Fearon WF, Harrington RA, & Heidenreich PA. "Association Between Current and Future Annual Hospital Percutaneous Coronary Intervention Mortality Rates." *JAMA Cardiology*, 1–8. https://doi.org/10.1001/jamacardio.2019.3221 (2019)
122. Patel M, Andrea N, **Bhattacharya J**, & Coker TR. "A Community-Partnered, Evidence-Based Approach to Improving Cancer Care Delivery for Low-Income

and Minority Patients with Cancer." *Journal of Community Health*, 44(5), 912–920. https://doi.org/10.1007/s10900-019-00632-x (2019)

123. Hamad R, Templeton ZS, Schoemaker L, Zhao M, & **Bhattacharya J**. "Comparing Demographic and Health Characteristics of New and Existing SNAP Recipients: Application of A Machine Learning Algorithm." *The American Journal of Clinical Nutrition*, 109(4), 1164–1172. https://doi.org/10.1093/ajcn/nqy355 (2019)
124. Erickson KF, Zhao B, Niu J, Winkelmayer WC, **Bhattacharya J**, Chertow GM, & Ho V. "Association of Hospitalization and Mortality Among Patients Initiating Dialysis with Hemodialysis Facility Ownership and Acquisitions." *JAMA Network Open*, 2(5), e193987. https://doi.org/10.1001/jamanetworkopen.2019.3987 (2019)
125. Jena AB, Farid M, Blumenthal D, & **Bhattacharya J**. "Association of Residency Work Hour Reform with Long Term Quality and Costs of Care of US Physicians: Observational Study." *BMJ*, 366, l4134. https://doi.org/10.1136/bmj.l4134 (2019).
126. Hamad R, Nguyen TT, **Bhattacharya J**, Glymour MM, & Rehkopf DH. "Educational Attainment and Cardiovascular Disease in The United States: A Quasi-Experimental Instrumental Variables Analysis." *PLoS Medicine*, 16(6), e1002834. https://doi.org/10.1371/journal.pmed.1002834 (2019)
127. Yu JX, Lin JL, Oliver M, Soetikno R, Chang MS, Kwong AJ, Limketkai BN, **Bhattacharya J**, Kaltenbach T. Trends in EMR for Nonmalignant Colorectal Polyps in The United States. *Gastrointestinal Endoscopy*. https://doi.org/10.1016/j.gie.2019.08.004 (2019)
128. Kim D, Chen C, Tysinger B, Park S, Chong MZ, Wang L, Zhao M, Yean JM, Koh WP, Yoong J, **Bhattacharya J**, & Eggleston K. Smoking, life expectancy, and chronic disease in South Korea, Singapore, and the United States: A microsimulation model [published online ahead of print, 2019 Dec 4]. Health Econ. 2019;10.1002/hec.3978. doi:10.1002/hec.3978
129. Ryckman T, Robinson M, Pedersen C, **Bhattacharya J**, Bendavid E. Impact of Feed the Future initiative on nutrition in children aged less than 5 years in sub-Saharan Africa: difference-in-differences analysis. *BMJ*.;367:l6540. Published 2019 Dec 11. doi:10.1136/bmj.l6540 (2019) PMID: 31802569 PMCID: PMC7269831
130. Erickson KF, Shen JI, Zhao B, Winkelmayer WC, Chertow GM, Ho V, & **Bhattacharya J**. Safety-Net Care for Maintenance Dialysis in the United States. *J Am Soc Nephrol*. 31(2):424-433. doi:10.1681/ASN.2019040417 (2020) PMID: 31857351 PMCID: PMC7003304
131. Bonde AN, Martinussen T, Lee CJ, Lip GYH, Staerk L, Bang CN, **Bhattacharya J**, Gislason G, Torp-Pedersen C, Olesen JB, Hlatky MA. Rivaroxaban Versus Apixaban for Stroke Prevention in Atrial Fibrillation: An Instrumental Variable Analysis of a Nationwide Cohort. Circ Cardiovasc Qual Outcomes.13(4):e006058. doi:10.1161/CIRCOUTCOMES.119.006058 (2020) PMID: 32283966

132. Sood N, Simon P, Ebner P, Eichner D, Reynolds J, Bendavid E, & **Bhattacharya J** Seroprevalence of SARS-CoV-2-Specific Antibodies Among Adults in Los Angeles County, California, on April 10-11, 2020 [published online ahead of print, 2020 May 18]. *JAMA.*;e208279. doi:10.1001/jama.2020.8279 (2020) PMID: 32421144 PMCID: PMC7235907
133. Packalen M, **Bhattacharya J**. NIH funding and the pursuit of edge science. Proc Natl Acad Sci U S A. 117(22):12011-12016. doi:10.1073/pnas.1910160117 (2020)
134. Alobuia WM, Dalva-Baird NP, Forrester JD, Bendavid E, **Bhattacharya J**, Kebebew E. Racial disparities in knowledge, attitudes and practices related to COVID-19 in the USA [published online ahead of print, 2020 Jun 3]. J Public Health (Oxf). 2020;fdaa069. doi:10.1093/pubmed/fdaa069
135. Shin SH, Lillard DR, **Bhattacharya J**. Understanding the correlation between Alzheimer's Disease polygenic risk, wealth, and the composition of wealth holdings. *Biodemography and Social Biology* (2020) Oct 28;268:113473. doi: 10.1016/j.socscimed.2020.113473
136. Curto V, Einav L, Levin J, and **Bhattacharya J**. Can Health Insurance Competition Work? Evidence from Medicare Advantage. *Journal of Political Economy* (2020, forthcoming)
137. Sandhu AT, **Bhattacharya J**, Lam J, Bounds S, Luo B, Moran D, Uwilingiyimana AS, Fenson D, Choradia N, Do R, Feinberg L, MaCurdy T, Nagavarapu S. Adjustment For Social Risk Factors Does Not Meaningfully Affect Performance On Medicare's MIPS Clinician Cost Measures. *Health Aff* (Millwood). 2020 Sep;39(9):1495-1503. doi: 10.1377/hlthaff.2020.00440. PMID: 32897780.
138. Kasajima M, Hashimoto H, Suen SC, Chen B, Jalal H, Eggleston K, **Bhattacharya J**. Future projection of the health and functional status of older people in Japan: A multistate transition microsimulation model with repeated cross-sectional data. *Health Econ.* 2020 Jul 14. doi: 10.1002/hec.3986. Epub ahead of print. PMID: 32662080.
139. Lin E, Chertow GM, **Bhattacharya J**, Lakdawalla D. Early Delays in Insurance Coverage and Long-term Use of Home-based Peritoneal Dialysis. Med Care. 2020 Jul;58(7):632-642. doi: 10.1097/MLR.0000000000001350. PMID: 32520837; PMCID: PMC7295012.

NON-PEER-REVIEWED WORK (32 total)

1. **Bhattacharya J**, Garber AM, MaCurdy T. Cause-Specific Mortality among Medicare Enrollees. *National Bureau of Economic Research Working Paper Series*. 1996;No. 5409.
2. **Bhattacharya J,** Currie J. "Youths at Nutritional Risk : Malnourished or Misnourished?" *National Bureau of Economic Research Working Paper Series*. 2000;No. 7686(7686):483–522.

3. **Bhattacharya J,** Lakdawalla D. Does Medicare Benefit the Poor? New Answers to an Old Question. *National Bureau of Economic Research Working Paper Series.* 2002;No. 9280.
4. **Bhattacharya J.** "Coinsurance, Cost Sharing, and the Demand Managed Behavioral Health Services" *Frontlines: Linking Alcohol Services Research & Practice*, June (2003).
5. **Bhattacharya J**, Lakdawalla D. Time-Inconsistency and Welfare. *National Bureau of Economic Research Working Paper Series.* 2004;No. 10345.
6. Sood N, Alpert A, **Bhattacharya J.** Technology, Monopoly and the Decline of the Viatical Settlements Industry. *National Bureau of Economic Research Working Paper Series.* 2005;No. 11164(March).
7. **Bhattacharya J**, Vogt WB. Employment and Adverse Selection in Health Insurance. *National Bureau of Economic Research Working Paper Series.* 2006;No. 12430(August).
8. **Bhattacharya J.** "Dollars to Doughnuts" *Hoover Digest* 3 (2007).
9. **Bhattacharya J**, Vogt WB. Do Instrumental Variables Belong in Propensity Scores? National Bureau of Economic Research, Inc, NBER Technical Working Papers: 0343; 2007;No. 343.
10. **Bhattacharya J**, Packalen M. Is Medicine an Ivory Tower? Induced Innovation, Technological Opportunity, and For-Profit vs. Non-Profit Innovation. *National Bureau of Economic Research Working Paper Series.* 2008;No. 13862.
11. Atella V, **Bhattacharya J**, Carbonari L. Pharmaceutical Industry, Drug Quality and Regulation: Evidence from US and Italy. *National Bureau of Economic Research Working Paper Series.* 2008.
12. Yoo B-K, Kasajima M, **Bhattacharya J.** Public Avoidance and the Epidemiology of novel H1N1 Influenza A. *National Bureau of Economic Research Working Paper Series.* 2010;15752:1–39.
13. Aranovich G, **Bhattacharya J**, Garber A, MaCurdy T, "Coping with Chronic Disease? Chronic Disease and Disability in Elderly American Population 1982-1999," NBER Working Paper *#14811* (2009)
14. Jena AB, Schoemaker L, **Bhattacharya J**, Seabury SA. "Authors' reply to Barbieri and Kovarik, Mariani, and Waxman and Kanzaria." BMJ. 351:h6774. doi: 10.1136/bmj.h6774. (2015) PMID: 26668033
15. Gidwani R, **Bhattacharya J.** "CMS Reimbursement Reform: Authors' Reply." *J Gen Intern Med.* 2015 30(11):1588. doi: 10.1007/s11606-015-3465-5. PMID: 26179821
16. **Bhattacharya J.** "A way out of the dismal arithmetic of hepatitis C treatment." *Am J Manag Care.* (6 Spec No.):SP183-4. (2016) PMID: 27266945
17. Liu V, Fielding-Singh V, Iwashyna TJ, **Bhattacharya J**, Escobar G. "Reply to the Timing of Early Antibiotics and Hospital Mortality in Sepsis - Playing Devil's Advocate. *Am J Respir Crit Care Med.* doi: 10.1164/rccm.201704-0774LE. (2017) PMID: 28485627

18. Bendavid E and **Bhattacharya J** "Is the Coronavirus as Deadly as They Say?" Wall Street Journal, March 24, 2020.
19. Bendavid, E., Mulaney, B., Sood, N., Shah, S., Ling, E., Bromley-Dulfano, R., Lai, C., Weissberg, Z., Saavedra, R., Tedrow, J., Tversky, D., Bogan, A., Kupiec, T., Eichner, D., Gupta, R., Ioannidis, J., & **Bhattacharya, J.** (2020). COVID-19 Antibody Seroprevalence in Santa Clara County, California. medRxiv, 2020.04.14.20062463. https://doi.org/10.1101/2020.04.14.20062463
20. **Bhattacharya J** and Packalen M "Lives vs. Lives: The Global Cost of Lockdown" Spectator, May 13, 2020
21. **Bhattacharya J** and Packalen M "Focused COVID-19 Restrictions Will Save Lives in Poor Countries", Financial Post, July 3, 2020.
22. **Bhattacharya J** and Agarwal S. "Lift lockdowns, protect the vulnerable, treat Covid like a health issue and not a disaster" The Print. July 24, 2020
23. **Bhattacharya J** and Kulldorff M. "The Case Against Covid Tests for the Young and Healthy" Wall Street Journal, Sept. 3, 2020
24. **Bhattacharya J.** A Sensible and Compassionate Anti-COVID Strategy. *Imprimis* 49(10). October 2020. https://imprimis.hillsdale.edu/sensible-compassionate-anti-covid-strategy/
25. Kulldorff M, Gupta S, and **Bhattacharya J.** Great Barrington Declaration. Oct. 4, 2020.
26. Kulldorff M, Gupta S, and **Bhattacharya J** "Our COVID-19 plan would minimize mortality and lockdown-induced collateral damage" USA Today, Oct. 22, 2020.
27. **Bhattacharya J** "It's Time for an Alternative to Lockdown" Spectator, Oct. 29, 2020.
28. Kulldorff M, Gupta S, and **Bhattacharya J** "We Should Focus on Protecting the Vulnerable from COVID Infection" Newsweek, Oct. 30, 2020.
29. Kulldorff M and **Bhattacharya J.** "Lockdown Isn't Working" Spectator, Nov. 2, 2020.
30. Kulldorff M, Gupta S, and **Bhattacharya J.** Focused Protection: The Middle Ground between Lockdowns and "Let it Rip". Great Barrington Declaration, Nov. 25, 2020.
31. **Bhattacharya J** and Makridis C "Facts – not fear – will stop the pandemic" The Hill, Dec. 3, 2020.
32. **Bhattacharya J** and Gupta S. "How to End the Lockdowns Next Month" Wall Street Journal, Dec. 17, 2020.

BOOKS AND REPORTS (9 total)

1. Yoshikawa A, **Bhattacharya J**, Vogt WB eds. Health Economics of Japan: Patients, Doctors, and Hospitals Under a Universal Health Insurance System, Tokyo: University of Tokyo Press, (1996).

2. Goldman DP, Hurd M, Shekelle PG, Newberry SJ, Panis CWA, Shang B, **Bhattacharya J**, Joyce GF, Lakdawalla D. Health Status and Medical Treatment of the Future Elderly: Final Report, TR-169-CMS, Santa Monica, CA: RAND (2004).
3. **Bhattacharya J**, Currie J, Haider SJ, Variyam J. Evaluating the Impact of School Nutrition Programs: Final Report. E-FAN-04-008, Washington D.C.: Economic Research Service, USDA (2004).
4. **Bhattacharya J**, Hyde T, Tu P. Health Economics, London: Palgrave-MacMillan, (2013).
5. MaCurdy T, **Bhattacharya J**, Perlroth D, Shafrin J, Au-Yeung A, Bashour H, Chicklis C, Cronen K, Lipton B, Saneinejad S, Shrestha E, Zaidi S. Geographic Variation in Spending, Utilization, and Quality: Medicare and Medicaid Beneficiaries. Acumen Report to the Institute of Medicine Committee Study of Geographic Variation in Health Care Spending and Promotion of High-Value Health Care, Washington, DC: Institute of Medicine (2013)
6. MaCurdy T, **Bhattacharya J**, Shafrin J, Chicklis C, Cronen K, Friley J, Lipton B, Rogers D, Zaidi S. IOM Study of Geographic Variation: Growth Analysis. Acumen Report to the Institute of Medicine Committee Study of Geographic Variation in Health Care Spending and Promotion of High-Value Health Care, Washington, DC: Institute of Medicine (2013)
7. **Bhattacharya J**, Chandra A, Chernew M, Goldman D, Jena A, Lakdawalla D, Malani A, Philipson T. Best of Both Worlds: Uniting Universal Coverage and Personal Choice in Health Care, American Enterprise Institute (AEI) White Paper, Washington DC: AEI Press (2013)
8. **Bhattacharya J**, Vail D, Moore D, Vogt W, Choradia N, Do R, Erickson K, Feinberg L, Isara F, Lin E, Narayanan V, Vaikath M, MaCurdy T. Medicare Current State and Future Trends Environment Scan. Center for Medicare and Medicaid Services (CMS) White Paper (2019)
9. **Bhattacharya J**, Packalen M. On the Futility of Contact Tracing. *Inference* 5(3) September (2020) https://inference-review.com/article/on-the-futility-of-contact-tracing

BOOK CHAPTERS (15 total)

1. **Bhattacharya J**, Garber AM, MaCurdy T. "Cause-Specific Mortality Among Medicare Enrollees," in Inquires in the Economics of Aging, D Wise (ed.), Chicago, IL: University of Chicago Press. (1997).
2. MaCurdy T, Nechyba T, **Bhattacharya J.** "Ch. 2: An Economic Model of the Fiscal Impacts of Immigration," The Immigration Debate: Studies on the Economic, Demographic, and Fiscal Effects of Immigration, J Smith (ed.), National Academy

of Sciences Commission on Behavioral and Social Sciences and Education: Washington D.C., (1998).

3. **Bhattacharya J**, Currie J. "Youths and Nutritional Risk: Malnourished or Misnourished?" in Risky Behavior Among Youths, J Gruber (ed.), (2001).
4. Yoshikawa A. and **Bhattacharya J**. "Japanese Health Care" in World Health Systems: Challenges and Perspectives, Bruce Fried and Laura M. Gaydos (eds.), Chicago, IL: Health Administration Press (2002).
5. **Bhattacharya J**, Cutler D, Goldman DP, Hurd MD, Joyce GF, Lakdawalla DN, Panis CWA, and Shang B, "Disability Forecasts and Future Medicare Costs" Frontiers in Health Policy Research, Vol. 6, Alan Garber and David Cutler (eds.) Boston, MA: MIT Press (2003).
6. **Bhattacharya J**, Choudhry K, and Lakdawalla D. (2007) "Chronic Disease and Trends in Severe Disability in Working Age Populations" Proceedings from the Institute of Medicine workshop, 'Disability in America: An Update,' Institute of Medicine: Washington, D.C.
7. **Bhattacharya J**, Garber AM, MaCurdy T. "Trends in Prescription Drug Use by the Disabled Elderly" in Developments in the Economics of Aging, D. Wise (ed), Chicago, IL, University of Chicago Press (2009).
8. **Bhattacharya J** and Richmond P "On Work and Health Among the American Poor" in Pathways to Self-Sufficiency: Getting Ahead in an Era Beyond Welfare Reform John Karl Scholz and Carolyn Heinrich (eds), New York, NY, Russell Sage Foundation (2009).
9. **Bhattacharya J**, Garber A, MaCurdy T "The Narrowing Dispersion of Medicare Expenditures 1997-2005" in Research Findings in the Economics of Aging, D. Wise (ed.), Chicago, IL, University of Chicago Press (2010)
10. **Bhattacharya J**, Bundorf MK, Pace N, and Sood N "Does Health Insurance Make You Fat?" in Economic Aspects of Obesity Michael Grossman and Naci Mocan (eds.), Chicago, IL, University of Chicago Press (2010)
11. **Bhattacharya J**, Garber A, Miller M, and Perlroth D "The Value of Progress against Cancer in the Elderly" Investigations in the Economics of Aging, David Wise (ed), Chicago, IL, University of Chicago Press (2012)
12. Yoshikawa A. and **Bhattacharya J**. "Japanese Health Care" in World Health Systems: Challenges and Perspectives, 2nd edition, Bruce Fried and Laura M. Gaydos (eds.), Chicago, IL: Health Administration Press (2012).
13. Hanson, J., Chandra, A., Moss, E., **Bhattacharya, J.** Wolfe, B., Pollak, S.D.. Brain Development and Poverty: Preliminary Findings. In Biological Consequences of Socioeconomic Inequalities. B. Wolfe, T. Seeman, and W. Evans (Eds). NY: Sage. (2012)
14. **Bhattacharya J** "The Diffusion of New Medical Technologies: The Case of Drug-Eluting Stents (A Discussion of Chandra, Malenka, and Skinner)" In Explorations

in the Economics of Aging, David Wise (ed.), Chicago, IL, University of Chicago Press (2014).

15. MaCurdy T and **Bhattacharya J** "Challenges in Controlling Medicare Spending: Treating Highly Complex Patients" in Insights in the Economics of Aging, David Wise (ed.) Chicago, IL, University of Chicago Press (2015).

ABSTRACTS (3)

1. Su CK and **Bhattacharya J**. Longitudinal Hospitalization Costs and Outcomes in the Treatment of the Medicare Breast Cancer Patient. *International Journal of Radiation Oncology Biology Physics* (1996); 36(S1): 282. [abstract]
2. Nguyen C, Hernandez-Boussard T., Davies S, **Bhattacharya J**, Khosla R, Curtin C. *Cleft Palate Surgery: Variables of Quality and Patient Safety*. Presented at the 69th Annual American Cleft-Palate Craniofacial Association (2012). [abstract]
3. Patel MI, Ramirez D, Agajanian R, Bhattacharya J, Milstein A, Bundorf MK. "The effect of a lay health worker-led symptom assessment intervention for patients on patient-reported outcomes, healthcare use, and total costs." Journal of Clinical Oncology 36(15 Suppl):6502 [abstract]

## D. PUBLIC AND PROFESSIONAL SERVICE:

JOURNAL EDITING

*Journal of Human Capital,* Associate Editor (2015-present)
*American Journal of Managed Care,* Guest Editor (2016)
*Journal of Human Resources,* Associate Editor (2011-13)
*Forum for Health Economics & Policy,* Editorial Board Member (2001-2012)
*Economics Bulletin,* Associate Editor (2004-2009)

SERVICE ON SCIENTIFIC REVIEW AND ADVISORY COMMITTEES (Selected)

- Standing member of the Health Services Organization and Delivery (HSOD) NIH review panel, 2012-2016
- NIH reviewer (various panels, too numerous to list) 2003-present
- NIH Review Panel Chair: 2018 (P01 review), 2020 (DP1 review).
- Invited Reviewer for the European Research Council, ERC Advanced Grant 2015 RFP
- NIH Stage 2 Challenge Grant Review Panel, July 2009
- Appointed a member of an Institute of Medicine (IOM) panel on the regulation of work hours by resident physicians, 2007-8.
- Standing member of the NIH Social Science and Population Studies Review Panel, Fall 2004-Fall 2008
- Invited Reviewer for National Academy of Sciences report on Food Insecurity and Hunger, November 2005.
- Invited Reviewer for the National Academy of Sciences report on the Nutrition Data Infrastructure, December 2004

- Invited Reviewer for the National Institute on Health (NIH) Health Services Organization and Delivery Review Panel, June 2004, Alexandria, VA.
- Invited Reviewer for the Food Assistance and Nutrition Research Program US Department of Agriculture Economic Research Service Research Proposal Review Panel, June 2004, Stanford, CA.
- Invited Reviewer for the National Institute on Health (NIH) Social Science and Population Studies Review Panel, February 2004, Alexandria, VA.
- Invited Reviewer for the National Institute on Health (NIH) Social Sciences and Population Studies Review Panel, November 2003, Bethesda, MD.
- Invited Reviewer for the National Institute on Health (NIH) Social Science, Nursing, Epidemiology, and Methods (3) Review Panel, June 2003, Bethesda, MD.
- Invited Reviewer for the Food Assistance and Nutrition Research Program US Department of Agriculture Economic Research Service Research Proposal Review Panel, August 2002.
- Research Advisory Panel on Canadian Disability Measurement, Canadian Human Resources Development Applied Research Branch, June 2001 in Ottowa, Canada.
- Invited Reviewer for the National Institute of Occupational Safety and Health R18 Demonstration Project Grants Review panel in July 2000, Washington D.C.
- Research Advisory Panel on Japanese Health Policy Research. May 1997 at the Center for Global Partnership, New York, NY.

TESTIMONY TO GOVERNMENTAL PANELS AND AGENCIES (9)

- US Senate Dec. 2020 hearing of the Subcommittee on Homeland Security and Governmental Affairs. Testimony provided on COVID-19 mortality risk, collateral harms from lockdown policies, and the incentives of private corporations and the government to invest in research on low-cost treatments for COVID-19 disease
- "Roundtable on Safe Reopening of Florida" led by Florida Gov. Ron DeSantis. September 2020.
- "Evaluation of the Safety and Efficacy of COVID-19 Vaccine Candidates" July 2020 hearing of the House Oversight Briefing to the Economic and Consumer Policy Subcommittee.
- Safely Restarting Youth Baseball and Softball Leagues, May 2020 US Senate virtual roundtable, invited testimony
- "Population Aging and Financing Long Term Care in Japan" March 2013 seminar at the Japanese Ministry of Health.
- "Implementing the ACA in California" March 2011 testimony to California Legislature Select Committee on Health Care Costs.
- "Designing an Optimal Data Infrastructure for Nutrition Research" June 2004 testimony to the National Academy of Sciences commission on "Enhancing the Data Infrastructure in Support of Food and Nutrition Programs, Research, and Decision Making," Washington D.C.
- "Measuring the Effect of Overtime Reform" October 1998 testimony to the California Assembly Select Committee on the Middle Class, Los Angeles, CA.

- "Switching to Weekly Overtime in California." April 1997 testimony to the California Industrial Welfare Commission, Los Angeles, CA.

REFEREE FOR RESEARCH JOURNALS

American Economic Review; American Journal of Health Promotion; American Journal of Managed Care; Education Next; Health Economics Letters; Health Services Research; Health Services and Outcomes Research Methodology; Industrial and Labor Relations Review; Journal of Agricultural Economics; Journal of the American Medical Association; Journal of Health Economics; Journal of Health Policy, Politics, and Law; Journal of Human Resources; Journal of Political Economy; Labour Economics; Medical Care; Medical Decision Making; Review of Economics and Statistics; Scandinavian Journal of Economics; Social Science and Medicine; Forum for Health Economics and Policy; Pediatrics; British Medical Journal

| **Trainee** | **Current Position** |
|---|---|
| Peter Groeneveld, MD, MS | Associate Professor of Medicine, University of Pennsylvania |
| Jessica Haberer, MD, MS | Assistant Professor of Medicine, Harvard Medical School |
| Melinda Henne, MD, MS | Director of Health Services Research, Bethesda Naval Hospital |
| Byung-Kwang Yoo, MD, PhD | Associate Professor, Public Health, UC Davis |
| Hau Liu, MD, MS, MBA | Chief Medical Officer at Shanghai United Family Hospital |
| Eran Bendavid, MD, MS | Assistant Professor, General Medicine Disciplines, Stanford University |
| Kaleb Michaud, MS, PhD | Associate Professor of Medicine, Rheumatology and Immunology, University of Nebraska Medical Center |
| Kanaka Shetty, MD | Natural Scientist, RAND Corporation |
| Christine Pal Chee, PhD | Associate Director of the Health Economics Resource Center, Palo Alto VA |
| Matthew Miller, MD | VP Clinical Strategy and Head of Innovation, Landmark Health |
| Vincent Liu, MD | Research Scientist, Kaiser Permanente Northern California Division of Research |
| Daniella Perlroth, MD | Chief Data Scientist, Lyra Health |
| Crystal Smith-Spangler, MD | Internist, Palo Alto Medical Foundation |
| Barrett Levesque, MD MS | Assistant Professor of Clinical Medicine, UC San Diego Health System |
| Torrey Simons, MD | Clinical Instructor, Department of Medicine, Stanford University |
| Nayer Khazeni, MD | Assistant Professor of Medicine (Pulmonary and Critical Care Medicine), Stanford University |
| Monica Bhargava, MD MS | Assistant Clinical Professor, UCSF School of Medicineilan |
| Dhruv Kazi, MD | Assistant Professor, UCSF School of Medicine |
| Zach Kastenberg, MD | Resident, Department of Surgery, Stanford University |
| Kit Delgado, MD | Assistant Professor, Department of Emergency Medicine and Faculty Fellow, University of Pennsylvania |
| Suzann Pershing, MD | Chief of Ophtalmology for the VA Palo Alto Health Care System |
| KT Park, MD | Assistant Professor, Department of Medicine, Stanford University |
| Jeremy Goldhaber-Fiebert, PhD | Associate Professor, Department of Medicine, Stanford University |
| Sanjay Basu, MD | Assistant Professor, Department of Medicine, Stanford University |
| Marcella Alsan, MD, PhD | Assistant Professor, Department of Medicine (CHP/PCOR), Stanford Univ. |
| David Chan, MD, PhD | Assistant Professor, Department of Medicine (CHP/PCOR), Stanford Univ. |
| Karen Eggleston, PhD | Senior Fellow, Freeman Spogli Institute, Stanford University |
| Kevin Erickson, MD | Assistant Professor, Department of Nephrology, Baylor College of Medicine |
| Ilana Richman, MD | VA Fellow at CHP/PCOR, Stanford University |
| Alexander Sandhu, MD | VA Fellow at CHP/PCOR, Stanford University |
| Michael Hurley | Medical Student, Stanford University |
| Manali Patel, MD | Instructor, Department of Medicine (Oncology), Stanford University |
| Dan Austin, MD | Resident Physician, Department of Anesthesia, UCSF School of Medicine |
| Anna Luan, MD | Resident Physician, Department of Medicine, Stanford University |

| | |
|---|---|
| Louse Wang | Medical Student, Stanford University |
| Christine Nguyen, MD | Resident Physician, Department of Medicine, Harvard Medical School |
| Josh Mooney, MD | Instructor, Department of Medicine (Pulmonary and Critical Care Medicine), Stanford University |
| Eugene Lin, MD | Fellow, Department of Medicine (Nephrology), Stanford University |
| Eric Sun, MD | Assistant Professor, Department of Anesthesia, Stanford University |
| Sejal Hathi | Medical Student, Stanford University |
| Ibrahim Hakim | Medical Student, Stanford University |
| Archana Nair | Medical Student, Stanford University |
| Trishna Narula | Medical Student, Stanford University |
| Daniel Vail | Medical Student, Stanford University |
| Tej Azad | Medical Student, Stanford University |
| Jessica Yu, MD | Fellow, Department of Medicine (Gastroenterology), Stanford University |
| Daniel Vail | Medical Student, Stanford University |
| Alex Sandhu, MD | Fellow, Department of Medicine (Cardiology), Stanford University |
| Matthew Muffly, MD | Clinical Assistant Professor, Dept. of Anesthesia, Stanford University |

**Dissertation Committee Memberships**

| | | | |
|---|---|---|---|
| Ron Borzekowski | Ph.D. in Economics | Stanford University | 2002 |
| Jason Brown | Ph.D. in Economics | Stanford University | 2002 |
| Dana Rapaport | Ph.D. in Economics | Stanford University | 2003 |
| Ed Johnson | Ph.D. in Economics | Stanford University | 2003 |
| Joanna Campbell | Ph.D. in Economics | Stanford University | 2003 |
| Neeraj Sood* | Ph.D. in Public Policy | RAND Graduate School | 2003 |
| James Pearce | Ph.D. in Economics | Stanford University | 2004 |
| Mikko Packalen | Ph.D. in Economics | Stanford University | 2005 |
| Kaleb Michaud* | Ph.D. in Physics | Stanford University | 2006 |
| Kyna Fong | Ph.D. in Economics | Stanford University | 2007 |
| Natalie Chun | Ph.D. in Economics | Stanford University | 2008 |
| Sriniketh Nagavarapu | Ph.D in Economics | Stanford University | 2008 |
| Sean Young | Ph.D. in Psychology | Stanford University | 2008 |
| Andrew Jaciw | Ph.D. in Education | Stanford University | 2010 |
| Chirag Patel | Ph.D. in Bioinformatics | Stanford University | 2010 |
| Raphael Godefroy | Ph.D. in Economics | Stanford University | 2010 |
| Neal Mahoney | Ph.D. in Economics | Stanford University | 2011 |
| Alex Wong | Ph.D. in Economics | Stanford University | 2012 |
| Kelvin Tan | Ph.D. in Management Science | Stanford University | 2012 |
| Animesh Mukherjee | Masters in Liberal Arts Program | Stanford University | 2012 |
| Jeanne Hurley | Masters in Liberal Arts Program | Stanford University | 2012 |
| Patricia Foo | Ph.D. in Economics | Stanford University | 2013 |
| Michael Dworsky | Ph.D. in Economics | Stanford University | 2013 |
| Allison Holliday King | Masters in Liberal Arts Program | Stanford University | 2013 |
| Vilsa Curto | Ph.D. in Economics | Stanford University | 2015 |
| Rita Hamad | Ph.D. in Epidemiology | Stanford University | 2016 |
| Atul Gupta | Ph.D. in Economics | Stanford University | 2017 |
| Min Kim | Ph.D. in Economics | Iowa State Univ. | 2019 |

## E. GRANTS AND PATENTS

PATENT (2)

1. "Environmental Biomarkers for the Diagnosis and Prognosis for Type 2 Diabetes Mellitus" with Atul Butte and Chirag Patel (2011), US Patent (pending).

2. "Health Cost and Flexible Spending Account Calculator" with Schoenbaum M, Spranca M, and Sood N (2008), U.S. Patent No. 7,426,474.

GRANTS AND SUBCONTRACTS (42)

CURRENT (6)

| | |
|---|---|
| 2019-2020 | Funder: Acumen, LLC.<br>Title: Quality Reporting Program Support for the Long-Term Care Hospital, Inpatient Rehabilitation Facility, Skilled Nursing Facility QRPs and Nursing Home Compare<br>Role: PI |
| 2018-2020 | Funder: Acumen, LLC.<br>Title: Surveillance Activities of Biologics<br>Role: PI |
| 2018-2020 | Funder: France-Stanford Center for Interdisciplinary Studies<br>Title: A Nutritional Account of Global Trade: Determinants and Health Implications<br>Role: PI |
| 2017-2023 | Funder: National Institutes of Health<br>Title: The Epidemiology and Economics of Chronic Back Pain<br>Role: Investigator (PI: Sun) |
| 2017-2021 | Funder: National Institutes of Health<br>Title: Big Data Analysis of HIV Risk and Epidemiology in Sub-Saharan Africa<br>Role: Investigator (PI: Bendavid) |
| 2016-2020 | Funder: Acumen, LLC.<br>Title: MACRA Episode Groups and Resource Use Measures II<br>Role: PI |

PREVIOUS (36)

| | |
|---|---|
| 2016-2018 | Funder: University of Kentucky<br>Title: Food acquisition and health outcomes among new SNAP recipients since the Great Recession<br>Role: PI |
| 2015-2019 | Funder: Alfred P. Sloan Foundation<br>Title: Public versus Private Provision of Health Insurance<br>Role: PI |
| 2015-2019 | Funder: Natural Science Foundation<br>Title: Health Insurance Competition and Healthcare Costs<br>Role: Investigator (PI: Levin) |
| 2014-2015 | Funder: The Centers for Medicare and Medicaid Services<br>Title: Effect of Social Isolation and Loneliness on Healthcare Utilization<br>Role: PI |

| | |
|---|---|
| 2014-2015 | Funder: AARP<br>Title: The Effect of Social Isolation and Loneliness on Healthcare Utilization and Spending among Medicare Beneficiaries<br>Role: PI |
| 2013-2019 | Funder: National Bureau of Economic Research<br>Title: Innovations in an Aging Society<br>Role: PI |
| 2013-2014 | Funder: Robert Wood Johnson Foundation<br>Title: Improving Health eating among Children through Changes in Supplemental Nutrition Assistance Program (SNAP)<br>Role: Investigator (PI: Basu) |
| 2011-2016 | Funder: National Institutes of Health (R37)<br>Title: Estimating the Potential Medicare Savings from Comparative Effectiveness Research<br>Role: PI Subaward (PI: Garber) |
| 2011-2016 | Funder: National Institute of Aging (P01)<br>Title: Improving Health and Health Care for Minority and Aging Populations<br>Role: PI Subcontract (PI: Wise) |

| | |
|---|---|
| 2010-2018 | Funder: National Institutes of Health<br>Title: Clinic, Family & Community Collaboration to Treat Overweight and Obese Children<br>Role: Investigator (PI: Robinson) |
| 2010-2014 | Funder: Agency for Health, Research and Quality (R01)<br>Title: The Effects of Private Health Insurance in Publicly Funded Programs<br>Role: Investigator (PI: Bundorf) |
| 2010-2013 | Funder: Agency for Healthcare Research and Quality<br>Title: G-code" Reimbursement and Outcomes in Hemodialysis<br>Role: Investigator (PI: Erickson) |
| 2010-2013 | Funder: University of Southern California<br>Title: The California Medicare Research and Policy Center<br>Role: PI |
| 2010-2012 | Funder: University of Georgia<br>Title: Natural Experiments and RCT Generalizability: The Woman's Health Initiative<br>Role: PI |
| 2010-2011 | Funder: National Bureau of Economic Research<br>Title: Racial Disparities in Health Care and Health Among the Elderly<br>Role: PI |
| 2009-2020 | Funder: National Institute of Aging (P30)<br>Title: Center on the Demography and Economics of Health and Aging<br>Role: PI (2011-2020) |
| 2009-2011 | Funder: Rand Corporation<br>Title: Natural Experiments and RCT Generalizability: The Woman's Health Initiative<br>Role: PI |
| 2008-2013 | Funder: American Heart Association<br>Title: AHA-PRT Outcomes Research Center<br>Role: Investigator (PI: Hlatky) |
| 2007-2009 | Funder: National Institute of Aging (R01)<br>Title: The Economics of Obesity<br>Role: PI |
| 2007-2009 | Funder: Veterans Administration, Health Services Research and Development Service<br>Title: Quality of Practices for Lung Cancer Diagnosis and Staging<br>Role: Investigator |
| 2007-2008 | Funder: Stanford Center for Demography and Economics of Health and Aging<br>Title: The HIV Epidemic in Africa and the Orphaned Elderly |

Role: PI

2007 Funder: University of Southern California
Title: The Changes in Health Care Financing and Organization Initiative
Role: PI

2006-2010 Funder: National Institute of Aging (K02)
Title: Health Insurance Provision for Vulnerable Populations
Role: PI

2006-2010 Funder: Columbia University/Yale University
Title: Dummy Endogenous Variables in Threshold Crossing Models, with Applications to Health Economics
Role: PI

2006-2007 Funder: Stanford Center for Demography and Economics of Health and Aging
Title: Obesity, Wages, and Health Insurance
Role: PI

2005-2009 Funder: National Institute of Aging (P01 Subproject)
Title: Medical Care for the Disabled Elderly
Role: Investigator (PI: Garber)

2005-2008 Funder: National Institute of Aging (R01)
Title: Whom Does Medicare Benefit?
Role: PI Subcontract (PI: Lakdawalla)

2002 Funder: Stanford Center for Demography and Economics of Health and Aging
Title: Explaining Changes in Disability Prevalence Among Younger and Older American Populations
Role: PI

2001-2003 Funder: Agency for Healthcare Research and Quality (R01)
Title: State and Federal Policy and Outcomes for HIV+ Adults
Role: PI Subcontract (PI: Goldman)

2001-2002 Funder: National Institute of Aging (R03)
Title: The Economics of Viatical Settlements
Role: PI

2001-2002 Funder: Robert Woods Johnson Foundation
Title: The Effects of Medicare Eligibility on Participation in Social Security Disability Insurance
Role: PI Subcontract (PI: Schoenbaum)

2001-2002 Funder: USDA
Title: Evaluating the Impact of School Breakfast and Lunch
Role: Investigator

2001-2002 Funder: Northwestern/Univ. of Chicago Joint Center on Poverty
Title: The Allocation of Nutrition with Poor American Families
Role: PI Subcontract (PI: Haider)

2000-2002 Funder: National Institute on Alcohol Abuse & Alcoholism (R03)
Title: The Demand for Alcohol Treatment Services
Role: PI

2000-2001 Funder: USDA
Title: How Should We Measure Hunger?

Role: PI Subcontract (PI: Haider)

## F. SCHOLARSHIPS AND HONORS

- Phi Beta Kappa Honor Society, 1988
- Distinction and Departmental Honors in Economics, Stanford University, 1990
- Michael Forman Fellowship in Economics, Stanford University, 1991-1992
- Agency for Health Care Policy and Research Fellowship 1993-1995
- Outstanding Teaching Assistant Award, Stanford University, Economics, 1994
- Center for Economic Policy Research, Olin Dissertation Fellowship, 1997-1998
- Distinguished Award for Exceptional Contributions to Education in Medicine, Stanford University, 2005, 2007, and 2013.
- Dennis Aigner Award for the best applied paper published in the *Journal of Econometrics*, 2013

**SIMON JAMES THORNLEY**

# CV: Simon James Thornley

| 1a. Personal details | | | | |
|---|---|---|---|---|
| **Full name** | **Dr** | **Simon** | **James** | **Thornley** |
| **Present position** | Epidemiologist; Senior Lecturer; Senior Research Fellow | | | |
| **Organisation/Employer** | Auckland Regional Public Health Service; The University of Auckland; Auckland University of Technology. | | | |
| **Contact Address** | 1/8 Puriri Ave, Greenlane, Auckland 1051 | | | |
| | New Zealand. | | | |
| | | | | |
| **Work telephone** | 0212991752 | **Mobile** | 0212991752 | |
| **Email** | sithor@gmail.com | | | |
| **Personal website** | https://unidirectory.auckland.ac.nz/profile/s-thornley | | | |
| **Date of birth** | 30 July 1975 | | | |

## 1b. Academic qualifications

1997 Bachelor of Human Biology, University of Auckland
2000 MBChB, University of Auckland
2006 Master of Public Health (first class honours), University of Auckland
2008 Fellow of the Australasian Faculty of Public Health Medicine
2008 Fellow of the New Zealand College of Public Health Medicine
2014 PhD (Medicine), University of Auckland.

## 1c. Professional positions held

2000 – 2002 House Officer, Auckland Hospitals
2003 – 2005 Adult Medicine Registrar, Auckland Hospitals.
2006 Public Health Medicine Basic Trainee, New Zealand College of Public Health Medicine
2006 -2007 Research Fellow, Clinical Trials Research Unit, University of Auckland.
2007-2008 Public Health Medicine Advanced Trainee, Auckland Regional Public Health Service
2008 Public Health Medicine Advanced Trainee, Counties Manukau District Health Board.
2009 to 2016 Assistant Research Fellow/Public Health Physician. Section of Epidemiology and Biostatistics, University of Auckland
2009 to 2011. Smoking Cessation Consultant, Quit Group.
2010 to 2014. Professional teaching fellow and PhD student, Section of Epidemiology and Biostatistics, University of Auckland
2012 Expert witness (epidemiology), Crown Law (NZ)
2014 to 2016. Epidemiologist, Auckland Regional Public Health Service (0.2 FTE)
2014 to 2017 Public Health Physician, Population Health Team and Māori Health Development Counties Manukau District Health Board (0.8 FTE)
2014 to present. Contracting epidemiologist to the Royal New Zealand Foundation for the Blind.
2016. Contracting epidemiologist, Auckland Regional Public Health Service.

2017 (current) Epidemiologist, Auckland Regional Public Health Service (0.4 FTE)
2017 (current) Senior Lecturer (level 5), University of Auckland (0.4 FTE)
2017 (current) Senior Research Fellow, Auckland University of Technology (0.2 FTE)
2020 (current) Senior Lecturer (over the bar) University of Auckland (1.0 FTE)
2020 Consultant to Auckland International Airport Inc.

**Teaching**

2012 to 2014 Course Co-ordinator, Principles of Applied Epidemiology, POPLHLTH 304.

2012 to 2014 Supervisor, Bachelor of Health Science Student Internship programme

2012-2014 Member Population Health Intensive steering group. MBChB V course.

2012 to present Guest lecturer, various undergraduate and postgraduate courses in the University of Auckland and Auckland University Technology (FOOD SCI 714 Research Methodologies in Food Safety, POPLHLTH 103G, Epidemics: From Black Plague to Bioterrorism, SPEX801 Applied Nutrition and Exercise Science, POPLHLTH 760 – Principles of Public Health). POPLHLTH 303 Health Informatics.

2018 Guest Lecturer Certificate in Public Health and Health Promotion, Manukau Institute of Technology (Friday 22nd June 2018).

2017 Co-course co-ordinator POPLHLTH 724 Quality in HealthCare; Co-ordinator of Quality component of MBChB V course.

2018 to 2020 Course co-ordinator POPLHLTH 709 Evidence for best practice, which incorporates half of the Pharmacy 764: Medicines Information and Critical Appraisal course.

2018 to present Guest Lecturer POPLHLTH 312 Health and Pacific People in NZ.

2018 to present Guest Lecturer POPLHLTH 303 Health Informatics

2019 to present: Course co-ordinator POPLHLTH 304 Principles of Applied Epidemiology.

2020 to present: Course co-ordinator POPLHLTH 216 Essential Epidemiology

2018 to 2019 Population Health Intensive Week Assessor MBChB V

| **1d. Present research/professional speciality** |
|---|

Simon is a public health medicine specialist and epidemiologist with considerable experience in the areas of scabies and rheumatic fever incidence, smoking cessation, cardiovascular health, nutrition and injury prevention research. He is an experienced data analyst and user of R software.

| **1e. Total years research experience** | 12 years |
|---|---|

| **1f. Professional distinctions and memberships (including honours, prizes, scholarships, boards or governance roles, etc)** |
|---|

2020 Top cited article in *Journal of Paediatrics and Child Health* for 2018 and 2019 (Thornley, S., Marshall, R., Jarrett, P., Sundborn, G., Reynolds, E., & Schofield, G. (2018). Scabies is strongly associated with acute rheumatic fever in a cohort study of Auckland children. Journal of Paediatrics and Child Health.)

2017 Runner up, Health Informatics New Zealand, Clinicians' Challenge, with a project entitled: 'internet-of-things ketone breath sensor'.
2014 to present. Health Research Council scientific assessing committee member
2014 Early career researcher award. Australasian Epidemiology Association.
2013 Student prize. Australasian Epidemiology Association.
2013 to present. Founding member of FIZZ [advocacy group: **F**ighting **S**ugar in **S**oft **D**rinks] (along with conference steering committee).
2008 Fellow of the Australasian Faculty of Public Health Medicine;
Fellow of the New Zealand College of Public Health Medicine.
2007- Present. Member Australasian Epidemiological Association
1997. Kingsley Mortimer Memorial Prize in Anatomy. Auckland University.

| **1g. Total number of *peer reviewed* publications and patents** | Journal articles | Books, book chapters, books edited | Conference proceedings |
|---|---|---|---|
| | 56 | 2 | 11 |

**PART 2**

## 2a. Research publications and dissemination

Peer-reviewed journal articles

**Thornley S**, Bach K, Bird A, Farrar R, Bronte S, Turton B, Atatoa-Carr P, Fa'alili-Fidow J, Morton S, Grant C. What factors are associated with early childhood dental caries? A longitudinal study of the Growing Up in New Zealand cohort. Int J Paediatr Dent. 2020 Jun 30.

Rodda SN, Booth N, Brittain M, McKean J, **Thornley S**. I was truly addicted to sugar: A consumer-focused classification system of behaviour change strategies for sugar reduction. Appetite. 2020 Jan 1;144:104456.

Dirks KN, Chester A, Salmond JA, Talbot N, **Thornley S**, Davy P. Arsenic in Hair as a Marker of Exposure to Smoke from the Burning of Treated Wood in Domestic Wood Burners. International Journal of Environmental Research and Public Health. 2020 Jan;17(11):3944.

**Thornley S**, King R, Marshall R, et al. How strong is the relationship between scabies and acute rheumatic fever? An analysis of neighbourhood factors. J Paediatr Child Health 2019.

**Thornley S**, Schofield G, Zinn C, Henderson G. How reliable is the statistical evidence for limiting saturated fat intake? A fresh look at the influential Hooper meta-analysis. Intern Med J 2019. epub ahead of print.

Shackleton N, Broadbent JM, **Thornley S**, et al. Inequalities in dental caries experience among 4-year-old New Zealand children. Community Dent Oral Epidemiol 2018;46(3):288-96.

**Thornley, S.**, Marshall, R., Jarrett, P., Sundborn, G., Reynolds, E., & Schofield, G. (2018). Scabies is strongly associated with acute rheumatic fever in a cohort study of Auckland children. Journal of Paediatrics and Child Health.

**Thornley, S.**, et al. The effect of a school nutrition policy on dental caries: a study of a primary school with a low sugar policy compared to surrounding schools. J Paediatr Child Health 2017; May;53(5):494-499.

**Thornley, S** and Marshall R. Lack of housing, hospital treatment and premature mortality: a cohort study of people in Counties Manukau district. The New Zealand Medical Journal 129.1440 (2016): 84.

**Thornley, S.**, et al. Sugar, dental caries and the incidence of acute rheumatic fever: a cohort study of Māori and Pacific children. J Epidemiol Community Health 2016; 0:1–7.

Schofield, G., et al. Very low-carbohydrate diets in the management of diabetes revisited. N Z Med J 2016; 129: 1432.

**Thornley, S.**, et al. Mass Shock-dosing of Cooling Towers in Response to A Legionella pneumophila Outbreak: Did it Work? J Biomet Biostat; 2015; 6:250

Reynolds, G., et al. Analysis of the Auckland 2014 measles outbreak indicates that adolescents and young adults could benefit from catch-up vaccination. N Z Med J 2015; 128(1422): 53-62.

Murphy R, **Thornley S**, et al. Sugar Sweetened Beverage Consumption among Adults with Gout or Type-2 Diabetes. PLoS One 2015; 10(5): e0125543.

**Thornley S**., et al. Alcohol intake, marijuana use, and sleep deprivation on the risk of falls occurring at home among young and middle-aged adults: a case-crossover study. N Z Med J; 2014; 127(1406): 32-38.

**Thornley S,** Sundborn G. The case to ban sugary food and drink from schools: these products are addictive, and kids will learn best without them. Pac Health Dialog 2014; 20(1).

**Thornley S**, et al. Rheumatic fever in New Zealand: what are the teeth trying to tell us? Pac Health Dialog 2014; 20(1).

**Thornley S,** Sundborn G. The story of FiZZ: an advocacy group to end the sale of sugar sweetened beverages in New Zealand. Pac Health Dialog 2014; 20(1).

**Thornley S**, et al. Alcohol intake, marijuana use, and sleep deprivation on the risk of falls occurring at home among young and middle aged adults: a case-crossover study. N Z Med J 2014; 127(1406): 32-38.

Grey C, Jackson R, Wells S, **Thornley S** et al. Maintenance of statin use over 3 years following acute coronary syndromes: a national data linkage study (ANZACS-QI-2). Heart 2014;100(10):770-4.

**Thornley** S, Marshall RJ, Wells S, Jackson R. Using Directed Acyclic Graphs for Investigating Causal Paths for Cardiovascular Disease. J Biomet Biostat 2013;4(182)

**Thornley, S**., K. N. Dirks, et al. Indoor air pollution levels were halved as a result of a national tobacco ban in a New Zealand prison. Nicotine Tob Res 2013; **15**(2): 343-347.

**Thornley, S**., R. J. Marshall, et al. Is serum urate causally associated with incident cardiovascular disease? Rheumatology 2013; 52(1): 135-142.

Jackson, G., C. Wright, et al. Potential unmet need for gout diagnosis and treatment: capture-recapture analysis of a national administrative dataset. Rheumatology 2012; 51(10): 1820-1824.

Mehta, S., S. Wells, et al.. Initiation and maintenance of cardiovascular medications following cardiovascular risk assessment in a large primary care cohort: PREDICT CVD-16. Eur J Prev Cardiol 2014; 21(2):192-202.

Winnard, D., C. Wright, et al. National prevalence of gout derived from administrative health data in Aotearoa New Zealand. Rheumatology 2012; 51(5): 901-909.

**Thornley S** et al. Sugar restriction: the evidence for a drug-free intervention to reduce cardiovascular disease risk. Intern Med J 2012; 42 Suppl 5: 46-58.

Ghias M, Pervaiz M, **Thornley S**, Marshall R. Statistical Modelling and Analysis of Risk Factors for Hepatitis C Infection In Punjab, Pakistan. World Applied Sciences Journal 2012; 20(2):241-52.

Ghias M, Pervaiz M, **Thornley S**, Marshall R. Identification of Risk Factors for Hepatitis C Infection in the Gujranwala District of Punjab, Pakistan. World Applied Sciences Journal 2012; 20(1):94-101.

Lawes CMM, **Thornley S** et al. Statin use in COPD patients is associated with a reduction in mortality: a national cohort study. Prim Care Respir J 2012; 21(1):35-40.

Sundborn, G., et al. The 'Endgame' for sugar sweetened beverages. Obesity Research & Clinical Practice 2012; 6: 62-63.

Chang E, Tsang B, **Thornley S**. Language barriers in the community pharmacy: a survey of northern and western Auckland. J Prim Health Care 2011;3(2):102-6.

**Thornley S** et al. Can the prevalence of diagnosed diabetes be estimated from linked national health records? The validity of a method applied in New Zealand. J Prim Health Care. 2011 3(4):262-8.

**Thornley S**, Stewart A, Marshall R, Jackson R. Per capita sugar consumption is associated with severe childhood asthma: an ecological study of 53 countries. Prim Care Respir J 2011;20(1):75-8.

**Thornley S**, Russell B, Kydd R. Carbohydrate reward and psychosis: an explanation for neuroleptic induced weight gain and path to improved mental health? Current Neuropharmacology 2011; 9:370-375.

Jonas MF, **Thornley SJ**. Smoky Rooms and Fuzzy Harms: How Should the Law Respond to Harmful Parental Practices? Public Health Ethics 2011; doi: 10.1093/phe/phr023

Jackson G, **Thornley S**, Woolston J, Papa D, Bernacchi A, Moore T. Reduced acute hospitalisation with the healthy housing programme. J Epidemiol Community Health 2011;65(7):588-93.

Mehta S, Wells S, Riddell T, Kerr A, Pylypchuk R, Marshall R, Marshall, R, Ameratunga S, Chan W C, **Thornley S** et al. Under-utilisation of preventive medication in patients with cardiovascular disease is greatest in younger age groups (PREDICT-CVD 15). J Prim Health Care 2011;3(2):93-101.

**Thornley, S.**, et al. Alcohol and risk of admission to hospital for unintentional cutting or piercing injuries at home: a population-based case-crossover study. BMC Public Health 2012; 11(1): 852.

**Thornley S**, et al. Four out of ten patients are not taking statins regularly during the 12 months after an acute coronary event. Eur J Cardiovascular Prev Rehabil 2012; 19(3):349-57.

McRobbie H, **Thornley S** et al. A randomised trial of the effects of two novel nicotine replacement therapies on tobacco withdrawal symptoms and user satisfaction. Addiction 2010; 19: 98-103.

Bullen C, McRobbie H, **Thornley S** et al. Effect of an electronic cigarette on desire to smoke and withdrawal, user preferences and nicotine delivery: randomised cross-over trial. Tobacco Control 2010; 19: 98-103.

**Thornley S**, Marshall R, Jackson G, Smith J, Chan W, Wright C, et al. Estimating diabetes prevalence in South Auckland: how accurate is a method that combines lists of linked health datasets? N Z Med J 2010;123(1327):76-86.

**Thornley S**, McRobbie H, Eyles H, Walker N, Simmons G. The obesity epidemic: is glycemic index the key to unlocking a hidden addiction? Medical Hypotheses 2008; 71:709-714

**Thornley S**, Bullen C, Roberts M. Hepatitis B in a high prevalence New Zealand population: A mathematical model applied to infection control policy. Journal of Theoretical Biology 2008; doi:10.1016/j.jtbi.2008.06.022

**Thornley S**, McRobbie H, Lin RB, Bullen C, Hajek P, Laugesen M, Senior H, Whittaker R. A single blind, randomized, crossover trial of the effects of a nicotine pouch on the relief of tobacco withdrawal symptoms and user satisfaction. Nicotine and Tobacco Research. 2009: ntp054

Tin Tin S, Woodward A, **Thornley S**, Ameratunga S. Cycling and walking to work in New Zealand, 1991-2006: regional and individual differences, and pointers to effective interventions. Int J Behav Nutr Phys Act 2009; 6:64.

Tin Tin S, Woodward A, **Thornley S** et al. Cyclists' attitudes toward policies encouraging bicycle travel: findings from the Taupo Bicycle Study in New Zealand. Health Promot Int 2010; 25(1):54-62.

**Thornley S**, Jackson G, McRobbie H, Sinclair S, Smith J Few smokers in South Auckland access subsidised nicotine replacement therapy. 2010; N Z Med J 123(1308):1-12

**Thornley S**, McRobbie H, Jackson G. The New Zealand sugar (fructose) fountain: time to turn the tide? N Z Med J 2010;123(1311):58-64.

Smith J, Jackson G, Orr-Walker B, Jackson R, Sinclair S, **Thornley S**, et al. A population-based approach to the estimation of diabetes prevalence and health resource utilisation. N Z Med J 2010;123(1310):62-73.

McRobbie H, **Thornley S**. The importance of treating tobacco dependence. Revista Española de Cardiologia 2008;61(6):620-8

**Thornley SJ**, Woodward A, Langley JD, Ameratunga SN, Rodgers A. Conspicuity and bicycle crashes: preliminary findings of the Taupo Bicycle Study. Inj Prev 2008, 14:11-18.

Novak B, Bullen C, Howden-Chapman P, **Thornley S**. Blue collar workplaces: an opportunity to reduce heart health inequalities. N Z Med J 2007; 120(1261):1-10

**Thornley S**. Windsor JA. The role of surgery in the management of obesity. N Z Med J 1998; 111(1078):445-8

**Editorials**

**Thornley, S**. Causation and Statistical Prediction: Perfect Strangers or Bedfellows?" J Biomet Biostat 2012; 3: 7.

**Thornley, S**. and R. Marshall "Measures of association in epidemiological studies: how best to compare discrete and continuous variables?" J Biomet Biostat 2012; 3: e111

**Letters and electronic comments to the editor**

**Thornley S**, Jackson D, Sundborn G. Masks, media, fact checkers and the interpretation of scientific evidence. *BMJ* 2020;371:m4586

Lee A, **Thornley S**, Morris AJ, Sundborn G. Should countries aim for elimination in the covid-19 pandemic? *BMJ*. 2020 Sep 9; 370.

**Thornley S,** Morris AJ, Sundborn G, Bailey S. How fatal is covid-19 compared with seasonal influenza? The devil is in the detail. *BMJ* 2020;371:m3883

**Thornley, S**., et al. (2018). Is impetigo a missed opportunity for scabies treatment? N Z Med J 131(1481): 78-81.

**Thornley S,** Henderson G, Schofield G. Meta-analysis in research on nutrition. JAMA 2018 13;319(10):1050

Sundborn, G., **Thornley S**. et al. (2017). "Policy brief: a sugary drink tax for New Zealand and 10,000-strong petition snubbed by Minister of Health and National Government." N Z Med J 130(1462): 114. (peer reviewed)

Sundborn, G. **Thornley, S**. et al. New Zealand infants weaned onto a high sugar diet from four months old: better health or better business? Part II. The New Zealand Medical Journal 2017 *In press* (peer reviewed)

Sundborn G, **Thornley S**, et al. Better health or better business: a critique of the childhood obesity plan. N Z Med J 2016; 129(1440):145-148. (peer reviewed)

Reynolds, R., Grant, N., **Thornley S** et al. Low uptake of maternal vaccination in notified pertussis cases aged less than 20 weeks. N Z Med J 2017; 130(1449):72-74 (peer reviewed).

**Thornley, S**., et al. Alcohol availability and sponsorship: integrating research and community voices to shape better public policy. N Z Med J 2014; 127(1401): 118-120.

**Thornley, S**., et al. Chewing the saturated fat: how many more negative studies do we need? N Z Med J 2015; 128(1421): 80-81.

Sundborn G, **Thornley S**, et al. New Zealand's growing thirst for a sugar-sweetened beverage tax. N Z Med J 2015; 128(1422): 80-82.

**Thornley S**, Henderson G, Schofield G. Chewing the saturated fat: should we or

shouldn't we? N Z Med J 2014; 127(1394):94-6.

Sundborn G, **Thornley S**, Te Morenga L, Merriman T. FIZZ Sugary Drink Free Pacific by 2030--Symposium Declaration. N Z Med J 2014; 127(1392):98-101

**Thornley SJ**, Barzi F. Faulty logic justifies aspirin use for primary prevention of cardiovascular disease. BMJ 2013;347.

Collinson L, Wilson N, Edwards R, Thomson G, **Thornley S**. New Zealand's smokefree prison policy appears to be working well: one year on. N Z Med J 2012; 125(1357):164-8.

Sundborn G, **Thornley S**, Jackson R. FIZZ: a new advocacy group to Fight Sugar in Soft-drinks. N Z Med J 2013; 126(1374):107-8.

Sundborn G, **Thornley S**, Jackson R. Coke's anti-obesity campaign: a FIZZ or not? N. Z. Med. J. 2013;126(1379):106-8.

**Thornley S**, McRobbie H. Carbohydrate withdrawal: is recognition the first step to recovery? N Z Med J 2009; 122(1290)

Jackson G, **Thornley S**. Burden of novel influenza A virus (H1N1) in Auckland and Counties Manukau District Heath Boards (July 2009): a capture-recapture analysis. N Z Med J 2009; 122(1301):66-9.

Bullen C, McRobbie H, **Thornley S**, Walker N, Whittaker R. Working with what we have before getting into bed with the tobacco industry. N Z Med J 2006; 119(1240):U2139.

Peer reviewed books, book chapters, books edited

McRobbie H, **Thornley S**. Nicotine Delivery Systems for Smoking Cessation *in* Encyclopedia of Addiction. 2008.

**Thornley S**. Sweeteners, glycemic index, addiction and the obesity epidemic: are they linked? Book Chapter in *" Sweeteners: Uses, Dietary intake, and Health Effects"*. Nova 2009.

**Refereed Conference Proceedings**

McRobbie H, **Thornley S**, Bullen, C, Hajek P, Laugesen M, Lin RB, Senior H, Whittaker R. The effects of three novel nicotine replacement therapies on the relief of tobacco withdrawal symptoms and user satisfaction. Society for Research on Nicotine and Tobacco 14th Annual Scientific Meeting. February 27 to March 1st 2008 Portland Oregon, USA.

**Thornley S**, Walker N, McRobbie H, Eyles H, Simmons G. The obesity epidemic: is glycemic index the key to unlocking a hidden addiction? Dangerous Consumptions Colloquium VI, University of Auckland. December 4-5. Auckland, New Zealand.

**Thornley S**. Effect of an E-Cigarette on Cravings and Withdrawal, Acceptability and Nicotine Delivery: Randomised Cross-Over Trial. 2009 Joint Conference of SRNT and SRNT-Europe April, 27-30 2009

**Thornley S**. Marshall R, Jackson R. Algorithms to Investigate Causal Paths to Explain the Incidence of Cardiovascular Disease. Oral presentation. AEA Scientific Meeting 2013. 20 to 24 October 2013. Brisbane, Australia.

**Thornley S**. Are Models Useful to Identify People for Preventive Treatment for Cardiovascular Disease? Poster presentation. AEA Scientific Meeting 2013. 20 to 24 October 2013. Brisbane, Australia.

**Thornley S.** Sugar addiction: evidence and relevance. Invited presentation. FIZZ Conference. 19th and 20th February 2014. Auckland, New Zealand.

**Thornley S,** Marshall R, Barzi F. Is publication bias present in the reported beneficial effects of statins for the primary prevention of cardiovascular disease? AEA conference 8-10 October 2014. Auckland, NZ.

**Thornley S**. Sugar, dental caries, and acute rheumatic fever: what is the link? FIZZ conference. Manukau Institute of Technology. October 2015.

**Thornley S**. Can improved diet and dental health prevent Rheumatic Fever? [Invited presentation]. University of Otago (Wellington School of Medicine) Summer School. 9 February 2016.

**Thornley S**, Gordon K, Shelton C. Estimating the prevalence of blindness and low vision in New Zealand using capture-recapture methods. Royal Australasian College of Ophthalmologists New Zealand Annual Branch Scientific Meeting. Dunedin. 27-28 May 2016.

**Thornley S**. What is the effect of a school nutrition policy on the oral health of its students? He Huliau International Indigenous Health Symposium. Hilton Hawai'ian Village, Honolulu, Hawai'i. 13-14 October, 2016.

**Thornley S**. Does a school nutrition policy improve the oral health of students? 10th National Oral Health Promotion Forum. New Zealand Dental Association. NZDA House, Building 1, 195 Main Highway, Ellerslie, Auckland. 12 April 2017.

**Thornley S**. Role of skin infections and scabies. Update on Rheumatic Fever prevention and control. 12 February 2019. University of Otago Wellington Medical School.



**Thornley S**. Saturated fat and heart health: a fresh look at the epidemiological evidence. Australasian Society of Lifestyle Medicine. 7 June 2019. Grand Millennium Auckland, New Zealand.

Other forms of dissemination (reports for clients, technical reports, popular press, etc)

**Book**

Thornley S, McRobbie H. Sickly Sweet: Sugar, Refined Carbohydrate, Addiction and Global Obesity. Nova, New York, 2011.

**Software**

**PubBias version 1.0:** Contributed library for the R software package, which implements an exploratory test for publication bias in meta-analyses.

**Conference presentation (not refereed)**

**Thornley S.** An epidemiologist's take on covid-19. Plan B covid science and policy symposium. Webinar. August 17, 2020. https://www.youtube.com/watch?v=Rt5GlK-5UtU&feature=emb_title

**Thornley S**. Why is scabies a likely cause of acute rheumatic fever? 13 September 2019. Improving Scabies Control Symposium. University of Auckland. Glen Innes, Auckland. https://www.youtube.com/watch?v=1QnGC9FDi6w&feature=emb_title

**Thornley S**. Has Dietary Research Helped Us With Our Food Choices? Invited oral presentation. Low carb down under. Sat 24th November 2012. Sydney, Australia.

**Thornley S.** Carbohydrate addiction. Lowcarb NZ conference. Oral presentation. 21st February 2014. Auckland, New Zealand.

**Thornley S**. Sugar, dental caries and rheumatic fever: What is the link? Invited oral presentation. FIZZ Conference. Manukau Institute of Technology. 7 October 2015.

**Thornley S**. Does a school nutrition policy affect the oral health of its students? FIZZ conference. Invited oral presentation. 11 October 2016. Wellington School of Medicine, University of Otago. 22 March 2017.

**Thornley S**. Managing the exposure of Legionnaires' disease. Invited oral presentation. Safety 360 Conference. Ellerslie Function Centre. 21 March 2017.

**Thornley S**. Ask the specialist: Q & A Clinic - Common and unique occupational health risks. Panel discussion. Safety 360 Conference. Ellerslie Function Centre. 21 March 2017.

**Thornley S**. Lack of housing, scabies and rheumatic fever. Invited oral presentation. Tōmaiora Seminar. School of Population Health, The University of Auckland. 21 March 2017.

**Thornley S**. Low sugar nutrition policies and dental caries – Yendarra school study results. Invited oral presentation. 10th National Oral Health Promotion Forum. New Zealand Dental Association House, Ellerslie, Auckland. 12 April 2017.

**Thornley S**. Lack of housing, scabies and rheumatic fever. Invited oral presentation. Mana Kidz Nursing Training Day. Ko Awatea, Middlemore Hospital. 20 April 2017.

**Thornley S**. Why is sugar a problem? Invited oral presentation. Practice Nurse and

General Practitioner Continuing Medical Education. Total Healthcare, Mt Eden, May 9th 2018.

**Thornley S**. Scabies and rheumatic fever. Manukau Institute of Technology. Pasifika Community Centre, North Campus. Certificate in Public Health and Health Promotion. 22 June 2018.

**Thornley S**. Is scabies the cause of acute rheumatic fever? Appraising Rheumatic Fever & Rheumatic Heart Disease Control in New Zealand. 19 August 2019. Ko Awatea, 100 Hospital Rd, Auckland.

Successful Grant Applications

| Year | Granting body, Title (role in grant) | Nature of Grant | Amount |
|---|---|---|---|
| 2011-2014 | Health Research Council (Principal investigator) Cardiovascular disease risk prediction in the era of effective drug treatment. | Clinical Research Training Fellowship (ref: 11/145) | NZ$250,000 |
| 2018 | School of Population Health PBRF Teledermatology for scabies. | Seeding Grant | NZ$10,000 |
| 2016 | Health Research Council - Prevention of Childhood Obesity through Sugar Reduction (Investigator) | NZ-US Enabling Grant (ref: 17/641) | NZ$37,181 |
| 2013 | School of Population Health- Investigation of the effects of a prison smoking ban on indoor quality (Principal investigator) | Internal Research fund | NZ$1,000 |
| 2008 | National Heart Foundation (Principal Investigator) | Travel grant | NZ$3,000 |

**Student Supervision**

| Year | Institution/ Course | Students | Degree | Topic |
|---|---|---|---|---|
| 2012 | University of Auckland POPLHLTH 302 Health Services Placement | Sakshi Kalani Hale Faiumu | Bachelor of Health Sciences | Analysis of trends in Blind Foundation Membership |
| 2013 | University of Auckland POPLHLTH 302 Health Services Placement | Saphiya Zaza Lauren Whitworth | Bachelor of Health Sciences | Developing a position statement on the place of sugar in the diet of New Zealanders |
| 2015 | University of Auckland Master of Public Health thesis | Win Le Shwe Sin Ei | Master of Public Health | Is Dental Caries a Risk Factor for Acute Rheumatic Fever in New Zealand? |
| 2015-ongoing | Auckland University of Technology | Cliff Harvey | Doctor of Philosophy | Variability in responses to keto-induction and individual tolerance to low-carbohydrate diets |

**ROGER HODKINSON**

# Curriculum Vitae
# Dr. Roger Hodkinson
## M.A., M.B., B.Chir.(Cantab), FRCPC, FCAP

EDUCATION

- State Grammar School, UK. 'A' and 'S' Levels with Distinction
- 1962–64 Cambridge University, UK. (Corpus Christi College)
- 1966–68 University College Hospital Medical School, London, UK.

PROFESSIONAL TRAINING

- 1970–73 Pathology Residency, University of British Columbia, Vancouver, British Columbia, Canada

AWARDS AND SCHOLARSHIPS

- Scholarship to Corpus Christi College, Cambridge University, UK
- 1994 Citizen of the Year Award, Edmonton, Alberta Canada
- Lifetime (25 year) Service Award, Action on Smoking and Health

PROFESSIONAL SOCIETIES AND MEMBERSHIPS

- Registered Medical Practitioner with the College of Physicians and Surgeons of Alberta, Canada, the Medical Council of Canada, and the General Medical Council (UK). All in good standing.
- Fellow, College of American Pathologists (current)
- Fellow, Royal College of Physicians of Canada, Ottawa, Canada (current)
- Past President, Alberta Society of Laboratory Physicians

OTHER SOCIETIES AND MEMBERSHIPS

- Action on Smoking and Health, Edmonton, Alberta, Canada. Past Honorary Chairman
- The Winston Spencer Churchill Society, Edmonton, Canada. Past President
- En-Garde Fencing Club, Edmonton, Alberta, Canada. Founding President.

## TEACHING EXPERIENCE

- Previously, Assistant Clinical Professor, Faculty of Medicine, University of Alberta, Edmonton, Alberta, Canada
- Past Chairman of Test Committee in General Pathology, Royal College of Physicians of Canada, Ottawa, Canada (This committee sets the annual Pathology Board Examination for the Royal College)

## WORK EXPERIENCE

- General Pathologist with special interest in Molecular Diagnostics and Hematopathology.
- Extensive involvement with resident and medical student teaching.
- Successful leadership of a large private retail medical diagnostic laboratory
- Long-term experience in medical politics and contract negotiations with Government.
- Successful serial entrepreneur in a variety of start-up medical businesses.
- Substantial experience in both print and electronic media.
- Experience in a variety of international medical diagnostic markets (USA, Poland, Phillipines).

## ADMINISTRATIVE EXPERIENCE

- Executive Chairman and Medical Director of Bio-ID Diagnostic Inc. (current)
- Chairman, MutantDx a molecular diagnostic company based in Greensboro, NC, USA (current)
- CEO and Medical Director, Western Medical Assessments Corp., Edmonton, Alberta (current)
- Previously, CEO of a major retail medical diagnostic testing company (Stirrat Laboratories) serving Northern Alberta.
- Previously, Pathologist in charge of the Hematology Laboratory and Blood Bank of an active Community/Teaching Hospital (Misericordia Hospital), Edmonton, Alberta, Canada.
- Past Member of the Committee on Laboratory Accreditation at the College of Physicians and Surgeons of Alberta

## INTELLECTUAL PROPERTIES

- 2000. Vinayagamoorthy, T., and Roger Hodkinson, US patent: Apparatus for point of care target amplification.
- 2000. Vinayagamoorthy, T., and Roger Hodkinson, US patent: Point of care target amplification.

## RESEARCH PUBLICATIONS

1. Vinayagamoorthy, T., Mulatz, K., Drebot, M., Hodkinson, R., Molecular typing of West Nile Virus, Dengue and St. Louis Encephalitis using Multiplex Sequencing. (Accepted for Publication in the Journal of Molecular Diagnostics.)
2. Vinayagamoorthy, T., Mulatz, K., Hodkinson, R., Identification of SARS-CoV using Simultaneous MultiGene DNA Sequencing. Journal of Clinical Microbiology. 2004 July;42(7): 3291–3294
3. Vinayagamoorthy, T., Mulatz, Wallis, P., Hodkinson, R., Detection of Giardia lamblia and Cryptosporidium parvum in Water Samples Using Multiplex Sequencing Technology. American Laboratory (May. 2004)
4. Vinayagamoorthy, T., Mulatz, Hodkinson, R., DNA Sequence-Based High-Though put Microbial Identification Using Multiplex Sequencing. American Biotechnology Laboratory (Dec 2003) Vol. 22 No. 2)
5. Vinayagamoorthy, T., Mulatz, Hodkinson, R., Identification of West Nile and other flaviviruses using multiplex sequencing (MultiGEN). Presented at the American Society of Microbiology Conference on Polymicrobial Diseases. October 19th-23rd, 2003 (Lake Tahoe, Nevada)
6. Hodkinson, R., Mulatz, K., Wylie, J., Vinayagamoorthy, T., Simultaneous Genotyping of Sexually Transmitted Bacterial Pathogens using MultiGEN Technology. Presented at the International Society for Sexually Transmitted Disease Research (ISSTDR) Congress. July 27th–30th, 2003 (Ottawa, Canada)
7. Vinayagamoorthy, T., Mulatz, Hodkinson, R., Nucelotide Sequence Based Mulit-Target Identification MultiGEN. Journal of Clinical Microbiology. 2003 July; 41(7): 3284–3292
8. Hodkinson, R., Vinayagamoorthy, T., Mulatz, Identification of Food Pathogens Using Multiple Signature Sequences.Presented at the 12th World Food Science and Technology Congress. July 16th–20th, 2003. (Chicago, USA).

**RODNEY X. STURDIVANT**

# Rodney X. Sturdivant, Ph.D.

Colonel (Retired), U.S. Army
Associate Professor and Director of the Statistical Consulting Center
Department of Statistical Science, Baylor University
Rodney_Sturdivant@baylor.edu


## *Education*

**Ph.D., Biostatistics,** *University of Massachusetts – Amherst* 2005
**M.S., Statistics,** *Stanford University* 1995
**M.S. (with Distinction), Operations Research,** *Stanford University* 1995
**B.S. (Distinguished Cadet),** *United States Military Academy, West Point* 1986

## *Academic Experience*

**Associate Professor and Director of the Statistical Consulting Center** 2020-present
*Department of Statistical Science, Baylor University*

**Research Biostatistician and Adjunct Professor** 2019-2020
*Henry M. Jackson Foundation (HJF) for the Advancement of Military Medicine supporting the Health Services Research Program (HSRP) Uniformed Services University of the Health Sciences (USUHS)*

**Professor of Applied Statistics** 2016-2019
**Program Director, M.S. in Applied Statistics and Analytics,**
*Department of Mathematics, Physics, and Statistics, Azusa Pacific University*

**Chair, Division of Biostatistics** 2015-2016
**Associate Professor of Clinical Public Health, Division of Biostatistics** 2013-2016
*College of Public Health, The Ohio State University*

**Professor of Applied Statistics** 2013
**Associate and Academy Professor, Department of Mathematical Sciences** 2003 – 2012
**Core Mathematics Program Director** 2011 – 2013
**Program Director,** *Probability and Statistics* 2007 – 2010
**Program Director,** *Differential Calculus* 2004 – 2007
**Director and Founder, Center for Data Analysis and Statistics (CDAS)** 2004 – 2013
*Department of Mathematical Sciences, United States Military Academy, West Point*

**Visiting Associate Professor, Division of Biostatistics** 2010 – 2011
*College of Public Health, The Ohio State University*

**Instructor and Assistant Professor** 1995 – 1998
**Course Director,** *MA103 Discrete Dynamical Systems*
**Assistant Director,** *Math Faculty Development Workshop (FDW)*
*Department of Mathematical Sciences, United States Military Academy, West Point*

## *Academic Awards*

3rd place poster award at SURF 2020 conference (2nd author), 2020.
Excellence in Teaching Award, College of Public Health, The Ohio State University, 2016
The Dexter C. Whittinghill III Outstanding Contributed Paper Award in Statistics Education (2nd author, Joint Mathematics Meetings, Baltimore, Maryland), 2014
Second runner-up, Journal of Athletic Training Kenneth L. Knight Award for Outstanding Research Manuscript (co-author), 2012
The Dexter C. Whittinghill III Outstanding Contributed Paper Award in Statistics Education (Sole author, Joint Mathematics Meetings, San Diego, California), 2009
Delta Omega Honorary Society, University of Massachusetts-Amherst, 2005
Graduate School Fellowship, University of Massachusetts-Amherst, *Declined* 2001
Pi Mu Epsilon Honor Society, 1996
M.S. with Distinction in Operations Research, Stanford, 1995
Distinguished Cadet (top 5% of class), USMA 1986
Robert E. Lee Award, (4 core math courses required of all 1013 students), USMA 1986
Phi Kappa Phi Honor Society, 1985

## *Educational Activities*

### Program Development and Leadership

**Azusa Pacific University (2016 – 2019)**

Created and launched (sole author) M.S. in Applied Statistics and Analytics, Department of Mathematics, Physics, and Statistics
Author of new minor in Statistics, Department of Mathematics, Physics, and Statistics,
Program Director, M.S. in Applied Statistics and Analytics, Department of Mathematics, Physics, and Statistics

**West Point**

Director, Core Mathematics, Department of Mathematical Sciences. (6 programs, > 50 faculty per semester)
Program Director, Probability and Statistics, Department of Mathematical Sciences. (>45 sections, >20 faculty per semester)
Author of new minor in Statistics (3rd minor approved at West Point), Department of Mathematical Sciences. (2008)
Program Director, Calculus, Department of Mathematical Sciences. (>50 sections, >25 faculty per semester)

### Course Teaching and Development:

**Azusa Pacific University, 2016 – 2019**

| Course | Semesters Taught | Students (approx.) | Developed |
|---|---|---|---|
| *Undergraduate* | | | |
| MATH 130 – Introduction to Statistics | 4 | 120 | |
| MATH 162 – Calculus II | 4 | 120 | |
| MATH 250 – Data Analysis | 1 | 30 | Yes |
| MATH 361 – Probability and Statistics I | 3 | 75 | |

| | | | |
|---|---|---|---|
| MATH 362 – Probability and Statistics II | 1 | 15 | Yes |
| *Graduate* | | | |
| STAT 501 – Intro to Modeling with Prob | 1 | 21 | Yes |
| STAT 502 – Mathematical Statistics | 1 | 16 | Yes |
| STAT 511 – Applied Regression Analysis | 1 | 15 | Yes |
| STAT 521 – Statistical Computing | 1 | 21 | Yes |

**The Ohio State University, 2010, 2013 – 2016**

| Course/Semesters | Semesters Taught | Students (approx.) | Developed |
|---|---|---|---|
| *Undergraduate* | | | |
| PUBH-BIO 2210 – Biostatistics for Public Health Research | 4 | 120 | |
| PUBH-BIO 2210H – Honors Biostatistics for Public Health Research | 2 | 30 | Yes |
| PUBH-BIO 3193 – Independent Study in Public Health | 2 | 1 | Yes |
| *Graduate* | | | |
| PUBH-BIO 601 – Statistical Methods for Public Health Practice I | 2 | 50 | |
| PUBH-BIO 726 – Advanced Longitudinal Data Analysis | 1 | 20 | Yes |
| PUBH-BIO 799 – Independent Study (Hierarchical Models) | 1 | 1 | Yes |
| PUBH-BIO 6200 – Statistical Methods for Public Health Practice I | | | |
| PUBH-BIO 6211 – Design and Analysis of Studies in Health Sciences II | 2 | 80 | |
| PUBH-BIO 7235 – Applied Survival Analysis | 1 | 11 | Yes |
| PUBH-BIO 7194 – Group Studies in Biostatistics (Survival/Logistic) | 2 | 30 | Yes |
| PUBH-BIO 8235 – Regression Modeling of Time-to-Event Data | 1 | 10 | Yes |

**West Point**

| Course | Semesters Taught* | Developed |
|---|---|---|
| *Undergraduate* | | |
| MA103 – Problem Solving and Intro to Calculus | 6 | |
| MA153 – Advanced Multivariable Calc | 4 | |
| MA104 – Differential Calculus | 10 | |
| MA205 – Integral Calculus | 2 | |
| MA206 – Probability and Statistics | 10 | |
| MA371 – Linear Algebra | 2 | |
| MA376 – Applied Statistics | 4 | Yes |
| MA385 – Chaos and Fractals | 1 | Yes |
| MA476 – Mathematical Statistics | 2 | Yes |
| MA488 – Sabermetrics | 4 | |

* estimated, does not include teaching multiple sections in a semester

## *Textbooks*

Belanger, J., Sturdivant, R. X., Libertini, J., Beecher, A., Coronges, K., Ge, T., and Wang, J. (2018). *Mathematical Modeling for the MCM/ICM Contests, Volume 3.* Higher Education Press, COMAP Press.

Sturdivant, R. X., Pardoe, I., Berrier, J., and Watts, K. (2016). *Statistics for Data Analytics.* Additional contributors: Vahid, F., Chan, C., and Nestler, S. Zyante, Inc. (zyBooks.com).

Pardoe, I., Sturdivant, R. X., Berrier, J., Nestler, S. and Watts, K. (2016). *Fundamentals of Data Analytics.* Additional contributors: Vahid, F. and Chan, C. Zyante, Inc. (zyBooks.com).

Belanger, J., Sturdivant, R. X., Hartley, T., Beecher, A., Wang, J. (2016). *Mathematical Modeling for the MCM/ICM Contests, Volume 2.* Higher Education Press, COMAP Press.

Hosmer, D. W., Lemeshow, S., and Sturdivant R. X. (2013). *Applied Logistic Regression, Third Edition*, Wiley, Inc., New Jersey.
***Over 60,000 citations (Google Scholar)***

## *Textbook Chapters*

Hartley, T. and Sturdivant, R. (2014). Judges Reflections on the ICM. In *ICM The Interdisciplinary Contest in Modeling: Culturing Interdisciplinary Problem Solving* Edited by Arney, C. and Campbell, P. J. Comap, Inc., Bedford, Massachusetts.

## *Refereed Publications*

Koehlmoos, T.P., Janvrin, M.L., Korona-Bailey, J., Madsen, C., Sturdivant, R. (2020). COVID-19 Self-Reported Symptom Tracking Programs in the United States: A Framework Synthesis. *Journal of Medical Internet Research.* DOI: 10.2196/23297 URL: https://preprints.jmir.org/preprint/23297

Thomas, D.M., Sturdivant, R., Dhurandhar, N.V., Debroy, S., and Clark, N. (2020). A primer on COVID-19 Mathematical Models. *Obesity* **28**(8), 1375-1377, doi:10.1002/oby.22881.

Cameron, K.L., Tennent, D., Sturdivant, R.X., Posner, M.A., Peck, K.Y., Campbell, S.E., Westrick, R.B, and Owens, B.D. (2019). Increased Glenoid Retroversion is Associated with Increased Rotator Cuff Strength in the Shoulder. *The American Journal of Sports Medicine* **47**(8), 1893-1900.

Cameron, K.L., Sturdivant, R.X., and Baker, S.P. (2019). Trends in the Incidence of Physician-Diagnosed Post Traumatic Stress Disorder Among Active Duty U.S. Military Personnel between 1999 and 2008. *Military Medical Research* **6**(1). doi: https://doi.org/10.1186/s40779-019-0198-5

Özkale, M.R., Lemeshow, S., and Sturdivant, R. (2018). Logistic regression diagnostics in ridge regression. Computational Statistics **33**(2): 563 – 593. doi: https://doi.org/10.1007/s00180-017-0755-x

Breathett, K., Maffett, S., Foraker, R.E., Sturdivant, R., Moon, K., Hasan, A., Franco, V., Smith, S., Lampert, B.C., Emani, S., Haas, G., Kahwash, R., Hershberger, R.E.,

Binkley, P.F., Helmkamp, L., Colborn, K., Peterson, P.N., Sweitzer, N., William T. Abraham, W.T. (2018). Pilot Randomized Controlled Trial to Reduce Readmission for Heart Failure Using Novel Tablet and Nurse Practitioner Education. *The American Journal of Medicine* **131**(8), 974-978. doi:https://doi.org/10.1016/j.amjmed.2018.02.017

Breathett, K., D'Amico, R., Adesanya, A., Hatfield, S., Willis, S., Sturdivant, R., Foraker, R., Smith, S., Binkley, P., Abraham, W. and Peterson, P. (2017). Patient Perceptions on Facilitating Follow -up After Heart Failure Hospitalization. *Circulation: Heart Failure* **10**(6), doi: *https://doi.org/10.1161/CIRCHEARTFAILURE.117.004099*

Kuiper, S. and Sturdivant, R. (2015). Using Online Game-Based Simulations to Strengthen Students' Understanding of Practical Statistical Issues in Real-Word Data Analysis. *The American Statistician*, doi: 10.1080/00031305.2015.1075421

Breathett, K., Sturdivant, R., Carpenter, D., Foraker, R., Binkley, P., and Abraham, W. (2014). High dose guideline directed medical therapy for heart failure at discharge improves 1-year mortality in African-Americans but not hypertensive patients. *Circulation: Heart Failure* **130**(suppl_2)

Kuiper, S. and Sturdivant, R. (2014). Games as a locus of self-empowered collaborative learning. Proceedings of the *9th International Conference on Teaching Statistics (ICOTS)*. Available at http://icots.info/9/proceedings/pdfs/ICOTS9_C117_KUIPER.pdf.

Cameron, K., Marshall, S., Sturdivant, R., and Lincoln, A. (2012). Trends in the incidence of physician-diagnosed mild traumatic brain Injury among active duty US military personnel between 1997 and 2007. *The Journal of Neurotrauma* **29**(7), 1313-1321.

Cummiskey, K., Kuiper, S., and Sturdivant, R. (2012). Using classroom data to teach students about data cleaning and testing assumptions. *Frontiers in Quantitative Psychology and Measurement*, **3**(354), doi: 10.3589/fpsyg.2012.00354.

Kane, J., Steinbach, S., Sturdivant, R. and Burks, R. (2012). Sex-associated effects on hematological and serum chemistry analytes in sand rats. *Journal of the American Association for Laboratory Animal Science*, **51**(6), 1-6.

Jones, J., Burks, R., Owens, B., Sturdivant, R., Svoboda, S., and Cameron, K. (2012). Incidence and risk factors associated with meniscus injuries among active-duty U.S. military service members. *Journal of Athletic Training*, **47**(1), 67–73. ***Second runner-up, 2012 Journal of Athletic Training Kenneth L. Knight Award for Outstanding Research Manuscript.***

Macdonald, F., Lennon, C., and Sturdivant, R. (2012). Evaluating NHL goalies, skaters, and teams using weighted shots. *arXiv*:1205.1746.

Sturdivant, R. and Souhan, B. (2011). Peer to peer teaching using multi-disciplinary applications as topics. *PRIMUS*, **21**(3), 283–293.

Wolf, J., Mountcastle, S., Burks, R., Sturdivant, R., and Owens, B. (2010). Epidemiology of lateral and medial epicondylitis in a military population. *Military Medicine*, **175**(5), 336–339.

Hsiao,M., Owens, B., Burks, R., Sturdivant, R., and Cameron, K. (2010). Incidence of acute traumatic patellar dislocation among active duty U.S. military service members. *The American Journal of Sports Medicine*, **38**(12), 1997–2004.

Lugo-Roman, L., Rico, P., Sturdivant, R., Burks, R., and Settle, T. (2010). Effects of serial anesthesia using ketamine or ketamine/medetomidine on hematology and serum biochemistry values in rhesus macaques (Macaca Mulatta). *Journal of Medical Primatology*, **39**(1), 41–49.

Sturdivant, R. and Watts, K. (2010). Modeling an outbreak of anthrax. *PRIMUS*, **20**(4), 344–361.

Huber, M. and Sturdivant, R. (2010). Building a model for scoring 20 or more runs in a baseball game. *The Annals of Applied Statistics*, **4**(2), 791–804.

Scher, D., Owens, B., Sturdivant, R., and Wolf, J. (2010). Incidence of joint hypermobility syndrome in a military population: impact of gender and race. *Clinical Orthopaedics and Related Research,* **468**(7), 1790–1795.

Taylor, D., DeBerardino, T., Nelson, B., Duffey, M., Tenuta, J., Stoneman, P., Sturdivant, R., and Mountcastle, S. (2009). Patellar tendon versus hamstring tendon autographs for anterior cruciate ligament reconstruction. *The American Journal of Sports Medicine*, **37**, 1946–1957.

Sturdivant, R., Dunham, P., and Jardine, R. (2009). Preparing mathematics teachers for technology-rich environments. *PRIMUS*, **19**(2), 161–173.

Wolf, J., Sturdivant, R., and Owens, B. (2009). Incidence of De Quervain's Tenosynovitis in a young, active population. *Journal of Hand Surgery*, **34**(1), 112–115.

Sturdivant, R., Rotella, J., and Russell, R. (2008). A smoothed residual based goodness-of-fit statistic for nest-survival models. *Studies in Avian Biology*, **34**, 45–54.

Bean, K., Nemelka, K., Canchola, P., Hacker, S., Sturdivant, R., and Rico, P. (2008). Effects of housing density on Long Evans and Fischer 344 rats. *LabAnimal*, **37**(9).

Nemelka, K., Bean, K., Sturdivant, R., and Rico, P. (2008). Effects of high density housing on behavioral and physiologic parameters in F344 rats and Long Evans rats (rattus norvegicus). *Online Journal of Veterinary Research*, **12**(1), 28–38.

Crowder, T., Beekley, M., Sturdivant, R., Johnson, C., and Lumpkin, A. (2007). Metabolic effects of soldier simulated graded road march while wearing two functionally equivalent military ensembles. *Military Medicine*, **172**(6), 596–602.

Sturdivant, R. and Hosmer, D. (2007). A smoothed residual based goodness-of-fit statistic for logistic hierarchical regression models. *Computational Statistics and Data Analysis*, **51**(8), 3898–3912.

Sturdivant, R. (1997). Uncle Euler games. *PRIMUS*, 7(4), 329–333.

## *Other Publications*

Arney, C., Coronges, K., Hartley, T., Sturdivant, R. and Ulman, R. (2015). Judges' commentary: managing human capital in organizations. *The UMAP Journal*, **36**(2), 137–149.

Sturdivant, R. (2013). Review: Riffenburgh, R. (2012) Statistics in Medicine, Third Edition. *Mathematics and Computer Education*, **47**(1), 77–79.

Kobza, J. and Sturdivant, R. (2011). Judges' commentary: the outstanding electric car papers. *The UMAP Journal*, **32**(2), 179–184.

Sturdivant, R. (2010). Judges' commentary: the outstanding marine pollution papers. *The UMAP Journal*, **31**(2), 183–188.

Piantanida, A., Fields, K.B., and Sturdivant, R. (2010). Application of Pneumatic Pressure in Lower Extremity Pain Improvement and Eradication (APPLE PIE). *Unpublished article.*

Miller, S., Garren, M., and Sturdivant, R. (2009). Judges' commentary: the outstanding coral reef papers. *The UMAP Journal*, **30**(2), 163–178.

Jones, J., Burks, R., Owens, B., DeBerardino, T., Sturdivant, R., and Cameron, K. (2009). Incidence of meniscal injuries in the U.S. military: demographic and occupational risk factors in a high risk population. Abstract in *Journal of Athletic Training*, **44**(3), S25.

Root, S., Sturdivant, R., and Wattenberg, F. (2008). Judges' commentary for ICM 2008: the outstanding health care papers. *The UMAP Journal*, **29**(2), 169–174.

Heidenberg, A. and Sturdivant, R. (2006). Don't forget to make connections. *Vision-Potential Newsletter of the HBCU College Algebra Reform Consortium*, **68**.

DeRosset, W. and Sturdivant, R. (2005). Patterned Armor Performance Against Multiple Impacts. *Army Research Laboratory (ARL) Technical Report*, ARL-TR-**3623**. *(Classified, could not submit to a refereed journal).*

Sturdivant, R., Melendez, B., Froyd, J., Heidenberg, A., and Picciuto, J. (2004). Assessment: working group report. *Generating a Vision for Undergraduate Mathematics (GVUM) Proceedings*, West Point, New York.

Olwell, D. and Sturdivant, R. (1997). Grand tours: a useful tool for preliminary data exploration and modeling. *PHALANX*, **30**, 1–32.

## *Tutorials, Workshops and Courses*

Kuiper, S. and Sturdivant, R. (2020). Using Games in Introductory and Advanced Statistics. Workshop at Middle Tennessee State University (virtual).

Sturdivant, R. (2017). Binary Data Analysis. Invited short course for the *United State Army Evaluation Center*, Aberdeen Proving Ground, Maryland.

Sturdivant, R. (2015). Applied Logistic Regression. Invited selection to the *Faculty Research Participation Program, Oak Ridge Institute for Science and Education*, Air Force Institute of Technology, Dayton, Ohio.

Sturdivant, R. (2015). Applied Survival Analysis. Invited short course for the *Boston Area SAS User's Group (BASUG)*, Boston, Massachusetts.

Sturdivant, R. (2015). Applied Logistic Regression. Invited *American Statistical Association (ASA) Council of Chapters Travelling Course*, Cleveland, Ohio.

Sturdivant, R. and Kuiper, S. (2015). Using Games in an Introductory Statistics Course. MAA Minicourse at the *Joint Mathematics Meetings (JMM)*, San Antonio, Texas.

Sturdivant, R. (2015). Applied Logistic Regression. Invited *American Statistical Association (ASA) Council of Chapters Travelling Course*, San Antonio, Texas.

Sturdivant, R. (2015). Applied Logistic Regression. Invited *American Statistical Association (ASA) Council of Chapters Travelling Course*, Houston, Texas.

Sturdivant, R. (2014). Advanced Topics in Logistic Regression. Invited *American Statistical Association (ASA) Council of Chapters Travelling Course*, Indianapolis, Indiana.

Kuiper, S. and Sturdivant, R. (2014). Using Fun and Games to Engage Real-World Learning. Workshop at the *Electronic Conference on Teaching Statistics (eCOTS)*, https://www.causeweb.org/ecots/ecots14/.

Kuiper, S. and Sturdivant, R. (2013). Playing Games with a Purpose: A New Approach to Teaching and Learning Statistics. Pre-Conference Workshop at the *United States Conference on Teaching Statistics (USCOTS)*, Cary, North Carolina.

Kuiper, S. and Sturdivant, R. (2013). Playing Games with a Purpose: A New Approach to Teaching and Learning Statistics. MAA Ancillary Workshop at the *Joint Mathematics Meetings (JMM)*, San Diego, California.

Sturdivant, R. (2011). Applied Logistic Regression. Invited two day tutorial for the *Army Conference on Applied Statistics (ACAS)*, Annapolis, Maryland.

Sturdivant, R. (2010). Logistic Regression. Invited short course for the *Boston Area SAS User's Group (BASUG)*, Boston, Massachusetts.

Horton, S. and Sturdivant, R. (2006). Discrete Dynamical Systems and Problem Solving. MAA Minicourse at the *Joint Mathematics Meetings (JMM)*, San Antonio, Texas.

## *Presentations*

Lee, M., Sturdivant, R., Forbes, W., Rittel, A., Wardian, J., and Colburn, J. (2020). Gotta LADA? Identifying Differences in Adults with Latent Autoimmune Diabetes and Type 2 Diabetes to Improve Screening and Diagnosis. Poster presentation at the (virtual) *SURF 2020 Conference*, San Antonio, Texas. **Awarded 3rd place outstanding poster.**

Lee, M., Sturdivant, R., Forbes, W., Rittel, A., Wardian, J., and Colburn, J. (2020). Gotta LADA? Identifying Differences in Adults with Latent Autoimmune Diabetes and Type 2 Diabetes to Improve Screening and Diagnosis. Poster presentation at the (virtual) *American Diabetes Association (ADA) 80th Scientific Sessions – Virtual.*

Sturdivant, R.X. and Burks, R.E. (2020). Data Driven Mathematical Modeling. Invited presentation at the *Joint Mathematics Meetings (JMM)*, Denver, Colorado.

Breathett, K., Maffett, S., Foraker, R., Sturdivant, R., Moon, K., Hasan, A., Franco, V., Smith, S., Lampert, B., Emani, S., Haas, G., Kahwash, R., Hershberger, R., Binkley, P., Helmkamp, L., Colborn, K., Peterson, P., Sweitzer, N., Abraham, W. (2018) Pilot Randomized Controlled Trial to Reduce Readmission for Heart Failure Using Novel Tablet and Nurse Practitioner Education. Poster presented at the *International Society for Heart and Lung Transplantation 38th Annual Meeting*, Nice, France.

Sturdivant, R.X. (2017). Structural Equation Modeling in Obesity. Invited presentation at the *4th Short Course on Mathematical Sciences in Obesity Research*, Birmingham, Alabama.

Breathett, K., D'Amico, R., Adesanya, T., Hatfield, S., Willis, S., Sturdivant, R., Foraker, R.E., Binkley, P., Abraham, W.T., Peterson, P. (2016). Patient perceptions on improving follow-up after heart failure hospitalization. Paper presented at the *American Heart Association (AHA) Scientific Sessions 2016*, New Orleans, Louisiana.

Sturdivant, R.X. and Andridge, R. R. (2016). A "hybrid flipped" introduction to biostatistics to promote research-like experiences. Presentation at the *Joint Mathematics Meetings (JMM)*, Seattle, Washington.

Sturdivant, R. and Huber, M. (2015). A High Scoring Introduction to Survival Analysis Models. Invited presentation for the *Boston Area SAS User's Group (BASUG)*, Boston, Massachusetts.

Sturdivant, R. (2015). A Statistical Smorgasboard. Invited presentation at Azusa Pacific University, Azusa, California.

Sturdivant, R. (2015). A Hall of Fame Introduction to Logistic Regression. Invited presentation at The College of Wooster, Wooster, Ohio.

Kuiper, S., and Sturdivant, R. (2015). Playing with statistics. Poster presentation at the *Joint Mathematics Meetings (JMM)*, San Antonio, Texas.

Sturdivant, R., and Kuiper, S. (2015). Playing games with a purpose: A New Approach to Teaching and Learning Statistics. Poster presentation at the *Joint Mathematics Meetings (JMM)*, San Antonio, Texas.

Breathett, K., Sturdivant, R., Carpenter, D., Foraker, R., Binkley, P., Abraham, W.T. (2014). High dose guideline directed medical therapy for heart failure at discharge improves 1-year mortality in African-Americans but not hypertensive patients. Poster presentation at the *American Heart Association (AHA) Scientific Sessions 2014*, Chicago, Illinois.

Andridge, R. R. and Sturdivant, R.X. (2014). Active learning in a flipped biostatistics classroom. Presentation at the *Undergraduate Education for Public Health Summit*, New Orleans, Louisiana.

Sturdivant, R., Kuiper, S., and Cummiskey, K. (2014). Playing and getting "messy" with data. Invited presentation at the *Joint Statistics Meetings (JSM)*, Boston, Massachusetts.

Kuiper, S., and Sturdivant, R. (2014). Games as a locus of self-empowered collaborative learning. Presentation at the *9th International Conference on Teaching Statistics (ICOTS)*, Flagstaff, Arizona.

Kuiper, S., Sturdivant, R., Kaczynski, B., Jackson, J., and Cummiskey, K. (2014). Playing games with a purpose: A New Approach to Teaching and Learning Statistics. Presentation at the *Joint Mathematics Meetings (JMM)*, Baltimore, Maryland. ***Outstanding Contributed Paper in Statistics Education.***

Sturdivant, R., Kuiper, S., and Cummiskey, K. (2014). Playing and getting "messy" with data. Presentation at the *Joint Mathematics Meetings (JMM)*, Baltimore, Maryland.

Kuiper, S., and Sturdivant, R. (2014). Playing games with a purpose: A New Approach to Teaching and Learning Statistics. Poster presentation at the *Joint Mathematics Meetings (JMM)*, Baltimore, Maryland.

Sturdivant, R., Cummiskey, K. and Jackson, J. (2013). TigerStat: An Immersive 3-D Game for Statistics Classes. Cause Activity Webinar, https://www.causeweb.org/webinar/activity/ .

Sturdivant, R. (2013). Playing Games with a Purpose: A New Approach to Teaching and Learning Statistics. Poster presentation at the *Transforming Undergraduate Education in STEM (TUES) Conference*, Washington, D.C.

Heidenberg, A., Kobylski, G., and Sturdivant, R. (2013). Assessment 2.0: SAUM meets accreditation. Presentation at the *Joint Mathematics Meetings (JMM)*, San Diego, California.

Sturdivant, R. (2012). A New Approach to Teaching and Learning Statistics. Invited presentation at The Ohio State University, Columbus, Ohio.

Sturdivant, R., Heidenberg, A., and Burks, R. (2012). Playing games with a purpose: Classroom labs. Poster presentation at the *Joint Statistics Meetings (JSM)*, San Diego, California.

MacDonald, B., Sturdivant, R., and Lennon, C. (2012). Predicting goal scoring in hockey. Poster presentation at the *Joint Statistics Meetings (JSM)*, San Diego, California.

Sturdivant, R. (2012). Euler games for differential equations. Invited presentation at the *Joint Mathematics Meetings (JMM)*, Boston, Massachusetts.

Sturdivant, R., Kuiper, S., Kaczynski, B., Jackson, J., and Cummiskey, K. (2012). Playing games with a purpose: a new approach to teaching and learning statistics. Poster presentation at the *Joint Mathematics Meetings (JMM)*, Boston, Massachusetts.

Cameron, K., Marshall, S., Sturdivant, R., and Lincoln, A., (2011). Incidence rates for mild traumatic brain injury among active duty US military personnel between 1997 and 2007. Presentation at the *American Public Health Association Annual Meeting*, Washington, D.C.

Cameron, K., Sturdivant, R., Marshall, S., and Lincoln, A., (2011). Trends in the incidence of persistent postconcussion syndrome among active duty US military personnel between 1997 and 2007. Presentation at the *American Public Health Association Annual Meeting*, Washington, D.C.

Cameron, K., Marshall, S., Lincoln, A., and Sturdivant, R., (2011). Trends in the incidence of traumatic brain injury and related conditions among active duty U.S. service

members between 1997 and 2007. Presentation at the *Army Conference on Applied Statistics*, Annapolis, Maryland.

Sturdivant, R. (2010). SASabermetrics: PROC logistic in the Hall of Fame. Invited presentation for the *Boston Area SAS User's Group (BASUG)*, Boston, Massachusetts.

Cameron, K., Sturdivant, R., Marshall, S., and Lincoln, A. (2010). Trends in the incidence of persistent postconcussion syndrome among active duty U.S. service members between 1997 and 2007. Presentation at the *Force Health Protection Conference*, Phoenix, Arizona.

Huber, M. and Sturdivant, R. (2010). Building a model for scoring 20 or more runs in a baseball game. Invited presentation at the *Regional Hot Stove Meeting of the Connie Mack Chapter of the Society of American Baseball Research*, Philadelphia, Pennsylvania.

Huber, M. and Sturdivant, R. (2010). A model for scoring 20+ runs in a baseball game. Invited presentation at the *MAA New Jersey Section Meeting*, Middlesex County College, Edison, New Jersey.

Wattenberg, F., Wright, A., Sturdivant, R., and Davis, N. (2009). TigerSTAT: A first person shooter game for statistics education. Presentation at the *Joint Statistical Meetings (JSM)*, Washington, D.C.

Cameron, K., Sturdivant, R., Marshall, S., DeBerardino, T., and Lincoln, A. (2009). Incidence of traumatic brain injury, mild traumatic brain injury and postconcussion syndrome among U.S. service members between 1997 and 2007. Presentation at the *Military Health Research Forum*, Kansas City, Missouri.

Sturdivant, R., Burks, R., Owens, B., Wolf, J., and Cameron, K. (2009). Epidemiological studies in the military. Presentation at the *Joint Statistics Meetings (JSM)*, Washington, D.C.

Jones, J., Burks, R., Owens, B., DeBerardino, T., Sturdivant R., and Cameron, K. (2009). Incidence of meniscal injuries in the U.S. military: Demographic and occupational risk factors in a high risk population. Paper presented at the *NATA Annual Meeting and Clinical Symposium*, San Antonio, Texas.

Helms, J. and Sturdivant, R. (2009). An interdisciplinary project for statistics and physics. Presentation at the *Joint Mathematics Meetings (JMM)*, Washington, D.C.

Helms, J., Sturdivant, R., and Wattenberg, F. (2009). Developing a video tutorial library to service upper level MSE courses. Presentation (listed under Smith, C.) at the *Joint Mathematics Meetings (JMM)*, Washington, D.C.

Sturdivant, R. and Watts, K. (2008). Modeling West Point graduate's retention. Invited presentation for the *BAAFEX (British, Australian and American Forecasting Exchange) Conference*, West Point, New York.

Sturdivant, R. and Watts, K. (2008). Studies in military medicine from the Center for Data Analysis and Statistics (CDAS) at West Point. Invited presentation for the *Washington Statistical Society (American Statistical Association, ASA) Seminar Series*, Washington, D.C.

Sturdivant, R. (2008). Anthrax, killer bees and murder to motivate statistics. Presentation at the *Joint Mathematics Meetings (JMM)*, San Diego, California. ***Outstanding Contributed Paper in Statistics Education.***

Sturdivant, R. and Watts, K. (2007). Studies in military medicine from the Center for Data Analysis and Statistics (CDAS) at West Point. Paper presented at the *Army Conference on Applied Statistics (ACAS)*, Rice University, Houston, Texas.

Watts, K., Sturdivant, R., Piantanida, N., and Phillips, G. (2007). Use of a lumbar support in relieving lower back pain in helicopter crews. Paper presented at the *Army Conference on Applied Statistics (ACAS)*, Rice University, Houston, Texas.

Burks, R., Sturdivant, R., Cameron, K., and Watts, K. (2007). Shoulder dislocation in active duty U.S. military personnel. Paper presented at the *Army Conference on Applied Statistics (ACAS)*, Rice University, Houston, Texas. *(Presenting author)*

Crowder, T., Vanderburgh, P., Sturdivant, R., Johnson, C., Leth, A., Gelineau, J., Newsom, J., Daniels, G., and Schaefer, S. (2007). Creation of a correction factor via allometry to eliminate body mass influence on the Army's physical fitness test. Poster at the *54th Annual American College of Sports Medicine Conference*, New Orleans, Louisiana.

Souhan, B., Sturdivant, R., and Burks, R. (2007). Involving students in their own learning: a follow-up. Presentation at the *Joint Mathematics Meetings (JMM)*, New Orleans, Louisiana.

Sturdivant, R. (2007). Center for Data Analysis and Statistics. Poster at the *Joint Mathematics Meetings (JMM)*, New Orleans, Louisiana.

DeRosset, W. and Sturdivant, R. (2006). Patterned armor performance against multiple impacts. Presented (as poster) paper at the *25th Annual Army Science Conference (ASC)*, Orlando, Florida.

Watts, K. and Sturdivant, R. (2006). Value added outcomes in military service educational programs: Comparing new and old technologies and methods. Paper presented at the *Army Conference on Applied Statistics (ACAS)*, Research Triangle, North Carolina.

Sturdivant, R., Heidenberg, A., and Souhan, B. (2006). Involving students in their own learning. Presentation at the *Joint Mathematics Meetings (JMM)*, San Antonio, Texas.

Sturdivant, R., Melendez, B., and Glen, A. (2005). Do we have to change? Isn't math just math? Presentation at the *TALENT Conference*, West Point, New York.

Krahn, G., Small, D., Sturdivant, R., Melendez, B., and Glen, A. (2005). *An Institutional Case Study*. Invited session and presentation at the *Project Kaleidoscope (PKAL) Leadership Initiative Seminar*, West Point, New York.

Sturdivant, R., Somers, B., Kasube, H., and Hastings, N. (2005). First semester calculus, meeting the needs of our students. Panel discussion at the *Joint Mathematics Meetings (JMM)*, Atlanta, Georgia.

DeRosset, W. and Sturdivant, R. (2004). Investigation of multiple hits on light armor. Presented paper at the *ARL/USMA Technical Symposium*, Aberdeen Proving Ground, Maryland.

Sturdivant, R. (2004). Establishing the Center for Data Analysis and Statistics (CDAS) at the United States Military Academy. Paper presented at the *Army Conference on Applied Statistics (ACAS)*, Atlanta, Georgia.

Sturdivant, R. (2004). Residual based goodness-of-fit statistics for logistic hierarchical regression models. Paper presented at the *Army Conference on Applied Statistics (ACAS)*, Atlanta, Georgia.

Sturdivant, R. (2003). Logistic hierarchical models: An introduction. Invited talk for the *Department of Mathematical Sciences Colloquium, Keene State University*, Keene, New Hampshire.

Sturdivant, R. (1996). Nonparametric methods for multivariate analysis using statistically equivalent blocks. Paper presented at the *ARL/USMA Technical Symposium*, Aberdeen Proving Ground, Maryland.

## *Funded Proposals, Awards and Collaborations*

Kuiper, S. and Sturdivant, R. (2017). Student Engagement in Statistics Using Technology: Making Data Based Decisions. *National Science Foundation (NSF) Grant*, 2017–2021.

Sturdivant, R. (2015). Academic Enrichment Grant: PUBHBIO 2210H: Honors Biostatistics for Public Health. *The Ohio State University Honors and Scholars Center*, 2014-2016.

P50-CA-180908-01(PIs Shields and Wewers) 09/2013-08/2018

NIH/FDA Tobacco Centers of Regulatory Science (TCORS): OSU Center of Excellence in Regulatory Tobacco Science (OSU-CERTS) 8%, Role: Biostatistics and Data Resources Core co-investigator, and project 2 biostatistician

Tietronix Software (2014). Consultant for: Playing with Statistics. *National Science Foundation (NSF) Grant.*

Kuiper, S. and Sturdivant, R. (2011). Playing games with a purpose: A new approach to statistics education. *National Science Foundation (NSF) Grant*, 2011–2014.

Sturdivant, R. (2009). *General Omar N. Bradley Research Fellowship in Mathematics.*

Sturdivant, R. (2009). Center for Data Analysis and Statistics research. *Army Research Office (ARO).*

Sturdivant, R. (2008). Real Data: the Art of Statistical Analysis. *Army Research Office (ARO).*

Cameron, K., Sturdivant, R., Marshall, S., and Lincoln, A. (2008). Incidence of traumatic brain injury, mild traumatic brain injury and postconcussion syndrome among US service members between 1997 and 2007. *Congressionally Directed Medical Research Program (CDMRP) Grant*, 2008–2011.

Sturdivant, R. (2007). *General Omar N. Bradley Research Fellowship in Mathematics.*

Sturdivant, R. (2007). Goodness of fit in hierarchical logistic regression models. *Dean's Faculty Development and Research Fund.*

Sturdivant, R. (2007). Supporting the Center for Data Analysis and Statistics. *Army Research Office (ARO).*

Sturdivant, R. (2006). Founding the Center for Data Analysis and Statistics. *Army Research Office (ARO).*

Sturdivant, R. (2005). Goodness of fit in hierarchical logistic regression models. *Dean's Faculty Development and Research Fund.*

## *Statistical Consulting Activity*

Founder/Director, Center for Data Analysis and Statistics (CDAS), 2004–2013.
Clients (partial list): West Point academic departments (12), Director of Admissions, Keller Army Community Hospital (several clinics including physical therapy, optometry, ophthalmology, orthopedic surgery), Walter Reed Army Institute of Research, Army Staff and several Army Agencies.
Faculty involvement: over 20 faculty participants, activities including consulting and attending CDAS sponsored workshops and seminars.

## *Student Research*

Advisor, Honors Thesis (2016). Asad, S. Maternal Characteristics and Fetal-Infant Mortality in Franklin County, The Ohio State University.

Advisor, Honors Thesis (2016). Venkat-Ramani, T. Curbing Infant Mortality in the Near East Side of Columbus, The Ohio State University.

Second Reader, Honors Thesis (2016). Figas, H. Low-Calorie Sweetened Beverage Consumption and Weight-Related Effects: A Systematic Review, The Ohio State University.

Committee Member, MPH (2015). Sharova, A.V. Prevalence of Staphylococcus aureus in Swine Exhibited at Five Agricultural Fairs in Ohio: Estimating the Public Health Risk, The Ohio State University.

Second Reader, MPH Project (2014). Husk, J. Longitudinal and Survival Analysis Approaches to Longitudinal Survey Data, The Ohio State University.

Examiner, Ph.D. Thesis (2013). Canary, J., A comparison of three goodness-of-fit statistics for binary regression models, University of Tasmania.

Co-Advisor, Cadet Senior Honors Thesis (2013), 1 student.

Committee member, Doctor of Science (D.Sc.) in Physical Therapy, Baylor University (2011), 5 students.

Committee member, Doctor of Science (D.Sc.) in Physical Therapy, Baylor University (2009), 4 students.

Co-Advisor, Cadet Senior Honors Thesis (2009), 1 student.

Committee member, Doctor of Science (D.Sc.) in Physical Therapy, Baylor University (2007), 3 students.

Advisor, Cadet Senior Honors Thesis (2007), 3 students.

Committee member, Doctor of Science (D.Sc.) in Physical Therapy, Baylor University (2006), 4 students.

Advisor, Cadet Senior Thesis (2005), 2 students.

## *Professional Service*

Faculty Promotion Reviewer, Associate Professor position, West Point, 2020.

Faculty Promotion Reviewer, Professor position, AFIT, 2019.

Mathematical Contest in Modeling (MCM), Final Judging, 2016–present.

Mathematical Contest in Modeling (MCM), Triage Judging, 2016–present.

External Reviewer, University of Kentucky EPB Program Review Self Study, 2016

Promotion and Tenure Outside Reviewer, Flinders University (Australia), 2015.

Interdisciplinary Contest in Modeling (ICM), Final Judging, 2008–2016.

Promotion and Tenure Outside Reviewer, West Point, 2014.

Session Chair Topic-Contributed Poster Presentations Section on Statistical Education, Joint Statistical Meetings, San Diego, 2012.

Independent Data Monitoring Biostatistician (IDMB), Ft. Benning MRSA prevention clinical trial, 2011.

Scientific Reviewer, IDCRP, USUHS/Ft. Benning, 2012.

Executive Board, Army Conference on Applied Statistics (ACAS), 2004–present.

Government Steering Committee, four MURI's, Army Research Office, 2007–2013.

Adjunct Professor Appointment, Baylor University Graduate School, supporting the Baylor-West Point physical therapy D.Sc. program, 2005–2013.
Statistical Consultant, Department of Defense (DoD) Leishmania PCR Diagnostic Device FDA approval validation plans and studies, Walter Reed Army Institute of Research (WRAIR), 2004–2010.
Army Research Office (ARO) Strategic Planning Committee, 2008.
Interdisciplinary Contest in Modeling (ICM), Associate Director, 2008–2012.
Interdisciplinary Contest in Modeling (ICM), Triage judging 1996–1998, 2004–2012.
Session Chair and Organizer, Army Conference on Applied Statistics (ACAS), 2005–2011.
AP Statistics Examination Reader, 2005–2008.
Steering Committee, ARO Language for Intelligent Machines (LIMES) Workshop, West Point, New York, 2006.
Leadership team, Project Kaleidoscope (PKAL) Leadership Initiative Seminar, West Point, New York, 2005.

**Azusa Pacific University Service**

Chair, Masters Admissions Committee, M.S. in Applied Statistics and Analytics
Program Directors Council, College of Liberal Arts and Sciences
Statistics Faculty Search Committee (2 searches)
Poster Judge, Association of Christian Schools (ACSI) Science Fair
Executive Committee, Big Data Summit Conference
Data Science Consortium Committee

Program Review Committee, Department of Mathematics, Physics, and Statistics
Academic advising, undergraduate mathematics students (6 – 10 per year)
Academic advising, M.S. in applied statistics and analytics students (21)

**The Ohio State University Service**

Executive Committee, College of Public Health, 2015-2016
Undergraduate Studies Committee, 2014 – 2016
Masters Admissions Committee – Biostatistics, 2013 – 2016
Masters Admissions Committee – Program for Experienced Professionals MPH, 2013 – 2016
Qualifying Examination Committee Member (Ph.D. in biostatistics), 2014 – 2015
MPH-PEP and HSMP Ad Hoc Curricula Committee, 2013 – 2015.
Academic Advisor M.S. in Biostatistics, 2 students, 2014 – 2016.
Academic Advisor MPH, 1 student, 2013 – 2015.

**United States Military Academy Service**

Center for Teaching Excellence (CTE) Advisory Committee, 2011–2013.
Math, Science and Engineering (MSE) Goal Team, Assessment Steering Committee, 2011–2013.
Engineering and Technology Goal Team, Assessment Steering Committee, 2011–2013.
Faculty Council, 2004–2013.
Author of new minor in Statistics (3rd minor approved at West Point), 2008.

Member of Academy Professor Search Committee (Department of Civil and Mechanical Engineering), 2008.
Scholarship Committee, United States Military Academy, 2006–2013.
Institutional Review Board (IRB), United States Military Academy, 2005–2013.
Admissions Committee, United States Military Academy, 2006–2010.
Teaching Committee, United States Military Academy, 2006–2009.
Creativity Goal Team, United States Military Academy, 2007–2010.
Mathematical Sciences Rotating M.S. Selection committee member, 2005, 2009, 2010.
Lead organizer for "Real Data: the Art of Statistical Analysis", West Point, April 2008.
Steering Committee, Faculty Development Workshop Conference, West Point, 2007.
Dept. of Mathematical Sciences Rotating Ph.D. Selection committee co-chair, 2006–2013.
Planning Committee, Biology & Mathematics Conference/Workshop, West Point,, 2006.
Lead organizer for the "CDAS Conference on Statistical Consulting", October 2005.
Liaison Professor for North Carolina State M.S. students from USMA, 2006–2009.
Liaison Professor for USMA math department with Department of Geography and Environmental Engineering, 2005–2010.
Selection Committee member, Hollis Award (best cadet research project), 2006–2010.
Co-Chair, Calculus textbook search committee, 2005.
Member, Differential Equations textbook search committee, 2004.

## *Reviews and Referee Activity*

Computational and Mathematical Methods in Medicine (2020)
Preventive Medicine (2018)
Biometrical Journal (2018)
Defense Analytics and Logistics (2018)
Statistics in Medicine
Journal of Applied Statistics
Biometrika
Military Operations Research
Journal of Wildlife Management
Journal of Field Ornithology
Circulation (the Journal of the American Heart Association)
Problems, Resources, and Issues in Mathematics Undergraduate Studies (PRIMUS).
Army Research Office (ARO) – numerous proposals (approx. 25, 2005-2015)

## *Memberships*

American Statistical Association (ASA)
Mathematical Association of America (MAA)

## *Student Development Service*

Officer Representative, West Point String Ensemble Club, 2011–2013.
Officer Representative, West Point Cadet Glee Club, 2011–2013.
Head Officer in Charge and founder, West Point String Ensemble Club, 2005–2010.
Head Officer in Charge, West Point Cadet Glee Club, 2006–2011.
Head Officer in Charge, Officer Christian Fellowship (OCF) Club, 2009–2010.
Officer Representative, Officer Christian Fellowship (OCF) Club, 2007–2013.

Officer Representative/class leader, Officer Christian Fellowship (OCF) Club, 2003–2007.
Cadet Academic Counselor (CAC), Cadet Company G-1/B-2, 2005–2010.
Officer Representative, Army Volleyball team, 1995–1998.
Cadet Honor Education Team (CHET) member, Cadet Company H-3, 1995–1997.

## *Community Service*

Church activities (partial list) – musician (violin), worship team leader/singer, choir, Sunday school teaching, lay pastor, usher.
Member, Central Ohio Symphony Orchestra, 2014-2016.

## *Selected Military Experience*

- **Branch Chief, Planning and Analysis Branch, Total Army Personnel Command,** *managed a $500 million dollar budget for soldier moves, analysis of distribution of over 400,000 enlisted soldiers, presented results to senior army leaders to include the Chief of Staff of the Army*
- **Company Commander**, *A Company 143rd Maintenance Company, Edgewood Arsenal with over 300 soldiers and equipment*
- **Action Officer, Ordnance Corps Combat Developments**, *Aberdeen Proving Ground, Maryland –artificial intelligence project named outstanding Department of Defense AI project in 1994*
- **Shop Officer**, **Executive Officer** *and* **Platoon Leader**, *B Company, 64th Ordnance, Fort Carson, Colorado*
- **Battalion Maintenance Officer**, *104th Military Intelligence, Fort Carson, Colorado*

## *Military Awards*

Legion of Merit
Superior Unit Citation (2 awards)
Meritorious Service Medal (3 awards)
Army Commendation Medal (3 awards)
Army Achievement Medal
Distinguished Graduate, Ordnance Officer Advanced Course, 1991
Heiser Award, Ordnance Officer Advanced Course, 1991
Honor Graduate, Ordnance Officer Basic Course, 1986
Honor Graduate, USAFA Survival Evasion Resistance and Escape (SERE) School, 1984

**RONALD B. BROWN**

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Updated December 18, 2020

# Dr. Ronald B. Brown ronbbrown@gmail.com, r26brown@uwaterloo.ca

## Education

**Ph.D. candidate, Epidemiology**, University of Waterloo School of Public Health and Health Systems, ON, CA., 2018 to present.

**Bachelor of Science, Dietetics**, Kansas State University, Manhattan, KS, U.S., 2012-2014.
• 4.0 GPA- Member Kappa Omicron Nu Human Sciences Honor Society.

**Ph.D., Business Administration-Industrial/Organizational Psychology**, Northcentral University, Prescott Valley, Arizona, USA, 2008-2011.
• Dissertation: Constructing a grounded theory of worker attitudes towards developing a plant-based nutrition intervention in the workplace, Dr. Leslie A. Miller, supervisor.
• 4.0 GPA - Member Delta Mu Delta Business Honor Society.

**Master of Business Administration**, Wilfrid Laurier University, Waterloo, Ontario, Canada, 2004-2005.
• Thesis: Retention of post-secondary school graduates in Canada's Technology Triangle, Dr. Jack Schnabel, supervisor.

**Bachelor of Arts, Psychology**, Wilfrid Laurier University, Waterloo, Ontario, Canada, 2001-2004.
• Graduated with distinction.

**Diploma, Software Professional**, University of Waterloo, Waterloo, Ontario, Canada, 1999-2001, (non-accredited).

**Diploma, Registered Massage Therapist**, Darcy Lane Institute, London, Ontario, Canada, 1992-1993, (non-accredited).

**Bachelor of Music, Percussion**, New England Conservatory of Music, Boston, Massachusetts, USA, 1968-1972.

## Other Awards, Distinctions and Fellowships

- 2004 Scholarship, Wilfrid Laurier University School of Business and Economics.
- 1972 Fellowship, Berkshire Music Festival, Tanglewood, Massachusetts.
- 1971 Fellowship, Berkshire Music Festival, Tanglewood, Massachusetts.

## Research Interests / Research Profile

- Pathophysiology; Epidemiology; Grounded Theory; Psychology; Dietetics

## Scholarly Publications

RB Brown. (2020). Stress, inflammation, depression, and dementia associated with phosphate toxicity. *Molecular Biology Reports*; https://doi.org/10.1007/s11033-020-06005

RB Brown. (2020). Phosphate and oxysterols may mediate an inverse relationship between atherosclerosis and cancer. *European Medical Journal – Oncology*

RB Brown. (2020). Public health lessons learned from biases in coronavirus mortality overestimation. *Disaster Medicine and Public Health Preparedness- EDITORS' CHOICE*

RB Brown. (2020). Diabetes, diabetic complications, and phosphate toxicity: a scoping review. Current diabetes reviews. 16 (7)

RB Brown. (2020).Breakthrough knowledge synthesis in the Age of Google. *Philosophies* 5 (1), 4

RB Brown. (2019). Potential interaction of inflammatory hyperemia and hyperphosphatemia in tumorigenesis. *Future Oncology* 15 (34)

RB Brown. (2019). Phospholipid packing defects and oxysterols in atherosclerosis: dietary prevention and the French paradox. *Biochimie* 167 (December), 145-151

RB Brown. (2019). Author Response to "In Defense of the UVB-Vitamin D-Cancer Hypothesis." *Endocrine* 66, 430–431

RB Brown. (2019). Vitamin D, cancer, and dysregulated phosphate metabolism. *Endocrine* 65 (2019), 238–243

RB Brown. (2019). Dysregulated Phosphate Metabolism, Periodontal Disease, and Cancer: Possible Global Health Implications. *Dentistry Journal* 7 (1), 18

R B Brown, M S Razzaque (2018). Chapter 31 - Endocrine regulation of phosphate homeostasis. In: *Textbook of Nephro-Endocrinology*, 2nd ed. Edited by:A. K. Singh, G H. Williams. 539-548 Elsevier. https://doi.org/10.1016/B978-0-12-803247-3.00032-5

R B Brown, M S Razzaque (2018). Phosphate toxicity and tumorigenesis. *Biochimica et Biophysica Acta (BBA) - Reviews on Cancer,* 1869, 2, 303-309 April. https://doi.org/10.1016/j.bbcan.2018.04.007

RB Brown, FA Anouti, MS Razzaque. (2016). Vitamin D supplements: Magic pill or overkill? *South East Asia Journal of Public Health* 5 (2), 1-3

Mahdi, A. A., Brown, R. B., & Razzaque, M. S. (2016). Phosphate toxicity: A stealth biochemical stress factor? *Medical Molecular Morphology*. https://doi.org/10.1007/s00795-015-0122-3

Mahdi, A. A., Brown, R. B., & Razzaque, M. S. (2015). Osteoporosis in populations with high calcium intake: Does phosphate toxicity explain the paradox? *Indian Journal of Clinical Biochemistry*, doi: 10.1007/s12291-015-0524-y

Brown, R. B., Haq, A., Stanford, C. F., & Razzaque, M. S (2015). Vitamin D, phosphate and vasculotoxicity. *Canadian Journal of Physiology and Pharmacology*, 0, 0, 10.1139/cjpp-2015-0083 Published online 05 May.

Brown, R. B., & Razzaque, M. S. (2015). Dysregulation of phosphate metabolism and conditions associated with phosphate toxicity. *BoneKEy Reports,* 4, Article number: 705. doi:10.1038/bonekey 74

## Research Experience

- **Brown, R. B**. (2012). *Exploring patient and staff attitudes toward improving eating disorder program long-term outcomes.* Eating Disorders Clinic, Homewood Health Centre, Guelph, Ontario, Canada.

- Ross, S. A., & **Brown, R. B.** (2007). *Patient outcome study.* Eating Disorders Clinic, Homewood Health Centre, Guelph, Ontario, Canada.

## Work Experience

Principal Timpani and Percussion, Kitchener-Waterloo Symphony, Ontario, 1975-Present

## Teaching Experience

Percussion studies, Music Department, Wilfrid Laurier University, Waterloo, Ontario, 1975-1984.

No: 200-

COUR SUPÉRIEURE
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**c.**
**Procureur général du Québec**
**et- als.**
**défendeurs**

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