Analysis of the scientific basis for Ontario, Canada's mandatory face masking and physical distancing law, 2020

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[See section about the author's expertise, at the end]

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Summary

I find that the transmission mitigation provisions of Regulation 364/20 of the *Reopening Ontario (A Flexible Response to COVID-19) Act, 2020* are arbitrary and nonsensical, in light of actual knowledge about transmission of viral respiratory diseases, including COVID-19. Given hard evidence of harm from the measures themselves, if Ontario was a science-based society, the government would apply the precautionary principle by declaring a moratorium on all transmission-mitigation regulations, until policy-grade studies prove their worth in a rigorous harm-benefit appraisal framework.

Purpose and context

The purpose of this analysis is to examine whether provisions in the Ontario law to regulate mandatory face masks and physical distancing are supported by, consistent with, or contrary to established science about the transmission of viral respiratory diseases, including COVID-19. **[Ontario Regulation 364/20: Rules for Areas in Stage 3, under the *Reopening Ontario (A Flexible Response to COVID-19) Act, 2020*, S.O. 2020, c. 17, https://www.ontario.ca/laws/regulation/200364]**

The version of interest of Regulation 364/20 (the "Regulation") is the one with major changes that came into force on 3 October 2020. I use the consolidation period from 9 January 2021, to the e-Laws currency date of the access date of 28 January 2021. The Regulation is one of several regulations under the *Act* (S.O. 2020, c. 17). I count 32 regulations under the *Act*, at present. The *Act* specifies overarching enforcement conditions for these 32 Ontario COVID-19 regulations.
[https://www.ontario.ca/laws/statute/20r17].

In my reviews, since 11 April 2020, of the science of efficacy of face masks to reduce the risk of viral respiratory disease transmission, I have emphasized [1][2][3]:

- The only way to scientifically measure the efficacy of masks is using a randomized controlled trial (RCT) with "verified outcome" (laboratory confirmed infection) because: (a) the efficacy is small compared to other known and unknown factors, (b) the person to person variations of infectiousness and

susceptibility are known to be large compared to the averages, and (c) there is a high potential for bias in data collection/selection and in interpretation, in any substandard study.

- There have been no less than 15 policy-grade RCTs with verified outcome, in health care, community, and general-population settings. All but the most recent one have been analyzed in published formal systematic reviews. All 15 studies find that no reduction in risk can be detected with statistical significance. This means that any benefit is too small to be detected by science.
- The government claims that masks work are in effect disingenuous propaganda, improperly relying on substandard and irrelevant studies [2].

Therefore, the presumption that masks work is incorrect. It is disproved by science: Any risk reduction is too small to be detected using usual and established statistical criteria.

In the present analysis, I examine whether provisions in Regulation 364/20 make sense regarding reducing the spread of a viral respiratory disease in society and regarding epidemiological harm reduction, in terms of known transmission mechanisms and known circumstances of transmission, with an eye to all-cause mortality by week for Ontario.

Mandatory covering of the “mouth, nose and chin”

The Regulation mandates that the face covering must be worn in a manner that covers “their mouth, nose and chin during any period when they are in the indoor area” unless an exemption applies.

The requirement that the “mouth, nose and chin” be covered is arbitrary for a number of reasons:

- The “chin” is not known to play any biological role in transmission by breathing, talking, singing, coughing, etc.; and viral shedding from the chin, or infection through the chin, is expected, on the basis of known science, to be a negligible transmission pathway. Why would it not suffice to cover the mouth and nose?
- If the lawmakers had a belief that covering the chin would probably “improve” nose and mouth coverage, then why would the said lawmakers not be expressly concerned about: The gaps on either side of the nose, especially for large noses; the gaps all around the face covering; the presence of large and modest amounts of facial hair (beards); the pore size of the face-mask material; and so on. The express statutory concern for the chin is nonsense.
- If forward-projected droplets are the mechanistic focus, then it is difficult to understand the statute’s express concern for (generally downward exhaling) noses. Forward-projected droplets are often advanced to be the target of mask mandates. In that case, why not simply cover the mouth and not impede nose breathing, thus also enabling the (masked) mouth to be closed more of the time?

In addition, the Regulation, by omission, does not discern hydrophobic surgical masks and hydrophilic cloth coverings, which is reckless given what is known about warm and humid surface environments in the growth of cultures and films of diverse microorganisms, here in close proximity to the mouth, nose, ears and eyes.

Logic of the statutory exemptions from mask wearing

Regulation 364/20 contains 12 general exemptions from wearing a face covering in the indoor area, listed in section 2(4) of Schedule 1 (labelled “(a)” through “(l)”), as follows. My comments are in the bullets:

(a) [unless the person in the indoor area] is a child who is younger than two years of age;

- This exclusion means that the statute allows unmasked infection and transmission by the youngest infants. Thus, the vector of infant transmission is left out entirely from the statutory “protection”. Presumably, a two year old can be made to mask without disproportionate enforcement difficulty or disproportionate harm, whereas an infant younger than two years of age cannot?

(b) is attending a school or private school within the meaning of the Education Act that is operated in accordance with a return to school direction issued by the Ministry of Education and approved by the Office of the Chief Medical Officer of Health;

- It appears that lawmakers either believe that children in schools allowed to be open do not need masks to prevent them from spreading the disease, or they assume that masking will be imposed by the school authorities? However, any measures approved by the Chief Medical Officer would not prevent transmission in this group, if known science matters, unless the children are always completely isolated in airtight enclosures, which obviously should be considered unacceptable. The lawmakers probably have not visited a school during active hours in a long time. Field trips may be in order.
- Epidemiologist Knut Wittkowski has authoritatively argued that schools play a major role in quickly and safely achieving herd immunity, which, in turn, is the best protection of vulnerable elderly persons constantly exposed to care-home support staff and hospital transfers. Delayed herd immunity kills the vulnerable. General-population transmission mitigation measures are motivated by achieving delay.

(c) is attending a child care program at a place that is in compliance with the child care re-opening guidance issued by the Ministry of Education;

- Several scientific articles show that day care facilities have been measured to have high concentrations of suspended virion-laden infectious aerosol particles (see: 1]). These facilities are known hot spots of transmission in a modern society. It is inconceivable that day care facilities would not be important vectors

of transmission during the viral respiratory disease season, irrespective of Ministry of Education guidance. Therefore, this exemption is arbitrary.

- If masks worked, and we know they do not, then the school and day care exemptions circumvent the purpose of the Regulation.
- Transmission will always find the path of “least resistance” or of highest likelihood in the circumstances, here among the most immune-immature (children). Any delay would not be measurable, given the frequency of transmission events. Virtually every susceptible person connected to children, or to people with children, can be infected.

(d) is receiving residential services and supports in a residence listed in the definition of “residential services and supports” in subsection 4 (2) of the Services and Supports to Promote the Social Inclusion of Persons with Developmental Disabilities Act, 2008;

- Here, the lawmakers either presume that masks provide no benefit to persons with developmental disabilities, or cannot imagine any acceptable way to adapt the protection of masks to persons with developmental disabilities? It seems to me, either mask protection is not real or significant, or it is real and significant and should be adapted to the most vulnerable sectors of society. In this instance, the law appears to guarantee a protection only to less vulnerable members of society.

(e) is in a correctional institution or in a custody and detention program for young persons in conflict with the law;

- Here, the lawmakers appear to be of the opinion that respiratory disease viruses do not transmit between persons in conflict with the law, or within prison walls?

There are many intricate rules for prisoner safety in a prison, and this is one rule that would additionally protect the guards and the general population, if masks work, but it is not a rule considered palatable or practical by the lawmakers, for reasons that are far from apparent.

(f) is performing or rehearsing in a film or television production or in a concert, artistic event, theatrical performance or other performance;

- What? Performers can spray out aerosol particles for an hour or more in a closed performance or production hall, and from a stage, exchange with multiple and changing crews and co-workers, then repeat at the next performance or practice or recording. How can this exemption be reconciled with any logic?

(g) has a medical condition that inhibits their ability to wear a mask or face covering;

- Consequently, all non-mask-wearers are visibly identified and stigmatized as having a “medical condition”.
- What is the “ability to wear a mask”, which is not defined in the Regulation or the *Act*?
- Does asthma count? The WHO reports that 5% of the global population has asthma, and that “there were 417,918 deaths due to asthma at the global level and 24.8 million years lived with disability attributable to Asthma in 2016” [https://www.who.int/news-room/fact-sheets/detail/asthma].
- What about dust and pollen allergies? Shortness of breath? Obesity?

(h) is unable to put on or remove their mask or face covering without the assistance of another person;

- Do such unable persons not transmit the virus?

(i) needs to temporarily remove their mask or face covering while in the indoor area,

(i) to receive services that require the removal of their mask or face covering,
(ii) to engage in an athletic or fitness activity,
(iii) to consume food or drink, or
(iv) as may be necessary for the purposes of health and safety;

- Does the virus not transmit during these periods of "need"? Does one not emit aerosol particles during athletic or fitness activity? Does one not emit aerosol particles while receiving a service, or consuming food or drink?

(j) is being accommodated in accordance with the Accessibility for Ontarians with Disabilities Act, 2005;

- Persons with disabilities causing accessibility challenges do not transmit the virus?

(k) is being reasonably accommodated in accordance with the Human Rights Code; or

- Accommodation under the Human Rights Code trumps the dangers of transmission of the deadly virus?

(l) performs work for the business or organization, is in an area that is not accessible to members of the public and is able to maintain a physical distance of at least two metres from every other person while in the indoor area.

- Here, lawmakers presume that outside persons performing work do not contribute aerosol particles suspended in the air in the indoor area, and cannot inhale such aerosol particles, even while moving around in the indoor area, as

> long as, at each instant, there is a separation of at least two meters from any other person.

Given the scientifically established dominance of respiratory transmission (e.g., [4]), the multi-decadal body of knowledge establishing the importance of aerosol particles in the transmission of viral respiratory diseases (see: [1][2][3]), and the fact that the minimal infectious dose is likely as small as a single aerosol particle (see: [1][2][3]), it belies reason that lawmakers would enact such haphazard measures as described above, without any grounding in empirical evidence.

Even if masks worked as presumed, which they do not, a given susceptible individual would be infected in the subset of the regulation-excluded transmission areas or circumstances, and the resulting delay would be negligible on the time-scale of the infectious season, because each such given individual must have contacts to live (access to resources, essential work, exercise, family contacts, etc.). This simple calculation leaves out the increase in susceptibility to viral respiratory diseases, which is known to increase significantly with psychological stress and social isolation of the individual (see the decades of landmark studies by Professor Sheldon Cohen), and leaves out non-linear effects such as increases in both number and infectiousness of the regulation-excluded transmission areas and circumstances.

In the present state of knowledge about viral respiratory disease transmission, a regulation with these excluded transmission areas and circumstances is an absurdity, even if masks worked, which they do not.

Logic of the statutory general provisions

Schedule 1 of the Regulation has several general provisions, which are arbitrary and nonsensical, in light of actual knowledge about transmission of viral respiratory diseases. Some examples follow.

3. (1) The person responsible for a place of business or facility that is open to the public shall limit the number of persons in the place of business or facility so that every member of the public is able to maintain a physical distance of at least two metres from every other person in the business or facility, except where Schedule 2 allows persons to be closer together.

- The lawmakers appear to be unaware that, when people move, the air surrounding them does not generally follow. Rather, people move away from and into air containing long-lived suspended infectious aerosol particles. The lawmakers presume the existence of a static field of air, which extends one meter and follows the moving person, which is ridiculous. In fact, air movement and ventilation are primary considerations in viral respiratory disease transmission in the built environment (see: [2][3]).

6. (1) The person responsible for a business or place that is open shall ensure that,

(a) any washrooms, locker rooms, change rooms, showers or similar amenities made available to the public are cleaned and disinfected as frequently as is necessary to maintain a sanitary condition; and

(b) any equipment that is rented to, provided to or provided for the use of members of the public must be cleaned and disinfected as frequently as is necessary to maintain a sanitary condition.

(2) For greater certainty, clause (1) (b) applies to computers, electronics and other machines or devices that members of the public are permitted to operate.

- Here, lawmakers avoid the problem of defining "a sanitary condition". In the media that bombards us, we are prominently informed of studies that show that viruses can remain viable on various surfaces ("fomites"). Such studies do not show that fomites are a significant vector for transmission. In fact, it is established that they are not.[3][4] Therefore, in terms of viral respiratory diseases, including COVID-19, the surface-cleaning rules serve no medical or safety purpose. The science shows that it is useless. There has not been a single reliably documented case of transmission by physical contact.[4]

Schedule 2: Specific Rules, regulatory absurdity in every sector

Schedule 2 of the Regulation goes on to fabricate arbitrary rules, not grounded in any empirical studies whatsoever, in every area of societal activity: Restaurants and bars etc., public libraries, real estate open houses, personal car services, food courts etc., fitting rooms, retail sales, rentals, shopping malls, driving instruction, facilities for sports and recreational fitness activities, outdoor recreational amenities, camps for children, cinemas, performing arts, drive-in or drive through cinemas, performances etc., water features, casinos, bingo halls and gaming, racing venues, amusement parks and

waterparks, museums, tour and guide services, strip clubs, bathhouses, sex clubs, campgrounds, gatherings, wedding, funeral or religious service, rite or ceremony, and gathering in motor vehicles for religious service, rite or ceremony.

The statute can be reasonably described as a regulatory orgy. The physical restrictions are arbitrary and nonsensical, in light of actual knowledge about transmission of viral respiratory diseases. Typical examples follow.

The rule about "*gathering in motor vehicles for religious service*" has: "*The driver of [the parked and closed] motor vehicle must ensure that it is positioned at least two metres away from other [parked and closed] motor vehicles.*" To my knowledge, motor vehicles do not exhale respiratory droplets that project out two meters, and droplets do not traverse glass and steel.

The rule about "*outdoor recreational amenities*" has:

(2) An outdoor recreational amenity described in subsection (1) may only open if the following conditions are met:

> *1. Any person who enters or uses the amenity must maintain a physical distance of at least two metres from any other person who is using the amenity.*
> *2. Any person in line for the amenity or who forms a line anywhere within the amenity must wear a mask or face covering in a manner that covers their mouth, nose and chin during any period that they are in the line …*

Such a rule is absurd on many counts.

Transmission areas in society are virtually all in the built environment. In the outdoor environment, from a tenuous mechanistic perspective, only a dense crowd that is

immobile for a prolonged period, in the absence of wind and convection currents, would have a chance of approaching transmission conditions of the built environment, but such outdoor transmission has never been confirmed in a controlled scientific study.

The 2020 systematic review by Bulfone et al. [5], including SARS-CoV-2, identified some 10,912 published studies. Of these, only seven studies met their quality threshold requirement and reported events of outdoor-environment transmission (their Table 1), in uncontrolled observational studies (i.e., in which indoor meetings during the outdoor events were not controlled). The reported fractions of assigned outdoor transmission events in each on those seven studies were: 2/7324 — 4/103 — 5.6/110 (av.) — 1/7 — 95/10926 — 0/3 — and 28/820 (deaths, sleeping in hammocks outside, 1918).

This means that there is no reason, based on empirical and reliable data, to presume that transmission of COVID-19 can occur in the outdoor environment, and conclusive evidence that such transmission must be exceedingly rare if it exists. The outdoor transmission provisions in the Regulation are fabrications, unrelated to science. They appear to come from superstitious beliefs about imagined transmission mechanisms and their likelihoods.

Finally, from my search, I conclude that there is not a single reliable scientific report of any event of transmission of a viral respiratory disease occurring while waiting and moving in a line outdoors. If this were possible, in terms of likelihood, then it is dubious

to presume that two-meter distancing and masking would have any impact on the residual said likelihood, for the reasons already explained above.

Increased transmission and disease severity induced by the Regulation, and collateral deaths

It is established — based on the illustrious multi-decadal work of Professor Sheldon Cohen — that two major determinants of both susceptibility to be infected and severity of disease for viral respiratory diseases are: (1) psychological stress, and (2) social isolation of the individual.

Furthermore, it is known that random aggressions maximize physiologically measured psychological stress, and social dominance hierarchy, compared to predictable and regular aggressions [6][7], such as those resulting from enforcement of unambiguous and unchanging laws.

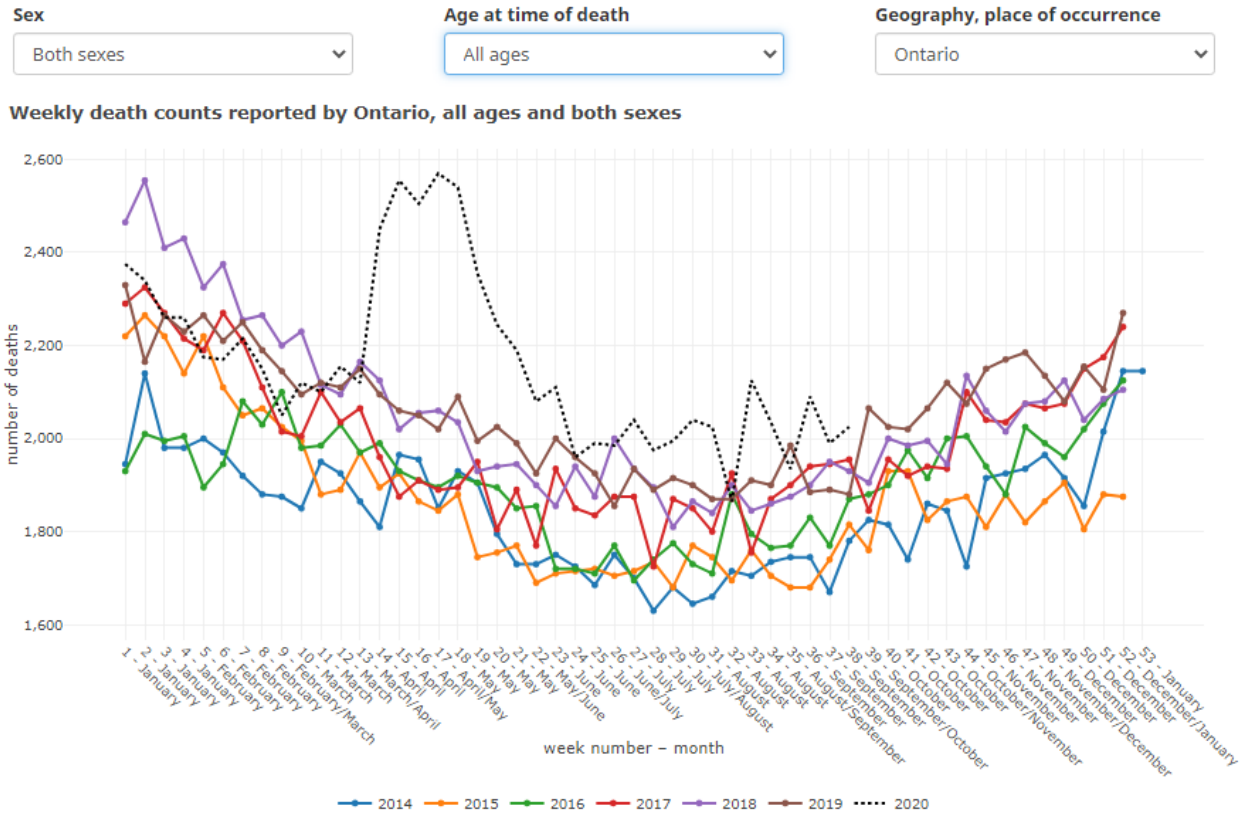
It is also known that changing and environmentally reinforced danger signalling is a major determinant of physiological stress. These factors are fundamental elements of individual health knowledge, in both animal and human studies.

It is therefore reasonable to expect that the Regulation probably has the opposite effect than its stated intended purpose, even without considering the many mechanisms of

collateral damage to health and society (loss of employment, loss of dignity, depression from isolation, small-business bankruptcies and closures, etc.).

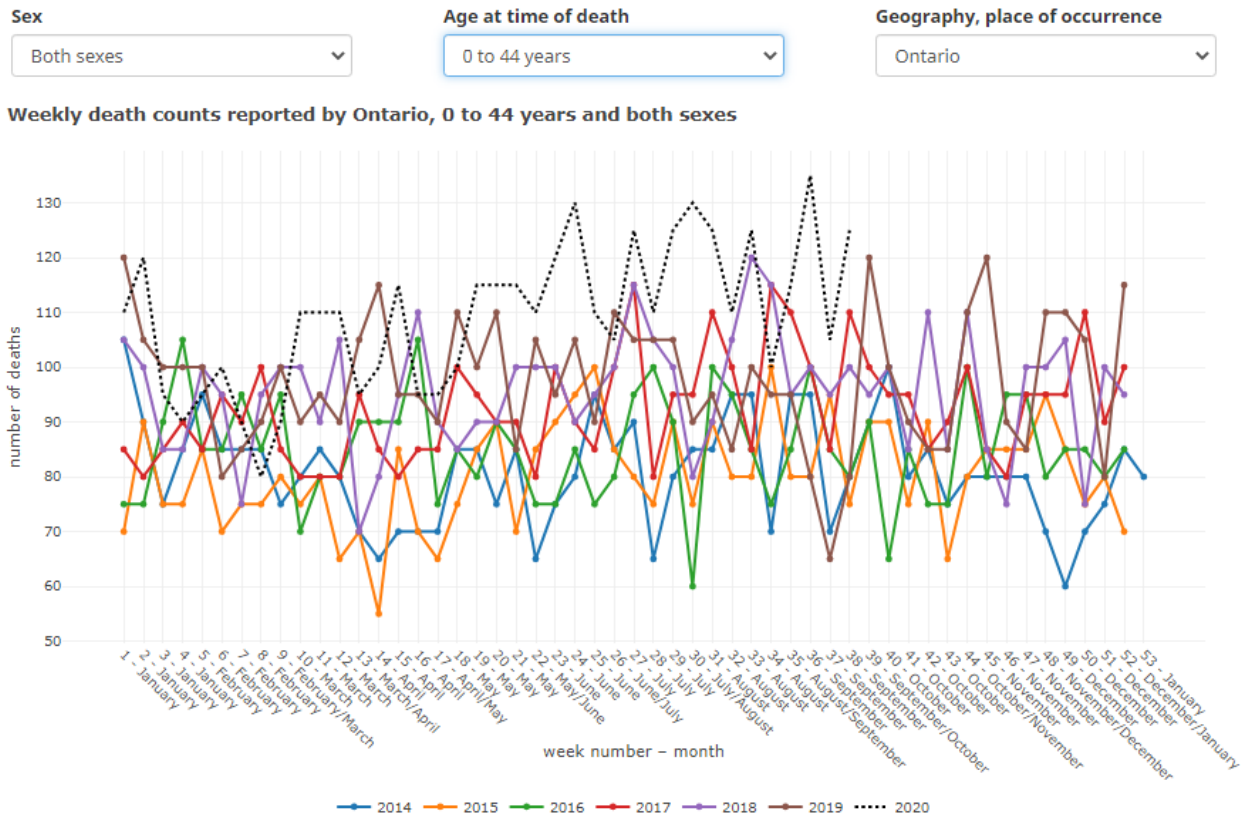
Finally, there is evidence in the available all-cause mortality by week data for Ontario that anomalous excess deaths have been caused by the barrage of public health measures intended to reduce transmission, applied in many jurisdictions prior to the October 2020 enactment of the Regulation.

The following figure [StatCan data, https://www150.statcan.gc.ca/n1/pub/71-607-x/71-607-x2020017-eng.htm, accessed 4 February 4, 2021] shows all-cause mortality by week for Ontario, for the years 2014 through 2020. The 2020 March-April “covid peak” of induced deaths in care homes is clearly discerned [8][9].

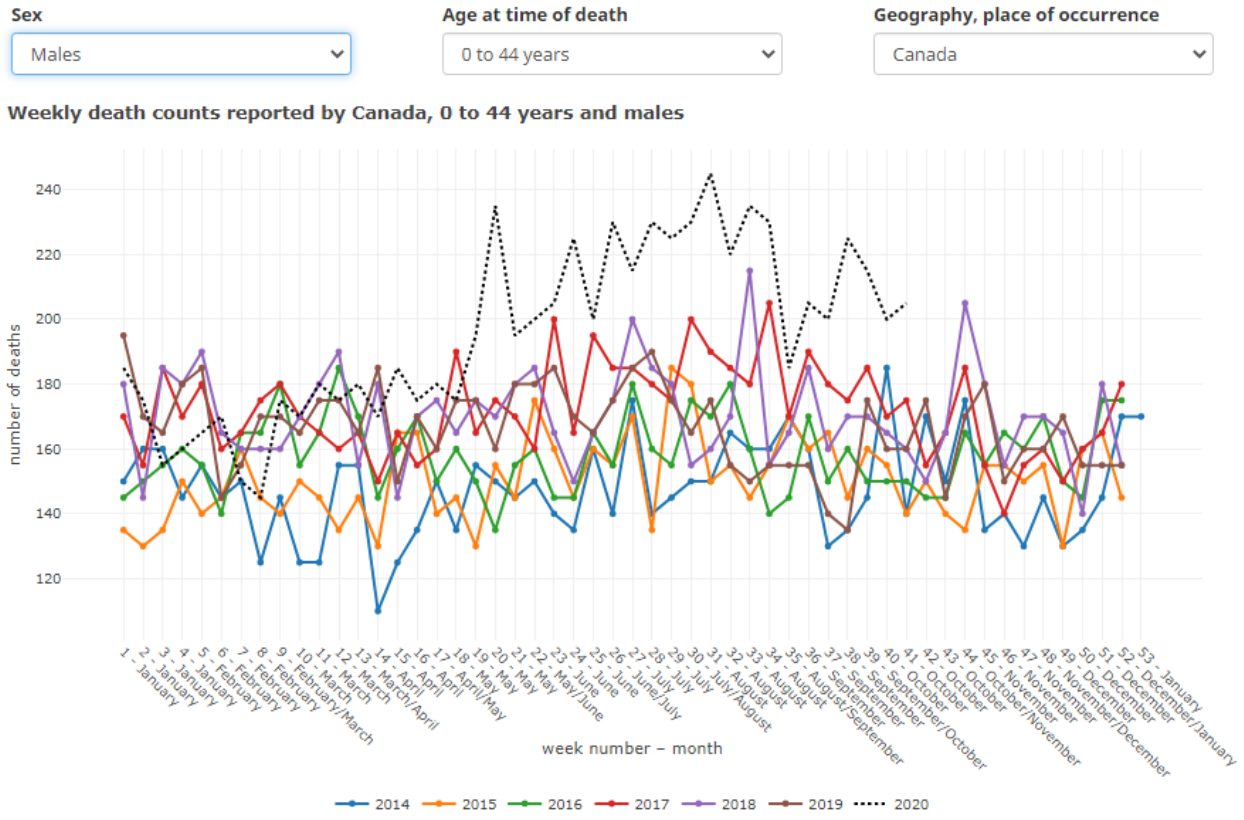


The said covid peak is followed by anomalous excess deaths seen in the June-August 2020 summer period. Such anomalous summer-time excess deaths have never previously been observed in any Western jurisdiction (province, state or country) in the last several decades, since quality data has been collected.

Approximately one quarter of the summer-time excess deaths by week are from the youngest age group of 0 to 44 years of age:



These anomalous summer-time deaths in the 0-44 age group are almost entirely deaths of males rather than females, with a male to female mortality sex ratio >4. The data are striking for Canada:



Viral respiratory diseases do not transmit in the summer [10], COVID-19 mortality itself is not so extremely differentiated by sex [11],[1] and COVID-19 virtually does not kill 0-44 year olds [11].[2] Clearly, the hard data of all-cause mortality for Ontario and Canada suggest that transmission mitigation measures are a high-risk Ontario government endeavour.

[1] The male to female COVID-19 mortality sex ratio in these ages is 0.8—1.8 [11], compared to >4 for all-cause excess mortality in 0-44 year old Canadians.

[2] 0.03—0.2 deaths of 0-44 year olds per 100,000 population, in 8 affected countries, from the start of the pandemic to 21 June 2020 [11].

If Ontario was a science-based society, the government would apply the precautionary principle by declaring a moratorium on all transmission-mitigation regulations, until policy-grade studies prove their worth, in a rigorous harm-benefit appraisal framework.

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Denis Rancourt's scientific background relevant to COVID-19

I am retired and a former tenured Full Professor of Physics, University of Ottawa. Full Professor is the highest academic rank. During my 23-year career as a university professor, I developed new courses and taught over 2000 university students, at all levels, and in three different faculties (Science, Engineering, Arts). I supervised more than 80 junior research terms or degrees at all levels from post-doctoral fellow to graduate students to NSERC undergraduate researchers. I headed an internationally recognized interdisciplinary research laboratory, and attracted significant research funding for two decades.

I have been an invited plenary, keynote, or special session speaker at major scientific conferences some 40 times. I have published over 100 research papers in leading peer-reviewed scientific journals, in the areas of physics, chemistry, geology, bio-geochemistry, measurement science, soil science, and environmental science.

My scientific h-index impact factor is 40, and my articles have been cited more than 5,000 times in peer-reviewed scientific journals (profile at Google Scholar: https://scholar.google.ca/citations?user=1ChsRsQAAAAJ).

My personal knowledge and ability to evaluate the facts in this article are grounded in my education, research, training and experience, as follows:

i. *Regarding environmental nanoparticles.* Viral respiratory diseases are transmitted by the smallest size-fraction of virion-laden aerosol particles, which are reactive environmental nanoparticles. Therefore, the chemical and physical stabilities and transport properties of these aerosol particles are the foundation of the dominant contagion mechanism through air. My extensive work on reactive environmental nanoparticles is internationally recognized, and includes: precipitation and growth, surface reactivity, agglomeration, surface charging, phase transformation, settling and sedimentation, and reactive dissolution. In addition, I have taught the relevant fluid dynamics (air is a compressible fluid), and gravitational settling at the university level, and I have done industrial-application research on the technology of filtration (face masks are filters).

ii. *Regarding molecular science, molecular dynamics, and surface complexation.* I am an expert in molecular structures, reactions, and dynamics, including molecular complexation to biotic and abiotic surfaces. These processes are the basis of viral attachment, antigen attachment, molecular replication, attachment to mask fibers, particle charging, loss and growth in aerosol particles, and all such phenomena involved in viral transmission and infection, and in protection measures. I taught quantum mechanics at the advanced university level for many years, which is the fundamental theory of atoms, molecules and substances; and in my published research I developed X-ray diffraction theory and methodology for characterizing small material particles.

iii. *Regarding statistical analysis methods.* Statistical analysis of scientific studies, including robust error propagation analysis and robust estimates of bias, sets the limit of what reliably can be inferred from any observational study, including randomized controlled trials in medicine, and including field measurements during epidemics. I am an expert in error analysis and statistical analysis of complex data, at the research level in many areas of science. Statistical analysis methods are the basis of medical research.

iv. *Regarding mathematical modelling.* Much of epidemiology is based on mathematical models of disease transmission and evolution in the population. I have research-level knowledge and experience with predictive and exploratory mathematical models and

simulation methods. I have expert knowledge related to parameter uncertainties and parameter dependencies in such models. I have made extensive simulations of epidemiological dynamics, using standard compartmental models (SIR) and new models.

v. *Regarding measurement methods.* In science there are five main categories of measurement methods: (1) spectroscopy (including nuclear, electronic and vibrational spectroscopies), (2) imaging (including optical and electron microscopies, and resonance imaging), (3) diffraction (including X-ray and neutron diffractions, used to elaborate molecular, defect and magnetic structures), (4) transport measurements (including reaction rates, energy transfers, and conductivities), and (5) physical property measurements (including specific density, thermal capacities, stress response, material fatigue…). I have taught these measurement methods in an interdisciplinary graduate course that I developed and gave to graduate (M.Sc. and Ph.D.) students of physics, biology, chemistry, geology, and engineering for many years. I have made fundamental discoveries and advances in areas of spectroscopy, diffraction, magnetometry, and microscopy, which have been published in leading scientific journals and presented at international conferences. I know measurement science, the basis of all sciences, at the highest level.