

Arguments Against UW Vaccine and Testing Mandate are Logically and Mathematically Unsound

Gordon V. Cormack

Professor

School of Computer Science

University of Waterloo

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I am distressed that four of my colleagues from the University of Waterloo—three from my own Faculty of Mathematics and one from the Faculty of Science—advance mathematically and logically flawed arguments to promote their stance against vaccination and testing requirements.

A vaccine doesn't need to induce perfect sterilizing immunity to help reduce transmission below the critical factor of $R(t)=1$, as necessary to contain spread.

The leading faulty argument in my colleagues' letter that was distributed through a mass email campaign and other media is: Only vaccines that induce "sterilizing immunity" are useful in controlling Covid-19; none of the currently available vaccines induce sterilizing immunity because there are breakthrough infections; vaccines are therefore useless for controlling the spread of Covid-19.

The validity of this argument depends on a tortured definition of "sterilizing immunity" to apply only to vaccines that are 100% effective at preventing infection. If we adopt this definition, the first clause in their argument is categorically false; vaccines that are less than 100% effective at preventing infection can and do play a critical role in controlling spread.

Many studies—both clinical and epidemiological—seek to quantify the degree of protection afforded by vaccines, against both infection and transmission. Without complete testing and contact tracing these quantities can only be estimated; and even so, only for a particular population, over a particular interval of time. None of these studies suggest that vaccines are either 0% or 100% effective at preventing infection and transmission. The essence of my colleagues' fallacy is to suggest that because vaccines are not 100% effective, they are 0% effective. The truth is somewhere in between. A reasoned argument regarding vaccine effectiveness can be made only when we estimate effectiveness as well as we can, based on current information.

One example of such an estimate is the Ontario Dashboard <https://covid19-sciencetable.ca/ontario-dashboard/> maintained by the Ontario COVID-19 Science Advisory Table, which indicates that as of September 18, 2021, vaccinated Ontario residents were 85%

less likely to become infected, 96.4% less likely to be hospitalized, and 98.1% less likely to be in an ICU. The Dashboard also reports the Effective Reproduction Number $R(t)$ to be 1.01, meaning that each infected person, on average, spreads the infection to 1.01 other people. The Dashboard further reports Doubling Time to be 235 days, indicating when, under the current conditions, the rate of infection (“incidence”) will be double the current rate of 48.4 cases per million per day. The Dashboard does not break down $R(t)$ by the relative contributions of vaccinated and unvaccinated individuals. If we assume that a vaccinated individual, once infected, is equally likely to spread the virus, that vaccinated person poses 85% lower risk than an unvaccinated individual.

No doubt my colleagues will quibble about the methodology by which these numbers were derived, which is fine. We can plug in other numbers of their choosing, but we still won’t get the 0% effectiveness on which their specious argument relies.

Adverse effects from vaccination cannot be quantified from VAERS reports.

My colleagues employ specious arguments inflating the risks of vaccines. Based on a Jane Doe affidavit in a lawsuit waged by political group “America’s Frontline Doctors,” my colleagues claim that 55,000 deaths in the United States are attributable to Covid-19 vaccination. The affidavit actually claims 45,000 deaths

(<https://storage.courtlistener.com/recap/gov.uscourts.alnd.177186/gov.uscourts.alnd.177186.15.4.pdf>) based on a purported 9,048 reported incidents¹ in the Vaccine Adverse Event Reporting System, coupled with the affiant’s guess that VAERS underreports by a factor of five the number of people who died within three days of receiving the vaccine. These raw numbers show neither correlation nor causation. “Dying within three days” is simply not the same thing as “dying because of”: *VAERS collects data on any adverse event following vaccination, be it coincidental or truly caused by a vaccine. The report of an adverse event to VAERS is not documentation that a vaccine caused the event* (<https://vaers.hhs.gov/data/dataguide.html>).

As of the date of the affidavit’s claim, about 350 million vaccine doses had been administered in the United States. The VAERS reports represent 0.0026% of all doses, or 1 in 38,682. The three days following each of the 350 million doses sum to 2.9 million person-years. In the age range of those vaccinated, the normal annual mortality rate is about 1%, indicating that we would naturally expect about 29,000 people to die within this amount of time. For comparison, more than 0.2% of Americans (1 in 500) in the same age range had died from Covid-19, as of the same date.

¹ I am unable to reproduce this number. On September 25, 2021, I downloaded and searched the VAERS dataset for deaths following COVID vaccination on or before July 9, 2021. I found reports for 5,268 incidents, among which only 1,354 reported death to have occurred on the date of vaccination or any of the following three days, and 2,138 reported death or onset within the same four-day interval.

Once again, we can quibble about the numbers, but the notion of “numerous grave adverse effects of the COVID vaccines” propounded by my colleagues derives from the flawed application of statistics. The evidence suggests that the adverse effects of being unvaccinated—or of being exposed to unvaccinated individuals—are far more numerous and far more grave.

In short, my colleagues’ method of counting vaccine deaths is mathematically unsound, and in any event, vaccination risks must be weighed against the benefits; not only the direct benefits to the recipient in terms of reduced risk of infection and serious illness, but also the direct benefits to others in terms of reduced risk of transmission, and the indirect benefits in terms of reducing $R(t)$, thus reducing prevalence and therefore risk to everyone.

Asymptomatic individuals do transmit Covid-19.

My colleagues use the terms “healthy people” and “clinically sick” to imply that asymptomatic individuals cannot transmit the disease, and that testing of asymptomatic individuals is therefore “scientifically baseless.” If we define “clinically sick” and “healthy people” to be those with and without active Covid infection, respectively, it is vacuously true that “healthy people don’t transmit Covid-19.” But it is well established that some infected individuals display no symptoms for some or all of the duration of their infections, while still transmitting the disease. Testing will detect some of these individuals so that they can be isolated to mitigate the spread.

My colleagues misrepresent the findings of “a very large study conducted in Wuhan, China” to support their claim that “a positive test does not imply contagiousness.” The Wuhan study, conducted where community transmission had been high but subsequently abated, found that most positives were false positives because they detected prior infections that were no longer active and therefore no longer contagious. As the authors of the study note, “it would be problematic to apply the results of our research to countries where Covid-19 outbreaks have not been successfully brought under control.” Where community transmission is high, a positive PCR test—especially following a succession of negative tests—is a strong indicator of current infection and therefore infectiousness.

Post-infection vaccination reduces the probability of re-infection.

Reinfections are known to occur. As for vaccination, the risks of reinfection and further transmission are difficult to evaluate, and are the subject of ongoing investigation. Regardless of whether prior infection affords “more robust” protection as claimed by my colleagues, their conclusion that “therefore those with natural immunity cannot possibly derive any additional benefit or protection from getting vaccinated” does not follow. Indeed, a growing body of evidence shows that prior (or subsequent) infection combined with vaccination provides superior protection to either one alone. This has absolutely nothing to do with which one alone is more effective.

None of the cited “Resources” is credible.

The cited resources merely recycle these and other fallacious arguments. The primary source appears to be America’s Frontline Doctors, whose founder, Simone Gold, is closely linked with right-wing organization Tea Party Patriots, and was arrested for her participation in the January 6 attack on the U.S. Capitol. *Time* recently ran an exposé titled *How “America’s Frontline Doctors” Sold Access to Bogus COVID-19 Treatments—And Left Patients in the Lurch* (<https://time.com/6092368/americas-frontline-doctors-covid-19-misinformation/>).

Throughout the world, reputable clinicians, epidemiologists, and data scientists are working to enhance our understanding of Covid-19 infection, abatement, and treatment. Organizations such as America’s Frontline Doctors, and those who repeat their misinformation, detract from this effort. I am disappointed that my four colleagues at the University of Waterloo have joined suit.