# A Pragmatic Perspective on COVID-19

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We need a way to separate hysteria, propaganda and conspiracy theory from reality so we can gain a pragmatic perspective on the current COVID-19 pandemic caused by the SARS-CoV-2 virus…

Let's start with a little education in virology. Columbia University offers a FREE introduction to virology course – covered in 26 lectures. The course is very good and I highly recommend it. The class slides are provided on the class web site along with links to the lectures on YouTube. Here is the link to the course:

https://www.virology.ws/course/

Even if you only understand 5% of what the class covered, it would be well worth your time to sit through the class. Turn off the TV and give the social media sites a rest – watch the lectures.

And you should take a look at the major historic pandemics – I will use the CDC's data:

https://www.cdc.gov/flu/pandemic-resources/basics/past-pandemics.html

The big recent pandemics were:

1918: H1N1 – killing an estimated 675 thousand people out of a US population of 105 million, killing roughly 0.64% of the US population. Scaled to the current US population (330 million), we would have to kill 2.1 million people to match the same death percentage.

1957: H2N2 – killing an estimated 116 thousand people out of a US population of 172 million, killing roughly 0.07% of the US population. Scaled to the current US population, we would have to kill 222 thousand people to match the same death percentage. This is expected to happen around mid-October, 2020.

1968: H3N2 – killing an estimated 100 thousand people out of a US population of 206 million, killing roughly 0.05% of the US population. Scaled to the current US population, we would have to kill 160 thousand people to match the same death percentage. This was matched around August 6, 2020.

Note that the killed percentage given above is for the entire population. However, not everyone in the population got the disease. Most estimates are that only 50% of the population got each disease. Thus, the percentage that died from the disease is twice the percentage provided.

I was too young to remember the 1957 pandemic. However, I was in junior high school during the 1968 pandemic. There was no hysteria. The pandemic was only occasionally covered in the news. No one was very concerned. Parents and school officials did not even ask us to wash our hands more often. When people got sick, they mostly stayed home.

To be fair, COVID-19 is not the flu. Flu infections tend to be seasonal – peaking in the winter months and being subdued during the summer months. Thus, if a flu pandemic spans multiple years, you expect to see multiple peaks. COVID-19 has shown no signs of being seasonal so how well the public follows appropriate hygiene practices will be the controlling factor for where and how high the peaks are.

The SARS-CoV-2 virus is covered with proteins that give the virus a spiked appearance under high magnification. Viruses of this type are commonly called Corona viruses due to that appearance – corona translates to crown.

The SARS-CoV-2 virus infects a cell through a process called endocytosis. The SARS-CoV-2 virus protein spikes attach to ACE2 cell receptors. ACE2 is often pronounced Ace Two. After a virus protein spike attaches to an ACE2 receptor, the cell brings the virus particle into the cell – at which point the viral replication process can begin.

Although the upper respiratory system has a large concentration of environmentally exposed ACE2 cell receptors, many other organs around the body also have ACE2 receptors. Thus it is possible for a viral infection to start in the respiratory system and then move to other organs of the body. This is why COVID-19 patients exhibit such a wide range of symptoms. The extent of symptoms and damage to body systems can vary widely from one patient to the next.

$R_0$ (capital R, little zero) is the measure of how infectious a virus is – i.e., how easily the infection can spread. The $R_0$ for SARS-CoV-2 virus (which causes COVID-19, the disease) is currently believed to be between 2 and 3. That means you need to infect 50% to 70% of the population before the virus stops spreading on its own. Thus, if we take the lower infectivity percentage, you have a roughly 50% chance of acquiring COVID-19 over the next 12 to 18 months. There's no need to get depressed – I'm just being pragmatic here.

There were no vaccines to inoculate the population during the three prior pandemics and thus those pandemics ran their course through the population unhindered. The three prior pandemics died out on their own when a sufficiently high percentage of the population had become infected and recovered from the disease. There is no reason to believe this pandemic will be any different. It's the way infections work. This is how Nature develops "herd immunity." That which does not kill you makes you stronger...

Although medical technology has come a long way, there is no evidence that it is possible to develop, test and deploy a new vaccine for COVID-19 in the next 12 months – or even 18 months. Thus, the scenario with the highest probability is that this pandemic will run its course through the population unhindered.

It is important to emphasize that the viruses that caused the three prior pandemics are still out there – in one form or another. Kids continue to be born and those kids present a new opportunity for those viruses to spread. And people travel from place to place and take their viruses with them. It is entirely possible one of these viruses will find the right conditions and the virus will flare up as an outbreak and then return to the background. SARS-CoV-2 will join the list after this pandemic.

So where are we in the current pandemic? It is a moving target. This paper was originally written in early May 2020 and has been updated many times over a period of many months. Although the basics have changed very little, the accumulated statistics have continued to climb as you would expect. Thus the referenced numbers are associated with the date they were valid for.

A common place to start is with the John Hopkins data:

https://www.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd4029942 3467b48e9ecf6 (copy/paste entire URL, remove extra space after first line)

The CDC (United States Centers for Disease Control and Prevention) weekly death data along with detailed information on the limitations of that data can be found here:

https://www.cdc.gov/nchs/nvss/vsrr/COVID19/index.htm

And if you want the Arizona data, you can go here:

https://azdhs.gov/preparedness/epidemiology-disease-control/infectious-disease-epidemiology/covid-19/dashboards/index.php

If you want to know what is currently happening and the trends, use the daily or weekly rates. But as is explained in detail by the CDC, these numbers need to age. By the time the numbers are many weeks old, they should be relatively close to where they are likely to end up. That means the data will become more stable and less likely to change dramatically. That does not mean the data is accurate – as will be discussed later – it just means the data is stabilizing around its likely final value.

There were 1.6 million "confirmed" COVID-19 cases by May 24, 2020. There were also 97 thousand "COVID-19 deaths." The data behind these two numbers is suspect, but it represents the best data published on that day – so that is the data I will use.

It is important to keep in mind that testing around May 2020 was generally restricted to people who were sick and showing COVID-19-like symptoms. Of those tested, you would typically see a positive result for only 6% to 8% of tested people. Later in the year, testing was expanded to also allow exposed people without symptoms. The positive rate rose to 10% to 12% by July during the summer peak and then dropped again. These are the "confirmed" cases.

If you are sick with relatively mild symptoms and stay home instead of going to the doctor, you will not be tested. Even if you are sick and try to see the doctor, you may not be tested. Thus, it was guesstimated in the May 2020 timeframe that there were 10 times more actual cases than "confirmed" cases. So let's just assume – for the sake of this discussion – that there are closer to 16 million cases. This is a very rough guesstimate at best.

The time between getting a test and receiving results has been an ongoing problem. The longer it takes to receive a result, the less useful the result will be. By the time the result is delayed by a week, the result is nearly useless because the decision about what to do was made long ago without any consideration for the test results.

The problem with testing accuracy has been an on-going problem. False positives and false negatives have been all too common. There have been some spectacular high profile failures showing false positive rates in the 80% range. Suffice it to say that the quality control on many test kits was lacking.

The problem with published data continues as the pandemic has worn on. On September 20, 2020, Arizona was reporting 214,018 cases but only 178,000 positive test results. That is a discrepancy of roughly 36,000 cases – ignoring the practice of testing the same person multiple times. Nothing on the dashboard page tries to explain the discrepancy.

On July 15, 2020, the Arizona data showed that 1.8% of the Arizona population had tested positive for COVID-19. If we assume the same 10x expansion to account for under testing noted above, we can guesstimate that 18% of the Arizona population has been infected. If we assume roughly 50% of the population has to get infected for the spread to stop on its own, we can guesstimate that we are one-third the way through the pandemic as far as Arizona is concerned. This rose to 2.9% and 29% respectively by September 20, 2020 using the larger case number, thus we may now be halfway through the pandemic in Arizona. But again, that is just a guestimate.

It is important to keep in mind that not all "COVID-19 deaths" are "confirmed" cases. It will be argued for quite some time how many of the deaths involving COVID-19-like symptoms were actually involving COVID-19. Keep in mind the wide discrepancy between tested and confirmed cases previously covered – not to mention all of the untested cases. And those with underlying medical conditions may be dying from the underlying conditions as opposed to COVID-19 – even if they test positive. All of this leads to a legitimate disagreement as to how to classify any given death. So COVID-19 deaths are a rough guesstimate at best.

The bottom line is this: how many people are going to die from this pandemic? What will be the eventual death count from the COVID-19 pandemic?

Using 16 million guesstimated cases and the published 97 thousand death count produces a guesstimated death percentage of 0.6%. If you assume 50% of the US population gets COVID-19 and this death percentage stays the same, we can guesstimate the pandemic will kill almost 1 million people – half the number of the 1918 pandemic when scaled to the current US population.

Sounds dreadful, doesn't it? However, the data and assumptions used to generate this figure are quite suspect and thus the guesstimate may be way off. Not to mention that the real death percentage can shift dramatically as the pandemic continues, as new populations become exposed and better data accumulates. Guessing is still guessing, no matter how many decimal places you use. Or put a different way, extrapolating suspect data into fanciful results is a fool's errand – but those results play well on the nightly news and are great for terrorizing the public.

Let's take a look at a second method to guess at the eventual death count. For this method, start with a monthly death count. The April 2020 COVID-19 death count as reported on May 29, 2020 by the CDC was roughly 50 thousand COVID-19 deaths. The data was at least a month old at the time so the data should have been sufficiently stable. Now extrapolate that for 12 months with the same monthly death count. This yields 600 thousand deaths in the US. Note that we have assumed the pandemic will run continuously at the same level for 12 months. It may actually run for fewer months and it may taper off rather than suddenly stopping. Or it may run for more months. We just don't know. If you want the answer today, you must predict the future – which is notoriously unreliable.

If you compare "COVID-19 deaths" to "Pneumonia and COVID-19", the death rate drops by half. That would lower the guess to only 300 thousand deaths using this method. Given the primary cause of death from COVID-19 is from pneumonia related issues, this may well be a better number.

On July 15, 2020, the Arizona data showed that 0.034% of the Arizona population had died from COVID-19. If we assume the pandemic is one-third over based on our earlier calculations and assume other things remain the same, we can assume there will be three times the deaths before the pandemic ends. From that, we can guesstimate that 0.1% of the population will die in Arizona from this pandemic. Given Arizona's population of 7.4 million people, we would expect 7,400 Arizona deaths. Applying the same death rate to the US population of 330 million, we would expect 330 thousand deaths.

On September 22, 2020, the Arizona data showed 5,498 total COVID-19 deaths – 0.074% of the Arizona population. If we keep our guesstimate that 0.1% of the population will die in Arizona from this pandemic, we are ¾ the way there.

Looking at the per capita death rates for early July 2020, Belgium is currently the highest with 86 per 100 thousand. The USA is at 41 per 100 thousand. If we were to assume the eventual per capita death rate will be 100 per 100 thousand, we might guess that the pandemic is mostly over for Belgium and not quite half over for the USA. But remember, 0.1% is just a guestimate and it could be way off. The rates reported as of September 16, 2020 were 86.9 per 100,000 for Belgium and 59.7 per 100,000 for the USA.

Finally, consider the weekly graph of all deaths against the averaged historic data of weekly deaths. Weekly numbers above the average numbers represent excess deaths that are presumably caused by some current phenomenon – such as the current pandemic. This method may do a better job of separating the folks that were going to die anyway from the folks that died primarily from COVID-19. Here is a link to the CDC data on excess deaths associated with COVID-19:

https://www.cdc.gov/nchs/nvss/vsrr/covid19/excess_deaths.htm

You will notice there was a large spike that peaked on the week ending April 11, 2020. After that, there was a rapid fall heading back toward the threshold for excess deaths line. You will notice that by the week ending June 6, 2020, excess deaths were approaching the threshold line. We have ignored the last month of data – which is well below the threshold line – due to the likelihood that data is incomplete. As it turned out, this was to be just a low point in the graph that was followed by a significant broad peak when several more months of data had become available. This particular graph combined with the early July 2020 death count (130 thousand deaths) might lead you to guest that perhaps 200 to 300 thousand people will die from the current pandemic. But again, it is just a guesstimate.

The John Hopkins reported deaths for the US had reached 199,411 on September 20, 2020, just in time to reach 200,000 for the fall equinox. But the CDC weekly excess deaths showed 246,377 deaths. That is a rather large discrepancy. Both data sets should have similar reporting lags – death counts always lag behind actual deaths by many weeks. Some – if not all – of this difference can be explained by the fact that the CDC data is for all deaths. The CDC data includes non-COVID-19 deaths that are in excess of the expected average. Isolating just the COVID-19 deaths from the total data is a lot more difficult and spot checking suggests it is likely to account for most of the 25% higher CDC value.

But this just begs a different question. Where did all of these non-COVID-19 excess deaths come from? Why is there such a large number of excess deaths caused by non-COVID-19 causes? Is it because the medical system is so focused on COVID-19 that they are ignoring the common fatal disease states such as cardiovascular diseases and cancer that kill a lot of people each year? How about trauma injuries? Has the medical system chosen to let these other very sick people die while they focus on COVID-19?

You may find it interesting to look at the excess deaths relative to the cause of death. Circulatory diseases and Alzheimers/dementia show the larger peaks above the historic data. But be careful about drawing any particular conclusions based only on the graphed data – there are many possible explanations.

As you can see, there are a lot of unknowns. We don't know how many people have already acquired the disease and recovered. We don't know how many people remain to get the disease. We don't know what percentage of otherwise healthy people who get the disease will die from the disease. We don't know how much the treatments for the disease – or the side affects of the disease – will improve and thus how that will affect the numbers of very ill people who survive instead of dying. It will likely be well after the pandemic is over before we have an accurate estimate of what really happened.

You should also consider long-term disability caused by COVID-19. Just because you don't die from the disease does not mean you fully recovered from the disease. Remember the ACE2 receptors all around the interior of your body? You may be left with damaged organs. That damage may remain for months, years or the rest of your life. There is currently no published data to help assess this issue.

Let's return to the infectivity rate discussed earlier. We will again assume 50% of the population has to be infected to stop the infectious spread. Wouldn't it be nice to know what percentage of the population has been infected with COVID-19 and is now part of the immune herd? Or put another way, what percentage of the population remains to be infected before the pandemic runs its course and quits? As of September 2020, I have seen no serious effort to quantify this.

Now let's turn our attention to reducing our probability of catching COVID-19. Is there any magic or anything special we need to do? Not really. Just do the same old stuff that's been taught for decades. Here's a link to the CDC's recommendations:

https://www.cdc.gov/coronavirus/2019-ncov/index.html

It should be emphasized that the following guidelines are good practice in general, especially during the annual flu season. We should have been doing this stuff all along.

The basic steps are very simple:

1. Get people to stay home when they feel sick
2. Wash your hands as needed
3. Don't touch your face with dirty hands
4. Social distance when interacting with others – 6 to 7 feet (2 meters)
5. If you cannot social distance, use appropriate PPE (personal protective equipment) and procedures
6. Get people with underlying medical conditions – those conditions that make them particularly vulnerable – to take extra precautions

The SARS-CoV-2 virus spreads most easily directly from person to person and less easily indirectly via other surfaces. This is mostly due to the amount of viable virus that can be transmitted and this determines the likelihood of transmission. In microbiology, it is the concept of the minimum infectious load needed to transmit an infection. Note that the minimum infectious load has not been determined for COVID-19 but the current evidence suggests the infectivity is similar to colds and flu.

The virus quickly degrades outside the body and thus infectivity drops rapidly with time at normal room temperatures. For this reason, most surfaces will decontaminate themselves and no disinfection is needed. In other words, the same level of cleaning used for colds and flu should suffice.

Having a good immune system is very important to fighting any infection. Your body's immune system is very capable. The standard guidelines of good nutrition, regular exercise, good sleep, low stress and social connectedness will keep your immune system in top shape. These very same guidelines also reduce the common comorbidities – i.e., things that increase the likelihood of worse outcomes - such as high blood pressure.

Some percentage of people with COVID-19 are asymptomatic – meaning that they do not feel sick and they do not show any signs of being sick – but they are still infectious. People can be asymptomatic prior to becoming symptomatic or they may never become symptomatic because they have a very mild case. And even after symptoms have abated, someone may return to being asymptomatic until the virus is finally cleared from their body. Such is life. If you treat everybody you meet as if they are asymptomatic, you are less likely to do the wrong thing by mistake and become infected.

Data now show that children are at very low risk from COVID-19. They rarely have complications requiring medical care unless they have an underlying medical condition. Further, they pose a lower risk of passing on the infection as their viral loads tend to be much lower than that of an adult.

What about masks? If you are coughing or sneezing, regardless of it being due to allergies or an illness, you should wear a high quality fitted mask that covers your mouth and nose. A cheap disposable surgical mask will also work. You are wearing the mask to protect others from your aerosolized mucosal particles. In other words, you are trying not to contaminate other people around you. Note that the protection is only provided for someone directly in front of your face – so if you are going to cough, sneeze or talk to someone, face the other person when you do so the mask can do its job. This is a very different reflex from turning away and using your elbow when you are not wearing a mask.

If you are not coughing or sneezing and you can social distance while minimizing interactions, a mask offers very little protection to those around you.

A mask should not be confused with a respirator – they are two very different devices and serve two very different purposes.

You wear a mask to stop larger particles from entering or leaving your mouth or nose along a direct path. For instance, mucosal particles from your cough or sneeze or talking are prevented from traveling forward but may still exit to the edges of the mask. In emergency medical environments, a medical person wears a mask to prevent a patient's splashed bodily fluids from entering the medical person's mouth and nose.

A respirator is designed to protect the person wearing the respirator from air-borne contaminants in the environment. To provide this protection, the respirator must be properly fitted, sealed and the seal must be tested. Respirators are generally NOT designed to protect others from the person wearing the respirator. Thus an appropriate respirator when properly fitted can protect you from inhaling viral particles. However, most respirators will not stop you for exhaling viral particles and are no more effective than masks for this purpose. Note that respirators with unfiltered front exhaust valves will be even less effective than masks for this purpose. Most respirators used in industry and for medical purposes are N-95 rated – meaning they stop 95% of all particles that are at least 0.3 microns in size *from being inhaled*.

Contact tracing is used to track down the origins of a disease and is commonly used to track many diseases. Properly implemented, contact tracing with treatment and isolation can theoretically stop the spread of most infectious diseases and even eliminate them from the general population.

The method is conceptually straight forward. When you discover a person with the target disease, you try to identify everybody the infected person has been in contact with over some period of time – such as the disease's incubation period plus a few days. Then you go to each of the identified people and repeat the process. Each identified person is evaluated and treated for the disease or placed in quarantine. In this way, you find the infected people and isolate them from the general population or otherwise treat the disease and thus prevent further spread of the infection.

Note that the CDC's definition of a contact for the purposes of COVID-19 is spending at least 15 minutes with someone at a distance of less than 6 feet without any personal protection equipment, such as a mask. This should give you a good idea of what it actually takes to transmit the disease. Casually passing someone on the street or stopping for a quick hello is not likely to transmit the disease.

There are factors that can reduce the effectiveness of contact tracing. For instance, if the disease can be spread asymptomatically, there will not be any cause for an asymptomatic person to contact the health system and thus the health system will not be aware of the infectious person other than through the symptomatic people infected. Or, if the health system fails to make a good case to the public to encourage voluntary cooperation and/or fails to engender trust in the population, people may not cooperate with the health system and volunteer the required information.

It is important to ask if the illness justifies the considerable effort needed to contact trace. For illnesses that have a high ongoing cost to society, contact tracing may be a good option to reduce the cost of treating an illness in the general population. However, many illnesses – such as the common cold or flu – will see a relatively low return on investment so contact tracing is usually not done in these cases.

The rapid spread of an infectious disease can produce a large spike in medical cases that can exceed the capacity of available local medical resources – such has hospital beds, medical equipment or medical personal. You can prevent a large spike in cases – and thus prevent overwhelming the medical system – by "flatten the curve." The curve (the graph of the number of cases over time) is flattened by slowing the rate of spread. The same number of people may still get sick and need medical attention, but now it happens over a much longer period of time so the medical system capacity is not exceeded.

How do you flatten the curve? Simple. You lower the population's probability of catching the disease over the period of interest. We already covered ways for individuals to accomplish this. To extend this to the whole population requires extensive public education and perhaps the expenditure of resources to implement the practices. You also need the public's trust and cooperation. If most people participate, this should be enough.

It is important to realize that as long as the infectious disease continues to exist in the general population and as long as a large percentage of the population is vulnerable to the disease, the risk of rapid spread continues to exist. The threat of rapid spread will exist until a high enough percentage of the population has had the disease and the disease can no longer spread efficiently. In other words, until the population has developed herd immunity. The goal of good public health education is to popularize good hygiene habits and sufficient social distancing so as to lower the probability of transmitting and/or catching the infectious disease.

Let's revisit the question of stopping the spread of COVID-19. We have discussed how individuals as well as populations can lower the probability of contracting the disease. We have also discussed how contact tracing can be used to track down and isolate cases. This begs the question: is it practical to stop a disease like COVID-19 once it has entered the general population or is it better to just let the disease run its course through the population?

If you want to eradicate the disease, you must isolate every case and completely eliminate it from the population. If even one case remains to infect a vulnerable population, the pandemic will be off and running – again. The cost in terms of contact tracing and isolating will be high. The benefit will be the lives saved if you are successful. The risk of failing will be high because perfection is the only acceptable outcome. Remember, to be effective, you must eradicate the disease from all populations of the world at the same time.

That said, if you can keep the number of infections low and if you assume you can eventually create a vaccine that the public will accept, accepting a low infection rate might be a good option.

If you let the pandemic run its course, some percentage of the world population will get sick and some percentage of the sick will die. The cost in terms of lives lost will be high. The benefit will be great because you now have a population that is mostly immune to the disease (herd immunity) and thus future outbreaks will be limited – the strong survived. The risk will be low as there is a natural tendency for the disease to spread through the population and so the spread will not stop until herd immunity has been established.

Now we turn to an interesting sociology question. What made this pandemic different from the last three pandemics?

Our population density has increased significantly in the last many decades. Our transportation infrastructure allows someone to travel between most population centers in a matter of hours. Social media allows truth and lies to spread at an alarming rate through the population. Modern medical technology can keep people alive for months beyond when they would have ordinarily died. Globalization has pushed manufacturing to the cheaper international labor pools and has led to vulnerable supply chains. General technology is far more advanced, and with it, our expectations for controlling our destiny. Let's not forget our changing society and the political climate. And finally, COVID-19 is not the flu.

In past pandemics, life mostly went on and people mostly went about their business. There was some social distancing and a few very large events got cancelled while other very large events took place. There was not much hysteria. People were not panicked even if they were fearful of the disease. People died and those deaths were accepted and mourned.

So many people died during the 1918 pandemic that they ran out of coffins but society generally kept going. Hospitals were filled to capacity and beyond but society soldered on. Medical technology to keep people alive for months on end was not available so very sick people just died – requiring fewer total beds for a similar volume of patients. A few large cities closed down entertainment establishments and even schools, but society mostly continued.

But then came COVID-19 followed by lock-downs and hysteria. Why did this happen? Why did governments choose to place their own healthy populations under house arrest instead of allowing their societies to continue functioning in a normal fashion as happened in prior pandemics? Historically, you isolate those who are sick – not the healthy.

Were lock-downs necessary to flatten the curve or were they counter productive? Would an honest, coordinated public health education program have accomplished the same thing without the hysteria and economic damage? Is it reasonable to think we can prevent the deaths that such a pandemic will bring without eradicating the disease through effective contact tracing or a vaccine?

Sweden is an example of a society that bucked the lock-down and hysteria trend and chose the more traditional route. Sweden's approach emphasized public education along with individual responsibility for social distancing and hygiene – the very things we have already discussed. Swedes were encouraged to work from home. Children under the age of 16 continued to go to school and as of June 15, 2020, older children have also returned to school. Anyone who felt ill and the elderly were asked to stay home. Restaurant tables were moved further apart. Congregating at the bar was discouraged. Gatherings of over 50 people were banned.

The Swedes understood the COVID-19 pandemic was a long-term event. The Swedes understood the pandemic was going to run its course, whether they liked it or not. The Swedes' philosophy was to flatten the curve unobtrusively and ride it out.

To be fair, the Swedes have taken the position that very sick people should be allowed to die instead of keeping them alive for weeks to months on end using the latest life support systems. These people are provided regular end-of-life hospice services – including "comfort" medication – and allowed to die. This eliminates a huge overhead on the hospital system and goes a long way to prevent COVID-19 cases from overwhelming the health system.

The Swedish per capita death rate was listed as 43 per 100,000 people for June 2, 2020 – roughly halfway between the USA and Italy at the time. But, the pandemic is still young and all per capita numbers will continue to climb. Sweden's per capita death rate had risen to 57.4 per 100,000 by September 16, 2020 while the USA's rate had risen to 59.7 per 100,000. Until the pandemic is over and the final numbers have been tallied, there is no point in trying to compare the Swedish outcome to the outcomes of other nations. But early results indicate the Swedes may be on the right track. Time will tell the tale.

It will be interesting to see what future research reveals when it looks back on the COVID-19 pandemic. What drove decisions? And what conclusions will history come to about those decisions. It will also be interesting to see what changes take place to the fabric of our society as a result of this pandemic.

Postscript

The original version of this article was written in early May 2020 in response to US Fish and Wildlife Services and USGS – along with other organizations – worrying about giving North American bats COVID-19. Why? The cavers, bat researchers and perhaps the general public were somehow going to give the North American bat population COVID-19. Then, somehow, those bats were going to spread COVID-19 to people – or other wildlife. Or perhaps COVID-19 was going to become the new WNS bat infection that would kill bats. There is no data to even suggest these scenarios are possible but that does not stop bureaucrats from speculating up a doomsday scenario. The human-to-human transmission vector is many orders of magnitude more efficient than any possible bat-to-human vector. The same holds true for vectors involving other wildlife. Not to mention a zoonotic change is probably required before any such transmission could take place.

This is the same lousy science displayed with White Nose Syndrome (WNS) – a Eurasian bat fungal disease that has killed a lot of North American bats. Cavers and even researchers were being excluded from caves because they would somehow infect bats with WNS. The bat-to-bat transmission vector is many orders of magnitude more efficient than any possible human-to-bat vector. The only documented human-to-bat transmissions of WNS involve a white lab coat, a swab and a spore loading of 100,000 to 300,000 – i.e., a scientist intentionally infecting a bat in the lab. That large spore loading is phenomenally high – but you cannot give a bat the disease without it. Bats are very social and groom each other so bat-to-bat contact can easily achieve the spore loading needed to pass on the infection to other bats.

Following the initial article oriented to the bat issues, the article was rewritten as a general article for a broad audience and has been expanded many times since. I hope you find it educational.