

THE SCIENCE OF THE COVID-19 PANDEMIC

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A crisis creates confusion, hopelessness, anxiety, and fear. Politicians, civic leaders, and reporters quickly jump to the front to assure us that they have the answers. But, some of their “best intentions” do not help. A crisis reveals a lack of knowledge and wisdom.

A word of advice - *“Influence: Be very careful of who you permit to influence you!”* This is especially important during this pandemic, as the TV news and social media are filled with misleading information about COVID-19. This is a time for us to know, *“Who are the reliable scientific, medical, and spiritual voices we can trust? Who are the people of knowledge and wisdom with a solid track record of truth-telling?”* Disregard the lies and sensational conspiracies that deny the most relevant facts. Disregard the conspiracies by false prophets stating that COVID-19 is caused by 5G radiation or that it is a man-made virus. Both assertions are not true. The vacuum of truth has drawn in all kinds of false stories, fueled by fear.

Together let us consider some highly relevant truths. This is a global issue, not a USA-only issue. It did start in China, most likely in Wuhan. It likely started as a bat-to-human infection (perhaps in Wuhan) of a naturally occurring RNA virus of ca. 29 thousand bases in length of the Coronavirus family. It can produce Severe Acute Respiratory Syndrome (SARS) disease in severely affected patients. It is a natural virus, not a man-made virus created in a laboratory.

RNA viruses “evolve” rapidly as they accumulate mutations. The mutations are being monitored in real time across the globe by many molecular biologists. I am a molecular biologist who discovers biomedical products, and I’m attempting to help you understand the pandemic. Multiple strains of COVID-19 have already become established in different geographic regions. There is some concern that as new strains of COVID-19 emerge, that this complexity might further complicate counter-measures to respond to the disease.

After the virus migrated into Europe and began claiming lives, the Western World became afraid of its potential. Some of the statistics, for instance the lethality (fatality) rate and the number of cases reported, have often been based more on fear than on facts. When America woke up to the reality of this pandemic in early March fear-based reporting suggested that several million would die in the US. Then it was subsequently re-estimated at several hundred thousand, then 80,000, then 60,000 most recently.

At that time I was telling anyone in my sphere of influence that these numbers are not based upon facts or good modeling with reasonable assumptions. They were fear-based speculations. My view and prayer back then was that this fatality rate would likely eventually be discovered to be approximately one percent or possibly less. Time will tell. We can’t understand this situation without reliable numbers, which we have lacked in sensational media reporting.

What is the **Fatality Percentage**? We only know the numerator (number of deaths) of the fraction, not the denominator (number of infected people). As of late-April, there is only one nation, Iceland, has sampled ~ 10 % of their populations using the polymerase chain reaction (PCR) tests. America is currently PCR testing only moderate-to-severe symptomatic cases. And, perhaps half of infected

individuals have no symptoms or only minor symptoms. Be careful of how you interpret the reported numbers.

For perspective, if we had lived in the 19th Century or earlier, one percent fatality in an epidemic wouldn't be viewed the same. Their hygiene and healthcare standards were lower than present. They were repeatedly affected by tuberculosis, influenza, pneumonia, malaria, cholera, and typhoid. Infectious disease deaths of infants and children were common. These types of diseases remain common in Third World today.

We have no evidence that the virus "discriminates" between different groups of individuals. Essentially anyone may become infected by the virus. However, the most severe symptoms and deaths have centered around the elderly and/or those with one or more of these health (comorbid) conditions: obesity, high blood pressure, diabetes, or the immuno-compromised.

From my perspective as a biomedical research scientist, the big deal isn't the number of COVID-19 deaths *per se*...although I'm not dismissive of those who have lost friends or family members. Rather, the most significant issue is the **Density** of cases in a geographic region and time. Too many moderate-to-severe cases can overwhelm the healthcare infrastructure of a region. So what is being done and what is possible to bring hope into this crisis?

Diagnostics: RNA viral testing by PCR is relatively easy to ramp up. This technology determines the number of "positive" cases being reported at present. However, some of the so-called positive cases are not based upon this PCR diagnostic test. Rather, they are presumed to be positive because of symptoms consistent with COVID-19. PCR tests will only give a positive result when the RNA of the virus is present, but not after an infection has resolved.

To determine if someone had been previously infected by the virus, an antibody test is required. But, the latter techniques have lagged behind the PCR testing. There are hundreds of different types of antibody testing products already developed or in development globally. But, it will take longer to establish the antibody screening to determine the number of post-infection antibody-positive cases. Some initial studies have been reported by the media from antibody sampling of "random" people in several states. If the selected tests are reliable and the samples are representative of the population (we don't know that yet), then the incidence of viral infection is vastly higher than the number of patients who have tested positive by PCR for the viral RNA.

Drug Treatments: In the near-term, some existing FDA-approved medicines for other diseases might coincidentally help treat infected patients "off-label". But, the clinical evidence demonstrating safety and efficacy will lag behind the crest of the tsunami wave of disease. One approach is of particular interest - An overactive immune system seems to produce life-threatening pneumonia symptoms in the most severe cases. Perhaps drugs known to dampen the hyper-immune response will be found to be effective, especially during hospitalizations. If you are looking for near-term hope, it is more likely to come quickly from drug treatments rather than vaccines.

Acquired Immunity: We don't know the percentage of infected individuals that produce antibodies against viral proteins (mentioned above). Plus, we don't know whether those antibodies provide anti-viral protection against re-infection, termed as acquired immunity. If we have a high percentage of the

population with acquired immunity, they can help slow down viral transmission to uninfected people, via herd immunity.

Vaccines: It will take perhaps 9-18 months to develop vaccine “candidates” and get them into manufacturing. Even then, we have no proof that we will have an effective vaccine for a long time. Physicians and immunologists are just beginning to learn about the immune system’s response to COVID-19. It is worth noting that HIV, which produces complex effects on the immune system in AIDS patients, has been around since the 1980’s. We still don’t have a vaccine for it. (Note that it probably unfair to compare both viruses side-by-side.) Just because we are hoping for a COVID-19 vaccine, it doesn’t mean that we will get one rapidly. While we wait for a vaccine, we would be reliant on public health policies plus drug treatments and acquired immunity.

Mental Health: We will experience heightened mental health problems. Anxiety and fear will manifest in increased numbers of patients with anxiety disorders, for which 45 million adults in the US were already affected before the pandemic. This will become a serious problem over the months and years ahead. The trauma to a disrupted society will have lasting effects.

Sunlight: RNA viruses are killed by UV rays in sunlight. Many viruses manifest seasonality, with low incidence in warm sunny months. Sunlight also helps generate vitamin D in our skin. Sunlight is likely to be our friend during this pandemic.

Public Health Policies: Should there be (or have been) a wholesale shut down of schools, businesses, and the like? Some have questioned, *“Is the solution more harmful than the pandemic?”* The ramifications of stay-at-home policies extend well beyond the issues of viral disease into employment, education, transportation, economics, mental health, etc. There are some alternative views on this issue. Some folks propose a less stringent set of public health controls, such as a staged roll-out of control measures based upon disease density and healthcare system preparedness.

What Narendra Modi, the leader of India, did in shutting down the entire nation was unwise. It drastically impacted and displaced the poor of India, who often live on about \$2 per day. That was a gross miscalculation with real costs to hundreds of millions of poor people who were adversely affected by an ill-conceived public policy. That should not have happened.

So, what are examples of less stringent measures beyond hand washing and social distancing, until we have effective pharmaceutical treatments, acquired immunity, and/or vaccines: (1) The high-risk elderly and immuno-compromised should be isolated; (2) Healthcare workers and first responders should have first access to personal protective equipment; and (3) Symptomatic individuals should isolate until PCR negative for the viral RNA or for at least two weeks symptom-free.

In the USA we have been blessed with high level hygiene and healthcare innovations. We have become reliant on the blessings of hospitals, doctors, nurses, pharmacists, medicines, and vaccines. But, the Third World countries don’t have the same level of privilege to these blessings. This pandemic is leveling the playing field between the Third World and Our World.

New Opportunities: A crisis also elevates new opportunities. Many of my friends and I within the biomedical research community are actively pursuing innovative healthcare solutions at this juncture. Undoubtedly new technologies, treatments, businesses, and professional careers will emerge.

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