A Detailed Review of the Inconsistencies and Violations of the Established Public Health Science during the COVID-19 Response.

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Executive Summary

Since the arrival of its first case into the United States, which has been estimated to be as early as mid-December 2019, public discourse on the SARS-2 virus has unfortunately devolved from the scientific to the soundbite. As is evident from the array of conflicting mitigations enacted by the States and localities, this dangerous virus has for the better part of a year failed to be discussed in a rational manner that is supported by the established public health science.

Known also by the disease condition it causes, COVID-19, this virus has sadly opened a political fault line which should never occur during the exigency of a public health emergency when the lives of so many are at risk. Culpability for this politicization falls across the public, the media, all levels of government, with members of each aligning their views on a virus to their political belief systems. Unfortunately, this politicization of COVID-19 has caused fear and seeded suspicion among neighbors, and promoted a distrust in our health institutions that may take many years to dispel.

This paper has been compiled so that the next public health emergency may be considered less on a political base and more on the solid foundation of the principles of public health science that have been established and tested for almost 200 years. To the discredit of the nation's public health establishment, much of what is discussed in this paper has received little to none of the attention that otherwise, had it been pronounced to the public and political leaders, could have alleviated needless fear and calmed many people into returning to their normal lives.

The following established public health principles are presented and explained in this paper as they apply to the SARS-2 virus. Where relevant, these principles are demonstrated mathematically:

- Farr's Law is the prevailing scientific law of epidemic spread and mandates that the course of an epidemic as plotted by its cases or deaths against time must follow an approximate bell-shaped curve. The peak of Farr's bell-shaped curve, commonly referred to as the Surge Event, is the point of herd immunity. Farr's curve may be plotted with either cases or deaths due to the inherent proportionality of deaths to cases. As a law of nature, Farr's Law is involatile, and apparent violations of Farr's Law indicates problems within policies and procedures surrounding data collection and reporting, errors in data collection or analysis, or data fraud.

- The base reproduction ratio, denoted as R0, is the number of people one infected person can infect in a perfectly infectable population. For COVID-19, this number is about 2.5: one person with COVID-19 can on average cause 2.5 other people to become infected. This number is a critical piece of information that allows for the calculation, prediction, and observation within the data, from several perspectives, of the herd immunity threshold. Additionally, nowhere within the herd immunity threshold formula is there a variable for a vaccine, showing that contrary to various public statements, herd immunity is not dependent on a vaccine.

- The herd immunity threshold is precisely calculated using R0 through the formula 1-(1/R0). Herd immunity is also described as the point when R0 falls below 1.0 – one person infects fewer than one other person – and the pandemic mathematically eliminates itself out. For any virus, a predicted date of herd immunity can be established using the herd immunity threshold formula, case fatality rate, and estimates of population size, the virus' infectious period, base reproduction ratio (R0), and date of first known infection. The predicted herd immunity threshold can also be aligned to observations on the graphs of the hospital occupancy rate and the case fatality rate. Together, these pieces allow the date of herd immunity to be established fairly accurately. Using this process, it is demonstrated within this paper that COVID-19 herd immunity predictions and observations all align to the second week of May 2020; and the "second COVID wave" mathematically fits the profile of an average influenza virus peaking at the third week of January 2021, the curve for which has been "flattened" most likely by the influenza vaccine.

- Mathematically, there are no realistic scenarios wherein SARS-2 could be considered "highly contagious" while taking almost 19 months to reach herd immunity. Such a scenario would include requiring a US population size of 6.5E+30 people. Other scenarios result in SARS-2 being extremely non-infectious with a doubling period of 27.6 days, or having a herd immunity threshold of only 6%. Otherwise, the extreme latest date that the SARS-2 virus under all current conditions could reach herd immunity within the US population is October 27, 2020, past which point a pandemic becomes mathematically eliminated.

- As the Surge Event increases cases, hospital occupancy rates must increase proportionally. However, at no time during the SARS-2 pandemic did the hospital occupancy rate exceed the 85% to 90% "financial sweet spot" for hospitals. Hospitals therefore admitted and released patients with positive COVID-19 tests not based on the Medicare standard of "medical necessity," but rather in ways that allowed them to reap a maximum financial return.

- The curve of the Case Fatality Rate (CFR) demonstrates that the mitigations of social distancing and mask use did not function to reduce the spread of COVID-19 and were thus ineffective. Additionally, the federal government's after-action report for the H1N1 pandemic notes that masks are ineffective if they are not rated for viruses, if they are not fit-tested to the individual wearer, and if the wearer is not trained to use the mask.

- Change in policies surrounding COVID-19 testing resulted in the propagation of the incorrect narrative that COVID-19 was devastating the population. This narrative is not supported by either the observed curves of the CFR or the hospital occupancy rate.

- The federal H1N1 after-action report states there is a six-month window after the initial detection of a pandemic virus for the development and deployment of an effective vaccine to have any impact on the Surge Event. The introduction of a COVID-19 vaccine in December 2020, seven months after this window closed in approximately May 2020, means that these vaccines have failed to materially reduce any deaths or injuries associated to the virus.

I. Introduction and Purpose

The science of public health has followed long-established laws, theories, and mathematics by which the course of an epidemic such as SARS-2 may be accurately predicted.[1] As a science, public health allows us to distinguish between causation and correlation, the latter as of late having unfortunately drifted from the scientific method and closer to divination.

Public health has at its disposal mathematical tools by which the herd immunity date of an epidemic may be accurately predicted and the actual threat to the public measured. These tools allow for mitigations to be evaluated, and lend additional methods of confirming specific viruses that have entered a population. Conversely, these mathematical tools allow various assertions and conjectures about a virus and viral spread to be tested and invalidated.

These tools of public health show the reduction of the state's infection rate, hospitalization rate, and death rate from COVID-19 have not been the result of social distancing, masking, and vaccinations. The reduction of the SARS-2 virus in fact represents the natural and predicted path of an epidemic through a population as described by *Farr's Law of Epidemics*.

It will be described in this paper how the application of these public health tools show:

(1) the predicted herd immunity threshold, observed herd immunity threshold, the case fatality rate, and hospital occupancy rates all peak to within one week in May 2020, as is required during an epidemic;
(2) the "second COVID wave" may be mathematically shown to be influenza;
(3) how no logical scenarios allow for the possibility of the SARS-2 virus to be both highly infectious while yet not reaching herd immunity after 19 months;
(4) how the persistent drop in the case fatality rate demonstrates the ineffectiveness of social distancing and mask use;
(5) how the introduction of a vaccine seven months after the peak of the SARS-2 virus can have little true effect on the material prevention of COVID-19 deaths and injuries;
(6) how the lack of associated surges in hospital occupancy rates demonstrate that COVID variants are not threats to the public; and
(7) how at no time during the COVID-19 pandemic did hospital occupancy rates exceed the 85% to 90% "financial sweet spot" for hospitals, indicating that hospital admissions and discharges for COVID-19 were fundamentally based on financial reward and not the actual severity of the cases.

[1] SARS-2 is the shorthand term for the SARS-CoV-2 virus. Although SARS-2 is the virus that causes the COVID-19 disease, the terms SARS-2 and COVID-19 are used interchangeably by both the public and government health agencies. They are interchanged in this paper as well.

II. Farr's Law Governs the Course of Epidemics

Farr's Law dictates that the rise and fall of an epidemic as graphed by cases or deaths across time will approximate a bell-shaped curve.[2,3,4,5,6] This approximate bell-shaped curve is the "Curve" referred to in the slogan "Flatten the Curve." As with all scientific laws (gravity, motion, thermodynamics, etc.), Farr's Law is involatile: due to epidemics' inherent mathematical spread, an approximate bell-shaped curve will appear regardless of any efforts to mitigate a virus. Mitigations applied to a population may reduce the slope of the curve (i.e., "flatten" it), or shorten the length of the curve, but as per Farr's Law an approximate bell-shaped curve of deaths or cases will appear regardless.

Farr's Law allows either cases or deaths to be plotted against time due to the inherent proportionality of deaths to cases for any disease condition. That is, a certain proportion of disease cases may be expected to result in deaths. This inherent proportionality is a cornerstone of our modern health sciences and its research efforts, and allows physicians to recommend risk-based treatment options to their patients.

This graphic shows how Farr's bell-shaped curve occurred across four radically different nations: the US, Denmark, Italy, and China.[7] These nations are vastly different in their population sizes, cultures, governing philosophies, land area, health systems, and when they instituted common mitigations. However, as a law of nature, Farr's Law held primacy and still produced its bell-shaped curve despite these nations' differences.

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[2] Santillana, M., Tuite, A., Nasserie, T., Fine, P., Champredon, D., Chindelevitch, L., Dushoff, J., & Fisman, D. (2018). Relatedness of the incidence decay with exponential adjustment (IDEA) model, "Farr's law" and SIR compartmental difference equation models. Infectious Disease Modelling, 3, 1–12. https://doi.org/10.1016/j.idm.2018.03.001.

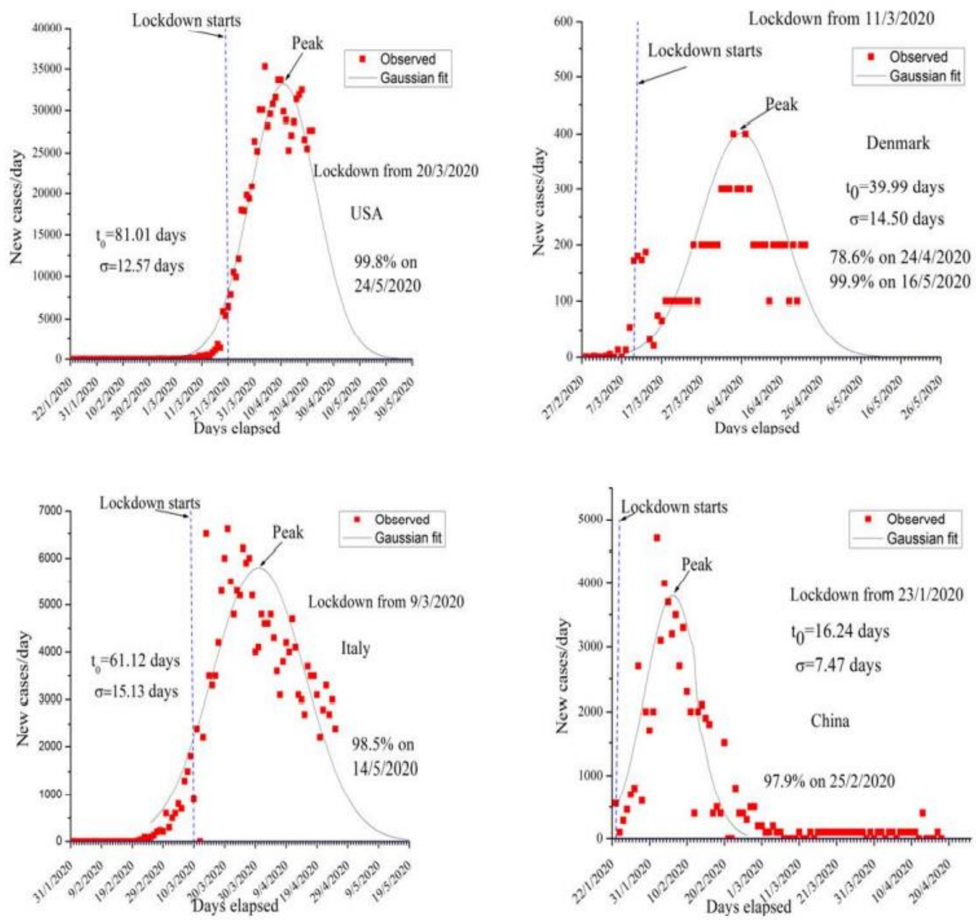
[3] The definition of Farr's Law, as slightly restated and applied to the AIDS epidemic of the 1980s, is located at https://jamanetwork.com/journals/jama/article-abstract/381044.

[4] Pacheco-Barrios, K., Cardenas-Rojas, A., Giannoni-Luza, S., & Fregni, F. (2020). COVID-19 pandemic and Farr's law: A global comparison and prediction of outbreak acceleration and deceleration rates. PloS one, 15(9), e0239175. https://doi.org/10.1371/journal.pone.0239175. Specific notation as to how either cases or deaths may be used is highlighted further below with this reference.

[5] Bhattacharya, S., Islam, M., De, A. (2020). Search for the trend of COVID-19 infection following Farr's law, IDEA model and power law. Retrieved from https://www.medrxiv.org/content/10.1101/2020.05.04.20090233v1. This reference is used in this statement to provide the fundamental background science. It is not to utilize the paper's specific results, which have not been peer reviewed.

[6] Ibid. The mathematical theory defining Farr's Law is stated as $K=[I(t+3)/I(t+2)]/[I(t+3)/I(t)]$. $I(t)$ represents the number of cases I at time t. K is the resulting rate of change. When $K>1$, the rate of change of cases are increasing and the epidemic is on the leading (left) side of Farr's approximate bell-shaped curve. When $K<1$, the trend of cases is reducing and the epidemic is on the trailing (right) side of the curve.

[7] Ibid. As per the above reference, this graphic is used to demonstrate the established science associated to Farr's Law on which the paper's theory is based, vis-à-vis the formation of Farr's bell-shaped curve.



III. The Surge Event Leads Up to the Point of Herd Immunity

As a "bell curve," Farr's law dictates an epidemic will have a single peak. This peak and the period of time leading to it are also referred to as the Surge Event. The Surge Event and its impact on hospitals and the US health system are described in detail within the federal government's June 2012 after-action report for the H1N1 pandemic of 2009 to 2010, *An HHS Retrospective on the 2009 H1N1 Influenza Pandemic to Advance All Hazards Preparedness*.[8] As the prior novel pandemic, the federal government sought to capitalize on its H1N1 response for future pandemics by documenting within the report certain principles of pandemic spread and pandemic response.[9]

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[8] PHE.gov (2012). An HHS Retrospective on the 2009 H1N1 Influenza Pandemic to Advance All-Hazards Preparedness. Retrieved from https://www.phe.gov/Preparedness/mcm/h1n1-retrospective/Documents/h1n1-retrospective.pdf.

[9] The H1N1 after-action report notes that this pandemic had two waves with two peaks, the first in May 2009 and the second during the winter of 2009-2010. Observing the trend of cases, this appears to be true, but absent of a mitigating factor, two peaks is a violation of Farr's Law. In reality the curve was "flattened" severely by the heat and humidity that lowers R0 for influenza viruses. H1N1 emerged in the southwest United States in the spring of 2009 and began to spread through the US during the summer months. The H1N1 report records health leaders as recognizing this mitigating factor and engaging in conference calls with colleagues in the Southern Hemisphere to

The federal H1N1 pandemic report shows the primary obstacle of responding to a novel pandemic virus to be the Surge Event. The Surge Event is the time leading up to and including the peak of the epidemic when the greatest number of infected people are seeking hospital-level care at one time. As a result of increased cases, the Surge Event overwhelms hospitals and forces health workers to begin splitting their time between more patients. As the face-to-face time between patients and providers begins to reduce, the proportion of confirmed deaths to confirmed cases begins to increase.

As more cases occur and more people seek hospital-level care, the Surge Event for a novel pandemic virus will be reflected in the hospital occupancy rate. Hospital occupancy rates will rise in proportion to the cases in the community.

The H1N1 pandemic report also discusses how the Surge Event will create a very limited period of time in which effective mitigations may be developed and put into place. Mitigations that arrive past the peak of the Surge Event will fail to materially reduce deaths and injuries. For influenza, this period of time is about six months between initial detection of the novel pandemic virus and the Surge Event.[10] For SARS-2, which spreads roughly 40% faster, this time for preparation is even less.

As per the federal H1N1 after-action report, and given the initial detection of cases in the US to be around mid-December 2019, the window of time for the development and distribution of effective mitigations would have closed in May 2020. Therefore, even if effective, mitigations delivered past the time of May 2020 will have failed to materially prevent any deaths and injuries associated with the virus.

IV. The Base Reproduction Ratio (R0) Forms Farr's Curve and Identifies Herd Immunity

Farr's curve can be described in terms of the base reproduction ratio, denoted R0.[11] R0 is simply the number of people one person can infect in a perfectly infectable population, and helps to quantify how fast a virus is spreading. Because this rate of spread will change during an epidemic, R0 is usually stated as an average. R0 will differ between viruses, and average R0 for the same virus can differ between nations for various reasons that include their cultural and social norms, population densities, and even the genetic predispositions of the population. Thus, the average R0 is a "best guess" measurement.

During the initial outbreak, and while the general population is yet unexposed, R0 will increase quickly. When R0 is above 1.0, it indicates that one infected person is passing the infection on to more than one other person. Depending on the virus, R0 can be much higher than 1.0, even reaching an estimated value of 18 for measles. R0 will lower as the epidemic continues, reaching 1.0 at the point of the herd

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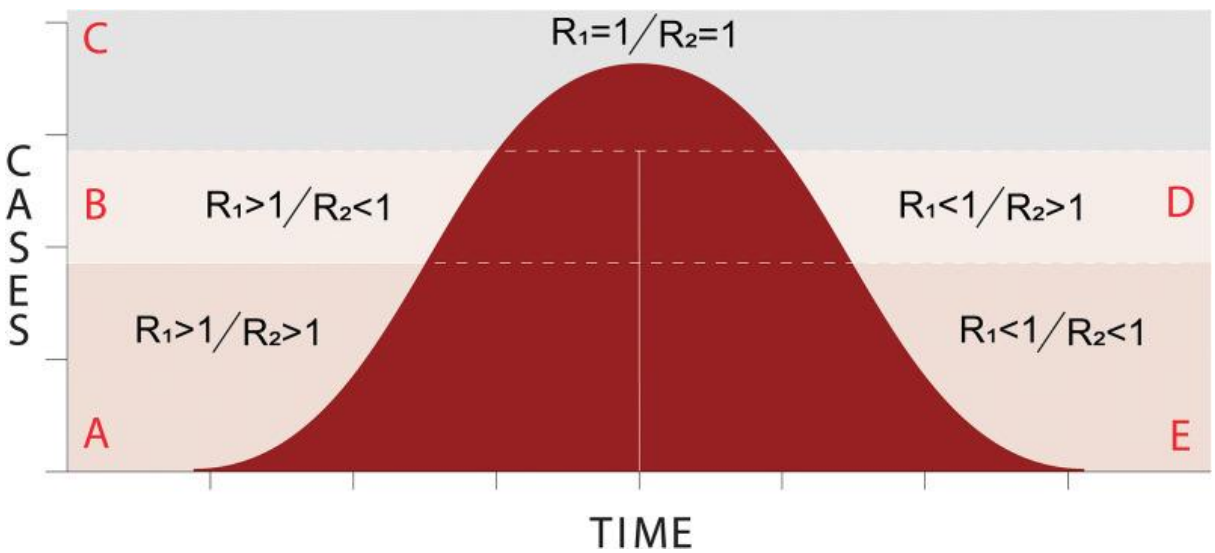
better understand how the pandemic spread during the winter months. Thus, only about 20,000 of the estimated 273,000 total hospitalizations for H1N1, or about 7%, were within the first six months of the pandemic. The remaining 93% of hospitalizations occurred in the last seven months of the pandemic, which included the winter of 2009-2010. For this reason, the H1N1 report refers to only a single Surge Event as having occurred, and not two Surge Events.

[10] PHE.gov (2012). P. 37.

[11] R0 is interchangeable termed as the base reproduction ratio, base reproduction rate, base reproduction number, and colloquially as the "rate of spread."

immunity threshold. Past the point of herd immunity, R0 falls below 1.0, indicating one infected person is infecting fewer than one other person. Thus, at the point of the herd immunity threshold, the virus begins dying out unless it can reach a previously unexposed population or find a non-human reservoir[12] in which to exist.

This graph represents how R0 varies as applied to Farr's Law through a theoretical perfect bell curve.[13,14] The period of time leading up to the peak of the curve represents the Surge Event.



The following text attached to the graphic describes in detail how the relationship between the base reproduction variables (denoted here as R1 and R2) variables shift as they are creating Farr's bell curve:[15]

> Farr's law stated that the epidemic's dynamic could be described as the relation of two arithmetic ratios. The first ratio (R1) represents the change of **cases or deaths** comparing one time against the immediately before time. The second ratio (R2) measures the rate of change of R1, or in mathematical terms, the acceleration of the estimate (new cases or deaths). Using this *[sic]* concepts and assumptions, we proposed a theoretical framework to classify the epidemic phase in a specific region and time as following: i) Phase A—both high change of events and acceleration; ii) Phase B—high change of events but low acceleration; iii) Phase C—no change of events nor acceleration; iv) Phase D—small change of events but higher acceleration; and v) Phase E—both small change of events and acceleration. *[Emphasis added to highlight that either cases or deaths may be used to plot Farr's curve.]*

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[12] Examples of non-human reservoirs of disease include rabies in wild animals and malaria in mosquitos. These diseases can be passed back to the human population.

[13] Pacheco-Barrios, K. et al. (2020).

[14] In reality, Farr's bell-shaped curve is approximate due to fluctuations in population movement and how cases and deaths are reported to governing health agencies.

[15] Ibid.

In layman's terms, if there is a pattern of more cases or deaths today than yesterday, then the spread of infectious disease is increasing through the population, and R0 is increasing.[16] Likewise, R0 is decreasing when there is a pattern of fewer new cases or deaths than yesterday, and the infectious disease is winding down.

V. Calculating the Herd Immunity Threshold for SARS-2

Note in the graphic at the peak of the theoretical bell-shaped curve where (R1 = 1)/(R2 = 1). The result, of course, is R1/R2 = 1.0, which is the herd immunity threshold. When R0 falls below 1.0 at the right side of the curve, herd immunity has been reached: one person is infecting fewer than one other person, and the epidemic begins to die out.

Thus, by examining the trend of cases or death, Farr's Law allows us to know which side of the bell-shaped curve a population is on, the front end (the beginning of the epidemic) or the back end (the end of the epidemic).[17] Furthermore, Farr's curve allows us to visually identify when the herd immunity threshold has been reached: the top of the curve.

The herd immunity threshold is thus at the top of Farr's bell-shaped curve, and also represents the peak of the Surge Event.

We can also confirm the visual observation of the occurrence of herd immunity mathematically using the herd immunity threshold formula:[18]

1-(1/R0)

The herd immunity threshold formula simply takes the number of people who *can* be easily infected (R0) and provides the opposite: the number of people who *cannot* be easily infected. Subtracting this inverse from 1 provides the fraction of who *can* be easily infected, and multiplying by 100 simply states this number as a percentage.

As the natural mathematical outcome of R0, the herd immunity threshold is unambiguous and distinct, leaving nothing to be estimated or guessed. With the SARS-2 virus having an estimated R0 of 2.5,[19] we can calculate the herd immunity threshold for SARS-2 very simply:

1-(1/2.5) = .6

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[16] Pacheco-Barrios et al. (2020) show the relation of R1 to R2 as described by the trend of Farr's K value in Bhattacharya, Islam, and De (2020). When R1>R2, the K value is greater than 1, and the trend of cases is increasing.

[17] Bhattacharya, Islam, and De. (2020). Again, when the rate of change of cases K are increasing, K is greater than 1, and the epidemic is on the leading (left) side of Farr's approximate bell-shaped curve. Likewise, when the trend of cases are reducing, K is less than 1, and the epidemic is on the trailing (right) side of the curve.

[18] Fine, P., Eames, K., and Heymann, D. (2011). "Herd Immunity": A Rough Guide. Clinical Infectious Diseases;52(7):911–916.

[19] Billah M., Miah M., Khan M. (2020). Reproductive number of coronavirus: A systematic review and meta-analysis based on global level evidence. PLoS One, 15(11). This study places the estimate for average R0 of SARS-2 at 2.9. Earlier estimates placed R0 at 2.5, which is the number used in this paper. Using the R0 estimate of 2.9 raises the herd immunity threshold to 66% from 60%, and moves the predicted date of herd immunity up three weeks to April 24, 2020 from May 15, 2020.

Stated as a percentage, the herd immunity threshold for SARS-2 is 60% of the population. Therefore, unless based off of a different estimate of R0 for SARS-2, any estimate or statement professing any other number than 60% as the herd immunity threshold is inarguably wrong.

Note also that nowhere within the threshold formula does there exist a dependent variable for a vaccine. Thus, *herd immunity is not dependent upon the existence of a vaccine*. R0 may be lowered by the introduction of an effective vaccine,[20] but the formula is very clear: vaccines are not necessary for herd immunity.

VI. Comparing Predicted and Observed Herd Immunity Thresholds for SARS-2

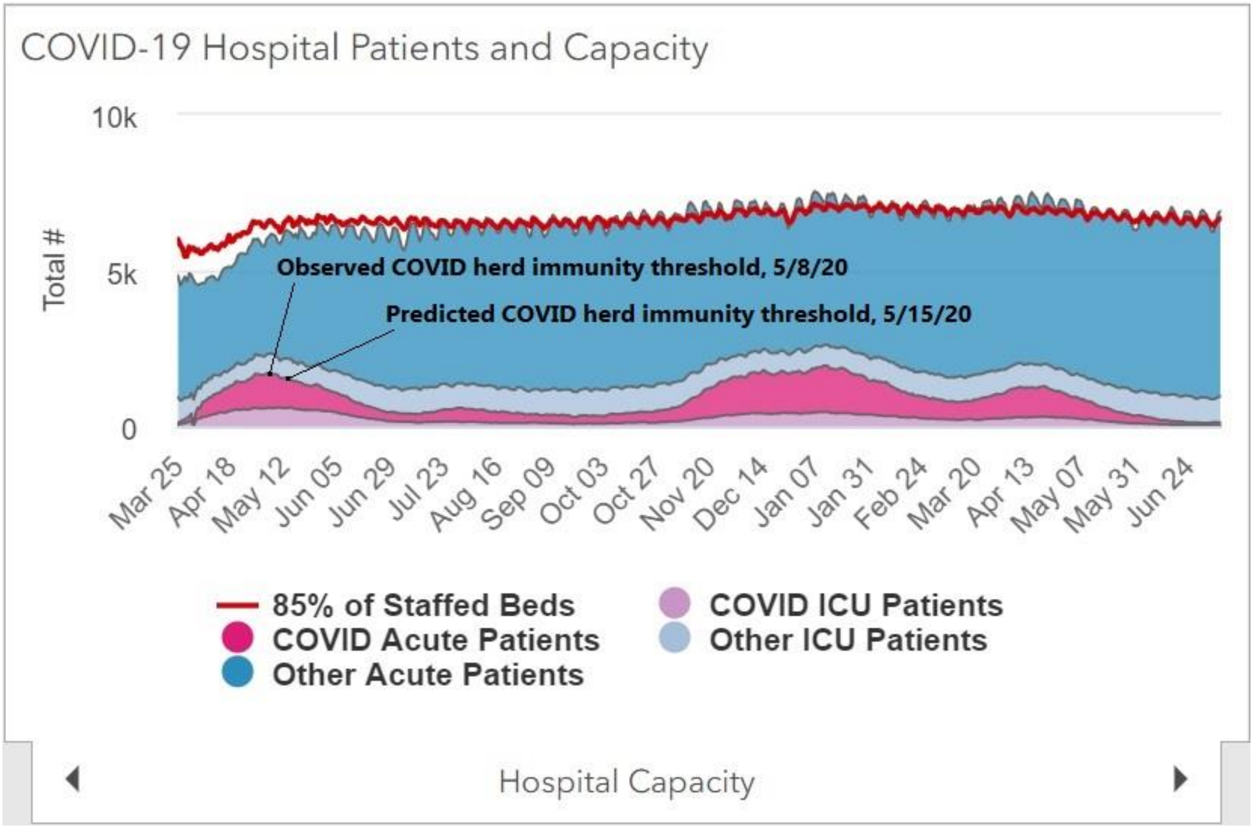
Using the estimated R0, infectious period, and date of first known infection for SARS-2, the herd immunity threshold formula may be used to provide a predicted date of SARS-2 herd immunity. As per the scientific method, this predicted date of herd immunity may be used to support the visible observation of herd immunity on Farr's curve. The predicted date of herd immunity may be calculated in the following manner:

Variable	Input	Source
US population size	330,000,000	Estimated
Infectious period (days)	14	Estimated
R0	2.5	Estimated
Herd immunity threshold (HIT)	60%	1-(1/R0) * 100
Population to reach HIT	198,000,000	US population size * HIT
Doubling period (days)	5.6	Infectious period / R0
Number of doubling periods	27.56093	Population to reach HIT = 2^n, $n = \frac{\text{natural log (HIT pop.)}}{\text{natural log (2)}}$
Days to HIT	154.3	Doubling period * number of doubling periods
Date of first known infection	December 13, 2019	Estimated[21]
Predicted date of SARS-2 herd immunity	**May 15, 2020**	Date of 1st infection + days to HIT
Observed date of SARS-2 herd immunity	**May 8, 2020**	Maryland hospital occupancy data from coronavirus.maryland.gov

[20] Fine, Eames, and Heymann (2011), citing Dietz (1975) and Smith (1970).

[21] New York Times (2020). Virus May Have Arrived in U.S. in December, but DIdn't Spread until Later. Retrieved from https://www.nytimes.com/2020/12/01/health/coronavirus-december-arrival.html. In fact, the SARS-2 virus would have begun spreading immediately, as is self-evident for any infectious disease.

Comparing the above mathematical herd immunity prediction of May 15, 2020 to the observations showing herd immunity as having been reached on May 8, 2020,[22] *there is an alignment of prediction to observations to within seven days over the 574-day period between December 13, 2019 and July 9, 2021.* More accurate estimations of the variables for R0, infectious period, population, and the date of first infection variables would likely place the prediction closer to the observation.



This alignment of prediction to observation supports the assertion that herd immunity has been long-achieved within the United States.

VII. Comparing Predicted and Observed Herd Immunity Thresholds for "Second COVID Wave" against Seasonal Influenza

As Farr's Law dictates a *single* surge event, multiple surge events are in violation of this law and thus cannot be SARS-2. The mathematical approach above may be used to show that the second wave of COVID-19 was not actually the SARS-2 virus, but in fact this wave fits very closely to the profile of a

[22] Chart is a screenshot from coronavirus.maryland.gov showing the State of Maryland's hospital occupancy data through July 9, 2021. Bolded comments on herd immunity threshold have been added.

typical influenza strain. Using the average variables for influenza's infectious period (6 days) and R0 (1.4) presents the following predicted date of herd immunity if the "second COVID wave" is influenza:

Variable	Input	Source
US population size	330,000,000	Estimated
Infectious period (days)	6	Estimated
R0	1.4	Estimated
Herd immunity threshold (HIT)	29%	1-(1/R0) * 100
Population to reach HIT	94,285,714	US population size * HIT
Doubling period (days)	4.2857	Infectious period / R0
Number of doubling periods	26.49054	Population to reach HIT = 2^n, n = $\frac{\text{natural log (HIT pop.)}}{\text{natural log (2)}}$
Days to HIT	113.5	Doubling period * number of doubling periods
Date of first known infection	October 3, 2020	Estimated[23]
Predicted date of influenza herd immunity	**January 24, 2021**	Date of 1st infection + days to HIT
Observed date of influenza herd immunity	**January 16, 2021**	Maryland hospital occupancy data from coronavirus.maryland.gov [24]

Comparing the above herd immunity threshold prediction for an average influenza strain of January 24, 2021 against the observation showing herd immunity as having been reached on January 16, 2021,[25] *there is an alignment of prediction to observation to within eight days over the 574-day period between December 13, 2019 and July 9, 2021.*

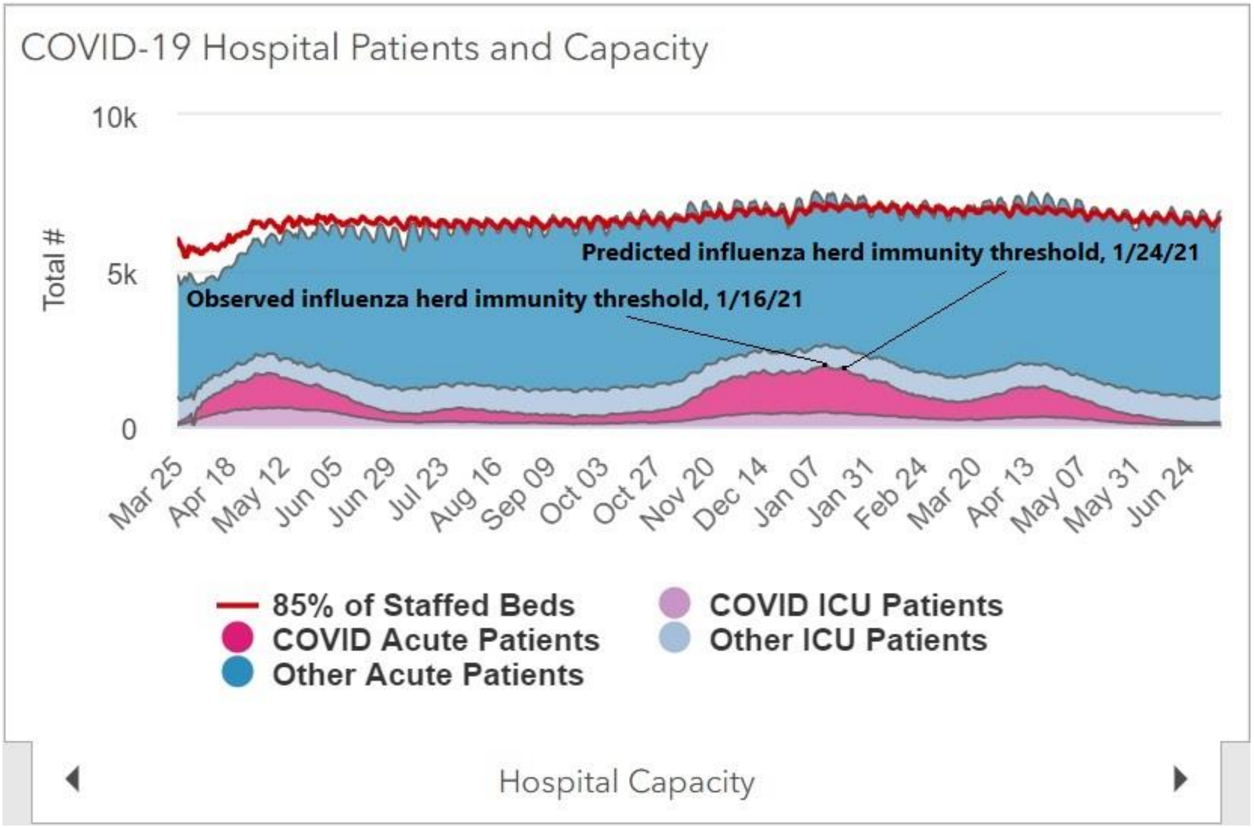
This near-perfect alignment strongly suggests the "second COVID wave" was actually a perfectly average flu virus. This is in compliance with Farr's Law, which states that there cannot be more than one Surge Event per virus: in this case, there is a single Surge Event for each of two different viruses. Once again.

[23] Date of first infection for the "second COVID wave" was visually estimated off of the State of Maryland's hospital occupancy data through July 9, 2021.

[24] This data compares Maryland's hospital occupancy rate to the US population. The date of the first known case in Maryland was announced March 5, 2020, which would place the herd immunity threshold date for Maryland closer to July 5, 2021. As is common for infectious diseases, the first unconfirmed positive case in Maryland would have arrived weeks before the first case was confirmed, especially given the maximum seven-hour travel time by air to travel across the contiguous United States. For the first case to align to the observed herd immunity threshold for Maryland proper, the first case would have arrived in Maryland on January 7, 2020, approximately three to four weeks after the first known case.

[25] Chart is a screenshot from coronavirus.maryland.gov showing the State of Maryland's hospital occupancy data through July 9, 2021. Bolded comments on herd immunity threshold have been added.

more accurate estimations of the variables for R0, infectious period, population, and the date of first infection variables would likely place the prediction closer to the observation.



The belief that SARS-2 was surging through the population for a second time in late 2020 and early 2021 was the unfortunate result of a flawed data collection policy on the part of CDC. By October 14, 2020[26], CDC began announcing the following on its influenza surveillance page:

> Due to the ongoing COVID-19 pandemic, this system will suspend data collection for the 2020-21 influenza season. Data from previous seasons are available on FluView Interactive.[27]

As a result of this flawed CDC policy, and surprisingly in opposition to a fundamental law of nature, public health leaders made the mistaken assumption that "flu had disappeared," when in fact *the low number of influenza cases were the result of not collecting data on influenza cases*.

This alignment of prediction to observation supports the assertion that the "second COVID wave" was actually the normal progression of the 2020-2021 influenza season. Furthermore, the lack of recorded

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[26] The date of October 14, 2020 was retrieved from the Internet Archive, which takes and stores "snapshots" of web pages at non-regular intervals. CDC's earliest mention of suspending its influenza surveillance for the 2020-2021 flu season was on the snapshot of October 14, 2020. The prior snapshot taken of the page on October 6th did not state that influenza surveillance had been suspended, meaning that this announcement had been included sometime over the prior week. The October 14, 2020 CDC announcement may be viewed at https://web.archive.org/web/20201014143855/https://www.cdc.gov/flu/weekly/overview.htm.

[27] Centers for Disease Control (2021). U.S. Influenza Surveillance System: Purpose and Methods. Retrieved from https://www.cdc.gov/flu/weekly/overview.htm.

influenza cases during 2020-2021 was the result of CDC policies that suspended the recording of influenza cases.

VIII. Evaluating Scenarios in Which SARS-2 May Be Considered "Highly Infectious" While Not Achieving Herd Immunity after 19 Months

Much has also been said about the policy goal of achieving herd immunity by July 4, 2021. Thankfully, in addition to allowing the accurate prediction of herd immunity threshold dates and the identification of viruses that are actually influenza, this same mathematical process allows for the discovery of those specific traits by which it would take a virus 19 months to reach herd immunity.

(1) Given the current SARS-2 qualities of R0 at 2.5 and an infectious period of 14 days, and with a period of 569 days between first case at about December 13, 2019 and herd immunity on July 4, 2021, *the US population would need to be 6.5 million trillion trillion (6.5E+30) people*, or about 60.7 billion billion times the number of humans who have ever existed. This is radically unrealistic.
(2) Given the current US population of 330 million and SARS-2 R0 of 2.5, the infectious period would need to be 51.7 days for herd immunity to be reached by July 4, 2021. *In turn, this calculates to a doubling period of 27.6 days, which would make SARS-2 an exceptionally non-infectious virus*.
(3) With the SARS-2 infectious period of 14 days and the current US population of 330 million, the absolute latest date for herd immunity to be reached would be October 27, 2020. *At this latest date, R0 would have to be between 1.057 and 1.063, with a herd immunity threshold of barely 6%, making SARS-2 a barely infectious virus. Additionally, any date later than October 27, 2020 would mathematically eliminate the pandemic because the doubling period becomes negative and average R0 falls lower than 1.0.*

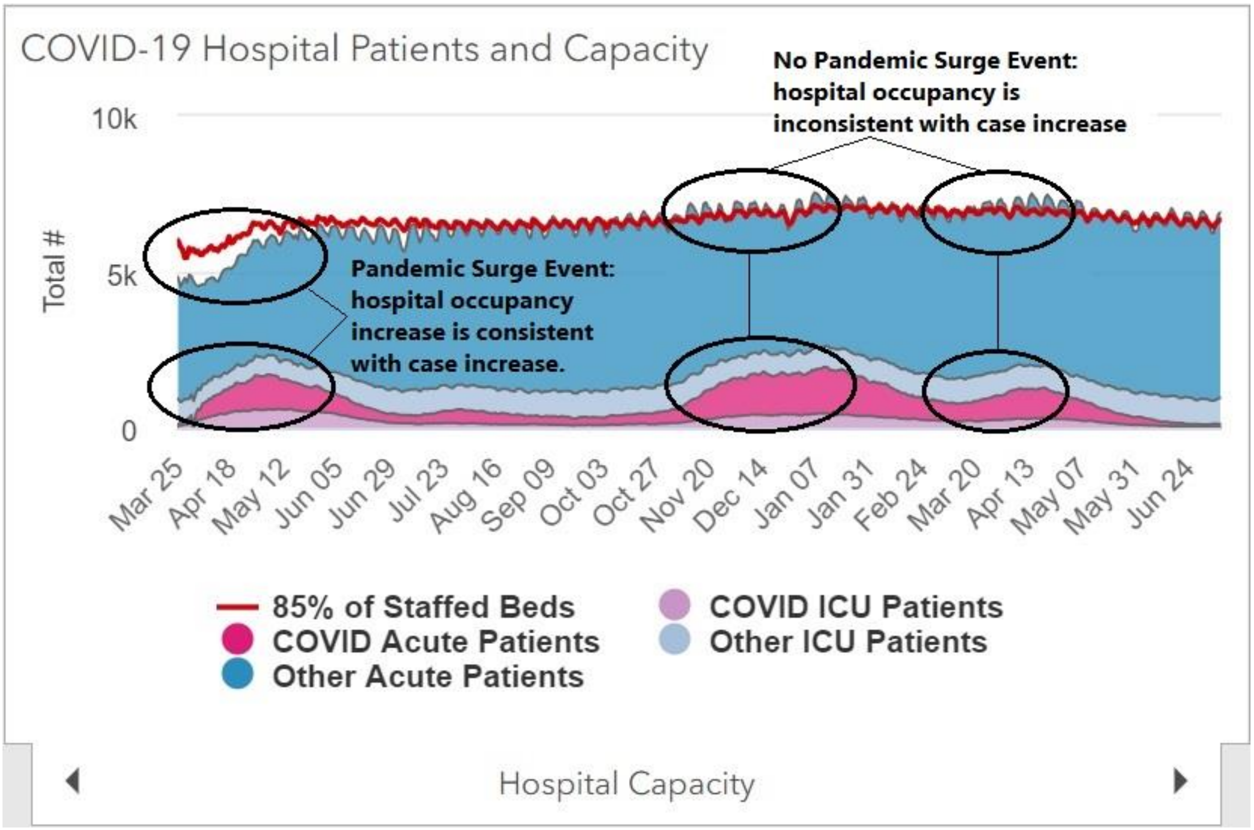
None of the above scenarios yield results that are remotely realistic: there cannot be 6.5E+30 people in the US, SARS-2 cannot have a doubling period of 27.6 days, R0 is nowhere near 1.06, and the herd immunity threshold is far greater than 6%. *This exercise simply supports the obvious: viruses that are "highly infectious" must run through a population quickly, while those that are less infectious spread through a population slowly.*

As demonstrated mathematically, it is an impossible scenario wherein the SARS-2 virus could be considered a "highly infectious" while requiring over 18 months to reach its 60% herd immunity threshold for the population.

IX. Evaluating the Danger of COVID Variants in Terms of the Absence of Surge Events

Much has been made of other COVID variants sweeping through the world, such as the "delta strain" and recent "lambda strain." However, the graphic below of Maryland's hospital occupancy rates through July 9, 2021 shows that only the original SARS-2 strain of March 2020 through June 2020 has the required proportional increase between COVID-19 hospitalizations and total hospital occupancy.[28] Likewise, the graphic shows no proportional increase between cases and occupancy for either of the other two apparent "COVID surges."

<u>Therefore, although these variants may be circulating through the community at some level, and causing the occasional hospital-level illness, the lack of an accompanying surge in hospital occupancy rates means that these COVID variants are not public health threats to the community. Thus, these variants do not require any extraordinary mitigations or precautions applied to the general public.</u>



X. Hospital Occupancy Rates Do Not Exceed 85% "Financial Sweet Spot"

In several graphics of the preceding pages are shown the State of Maryland's hospital occupancy rates. Special attention must be paid to the red line representing 85% of Staffed Beds.

[28] The term "cases" is being used to denote those COVID-19 cases that require hospital-level care and are thus reflected in the hospital occupancy data. This can be done because, as again per Farr's Law, there is a proportional relationship between deaths and cases. Thus, as cases in the community increase, the proportion of those cases severe enough to require hospital-level care also increase. This proportionality allows for a general comparison of the rate of change between cases within the general community and hospital occupancy rates.

A rule of thumb among hospital executives is to aim for an occupancy rate of between 85% to 90%.[29] Although hospital executives and academics debate over the exact threshold, which can and does vary between facilities, 85% is generally considered to be a good estimate of where the "financial sweet spot" for a hospital lies. When hospital occupancy falls below 85%, the hospital loses money. When hospital occupancy rises above 85%, the hospital risks a decline in the quality of care as health workers begin to split their time between more patients. With Medicare now tying its reimbursement rates to quality of care, exceeding the 85% occupancy rate places the hospital at risk of a financial loss.

It must be noted that at no time during the SARS-2 pandemic did hospital occupancy rates in Maryland exceed the 85% to 90% "financial sweet spot" for hospitals. This is the precise opposite of what would be expected during an actual pandemic Surge Event when hospital occupancy rates should follow the increase in cases. Pandemic Surge Events cannot coincidentally align precisely to hospitals' artificially set "financial sweet spot" of 85% to 90%, and this is especially true when a pandemic is over the course of 19 months.

Therefore, during the COVID-19 response hospital executives made the conscious decision to admit and release patients with positive COVID-19 tests in ways that allowed them to reap a maximum financial return and independent of actual medical necessity.

XI. Applying the Case Fatality Rate to the SARS-2 Pandemic

The inherent proportionality of deaths to cases provides a useful tool in determining whether mitigations were or were not effective. As noted earlier, it is this proportionality between deaths and cases that allows physicians to make risk-based treatment recommendations to patients, and this proportion is measured by the Case Fatality Rate (CFR) through the following formula:

Confirmed deaths/Confirmed cases

The CFR is important because it will remain relatively constant for a population through an epidemic, raising and lowering only when effective mitigations are introduced and removed. Effective mitigations will lower the CFR by lowering the proportion of deaths (the numerator) as the cases (the denominator) continues to increase. Effective mitigations include sanitation, education, medications, and vaccines, but also includes access to effective hospital-level care.

Therefore, an effective mitigation will be recognized in the graph of the CFR for COVID-19 by a reduction in the curve of the CFR soon after implementation of the mitigation, followed by a flattening of the CFR as it drops to a new level. After the implementation of a mitigation that is not effective, the CFR will either remain at its original level or increase.

[29] The Hospital Medical Director (2017). What Is The Ideal Hospital Occupancy Rate? – The Hospital Medical Director. Retrieved from https://hospitalmedicaldirector.com/what-is-the-ideal-hospital-occupancy-rate/.

However, a reduction in the CFR in the absence of effective mitigations is a violation of Farr's Law, as now deaths and cases are no longer interchangeable. Such reductions in the CFR are therefore indicative of errors in data collection or analysis that favor an increase in the number of cases (the denominator) that is disproportionate over the increase in the number of deaths (the numerator).

Likewise, an increase in the CFR following the introduction of a mitigation indicates the mitigation was either ineffective, or inadvertently contributed to the increase in cases and deaths. A common example of mitigations actually increasing the number of infections is from the West African Ebola outbreak of 2013-2014. This Ebola outbreak killed 8% of health care workers in Liberia,[30] not because the Ebola virus was able to breach masks and other personal protective equipment (PPE), but rather because of health workers becoming infected due to improperly using their PPE. Because people can be infected by using PPE improperly, CDC produced guidance for health workers that directed the proper donning, use, and removal of PPE for Ebola.[31]

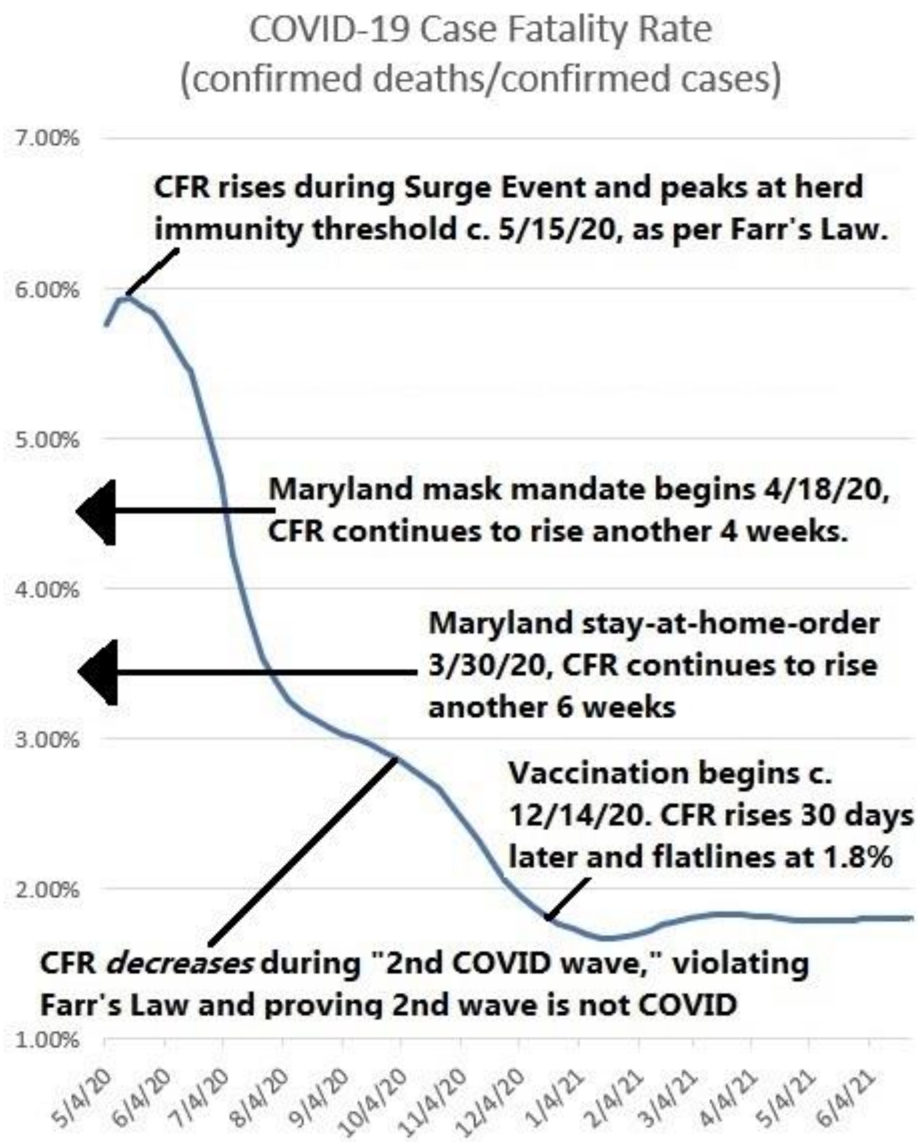
As noted earlier, when access to hospital-level care is removed or reduced, such as when hospitals become overwhelmed as Farr's Surge Event approaches its peak, the CFR will climb as increasing delays in care result in more preventable deaths (the numerator) per cases (the denominator). Likewise, as cases begin to decline after the Surge Event, face-to-face time between patients and health workers increases and the CFR begins to fall until it reaches a steady level that is commensurate to an increased access to hospital-level care. *Thus, the peak of the CFR should align to the peak of the Surge Event.*

As seen in the two graphics below, despite the ordering of social distancing and masks among the general population in March 2020 and April 2020 respectively, the CFR continues to rise until May 15, 2020.[32] Additionally, the date of the peak of the CFR correlates to the date of the peak of Farr's curve, a.k.a. the Surge Event. Note that improved estimates of R0, the infectious period, and date of first known SARS-2 infection will improve this correlation.

[30] Evans, D. Goldstein, M., Popova, A. (2015). Health-care worker mortality and the legacy of the Ebola epidemic. Retrieved from https://www.thelancet.com/journals/langlo/article/PIIS2214-109X(15)00065-0/fulltext.

[31] Centers for Disease Control (2014). Guidance on Personal Protective Equipment (PPE) To Be Used By Healthcare Workers during Management of Patients with Confirmed Ebola or Persons under Investigation (PUIs) for Ebola who are Clinically Unstable or Have Bleeding, Vomiting, or Diarrhea in U.S. Hospitals, Including Procedures for Donning and Doffing PPE. Retrieved from https://www.cdc.gov/vhf/ebola/healthcare-us/ppe/guidance.html.

[32] Data on cases and deaths are retrieved from Johns Hopkins University. See Appendix A.


COVID-19 Case Fatality Rate
(confirmed deaths/confirmed cases)
7.00%
6.00%
5.00%
4.00%
3.00%
2.00%
1.00%
CFR rises during Surge Event and peaks at herd immunity threshold c. 5/15/20, as per Farr's Law.
Maryland mask mandate begins 4/18/20, CFR continues to rise another 4 weeks.
Maryland stay-at-home-order 3/30/20, CFR continues to rise another 6 weeks
Vaccination begins c. 12/14/20. CFR rises 30 days later and flatlines at 1.8%
CFR *decreases* during "2nd COVID wave," violating Farr's Law and proving 2nd wave is not COVID
5/4/20
6/4/20
7/4/20
8/4/20
9/4/20
10/4/20
11/4/20
12/4/20
1/4/21
2/4/21
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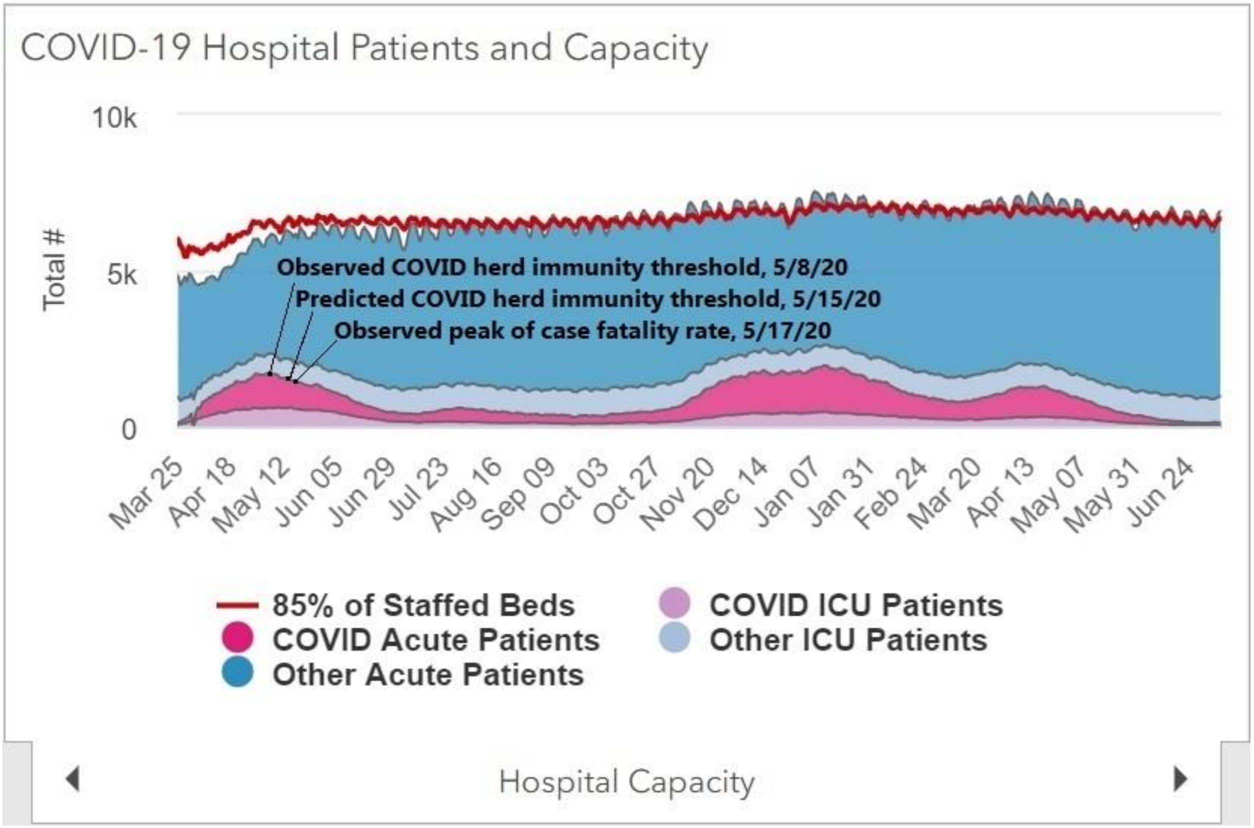
5/4/21
6/4/21



As required by Farr's Law, the peak of the CFR correlates closely to the predicted peak of the Surge Event/herd immunity threshold, and within nine days after the observed peak of the Surge Event/herd immunity threshold. This is further confirmation that herd immunity for SARS-2 was reached in the US in May 2020.

Additionally, the CFR decreases during the "second COVID wave" when it should either remain steady of increase, a violation of Farr's Law. This decline in the CFR further supports that the "second COVID wave" is a virus other than the SARS-2 virus.

XII. Reviewing the Effectiveness of Social Distancing, Masks, and Vaccines in Terms of the Case Fatality Rate

During the COVID-19 response, the three primary mitigations of social distancing, mask use, and vaccines were employed to stop the spread of the virus:

- ***Social distancing***. Governor Hogan issued a general stay-at-home executive order on March 30, 2020 requiring all Marylanders only leave home for non-essential activities.[33] This order added

[33] State of Maryland Executive Department (2020). ORDER OF THE GOVERNOR OF THE STATE OF MARYLAND NUMBER 20-03-30-01. Retrieved from https://governor.maryland.gov/wp-content/uploads/2020/03/Gatherings-FOURTH-AMENDED-3.30.20.pdf.

to Hogan's previous executive orders that began with an executive order on March 12, 2020 that banned on large gatherings.

<u>However, as seen in the graphic above, the CFR went up for an additional six weeks after the social distancing order was issued. Therefore, because of the increase in the proportion of deaths to cases, social distancing was not an effective mitigation to contain the spread of the SARS-2 virus.</u>

Social distancing failed to eradicate or contain the spread of the SARS-2 virus for the simple reason that it was not a full and complete quarantine. Individuals were still in social contact in the "essential" areas such as supermarkets, which allowed for avenues of disease transmission. For the same reason, a boat will sink whether one giant hole or multiple tiny holes are poked through the hull that allow for the transmission of water into the hull.

- ***Mask use.*** Governor Hogan's original mask mandate was implemented on April 18, 2020.[34]

  <u>However, as seen in the graphic above, the CFR went up for an additional four weeks after the mask mandate was ordered. Therefore, because of the increase in the proportion of deaths to cases, masks were not an effective mitigation to contain the spread of the SARS-2 virus.</u>

  The reason for the failure of the mask mandate can be understood in terms of the H1N1 after-action report's explanation of the three requirements needed for proper mask usage. The H1N1 report states the following:

  > The evidence base to support guidance on **appropriate level of respiratory protection [1]** (N95 respirators or surgical masks) to prevent occupational acquisition of 2009 H1N1 infection in health care workers was insufficient. This lack of evidence made developing science-based guidance difficult and controversial. In some cases, the **PPE that was delivered was different from what those recipients were familiar with [2]**, therefore requiring that users undergo time-consuming **fit testing [3]** with the new product *[emphases and numbers in brackets added]*.[35]

  The numbers in bold refer to the three requirements that must be adhered to for masks to be effective:

  (1) Masks must provide the appropriate level of respiratory protection: Masks must be rated for coronaviruses.
  (2) Users must be familiar with the PPE they are using: Training is required in order for masks to be used properly.
  (3) Fit testing: Masks must conform to the face of the user and cannot leak air.

  With these requirements in mind, it is self-evident as to why masks failed to prevent SARS-2 from spreading through the community. Few among the public were wearing masks that were

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[34] Baltimore Sun (2020). Gov. Hogan mandates masks in stores, on transit; warns against quick end to measures to contain the coronavirus. Retrieved from https://www.baltimoresun.com/coronavirus/bs-md-hogan-masks-executive-order-20200415-ryu3ip55zzcktg324bx54w35va-story.html.

[35] PHE.gov (2012). P.37.

rated for coronaviruses, nor were the masks used by the public fit-tested by professionals. Apart from health workers and various industrial occupations, few in the community are trained on how to properly use masks in the first place. Mask use was a mitigation that was destined to fail from the beginning.

- ***Vaccines.*** The curve of the CFR shows that the efficacy of vaccines on the spread of COVID-19 is undeterminable. The vaccines were introduced in mid-December 2020 during a precipitous drop of the CFR that occurred outside any known mitigations, indicating that an alteration occurred to the data that greatly increased cases (the denominator) far beyond the proportion of deaths (the numerator).

  The increase in cases without the accompanying increase in deaths is undoubtably due to the expansion of COVID-19 testing outside of the hospital patient population. This non-hospitalized population represents individuals who tested as positive for COVID-19 positive but were either asymptomatic, not sick enough to be hospitalized, or false positives.

  Additionally, both in the absence of any effective mitigations and in the face of the testing change to include non-at-risk individuals, the drop of the CFR from 6% at the peak of the Surge Event down to about 1.8% indicates that at the end of the COVID-19 pandemic over three times as many people were being incorrectly attributed as being at-risk of injury or death from COVID-19 than who were actually at-risk.

  <u>The change in testing resulted in the propagation of the incorrect narrative that COVID-19 was devastating the population, when in fact it was not. This is reflected not just in the persistent downward slope of the CFR, it is also reflected in the lack of any surge in hospital occupancy rates past May 15, 2020.</u>

  Despite this inflation of cases hiding the efficacy of COVID-19 vaccines, as stated earlier the H1N1 pandemic report notes how if mitigations such as vaccines are expected to materially prevent any deaths or injuries, they must be ready for distribution to the public prior to the peak of the Surge Event. Mitigations that arrive past the peak of the Surge Event will fail to effectively mitigate the pandemic virus. This period of time for influenza is about six months. For SARS-2, which spreads roughly 40% faster, this time for preparation is even less. As stated in the H1N1 report:

  > One of the goals in the November 2005 National Strategy for Pandemic Influenza was to establish sufficient domestic production capacity to **ensure sufficient vaccine to vaccinate the U.S. population within six months of the emergence of a virus with pandemic potential**...However, the construction of a new manufacturing facility for cell-based influenza vaccines was not completed until November 2009, and thus it was not operational to produce vaccine during the pandemic.[36]
  >
  > In addition, completing the manufacture and distribution of 2009 – 2010 seasonal influenza vaccine contributed to delays in production and delivery of 2009 H1N1

[36] PHE.gov (2012). P. 47.

> pandemic vaccine. As a result, **even though the six-month goals for initial vaccine delivery were met, most of the vaccine arrived too late to vaccinate much of the public before the pandemic peaked** *[emphases added]*.[37]

Independent of any discussions of the efficacy and safety of the SARS-2 vaccines now available on the market, these vaccines arrived to the public at least seven months after the peak of the SARS-2 Surge Event occurred in May 2020, far too late to materially prevent any deaths or injuries from COVID-19.

This table provides a summary of SARS-2 mitigation efforts and their results:

Mitigation Summary					
Mitigation	**Start Date**	**Targeted Change in CFR**	**Actual Change in CFR**	**Result**	**Reason(s)**
Social distancing	3/30/20	Decrease	INCREASED	NOT EFFECTIVE	100% isolation could not be reasonably mandated.
Masking	4/18/20	Decrease	INCREASED	NOT EFFECTIVE	1. Masks not rated for SARS 2. Public not trained 3. Public not fit tested
Vaccination	12/14/20	Decrease	INCREASED	NOT EFFECTIVE	Vaccine could not materially reduce deaths and injuries because it was not delivered within 6 months of initial detection of the SARS-2 virus.

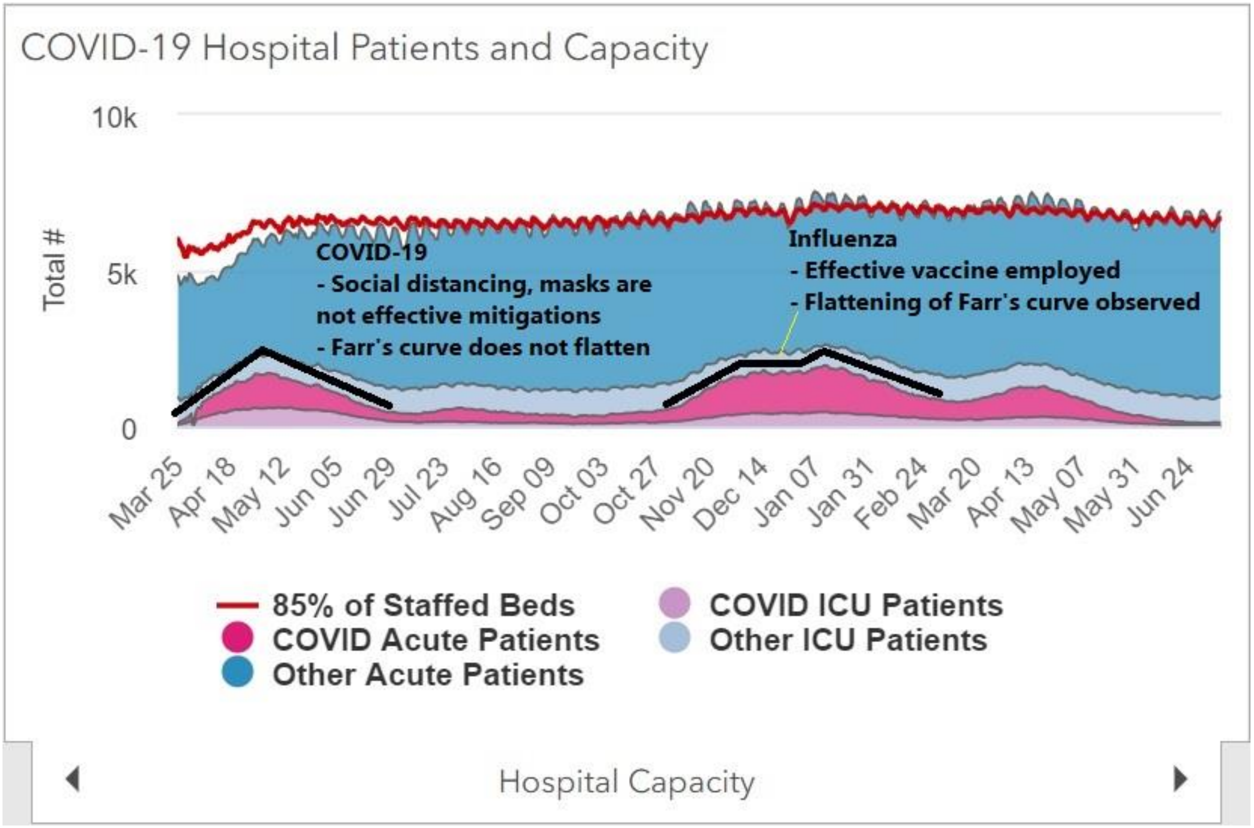
As noted throughout this paper, *effective* mitigations delivered during the Surge Event will suppress ("flatten") Farr's curve by lowering the peak of cases and deaths. Thus, we can visually confirm whether, as asserted above, the COVID-19 mitigations of masking, social distancing, and vaccines were ineffective. This can be done by observing for a flattening of Farr's curve on the State of Maryland's hospital occupancy graphic.

Below is compared the SARS-2 Surge Event that peaked in May 2020 against the "second COVID wave" that peaked in January 2020, the latter having above been mathematically demonstrated to fit the profile of a typical influenza virus. In the case of influenza, a vaccine exists that is known to promote some level of immunity (although not total) against that virus within the population.

Thus, to sustain the assertions that:

1) the COVID-19 mitigations of masks, social distancing, and vaccines were not effective, there *should not* be a flattening of Farr's curve as it relates to the hospital occupancy rate below; and
2) the "second COVID wave" was actually an influenza virus for which a mitigation that was at least partially effective was applied, a "flattening" of Farr's curve *should* be observed as it relates to the hospital occupancy rate below.

[37] PHE.gov (2012). Pp. xi and 59.



As per the above graphic, no flattening is observed on the curve of COVID-19 Surge Event that peaked in May 2020. However, a clear flattening of Farr's curve appears during the "second COVID wave" that peaks in January 2021, and which was shown above to mathematically fit the profile of a typical influenza virus for which a mitigation was employed that is known to provide a level of immunity to the population.

Therefore, as Farr's curve is not observed to flatten during the initial COVID Surge Event that peaked in May 2020, the assertion that masks, social distancing, and vaccines were not effective mitigations for COVID-19 is sustained. Likewise, as Farr's curve is observed to flatten during the "second COVID wave," the assertion is sustained that this second wave was actually influenza that was mitigated by the influenza vaccine.

XIII. Summary

- Farr's Law is the prevailing scientific law of epidemic spread and mandates that the course of an epidemic as plotted by its cases or deaths against time must follow an approximate bell-shaped curve. As a scientific law, no mitigation or combination of mitigations will prevent Farr's bell-shaped curve from forming. The peak of Farr's bell-shaped curve, commonly referred to as the

Surge Event, is the point of herd immunity. Farr's curve may be plotted with either cases or deaths due to the inherent proportionality of deaths to cases.

- Farr's Law is violated when more than one Surge Event (peak) occurs, hospital occupancy rates do not rise concurrent to a Surge Event and in proportion to the cases, or the Case Fatality Rate raises or lowers independent of the introduction of effective mitigation measures. These measures include but are not limited to sanitation, education, medication, vaccines, and access to hospital-level care. Apparent violations of Farr's Law are due to factors including but not limited to policies and procedures surrounding data collection and reporting, errors in data collection, errors in analysis, and data fraud.

- The alignment of (1) the predicted herd immunity threshold; (2) observed herd immunity threshold; (3) the COVID-19 Surge Event; (4) hospital occupancy rates; and (5) the peak of the Case Fatality Rate around the seven-day period of May 8, 2020 to May 15, 2020; over (6) a range of 574 days strongly supports that this week represents when herd immunity was achieved within the United States.

- The alignment of (1) the predicted herd immunity threshold; to (2) the observed herd immunity threshold; to (3) the average R0; and (4) the average infectious period of influenza around the eight-day period of January 16, 2021 to January 24, 2021; over (5) a range of 574 days occurring (6) in a period of the persistent decline in the Case Fatality Rate; along with (7) a lack of the required Surge Event as reflected in the hospital occupancy rates; while (8) demonstrating a flattening of Farr's curve that is consistent with the application of an effective mitigation of a vaccine; strongly supports that the "second COVID wave" was simply the natural progression of the 2020-2021 influenza season.

- As per the herd immunity threshold formula 1-(1/R0), with the R0 of SARS-2 at 2.5, herd immunity is therefore achieved when 60% of the population is immune.

- As per the herd immunity threshold formula 1-(1/R0), a vaccine is not required for herd immunity to be achieved.

- There are no realistic scenarios wherein SARS-2 could be considered "highly contagious" while taking almost 19 months to reach herd immunity. Such a scenario would include requiring a US population size of 6.5E+30 people. Other theoretical scenarios result in SARS-2 being extremely non-infectious with a doubling period of 27.6 days; having a herd immunity threshold of only 6%, and again being extremely non-infectious; or having herd immunity at the extreme latest date of October 27, 2020, past which point R0 falls below 1.0, the doubling period becomes negative, and a pandemic becomes mathematically eliminated.

- As the Surge Event increases cases, hospital occupancy rates must increase proportionally.

- At no time during the SARS-2 pandemic did the hospital occupancy rate exceed the 85% to 90% "financial sweet spot" for hospitals. Hospitals therefore admitted and released patients with positive COVID-19 tests in ways that allowed them to reap the maximum financial return.

- The Case Fatality Rate (CFR) increased six to eight weeks after the implementation of the mitigations of social distancing and mask use, showing these mitigations did not function to reduce the spread of COVID-19 and were thus ineffective.

- The failure of Farr's curve to be flattened after the introduction of social distancing and mask mandates in March 2020 and April 2020 respectively indicate these mitigations did not function to reduce the spread of COVID-19 and were thus ineffective.

- Given the six-month window after the initial detection of a pandemic virus for the development and deployment of an effective vaccine, the introduction of a COVID-19 vaccine seven months after this window closed means that these vaccines have failed to materially reduce any deaths or injuries associated to the virus.

- The lack of an accompanying Surge Event as reflected in hospital occupancy rates therefore means COVID variants do not present a health risk to the general public.

Appendix A: Case Fatality Rate Data

Date	Confirmed Cases[38]	Confirmed Deaths	CFR
5/4/20	1,198,346	69,063	5.76%
5/10/20	1,351,225	80,001	5.92%
5/17/20	1,516,343	89,932	5.93%
5/24/20	1,668,246	97,781	5.86%
5/28/20	1,786,171	104,235	5.84%
6/1/20	1,839,445	106,186	5.77%
6/15/20	2,145,240	117,566	5.48%
6/17/20	2,179,694	118,717	5.45%
6/24/20	2,417,072	123,590	5.11%
7/2/20	2,741,841	130,147	4.75%
7/9/20	3,215,074	135,709	4.22%
7/17/20	3,677,453	140,888	3.83%
7/24/20	4,166,788	147,324	3.54%
7/31/20	4,594,006	154,830	3.37%
8/7/20	4,978,641	161,961	3.25%
8/14/20	5,353,608	169,634	3.17%
8/21/20	5,605,858	174,963	3.12%
8/28/20	5,997,452	184,099	3.07%
9/4/20	6,283,209	190,058	3.02%
9/11/20	6,500,842	195,086	3.00%
9/18/20	6,780,553	200,985	2.96%
9/25/20	7,099,967	206,592	2.91%
10/2/20	7,361,455	210,874	2.86%
10/9/20	7,750,761	216,879	2.80%
10/16/20	8,078,911	220,941	2.73%
10/23/20	8,498,360	226,314	2.66%
10/30/20	9,091,684	232,708	2.56%
11/6/20	9,795,886	239,186	2.44%
11/13/20	10,624,056	246,291	2.32%
11/20/20	11,760,051	255,496	2.17%
11/27/20	13,016,149	266,966	2.05%
12/4/20	14,281,380	279,634	1.96%
12/11/20	15,715,231	295,450	1.88%
12/18/20	17,287,875	313,797	1.82%
12/25/20	18,846,059	332,283	1.76%
1/1/21	20,212,820	349,397	1.73%
1/8/21	21,766,130	367,662	1.69%
1/15/21	23,489,378	390,738	1.66%
1/22/21	24,861,388	413,259	1.66%
1/29/21	26,027,106	437,743	1.68%
2/3/21	26,524,218	447,715	1.69%
2/10/21	27,485,802	474,034	1.72%
2/16/21	27,965,785	491,096	1.76%
2/22/21	28,409,397	504,012	1.77%
3/2/21	28,936,161	519,735	1.80%
3/8/21	29,293,090	530,614	1.81%
3/15/21	29,676,645	540,452	1.82%
3/22/21	30,054,603	548,171	1.82%
3/29/21	30,486,286	555,015	1.82%
4/5/21	30,925,269	560,601	1.81%
4/12/21	31,397,113	567,591	1.81%
4/19/21	31,867,374	572,627	1.80%
4/26/21	32,244,617	577,224	1.79%
5/3/21	32,580,305	582,838	1.79%
5/9/21	32,861,204	587,425	1.79%
5/19/21	33,141,417	592,049	1.79%
5/27/21	33,339,411	596,943	1.79%
5/30/21	33,416,364	600,067	1.80%
6/8/21	33,518,669	603,410	1.80%
6/18/21	33,611,037	605,915	1.80%
6/25/21	33,577,651	602,837	1.80%

[38] Data retrieved from Johns Hopkins University.