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COVID-19 and its global impacts

The topics of this essay will vary, however all will be regarding COVID-19. We will research, discover, and analyze vital COVID-19 data, info, and recent news. The first several pages will discuss state closures of schools and other public facilities, as well as analyze its overall effectiveness in the goal of reducing COVID spread. We will also examine whether or not masks, and social distancing function as excellent/good preventative measures against COVID-19, or if they even work at all for that matter. We will briefly discuss the impact of the virus on food expenditures which is mainly being affected due to involuntary unemployment. We will discuss the economic effects of the virus as well. Another important COVID topic is the healthcare industry itself. The irony of a virus hurting/harming the healthcare industry is confusing, if not bizarre. Thus the main goal of this extended paper is to get a general idea of a diverse range of COVID related topics. So that we can get an excellent overall understanding and knowledge base of COVID and its national as well as global effects.

The first few pages of this essay will discuss school closures, and whether or not its absolutely effective, just a little effective, or has no real effect at all on slowing the spread/transmission of COVID-19. This is important because this particular type of COVID was unseen/unknown, so scientists/healthcare experts were unsure of exactly how communicable this disease is. Several nationally conducted studies show evidence that school closures have zero impact on reducing COVID infections. However, the majority of studies provided evidence/proof that the school closures have positive effects in terms of stopping the spread of the virus. Billions of children have been told to stay home in 2020 and no longer attended in person classes. These closures have the potential to worsen/exacerbate existing economic gaps and inequalities. This is mainly due to the fact that wealthy children will have more opportunities as well as better quality opportunities for remote learning. “Children in higher income families may have better opportunities for remote learning” (Walsh, et al). The overall impact of school closures is still unclear, as some suggest that children/teens are less of a risk in terms of contracting and transmitting the virus. So the validity of school closures is up for debate. “The two studies with the lowest risk of bias reported no effect of school closures on transmission” (Walsh, et al). The previous quote exemplifies and supports claims that kids are at lower risk of catching and spreading the virus. However, most of the studies examined by this same source disagree, claiming that we can reduce infection rates by closing down schools and high schools. Despite this, it’s important to note that these claims in favor of school closures have a high probability of bias (according to the author of the source). This means that the unbiased studies (which were against school closures and reported that they have little to zero impact upon COVID-19 infection rates) have a higher chance of being correct. Thus the results, according to Walsh and his fellow authors, are ambiguous. Which means schools and state

governments should lean on the side of uncertainty/precaution, and ensure the safety of citizens and students by keeping schools closed. If the effects of closure/shutdown are unknown, then it would be safer and better to conclude/assume that opening schools back up is dangerous. Essentially they (schools and state governments) should assume that closing down schools is the right thing to do, because its overall effect is uncertain in terms of stopping the spread of the virus.

Other researchers have found evidence supporting school closures as well "...school closures should not be discounted… (they) have a significant impact on COVID-19 infection rates… virtual or remote learning may be an impactful intervention" (Staughn). The quote provides evidence that school closures are effective in its goal, because they do help in preventing COVID-19 transmission/infection. Thus we can safely say that school closures are generally beneficial in the fight against the pandemic. However, this raises two important questions. How effective is social distancing in terms of reducing COVID-19 infections, and also how effective are masks as well?

In this upcoming paragraph we will discuss and examine the overall efficiency and effectiveness of masks regarding whether or not they are partially/completely preventing the spread of the virus, or if they even have any real measurable effect at all. Several sources which I'll cite in this essay seem to support evidence that masks do have positive effects, and that we can benefit from its preventive measures. "Compelling data now demonstrate that community mask wearing is an effective non pharmacologic intervention to reduce the spread (of COVID-19), especially as source control to prevent spread from infected persons, but also as protection to reduce wearers' exposure to infection" (Brooks). This previous quote explains that masks are effective in protecting people who're already infected from transmitting/spreading the virus, and also helps the healthy/uninfected people from catching/getting the virus themselves.

Table. Studies of the Effect of Mask Wearing on SARS-CoV-2 Infection Risk[a]

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Source	Location	Population studied	Intervention	Outcome
Hendrix et al	Hair salon in Springfield, Missouri	139 Patrons at a salon with 2 infected and symptomatic stylists	Universal mask wearing in salon (by local ordinance and company policy)	No COVID-19 infections among 67 patrons who were available for follow-up
Payne et al	USS Theodore Roosevelt, Guam	382 US Navy service members	Self-reported mask wearing	Mask wearing reduced risk of infection by 70% (unadjusted odds ratio, 0.30 [95% CI, 0.17-0.52])
Wang Y et al	Households in Beijing, China	124 Households of diagnosed cases comprising 335 people	Self-reported mask wearing by index cases or ≥1 household member prior to index case's diagnosis	Mask wearing reduced risk of secondary infection by 79% (adjusted odds ratio, 0.21 [95% CI, 0.06-0.79])
Doung-ngern et al	Bangkok, Thailand	839 Close contacts of 211 index cases	Self-reported mask wearing by contact at time of high-risk exposure to case	Always having used a mask reduced infection risk by 77% (adjusted odds ratio, 0.23 [95% CI, 0.09-0.60])
Gallaway et al	Arizona	State population	Mandatory mask wearing in public	Temporal association between institution of mask wearing policy and subsequent decline in new diagnoses
Rader et al	US	374 021 Persons who completed web-based surveys	Self-reported mask wearing in grocery stores and in the homes of family or friends	A 10% increase in mask wearing tripled the likelihood of stopping community transmission (adjusted odds ratio, 3.53 [95% CI, 2.03-6.43])
Wang X et al	Boston, Massachusetts	9850 Health care workers (HCWs)	Universal masking of HCWs and patients in the Mass General Brigham health care system	Estimated weekly decline in new diagnoses among HCWs of 3.4% after full implementation of the mask wearing policy
Mitze et al	Jena (Thuringia), Germany	City population aged ≥15 y	Mandatory mask wearing in public spaces (eg, public transport, shops)	Estimated daily decline in new diagnoses of 1.32% after implementation of the mask mandate
Van Dyke et al	Kansas	State population	Mandatory mask wearing in public spaces	Estimated case rate per 100 000 persons decreased by 0.08 in counties with mask mandates but increased by 0.11 in those without
Lyu and Wehby	15 US states and Washington, DC	State populations	Mandatory mask wearing in public	Estimated overall initial daily decline in new diagnoses of 0.9% grew to 2.0% at 21 days following mandates
Karaivanov et al	Canada	Country population	Mandatory mask wearing indoors	Estimated weekly 25%-40% decline in new diagnoses following mask mandates

[a] See the Supplement for the complete table.

The table above shows evidence indicating that wearing masks is critical/vital to stopping the spread of COVID-19. An important note to understand from the table is the Payne et al study conducted in Guam. The info/results gatherers suggest that masks can reduce risk of infection tremendously (up to 70%). This is not the only evidence supporting the effectiveness/importance of masks and mask mandates though. “Another study looked at the difference (in virus infections) between US states with mask mandates, and those without and found that the daily growth rate was 2.0 percentage points lower in states with mask mandates, estimating that these mandates had prevented 230,000 to 450,000 COVID-19 cases by May 22 2020” (Howard, et al). As one can assume and infer from the previous quote, the state mask mandates have largely been effective and successful. Studies indicate that even as early as May 2020, the mask mandates prevented nearly half a million citizens from catching the virus. The following quote supports the mask mandates even further. “Because the virus is transmitted predominantly by inhaling respiratory droplets from infected persons, universal mask use can help reduce transmission.” (Guy Jr, et al). This is yet another source which agrees with our previous conclusions, being that masks are beneficial in preventing COVID-19 infections.

TABLE 1

Association between state-issued mask mandates[*] and changes in COVID-19 case and death growth rates[†] — United States, March 1–December 31, 2020

Time relative to day state mask mandate was implemented	Case growth rates		Death growth rates	
	Percentage point change (95% CI)	p-value[§]	Percentage point change (95% CI)	p-value[§]
41–60 days before	0.0 (−0.7 to 0.7)	0.98	−0.8 (−1.8 to 0.1)	0.07
21–40 days before	0.5 (−0.8 to 1.8)	0.49	0.3 (−0.8 to 1.5)	0.56
1–20 days before	Referent	—	Referent	—
1–20 days after	−0.5 (−0.8 to −0.1)	0.02	−0.7 (−1.4 to −0.1)	0.03
21–40 days after	−1.1 (−1.6 to −0.6)	<0.01	−1.0 (−1.7 to −0.3)	<0.01
41–60 days after	−1.5 (−2.1 to −0.8)	<0.01	−1.4 (−2.2 to −0.6)	<0.01
61–80 days after	−1.7 (−2.6 to −0.9)	<0.01	−1.6 (−2.4 to −0.7)	<0.01
81–100 days after	−1.8 (−2.8 to −0.7)	<0.01	−1.9 (−3.0 to −0.8)	<0.01

The table above is easy to misread and difficult to understand. However, the main takeaway from it is that COVID-19 infections and its related deaths have seen dramatic decreases in the weeks and months following the government issued mask mandates. It shows clearly that large portions/percentages of the population were being protected successfully by masks. So we can conclude from the previous several sources (as well as from our own

intuition) that masks are indeed very effective in preventing,stopping, and reducing COVID-19 infections and transmissions. One more important question regarding health protocol efficiency remains; how useful/beneficial is social distancing in terms of fighting the pandemic?

As we've just mentioned, we will examine and analyze the efficiency of social distancing in regard to fighting the pandemic. The results may be shocking to some, however there are others who might not be as surprised by the answer. "Student case rates were similar in the 242 districts with >= 3 versus >= 6 feet of physical distancing between students… cases among school staff… were also similar... lower physical distancing requirements can be adopted in school setting switch mask mandates without negatively affecting student life or staff safety" (Berg, et al). Thus we can conclude that social distancing has no real effect on COVID-19 transmission rate. This is because with masking mandates it becomes far less likely to contract or transmit the virus. Wearing a mask is sufficient protection against the virus, and masks are one of the best ways to prevent it from spreading. The mask mandates, and school closure mandates, have been very effective or moderately effective (depending upon which studies you trust) in terms of fighting the pandemic, because there is tons of empirical data and info which shows just how successful they have been at reducing COVID-19 transmission rates. So we are fighting off the pandemic correctly if we wear masks and continue to do virtual learning (keep schools closed). However, we must also consider the negative implications/consequences of these government mandates. For example, what total cost/effect will these precautionary measures have on the health/wellbeing of citizens, as well as the global economy?

We've discussed that the government mandates to fight the pandemic have largely/mostly been successful. But just how much have these protocols impacted the economy, and what are some of the implications for impoverished citizens and middle class citizens, especially as large corporations like Amazon receive federal bailouts and accumulate even more massive amounts of wealth, and unemployment reaches levels we've not seen recently in multiple decades? In this paragraph we'll briefly discuss the effects it has on impoverished as well as middle class people and in particular we'll examine the groups in regards to food security. It's reported that less food is being spent on food (thereby directly hurting restaurants, bars, grocery stores, manufacturing companies, and service industry workers). "...households with respondents who lost their jobs due to coronavirus induced firm closures spent 15% less on food, were 36% more likely to receive free food, were 10% less likely to have enough food to eat, and were 21% less likely to report at least moderate confidence in their ability to afford

needed foods" (Restrepo, et al). This previous quote suggest that COVID induced unemployment and company foreclosure has resulted in Americans having far less food security. This is because a stable/consistent income is required and vital in terms of being able to purchase enough food. "One of the most important determinants of a household's food security status is the level of financial resources available to the household… the percentage of food insecure households in May 2020 was roughly similar to the level seen during the Great Recession (in 2008)... during the COVID-19 pandemic the food insufficiency rate has tripled compared to 2019 and more than doubled relative to the Great Recession" (Restrepo, et al). The previous quote exemplifies the claim that I've made earlier. Which is that many people are having difficulty being able to afford food during the pandemic. The rates of food insecurity are reaching unprecedented and quite frankly scary levels. There is much work to do once most people get vaccinated and shutdowns come to an end (as well as other mandates like masks). For now state and federal governments must provide food stamps, tax reliefs, extended due dates for rentals/mortgages, and other sources of financial support.

Despite our previous observations, food insecurity is not the only risk/negative implication caused by coronavirus foreclosures, unemployment, and shutdowns/government mandates. The irony of a virus hurting the healthcare industry, as mentioned in the intro paragraph, is bizarre. "People are being asked to curtail outside activities" (Cutler). This means less people are visiting physicians/doctors in general as a part of COVID-19 lockdown protocols from the government. The healthcare industry is also being affected in a trickle down sort of effect, due to the collapsing global economy. What this means is that because people have less money and less employment, it's harder to afford visits to the hospital/doctor's office. "...some primary practices are reporting reductions in use of healthcare services up to 70%" (Cutler). This has resulted in increased healthcare unemployment/layoffs, as well as frozen or reduced salaries in the sector. In fact, healthcare workers were losing jobs at an astonishing rate at the beginning of the pandemic, nearly as much as restaurant and bar workers.

The following few pages will explore the effects of COVID on the global economy. In this particular paragraph we will examine/analyze Indonesia's economy.

Table 2. Economic Losses

Variable	Impact
Workers	1.5 million workers experience a break
Purchasing Managers Index (PMI)	Below level 50
Flight	> 12,703 flights at 15 airports cancelled
Air Service	Loss of revenue amounted to Rp 207 billion
Tourist	Dropped drastically by 6,800 per day
Hotel and Restaurant	Occurrence of decreased occupancy rate around 6,000 hotels in Indonesia reached 50%
Import	Down 3.7% year to date (YTD)
Inflation	Inflation of 2.96% year on year (yoy)

Source: Kontan.co.id

The table above shows that some of the biggest/most vital sectors and industries of the Indonesian economy are either not doing well or completely failing. This is bad news for lower class and middle class Indonesians. “This means that the government is seriously providing is seriously providing an economic stimulus package. The Government realized the true non-medical impact of the plague caused by the SARS-CoV-2 virus and can be seen from the many people who lost their jobs and livelihoods because they had to be home. Seeing the condition, the Government has made various efforts to help the Community economy through various policies” (Susilawati). The economy of this huge Asian country is plummeting due to the pandemic. Less people are employed, resulting in more inflation and less circulation of money/stimulation of the economy. Despite this, Indonesia is not the only large Asian country suffering economic consequences from the virus. “ With the prolonged country-wide lockdown, global economic downturn and associated disruption of demand and supply chains, the economy is likely to face a protracted period of slowdown. The magnitude of the economic impact will depend upon the duration and severity of the health crisis, the duration of the lockdown and the manner in which the situation unfolds once the lockdown is lifted.” The previous quote exemplifies the fact that numerous Asian countries are experiencing large scale financial failures/crashes due to pandemic related lockdowns, company failures, company reduction in staff, and other more general government mandates. There were other crashes in 1920, 1970, and regional ones throughout the world in the 20th century. However, governments have been taking austerity measures since 2010 onwards, which has only exacerbated this problem especially for lower class individuals. “Each (country) decided whether or not to develop austerity measures to fight against global financial crises”. Many people who were living as middle class workers in the 2000’s found themselves living less luxurious/more uncertain

lives by the 2010s.”Increasingly (as a result of higher government taxes) many people found themselves living from month to month… as a result many European nations are reporting ‘diseases of despair’” (McKee). The previous quote exemplifies the fact that European nations were already suffering from their own issues of high taxes and low wages even before the virus. Compound these economic problems with the challenges proceeding the COVID-19 pandemic, and it’s easy to see why so many nations are struggling financially across Europe. As a result, many people are developing ‘diseases of despair’ like alcoholism, gambling addiction, and other severe life altering problems.

There’s even more evidence supporting the fact that the pandemic has negatively impacted the global economy. “As a result (of the COVID-19 pandemic and ensuing global crash)... many countries plunged into a recession… 30 day social distancing policy or lockdown restriction hurts the economy” (Ozili, et al). Thus we can conclude that although lockdown measures and other government protocols ar reducing COVID-19 transmission, it’s terrible for the economy. It stagnates financial circulation, and created a myriad/wide array of unemployment in various sectors as well. There are huge implications of these COVID-19 government protocols for the US economy as well. “The overall economic cost of the measures being adopted to slow down the spread of the Covid-19 epidemic is still unknown. But it will undoubtedly be very large. The decline in US stock market prices in recent months is comparable to that observed during the Global Financial Crisis, and even to that of the Great Depression” (World Bank). There are many reasons that the pandemic and government response of mandated safety protocols have hurt/adversely affected the global economy. Another large reason for global financial collapse in 202 is China’s shutdown to stop the pandemic. “Chinese government, in order to control the spread of the disease, had to close the major production centers and as China being a manufacturing hub, led to disruption in the global supply chain which affected almost all sectors ranging from pharmaceuticals to automobile. The disruption of pharmaceutical industry in China had impact on other countries, where the prices of lifesaving drugs increased due to shortage of raw materials from China. As the Chinese industries had ceased production, the global prices of raw materials like metals fell all over leading to major slowdown in various metal producing economies.” (Gupta, et al). China, as most people know, is a large provider of many vital resources and materials to other countries. As soon as they closed down public facilities, factories, and other manufacturing industries in April/May 2020 due to the pandemic, many other countries suffered heavily. They

were missing cheap and important materials from the largest provider of manufactured items and resources on earth.

Despite the difficulties raised by COVID-19, some people ironically see that there could be some potential benefits from the pandemic. Funnily enough the pandemic could create jobs, as increased public spending in the green energy/power sector would be timely and prove to create many long term companies and occupations. “...well directed public spending, particularly investments in the green transition, can be timely…” (Stiglitz) It could effectively and nearly absolutely solve 2 huge/global issues simultaneously; the lack of economic stimulation and circulation caused by the pandemic, and also solve the problem of fossil fuel induced climate change. Thus the time to act on unemployment caused by COVID-19, and fossil fuel induced climate change would best be sooner, and not later.

In conclusion, we have discussed a wide array of COVID-19 topics. We started by examining the efficiency/effectiveness of government imposed mandates. We then discuss the effects it has on the economy, food security, and we even discussed some potential positive effects and benefits from the pandemic. But in the end, we gained a very practical and sufficient knowledge base regarding COVID-19 and its various effects on our world.

Bibliography

Berg, Polly van den, et al. “Effectiveness of 3 Versus 6 Ft of Physical Distancing for Controlling Spread of Coronavirus Disease 2019 Among Primary and Secondary Students and Staff: A Retrospective, Statewide Cohort Study.” *Watermark.silverchair.com*, IDSA, 10 Mar. 2021, watermark.silverchair.com/ciab230.pdf?token=AQECAHi208BE49Ooan9kkhW_Ercy7Dm3ZL_9Cf3qfKAc485ysgAAAq8wggKrBgkqhkiG9w0BBwagggKcMIICmAIBADCCApEGCSqGSIb3DQEHATAeBglghkgBZQMEAS4wEQQMJtxzeMRJKosGRAagAgEQgIICYjapPqGN_y-Nc1m13TYYYuEtK7YuXC66dl-GnhBltQWTdie8kBs6FpwPVakkUo8kcde7d84K39VS5lNT6_YUzOea1kjOGVXBL_r35-Rn9VeVAiIR-YB8Nz0SZtNhTjl-y4xPsFQ8xdgyZ_wnuBV8EbUmSXbkdziLSgkC43lbLL39Df0Cr7wM3qC7AcIzgRymnIrVUWeRzypcC3QY73tm9gmtZG4Wxh8A1yBGMR-zKjwRk0Sikwevozu EFleh_Tro5Se51JjXa8XxrsRd2l3jRNqca9rH0XU2mL6U4D7ScNXeABdz2hzFewZu0dUcy2CgmVqDsObbz7CtdN10ujruQ8k59nJjd4ftAZHKaU3wCNnNsu-mvNQ9i_VQZvqXoExfyqssywdXFFnEg0PLI55swq3J9Fii7RzC8HfGQMICtMgxKER6pCCzm0cNVIGVzUHC4Vq6Ue--KD7Og8YYlvrV2fJw6XKbTUcKSRCA-Z8USl6h7HH5QOFSjNTlABuJsn7l2Aacez2X3J7KL4QUO9PzXn-i9W4ArrjeBLGNkyJtUv5PFSejp_ZN8SGWoYG7ywC806D7kNn7kGzK3bdGjxzSKEmpjSSy9esQOXDslHSELaws115MHw6qHnB3eLHKYnurBCn8rexYPqzY96QtDm55DEKeBixnqBj4n2W4ujbUZlO7nadDev8xO7da5WT6ct1YeBjJTe96TNp8PU1qcB5NpqPqOHPI8R2EE-u2ye_1u43apaDwL33AbGlhLutHsD1rEA6rAmL36EDD0g9CvdbFSfN_3acgbQqILlqZDXO_d1t6Mvw.

“Covid-19: Impact on the Indian Economy.” *Www.igidr.ac.in*, Indira Gandhi Institute of Development Research, Mumba, 26 Jan. 2021, www.igidr.ac.in/pdf/publication/WP-2020-013.pdf.

David Cutler, PhD. “How Will COVID-19 Affect the Health Care Economy?” *JAMA*, JAMA Network, 9 June 2020, jamanetwork.com/journals/jama/article-abstract/2766852.

"The Economy in the Time of COVID-19." *documents1.Worldbank.org*, The World Bank, Apr. 2020, documents1.worldbank.org/curated/en/615381586795710086/pdf/The-Economy-in-the-Time-of-COVID-19.pdf.

Gupta, Mrinal, et al. "COVID-19 and Economy." *Dermatologic Therapy*, John Wiley & Sons, Inc., 8 July 2020, www.ncbi.nlm.nih.gov/pmc/articles/PMC7228404/.

Guy, Gery P, et al. "Association of State-Issued Mask Mandates and Allowing On-Premises Restaurant Dining with County-Level COVID-19 Case and Death Growth Rates - United States, March 1-December 31, 2020." *MMWR. Morbidity and Mortality Weekly Report*, Centers for Disease Control and Prevention, 12 Mar. 2021, www.ncbi.nlm.nih.gov/pmc/articles/PMC7951820/.

Howard, Jeremy, et al. "An Evidence Review of Face Masks against COVID-19." *Www.pnas.org*, Pnas, 5 Dec. 2020, www.pnas.org/content/pnas/118/4/e2014564118.full.pdf.

John T. Brooks, MD. "Effectiveness of Mask Wearing to Control Community Spread of SARS-CoV-2." *JAMA*, JAMA Network, 9 Mar. 2021, jamanetwork.com/journals/jama/fullarticle/2776536%C2%A0.

McKee, Martin, and David Stuckler. "If the World Fails to Protect the Economy, COVID-19 Will Damage Health Not Just Now but Also in the Future." *Nature.com*, Comment, 7 June 2020, www.nature.com/articles/s41591-020-0863-y.pdf.

Ozili, Peterson K, and Thankom Arun. "Spillover of COVID-19: Impact on the Global Economy." *SSRN*, Peterson Ozili, Central Bank of Nigeria, Nigeria and Thankom Arun, University of Essex, United Kingdom, 30 Mar. 2020, poseidon01.ssrn.com/delivery.php?ID=413074031111068094003080122067029106002054027061023062027093009090013029030102068124042100017007024022045011108093088018028096039010011061018092105096093090085013067050087064064122120100089009121018089072065080000091107001067127085095122122027082119116&EXT=pdf&INDEX=TRUE.

Restrepo, Brandon J, et al. “JavaScript Disabled.” *The Effect of Unemployment on Food Spending and Adequacy: Evidence from Coronavirus-Induced Firm Closures*, Agricultural and Applied Economics Association, 10 Dec. 2020, onlinelibrary.wiley.com/doi/epdf/10.1002/aepp.13143.

Staguhn, Elena D., et al. “The Impact of Statewide School Closures on COVID-19 Infection Rates.” *American Journal of Infection Control*, Mosby, 8 Jan. 2021, www.sciencedirect.com/science/article/pii/S0196655321000018.

Stiglitz, Joseph E. “Priorities for COVID-19 Economy.” *Www.ipsos.co.ug*, Daily Monitor, 2020, www.ipsos.co.ug/NEWBASE_EXPORTS/Mastercard_Foundation/200708_Daily%20Monitor%20-%20Wednesday_33_61e9.pdf.

Susilawati, Susilawati, et al. “Impact of COVID-19's Pandemic on the Economy of Indonesia.” *Budapest International Research and Critics Institute (BIRCI-Journal): Humanities and Social Sciences*, State Islamic University of North Sumatra, 10 Feb. 2021, bircu-journal.com/index.php/birci/article/view/954/1284.

Walsh, Sebastian, et al. “Do School Closures Reduce Community Transmission of COVID-19? A Systematic Review of Observational Studies.” *MedRxiv*, Cold Spring Harbor Laboratory Press, 1 Jan. 2021, www.medrxiv.org/content/10.1101/2021.01.02.21249146v1.full.pdf+html.