

QUALITY OVER QUANTITY AND EQUITY OVER EQUALITY

A Research Paper submitted to the Department of Engineering and Society
In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science in Chemical Engineering

By

Nana Aba Acquah

March 25, 2021

On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

ADVISOR

Catherine D. Baritaud, Department of Engineering and Society

ANALYSIS OF CURRENT AND POTENTIAL OBSTACLES TO CURBING COVID-19 TRANSMISSION AND AN INTRODUCTION TO PLANS TO OVERCOME THEM

It would take less than a year for every person in the world to be exposed to COVID-19 without social distancing measures and vaccinations (Dong, Du, & Gardner, 2020, p. 533-534). Natural infection with COVID-19 could lead to serious, life-threatening complications because the disease combines unfavorable traits of other illnesses (Centers for Disease Control and Prevention [CDC], 2021d, p. 2, Jaimes et al., 2020, p. 3309). Increasing severity with comorbidity is characteristic of the first SARS virus, SARS-CoV-1, and high contagiousness and delayed onset or absence of symptoms is a trademark of the human coronavirus HCoV-HKU1 (Jaimes et al., 2020, p. 3310-3311). The latter features complicate controlling the transmission of COVID-19 through natural infection. Genetic changes and selection cause viruses to mutate over time, and these modifications have biological consequences. According to Li et al. (2020), mutations of the SARS-CoV-2 spike protein result in viral strains that are more infectious and resistant to neutralizing antibodies (p. 1284). There are currently three known SARS-CoV-2 variants, which constricts vaccination plan timelines, reinforces the need to limit transmission through natural infection, and warrants plans to ensure global vaccination (CDC, 2021a, p. 1-6).

The STS thesis argues that plans to achieve full immunization need to inquire about the public's propensity toward and access to vaccines. Additionally, the disparities in the effects of COVID-19 require equity-based vaccination plans, not equality-based ones. It uses the Social Construction of Technology (SCOT) theory to analyze the relationships that exist between the vaccine and the public because this theory recognizes technology as a social construct and technological development as a social process (Pinch & Bijker, 1984, p. 399-441). Community-based knowledge of the relationship between medical advancements and people of color will lead to distribution plans that effectively encourage their participation in local

vaccination efforts. The tightly coupled technical project addresses the demand for doses of conventionally storable vaccines.

The technical project supports vaccination efforts by developing a yield-driven manufacturing process and chemical plant design for Bharat Biotech's COVID-19 vaccine, Covaxin. Covaxin is a two-dose, inactivated vaccine (Corum & Zimmer, 2021, p. 1). The project strives to produce 570 million viable doses in its first year of manufacturing and 713 million doses in subsequent years. This quantity is enough to vaccinate over six percent of the world population. The amount of antigen required to vaccinate this target market served as a basis for the manufacturing process. This stipulation ensures the quality of the vaccine will not compete with measures to increase profits. To protect company assets, Bharat Biotech did not release a complete manufacturing plan to the public, requiring the team to incorporate data from similar manufacturing processes to compensate. With a rolling day average of 16 million doses per day, it would take more than two years to complete global vaccination, barring any delays (Pettersson et al., 2020, p. 3). An additional supply of stable vaccines would expedite this process.

Both projects aim to curb the transmission of COVID-19 through natural infection. The technical project is a component of the STS research topic and attempts to eliminate an insufficient supply of vaccines as an obstacle to full immunization. The STS research provides the best strategy for higher vaccination rates in Atlanta, GA. An expansion of this plan to promote immunization in other American regions and middle and low-income countries can be the aim of future research applications.

UNDERSTANDING THE ROLE ENGINEERS AND MEDICAL TECHNOLOGY HAVE IN SOCIETY

The vaccines engineers develop for the public are impacted by social groups that influence the production and demand for a vaccine, illustrated below in Figure 1. To pharmaceutical companies, the development of a vaccine is a potential source of revenue and distinction. To government agencies, a vaccine is a necessity to promote societal well-being and functioning. Insurance companies decide whether or not a COVID-19 infection is a pre-existing condition. Healthcare providers influence the popularity of vaccines by administering the ones they prefer to their patients.

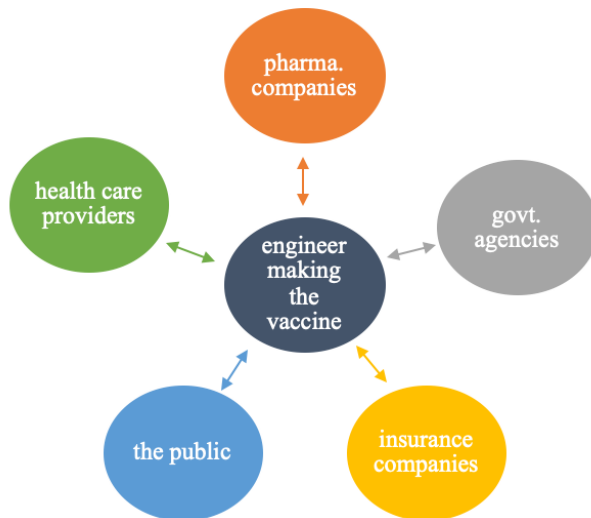


Figure 1: Social Construction of Vaccinations: The engineer does not impact the diffusion of the vaccine produced but they are necessary to allow the social groups to plan what to do with the artifact once it is developed. The engineer and the vaccine serve as a connection between pharmaceutical companies, healthcare providers, government agencies, insurance companies, and the public (Adapted by Aba Acquah 2020 from W. Bernard Carlson 2009).

The public determines the extent of immunization in a community, requiring a deeper understanding of the influencers of immunization compliance. The sluggish response of the United States to the pandemic has affirmed the country's title as a global leader: in COVID-19 cases and deaths. Dennis Proffitt, a recently retired UVA professor, attributes the differences in COVID-19 responses amongst Americans to two competing and equally American ideals (Proffitt, 2020, p. 1). The country's motto, "E Pluribus Unum," emphasizes that national unity

can overcome obstacles (Proffitt, 2020, p. 1). Conversely, Revolutionary War cries like "don't tread on me" embody the nation's dedication to upholding individual freedoms (Proffitt, 2020, p. 1). The pushback on restrictions to advocate for freedom, a lack of government planning, and increasing accommodations to make life appear more "normal" have disengaged Americans from the problem they face (Yong, 2020, p. 27-29). While deliberation continues about what constitutes an infringement of rights, some Americans are losing the real battle with the pandemic.

AN AMALGAMATION OF ADVERSITY

There are 3,006 counties in the United States (U.S. Census Bureau, n.d., p. 4-11). Millet et al. (2020) reported that the 677 disproportionately black counties in the United States accounted for 52% of COVID-19 cases and 58% of deaths (p. 37). 40% of Black adults have used money from savings or retirement accounts to pay bills since the pandemic began, 43% have had trouble paying bills, and 33% have gotten food from a food bank or organization compared to 33%, 25%, and 17% of all adults (Parker et al., 2020, p. 2). Independent of the level of compliance with social distancing measures, natural infection transmission hurts minorities more than other groups because of underlying disparities that make them more at risk.

Higher-income individuals are more likely to engage in social distancing practices, report being able to work from home, and transition to teleworking instead of losing their job (Papageorge et al., 2020, p. 695-715). Consequently, lower-income individuals, who are less financially capable of dealing with the illness and its consequences, cannot engage in practices that would ensure their protection from COVID-19. As Henry-Nickie and Hudak state, "because of work demands, transportation needs, housing settings, etc., social distancing is not an option"

(Henry-Nickie & Hudak, 2020, p. 5). In several American states, minorities make up at least 40% of the working class (Rowell, 2018, p. 4).

The United States government launched the Paycheck Protection Program (PPP), established by the CARES Act, to offer relief to small businesses during the pandemic (Zhou, 2020, p. 2). Because this program initially relied on traditional banks to distribute loans, neighborhoods of color with the most extensive financial burdens received loans last (Lui & Parilla, 2020, p. 3). Black business owners also disproportionately did not receive PPP money (Popken, 2020, p. 1-5). Parker et al. (2020) report that 29% of black adult Americans have lost their jobs since the pandemic began (p. 6). These compounding financial hardships make it difficult to participate in preventative behaviors and make the overwhelming cost of healthcare a more pervasive obstacle. These implications increase the importance of vaccinations for these communities that do not have alternative forms of protection.

EQUALITY-BASED DISTRIBUTION PLANS ARE INSUFFICIENT

Vaccinations are a safer method of exposure to COVID-19, but trends in vaccination are disproportionate. According to Recht and Weber, in 16 states, white residents are being vaccinated at significantly higher rates than Black residents, two or three times higher in many cases (Recht & Weber, 2021, p. 2). Vaccination plans that do not prioritize equity rely on the disadvantages one group faces to have an easy resolution. Consequently, equality-based plans are incapable of generating equal vaccination rates across races and ethnicities because of existing disparities in healthcare coverage and medical treatment. Additionally, these plans do not create an environment that deters the use of societal privileges.

Equity is Not a Revolutionary Concept

Most vaccination rollout plans involve vaccinating frontline healthcare workers and older individuals first because they face elevated risks. Higher vaccination rates for at-risk groups make death rates less disproportionate. The disproportionate effects of COVID-19 result in the African American community facing elevated risks.

The success of equity-based vaccination plans relies on the inclination of the African American community to use medical innovations. Therefore, the relationship between the government, the medical industry, and the African American community warrants evaluation. The SCOT theory analysis of vaccination is expanded below in Figure 2 to include major influencers of public perception of vaccines.

EXPANDING THE CURRENT SOCIAL CONSTRUCTION OF VACCINATIONS MODEL

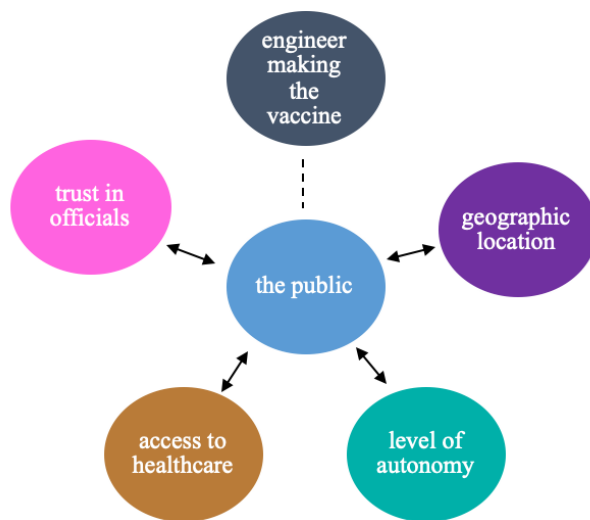


Figure 2: Updated Social Construction of Vaccinations: Updates the current model to account for the different contexts recipients of the vaccine live in. The engineer and vaccine are still fundamental to connecting the public with other social groups, but the characteristics of the public alter how a vaccine is viewed (Adapted by Aba Acquah 2021 from W. Bernard Carlson 2009).

A Precautionary Asset Replaced by Intimidation

The adverse conditions African American communities face in the United States lead to higher rates of underlying health conditions than other demographics, making visits to the doctor

more daunting. Consequently, communities of color are at increased risk for experiencing severe illness if they become infected with coronavirus compared to White Americans (Artiga et al., 2020, p. 1). The potential for receiving disagreeable news accompanies a decrease in the quality of treatment. Imhof reports that racial and ethnic disparities in maternal and child health are a national health crisis (Imhof, 2020, p. 5). Minorities fare better when they visit minority doctors, but they only make up four percent of practicing physicians (Imhof, 2020, p. 3, Wells & Gowda, 2020, p. 2).

The CDC reports that factors like “[a] lack of transportation, child care, or ability to take time off of work; communication and language barriers; cultural differences between patients and providers; and historical and current discrimination in healthcare systems” may limit healthcare access (CDCc, 2021, p. 1-2). Those disparities and discrimination make the current healthcare system an unreliable entity to properly deal with medical problems faced by minorities (Doherty & Kenen, 2021, p. 4). These limitations directly translate to disparities in measures of medical compliance like childhood immunization. Black children in American are ten percent less likely to be fully immunized than White children (US Department of Health and Human Services Office of Minority Health, 2020, p. 2). After the passage of the Affordable Care Act, 11.5% of Black Americans are still uninsured compared to 7.5% of White Americans (Artiga et al., 2020, p. 2).

An Inexcusable Track Record

The responses of the US government to issues that disproportionately impact minorities have fostered mistrust.

April 25th will mark the seventh anniversary of the Flint Water Crisis, a public health emergency that exposed residents to a tainted water supply (Sneed et al., 2020, p. 3). The crisis

has not been resolved and impacts a city that is 56% African American (Sneed et al., 2020, p. 3). Between the years 1932-1972, the Tuskegee Institute studied the progression of syphilis in poor, black men without treatments or consent (Wells & Gowda, 2020, p. 2).

The Responsibility of Equity

Anne Sosin, the program director for the Dartmouth Center for Global Health Equity, acknowledges that vaccine hesitancy is a concern but warns fascination with the topic deflects responsibility for equitable distribution away from governing bodies (Doherty & Kenen, 2021, p. 7). Distributing resources and vaccines based on need instead of access is a starting point for placing positive attributes in the public's contexts shown in Figure 2 (p. 6).

COMMUNITY-BASED RESEARCH FOR THE BEST WAY TO VACCINATE ATLANTA, GEORGIA

COVID-19 from the Perspective of Atlanta Residents

Fulton and DeKalb County have a combined population of 1.8 million residents, almost 150,000 COVID-19 cases, and approximately 2,000 deaths (Georgia Department of Public Health, 2021a, p. 3). 82% of inpatient beds, 79% of ICU beds, 56% of emergency department beds, and 34% of ventilators are in use in those counties (Georgia Department of Public Health, 2021a, p. 1). The 1.8 million residents in these counties share 20 vaccination sites (Georgia Department of Public Health, 2021b, p. 1). Their locations are indicated below in Figure 3 (p. 9). The state of Georgia currently has the smallest percentage of its population receiving at least one dose of a COVID-19 vaccine in the country (CDC, 2021b, p. 2).

The majority of vaccine sites, pharmacies, hospitals, and medical centers are within 10 miles of Emory University and other close, high-traffic areas (Figure 3, p. 9). A distribution plan that utilizes these institutions is not as accessible to people residing outside of those areas. The

demographics of the medical professionals in this area increase the possibility of adequate medical treatment. 12% of physicians and 10% of physician assistants are African American in Georgia (Georgia Board of Health Care Workforce, 2018, p. 1). Drastic differences from national statistics could potentially increase the level of trust between residents and physicians. However, confining vaccination centers to medical centers may discourage people who don't have health insurance or distrust medical professionals regardless of their race to be vaccinated.

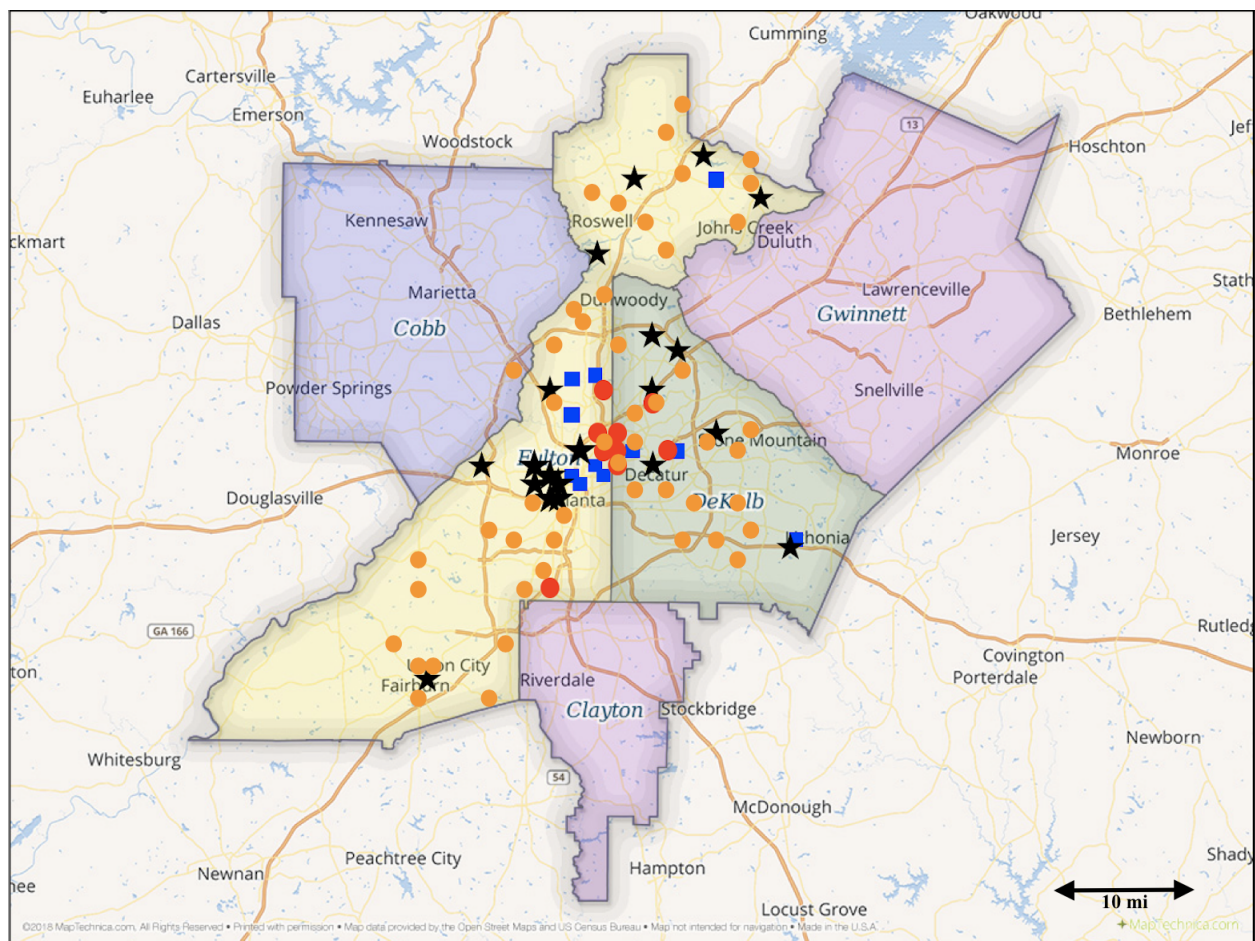


Figure 3: Healthcare and Church Distribution in Atlanta, GA, and the Surrounding Areas: ★ represents vaccine distribution sites, ■ represents hospitals and medical centers, ● represents pharmacies, and ● represents churches (Adapted by Aba Acquah 2021 from NeighborWorks Columbus 2021)

Each orange dot in Figure 3 corresponds to at least one church (p. 9). Church distribution is more uniform throughout the two counties and populous than existing vaccination sites.

The Moderna and Janssen vaccines can be stored in conventional stand-alone freezers and refrigerators, respectively, making storage at churches possible (Tennessee State Government, 2021, p. 13-14). Online church bulletins in the Atlanta area incorporate programs to help students in school, marriage enrichment programs, and shuttles services to vote in elections (<https://buckheadchurch.org>). Helping community members with vaccinations would not be outside of the scope of their services. Additionally, church voting drives are so effective several new voter suppression laws in the state target them specifically, showcasing the church's power as an entity capable of persuading public opinion and increasing community participation (Niese, 2021, p. 2).

The best plan for vaccine distribution should encompass all of the access points listed in Figure 3 (p. 9).

ASSISTING THE BIDEN PLAN TO VACCINATE AMERICA

In a society where discrimination exists, the best way to ensure the safety of marginalized groups is to acknowledge unfairness and compensate for it. Federal policies about the pandemic lack the specificity required to encourage full immunization at the local level. However, high immunization rates in local communities collectively promote higher national immunization.

The most successful vaccination effort in the United States took place in New York City in the late 1940s against smallpox (Florio & Shapiro, 2020, p. 7). The keys to this effort were transparency from officials, enlisting civilian volunteers to help with vaccine delivery, and local vaccination sites (Florio & Shapiro, 2020, p. 6). Focusing on institutions that can already store and administer vaccines is more financially feasible but impacts a narrower scope of individuals.

Assigning ancillary healthcare workers to churches and providing them resources to safely store vaccines would be a rewarding investment in the Atlanta area.

A PROPOSAL FOR THE INTERSECTION OF CHURCH AND STATE

An alliance between Black Americans and White Americans to take advantage of financial opportunities that white supremacy would have otherwise undermined has led to the success of Atlanta's economy (Badger, 2020, p. 3). The booming economy caused an influx of ethnic minorities to settle in and around Atlanta and led to an expansion of urban life (Badger, 2020, p. 5). The realization of urban problems like infrastructure and discussion of civil affairs that higher taxes could remedy caused a schism between white residents in those communities and their shared Republican ideas (Badger, 2020, p. 5).

Understanding the drivers of social change in a community leads to developing efficient avenues to influence public thought. Senators Warnock and Ossoff's victories showcase the popularity of the progressive ideas of Atlanta residents and their neighbors. Political campaigns rely on convincing the public that a candidate is poised to move a community in a direction that resonates with its constituents. The notion of a separation between church and state is fundamental to the United States. Raphael Warnock's amplified connection to his faith throughout his campaign is discordant with this belief, but his strategy was successful.

Warnock's position as a senior pastor at the same church Dr. Martin Luther King Jr. preached gives him a direct connection to the Atlanta community, where historical residents are wary of outsiders (Badger, 2020, p. 4, Fausset, 2021, p. 1). It also emphasizes how churches have been at the forefront of the ongoing civil rights movement and their importance to African Americans in Atlanta (Fausset, 2021, p. 1).

Socialization is the basis of almost every institution in America. The rules for acceptable ways to interact with one another are not limited to just citizens. Debates about the interaction between the government and its citizens are endless. The pandemic altered this relationship by making government success a function of its citizens' compliance with medical recommendations. Effective communication can increase compliance, but it is reliant on an understanding of individual values. For the African American community, the church has historically been a place of refuge from the inequities brought on by their roles in society. This feeling of security makes churches viable local points of contact between Atlanta residents and innovative COVID-19 vaccines.

The mobility of social change presented by Badger indicates the divide between cities and the suburbs is not definite and the social interaction between the two lead to social similarities. Therefore, initiatives that aim to change public opinion can transcend city boundaries. The progressiveness of Warnock's platform separates practicing religion from holding old-fashioned beliefs (Fausset, 2021, p. 5). Modernity to appeal to younger demographics, churches as a point of contact, and the possibility of influence outside of cities are vital features of a plan to alter the relationship between black communities, the government, and the medical industry in Atlanta, GA, and its surrounding areas.

WORKS CITED

- Acquaah, A. (2021). *Healthcare and Church Distribution in Atlanta, GA, and the Surrounding Areas*. [Figure 3]. STS Research Paper: *Quality Over Quantity and Equity Over Equality* (Unpublished undergraduate thesis). School of Engineering and Applied Science, University of Virginia. Charlottesville, VA.
- Acquaah, A. (2021). *Updated Social Construction of Vaccinations*. [Figure 2]. STS Research Paper: *Quality Over Quantity and Equity Over Equality* (Unpublished undergraduate thesis). School of Engineering and Applied Science, University of Virginia. Charlottesville, VA.
- Acquaah, A. (2020). *Social Construction of Vaccinations*. [Figure 1]. *Prospectus* (Unpublished undergraduate thesis). School of Engineering and Applied Science, University of Virginia. Charlottesville, VA.
- Artiga, S., Orgera, K., & Damico, A. (2020, March). *Changes in health coverage by race and ethnicity since the ACA, 2010-2018*. Retrieved from Kaiser Family Foundation website: <https://www.kff.org/racial-equity-and-health-policy/issue-brief/changes-in-health-coverage-by-race-and-ethnicity-since-the-aca-2010-2018/>
- Artiga, S., Garfield, R., & Orgera, K. (2020, April). *Communities of color at higher risk for health and economic challenges due to COVID-19*. Retrieved from Kaiser Family Foundation website: https://www.kff.org/coronavirus-covid-19/issue-brief/communities-of-color-at-higher-risk-for-health-and-economic-challenges-due-to-covid-19/?utm_campaign=KFF-2020-Uninsured&utm_source=hs_email&utm_medium=email&utm_content=2&_hsenc=p2ANqtz-UqLIooowVMibewUsBF8kGfwkh4ndUc-Ng7RZ8if---KZNFdsVsWt8UG2un7FH2DxliVe3nEefuXSQR1155GRcIUWd7mg&_hsmi=2
- Badger, E. (2020, December 9). How Atlanta's politics overtook the suburbs, too. *The New York Times*. Retrieved from <https://www.nytimes.com>
- Centers for Disease Control and Prevention. (2021a, January). *Emerging SARS-CoV-2 variants*. Retrieved from <https://www.cdc.gov/coronavirus/2019-ncov/more/science-and-research/scientific-brief-emergin-g-variants.html#print>
- Centers for Disease Control and Prevention. (2021b, March). *COVID-19 vaccinations in the United States*. Retrieved from <https://covid.cdc.gov/covid-data-tracker/#vaccinations>
- Centers for Disease Control and Prevention. (2021c, February). *Health equity considerations and racial and ethnic minority groups*. Retrieved from <https://www.cdc.gov/coronavirus/2019-ncov/community/health-equity/race-ethnicity.html>

- Centers for Disease Control and Prevention. (2021d, April). *Benefits of getting a COVID-19 vaccine*. Retrieved from <https://www.cdc.gov/coronavirus/2019-ncov/vaccines/vaccine-benefits.html>
- Corum, J., & Zimmer, C. (2021, January 4). How Bharat Biotech's vaccine works. *The New York Times*. Retrieved from <https://www.nytimes.com>
- Doherty, T., & Kenen, J. (2021, January 1). Just 5 percent of vaccinations have gone to Black Americans, despite equity efforts. *POLITICO*. Retrieved from <https://www.politico.com>
- Dong, E., Du, H., & Gardner, L. (2020). An interactive web-based dashboard to track COVID-19 in real time. *The Lancet Infectious Diseases*, 20(5), 533-534.
- Fausset, R. (2021, January 5). Can Raphael Warnock go from the pulpit to the Senate? *The New York Times*. Retrieved from <https://www.nytimes.com>
- Florio, J., & Shapiro, O. (2020, December 18). How New York City vaccinated 6 million people in less than a month. *The New York Times*. Retrieved from <https://www.nytimes.com>
- Georgia Department of Public Health. (2021a, March). Georgia Department of Public Health daily status report, March 2021. Retrieved from <https://dph.georgia.gov/covid-19-daily-status-report>
- Georgia Department of Public Health. (2021b, March). Georgia Vaccine Locator. In *COVID-19 Vaccine*. Retrieved from <https://dph.georgia.gov/covid-vaccine>
- Georgia Board of Health Care Workforce. (2018). Retrieved from <https://healthcareworkforce.georgia.gov/physician-workforce-data>
- Henry-Nickie, M., & Hudak, J. (2020, May 19). Social distancing in Black and white neighborhoods in Detroit: A data-driven look at vulnerable communities [Blog post]. Retrieved from <https://www.brookings.edu/blog/fixgov/2020/05/19/social-distancing-in-black-and-white-neighborhoods-in-detroit-a-data-driven-look-at-vulnerable-communities/>
- Imhof, J. (2020, June 3). Health inequality actually is a “black and white issue”, research says [Blog post]. Retrieved from <https://healthblog.uofmhealth.org>
- Jaimes, J. A., André, N. M., Chappie, J. S., Millet, J. K., & Whittaker, G. R. (2020). Phylogenetic analysis and structural modeling of SARS-CoV-2 spike protein reveals an evolutionary distinct and proteolytically sensitive activation loop. *Journal of Molecular Biology*. 432(1), 3309-3325. doi: 10.1016/j.jmb.2020.04.009
- Li, Q., Wu, J., Nie, J., Zhang, L., Hao, H., Liu, S., ... Wang, Y. (2020). The impact of mutations in SARS-CoV-2 spike on viral infectivity and antigenicity. *Cell Press*, 182(5), 1284-1294.E9. doi: 10.1016/j.cell.2020.07.012

- List of hospitals in Georgia (U.S. state). (2021, February 15). In *Wikipedia*.
[https://en.wikipedia.org/wiki/List_of_hospitals_in_Georgia_\(U.S._state\)](https://en.wikipedia.org/wiki/List_of_hospitals_in_Georgia_(U.S._state))
- Liu, S., & Parilla, J. (2020, September 17). New data shows small businesses in communities of color had unequal access to federal COVID-19 relief. *Brookings*. Retrieved from
<https://www.brookings.edu>
- Millett, G. A., Jones, A. T., Benkeser, D., Baral, S., Mercer, L., Beyrer, C., ... & Sullivan, P. S. (2020). Assessing differential impacts of COVID-19 on black communities. *Annals of Epidemiology*, 47(1), 37–44. doi: 10.1016/j.annepidem.2020.05.003
- NeighborWorks Columbus. (2021). Fulton, DeKalb, Cobb, Gwinnet or Clayton County. In NEIGHBORHOODLIFT program information. Retrieved from
<https://nwcolumbus.org/neighborhoodlift-program-information-2/>
- Niesse, M. (2021, March 12). Plan to limit Georgia Sunday voting disrupts Black church efforts. *The Atlanta Journal-Constitution*. Retrieved from <https://www.ajc.com>
- Papageorge, N. W., Zahn, M. V., Belot, M., van den Broek-Altenburg, E., Choi, S., Jamison, J. C., & Tripodi, E. (2020). Socio-demographic factors with self-protecting behavior during the Covid-19 pandemic. *Journal of Population Economics*. 34(1), 691-738. doi: 10.1007/s00148-020-00818-x
- Parker, K., Minkin, R., & Bennett, J. (2020, September 24). Economic fallout from COVID-19 continues to hit lower-income Americans the hardest. *Pew Research Center*. Retrieved from <https://www.pewresearch.org>
- Pettersson, H., Manley, B., Hernandez, S., & McPhillis, D. (2021, February 24). Tracking COVID-19 vaccinations worldwide. *CNN*. Retrieved from
<https://www.cnn.com/interactive/2021/health/global-covid-vaccinations/>
- Pinch, T. J. & Bijker, W. E. (1984). The social construction of facts and artefacts: or how the sociology of science and the sociology of technology might benefit each other. *Social Studies of Science*. 14(3), 399-441. Retrieved from <https://www.jstor.org/stable/285355>
- Popken, B. (2020, April 29). Why are so many black-owned small businesses shut out of PPP loans? *NBC News*. Retrieved from <https://www.nbcnews.com>
- Proffitt, D. (2020, October 13). Why certain people are biased to ignore the risks of the pandemic, according to a psychology professor. *Business Insider*. Retrieved from
<https://www.businessinsider.com>
- Recht, H., & Weber, L. (2021, January 17). Black Americans are getting vaccinated at lower rates than white Americans. *KHN*. Retrieved from <https://khn.org>

- Rowell, A. (2018, July 6). Who makes up the working class? *Center for American Progress Action Fund*. Retrieved from <https://www.americanprogressaction.org>
- Sneed, R. S., Key, K., Bailey, S., and Johnson-Lawrence, V. (2020). Social and psychological consequences of the COVID-19 pandemic in African-American communities: Lessons from Michigan. *Psychological Trauma: Theory, Research, Practice, and Policy*, 12(5), 446–448. doi: 10.1037/tra0000881
- Tennessee State Government. (2021, February). *Tennessee Vaccine-Preventable Diseases and Immunization Program*. Retrieved from https://www.tn.gov/content/dam/tn/health/documents/cedep/novel-coronavirus/Vaccine_Storage_Handling.pdf
- U.S. Census Bureau. (n.d.). *States, counties, and statistically equivalent entities*. Retrieved from <https://www2.census.gov/geo/pdfs/reference/GARM/Ch4GARM.pdf>
- U.S. Department of Health and Human Services Office of Minority Health. (2020, December 14). Immunizations. In *Policy and Data*. Retrieved from <https://minorityhealth.hhs.gov/omh/browse.aspx?lvl=4&lvlid=22>
- Wells, L., & Gowda, A. (2020). A legacy of mistrust: African Americans and the US healthcare system. *Proceedings of UCLA Health*, 24(1). Retrieved from <https://proceedings.med.ucla.edu/wp-content/uploads/2020/06/Wells-A200421LW-rko-Wells-Lindsay-M.D.-BLM-formatted.pdf>
- Yong, E. (2020, August 4). How the pandemic defeated America. *The Atlantic*. Retrieved from <https://www.theatlantic.com>
- Zhou, L. (2020, October 5). The Paycheck Protection Program failed many Black-owned businesses [Blog post]. Retrieved from <https://www.vox.com>