

**Lessons Learned from the COVID-19 Outbreak in the United States**

A Research Paper submitted to the Department of Engineering and Society

Presented to the Faculty of the School of Engineering and Applied Science  
University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements for the Degree  
Bachelor of Science, School of Engineering

**Andrew Spaziani**

Spring 2020

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

Richard D. Jacques, Ph.D., Department of Engineering and Society

In December of 2019 COVID-19 was identified in Wuhan China. In one of China's densest cities the novel coronavirus had infected nearly 50,000 Wuhan residents. On January 23 Chinese residents were restricted from leaving or entering Wuhan for it was the first time a Coronavirus could be transmitted from person to person (Zhu). A day earlier the first case of COVID-19 was confirmed in the United States. The infected 35-year-old man had checked himself into a Washington State clinic after recently visiting Wuhan (Holshue). Only a month later there were only 15 confirmed cases in the US (Cases in U.S.). As the number of confirmed cases in the US stayed below 20, on February 24 The President of The United States tweeted, "The Coronavirus is very much under control in the USA" (Trump). As of April 12, the number of confirmed cases in the US had risen to over 500,000 with the death toll nearing 21,000 (Cases in U.S.). With time to prepare for the Virus, the US has proven to be inept in dealing with this global pandemic. Although the country proudly boasts its power and wealth, the United States has more COVID-19 cases than any country in the world. As the cases overwhelm the US's health system, the economy has floundered. Quarantining has caused job layoffs, small business struggles, school closures, and millions of Americans to perform their work from home. These dramatic changes to the American people's everyday lives has already proven to be socially detrimental. The Coronavirus in the US has highlighted issues within our health system, and economy that have adverse effects on the wellbeing of the American people.

The US leads the world in COVID-19 related deaths. The country also has many of the world's best hospitals and medical technology. Although the entire world was blindsided by this pandemic, the US is encountering the worst of it. Health Care Personnel around the country have pleaded with the government to assist in providing more resources to fight the virus. In an interview with CBS News, Kelly Cabrera, an emergency room nurse at the Jacobi Medical

Center in the Bronx, described the medical shortage at her hospital. She pleaded for the viewers to “do a simple Google search, look at what other countries are wearing in comparison to us. I mean, it makes, I mean, it makes sense that we're getting infected. How could we expect not to?” (Whitaker). Around the country HCP are experiencing shortages of protective gear. Having to reuse masks, gloves and other essential equipment the CDC reports that from February 12 to April 9 at least 9,000 HCP have contracted the Coronavirus. Because the shortage of personal protective equipment, nurses like Cabrera are forced to reuse gowns, masks, and gloves. The reuse of these potentially infected devices are likely contributing to more cases among patients and HCP in the hospitals. While hospitals struggle to get their hands on more personal protective gear, some of the workers are using makeshift equipment to protect themselves. Rachel Meislin, a New York physician tweeted a picture of a New York Yankees branded rain poncho. She wrote “THIS IS THE “PPE” I WAS JUST HANDED for my shift. Our federal government has completely failed its health care workers. #GetUsPPE” (Meislin). Being forced to reuse or makeshift PPE, the US’s health care personnel were massively undersupplied with necessary equipment. This shortage puts our doctors and nurses in danger, as well as their families. Much of the US’s HCP have risked their own health to fight the Coronavirus as the country struggles to provide them with more resources. In addition to a shortage of protective equipment, some hospitals have pleaded for more ventilators as the conditions of thousands of patients continue to decline.

A ventilator is a device that helps a patient breathe when they cannot on their own. Studies on ventilators effectiveness for COVID-19 positive patients have been assessed all over the world. One done in Washington State found only 6 of 22 patients recovered to breathe on their own (Bhatraju). Although grim, similar statistics show the need for ventilators. While

much of the world's efforts to find a treatment for the Coronavirus have failed, ventilation has been one of the only successful measures. Although they remain many families' last hope, the US faced a potential mass shortage of the device. On April 3 Governor Andrew Cuomo of New York said, "At the current burn rate, we have about six days of ventilators in our stockpile" (Kaste). With ventilator supplies quickly being diminished, hospital workers faced the possibility of having to decide which patients receive the device. Government officials around the country pleaded for more devices as President Trump called on the Defense Production Act. The act allows the federal government to force private companies to prioritize government orders. Although this action helped unite a lot of private American companies to fight the virus, much of America was already doing whatever possible to help. On March 31, the CEO of Tesla, Elon Musk, tweeted; "We have extra FDA-approved ventilators. Will ship to hospitals worldwide within Tesla delivery regions. Device & shipping cost are free" (Musk). Along with Tesla, General Electric is also helping produce ventilators for the government. The Department of Health and Human Services announced a contract with GE to produce 50,000 ventilators by July 13 (HHS). Although support from companies like GE and Tesla are commendable, the lack of preparedness by the US is astounding. Having to rely on large corporations to save American people and provide healthcare products highlights the inadequacies within our current system. The US is home to some of the best education and healthcare expertise in the world. Students and Faculty at The Massachusetts Institute of Technology have developed and shared specifications to their solution to the ventilator shortage issue. Their alternative ventilator costs significantly less than a regular one and uses materials readily available (Chandler). The ventilator shortage has gotten so serious even some students have been compelled to help. Companies like GE and Tesla and the students from MIT highlight a larger problem the US

faces. While they are offering lifesaving help, companies that produce ventilators are overseas. Like the PPE shortage, the US relies on foreign manufacturing to supply our workers. While cost effective and convenient during normal times, this system has proven to be inadequate during the Coronavirus.

According the Bureau of Labor Statistics, manufacturing employment in the US has decreased by 5.5 million jobs from 2000 to 2017 (Hernandez). During the beginning of that span from 2002 to 2009 the Chinese saw an increase in manufacturing jobs of about 13 million (Banister). The biggest reason for this shift in jobs is because of Chinese wage rates. During the height of the manufacturing job loss in the US, Chinese manufacturing workers were being paid an average of \$1.59/hr (Banister). The US could not compete with these low wages in China and other countries leading to companies shipping jobs overseas to save money. While this job migration was beneficial for business owners and large corporations, millions of Americans have lost manufacturing jobs during the 2000s. In addition to this job loss, foreign manufacturing increases the US's dependence on foreign countries. During times of economic and relative social prosperity, overseas production can be tolerated. It is the reason an iPhone or a television set have become more affordable to more Americans. However, as the Coronavirus proves, this current system is not sustainable. During a global pandemic or any type of national emergency America needs manufacturers on its soil. Peter Navarro is an American economist who serves in the Trump Administration as the Director of the Trade and Manufacturing Policy and has been put in charge of the Defense Production Act during the Coronavirus. During an interview aired on April 12<sup>th</sup>, Navarro was asked about the US's PPE and ventilator shortage. He responded, "It's the global --globalization of production through multinational corporations, who salute no flag, who love cheap sweatshop labor, and who love the massive subsidies that the Chinese

government throws at production to bring it from here to there” (Whitaker). Navarro compared the Coronavirus to a 500-year flood and as this flood recedes it needs to be a lesson on the importance of keeping sustainable jobs in the American economy. While foreign countries have banned US and most international exports during the pandemic, important medical equipment is devoid in American Hospitals. In 2020 it was medical gear, but in the future America must not rely on other nations, for a shortage of another vital good might again become the American reality. Our resources must stay home in the event of another catastrophic world occurrence. While it may be decades until this next disastrous event, the US economy and America’s wellbeing need the return of foreign jobs.

The US Department of Labor has announced that during the month of March in 2020 the unemployment rate increased more than any month since 1975 (The Employment Situation). While Americans scramble to protect themselves and their family during the Coronavirus, businesses have shut down. People flood the supermarkets as restaurants are mainly closed. While most businesses will bring in severely less revenue during the pandemic, millions of Americans have been laid off. As the virus continues to infect thousands daily, the number of jobless in the US will rise. If the US did not ship millions of jobs overseas during the 2000s many medical manufactures would be producing jobs in the US. Because those have disappeared, the US has a shortage of medical supply imports likely causing more infections leading to more panic.

In 2019 the unemployment rate was as low as it has ever been in nearly 50 years (Labor Force Statistics). With an unemployment rate of 3.7 percent, America’s economy was thriving by many expert’s opinion. However, as disaster struck with the Coronavirus, more than 10 million Americans claimed unemployment in March of 2020, and more than 11 million in April

(Unemployment). Although necessary that most businesses got shut down, the unemployment during the Coronavirus shows the fragility of many American jobs. The Bureau of Labor Statistics project the driving industry to grow by 20 percent, much faster than most occupations due to “self-employed” drivers whose employment is predicted to grow 37 percent from 2018 to 2028 (Taxi Drivers). Ride hailing drivers join millions of Americans in the gig economy. They are private contractors whose work has been affected by the Coronavirus’ social distancing practice. These people do not have employers or corporations behind them for financial support during a pandemic. Similarly, small business owners are struggling to maintain their businesses and pay their employees. The nature of many peoples’ employment does not allow them to provide a service during a pandemic and they suffer financially. While most Americans cannot work during the pandemic, the unemployment claims show that millions of people were relying on their incremental paychecks to support themselves. While many considered the economy of 2019 and early 2020 to be one of the best, millions were unable to sustain their lifestyles by missing about a month’s worth of pay. A better measure of our economy would be how resilient individuals are to catastrophic events. Rather than measuring how high stock prices soar, the US should focus on how well the average American can support themselves during a personal or national crisis.

While the Coronavirus exposes flaws in the US health system and economy, the effects on the American people are equally harmful. Folks around the country are told to stay home, while the end of the virus is nowhere in sight. Every day, millions of Americans tune into the news to hear about new cases, and new proposals that suggest the outbreak continues to worsen. The cancellation of schools is one new adjustment families must deal with. At least 55 million students have been sent home, forcing them to complete schoolwork and assignments from home

(Map: Coronavirus). Although many kids welcome the cancellation of school, this new system creates problems that affect many of these kids and their families. According to Education Week nearly 30 million students rely on subsidized school meals (Mitchell). Without access to these meals, students must depend on their families for food. While many families' income has been cut by the Coronavirus, supporting their children's nutritional needs has become more difficult. In addition to having to provide more food for their children, families now have to supervise their kids for longer hours as school and school activities can no longer serve as the kids' overseers. While many parents around the country lost their paychecks, they now must provide more meals and stay home with their kids, preventing them further from finding an income.

In addition to the increased burden on families due to school closures, kids now must deal with the reality of life at home. The CDC state six ways to mitigate the negative effects on kids' psyche during the pandemic. They say, "Limit your family's exposure to news coverage" and "Try to keep up with regular routines" (Mental Health). As parents struggle to find work to feed their kids, maintaining a regular routine during a pandemic is near impossible for many families. Finding a new income as well as providing children with learning resources and a routine is difficult. Parents are having to prioritize their work in order to provide but also having to care for children puts stress on the kids as well as the parents. And if parents cannot provide the unrelenting supervision kids need, how can the children avoid news coverage. The news has infiltrated almost every social media outlet. With all the extra time kids have due to school closures, avoiding the media is near impossible. Because many kids are left to their own while their parents work, the young people will undoubtedly hear the news. The CDC suggests young people avoid the news because of the overwhelming negative perspective it has during a pandemic. While schools remain closed, the mental health of the US's young people need to be



closely monitored. The pandemic has ruined the routine of the nation's school kids as well exposes them more to the terrors brought about by COVID.

Although the Coronavirus has exposed flaws within our health system and economy, the effect on the American people is not all negative. While the virus temporarily shuts down many of the worlds current systems, the US has faced worse and come out better for it. Life for many Americans is tough during the pandemic; however, this can be an opportunity for the country to realize its flaws and improve upon them to make sure US citizens never suffer like this again. The Coronavirus Pandemic sheds light on all the important services in the US that often are taken for granted. Healthcare workers, postmen, garbage collectors, and others are needed more than ever. As these workers continue relentlessly serving the rest of the country, US citizens should sit back and appreciate the real heroes among us. During quarantine families can bond together and accomplish chores around the house that have been put off for years. Phone calls from old friends looking to reconnect can be made. The pandemic shows us what is truly valuable in 2020. If we take the lessons we learned from COVID and from our time in quarantine a better society for everyone can be rebuilt.

## Works Cited

- Banister, Judith. "China's Manufacturing Employment and Hourly Labor Compensation, 2002-2009." *U.S. Bureau of Labor Statistics*, US BLS, 7 June 2013, [www.bls.gov/fls/china\\_method.htm](http://www.bls.gov/fls/china_method.htm).
- Bhatraju, Pavan. "COVID-19 in Critically Ill Patients in the Seattle Region." *The New England Journal of Medicine*, NEJM, [www.nejm.org/doi/pdf/10.1056/NEJMoa2004500?articleTools=true](http://www.nejm.org/doi/pdf/10.1056/NEJMoa2004500?articleTools=true).
- "Cases in U.S." *Centers for Disease Control and Prevention*, Centers for Disease Control and Prevention, 24 Apr. 2020, [www.cdc.gov/coronavirus/2019-ncov/cases-updates/cases-in-us.html](http://www.cdc.gov/coronavirus/2019-ncov/cases-updates/cases-in-us.html).
- Chandler, David L. "MIT-Based Team Works on Rapid Deployment of Open-Source, Low-Cost Ventilator." *MIT News*, 26 Mar. 2020, [news.mit.edu/2020/ventilator-covid-deployment-open-source-low-cost-0326](http://news.mit.edu/2020/ventilator-covid-deployment-open-source-low-cost-0326).
- Hernandez, Richard. "The Fall of Employment in the Manufacturing Sector : Monthly Labor Review." *U.S. Bureau of Labor Statistics*, U.S. Bureau of Labor Statistics, 1 Aug. 2018, [www.bls.gov/opub/mlr/2018/beyond-bls/the-fall-of-employment-in-the-manufacturing-sector.htm](http://www.bls.gov/opub/mlr/2018/beyond-bls/the-fall-of-employment-in-the-manufacturing-sector.htm).
- "HHS Announces Ventilator Contract with GE Under Defense Production Act." *HHS.gov*, US Department of Health and Human Services, 16 Apr. 2020, [www.hhs.gov/about/news/2020/04/16/hhs-announces-ventilator-contract-with-ge-under-defense-production-act.html](http://www.hhs.gov/about/news/2020/04/16/hhs-announces-ventilator-contract-with-ge-under-defense-production-act.html).
- Holshue, Michelle L., et al. "First Case of 2019 Novel Coronavirus in the United States: NEJM." *New England Journal of Medicine*, NEJM, 22 Apr. 2020, [www.nejm.org/doi/full/10.1056/NEJMoa2001191](http://www.nejm.org/doi/full/10.1056/NEJMoa2001191).
- Kaste, Martin, and Rebecca Hersher. "Ventilator Shortages Loom As States Ponder Rules For Rationing." *National Public Radio*, NPR, 3 Apr. 2020, [www.npr.org/sections/health-shots/2020/04/03/826082727/ventilator-shortages-loom-as-states-ponder-rules-for-rationing](http://www.npr.org/sections/health-shots/2020/04/03/826082727/ventilator-shortages-loom-as-states-ponder-rules-for-rationing).
- "Labor Force Statistics." *US Bureau of Labor Statistics*, BLS.

“Map: Coronavirus and School Closures.” *Education Week*, 24 Apr. 2020,

[www.edweek.org/ew/section/multimedia/map-coronavirus-and-school-closures.html](http://www.edweek.org/ew/section/multimedia/map-coronavirus-and-school-closures.html).

Meislin, Rachel. *Twitter*, Twitter, 31 Mar. 2020,

[twitter.com/racheljulie/status/1245114069339852802?ref\\_src=twsrc%5Etfw%7Ctwcamp%5Etwembed%7Ctwterm%5E1245114069339852802&ref\\_url=https%3A%2F%2Fwww.nytimes.com%2F2020%2F04%2F02%2Fnyregion%2Fcoronavirus-yankees-ponchos.html](https://twitter.com/racheljulie/status/1245114069339852802?ref_src=twsrc%5Etfw%7Ctwcamp%5Etwembed%7Ctwterm%5E1245114069339852802&ref_url=https%3A%2F%2Fwww.nytimes.com%2F2020%2F04%2F02%2Fnyregion%2Fcoronavirus-yankees-ponchos.html).

“Mental Health and Coping During COVID-19.” *Centers for Disease Control and Prevention*, CDC, 16

Apr. 2020, [www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/managing-stress-anxiety.html](http://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/managing-stress-anxiety.html).

Mitchell, Corey. “Shut Down by Coronavirus, Schools Scramble to Feed Students.” *Education Week*, 23

Mar. 2020, [www.edweek.org/ew/articles/2020/03/09/shut-down-by-coronavirus-schools-scramble-to.html](http://www.edweek.org/ew/articles/2020/03/09/shut-down-by-coronavirus-schools-scramble-to.html).

Musk, Elon. *Twitter*, Twitter, 31 Mar. 2020, [twitter.com/elonmusk/status/1245009716935188481](https://twitter.com/elonmusk/status/1245009716935188481).

“Taxi Drivers, Ride-Hailing Drivers, and Chauffeurs .” *U.S. Bureau of Labor Statistics*, BLS, 4 Sept.

2019, [www.bls.gov/ooh/transportation-and-material-moving/taxi-drivers-and-chauffeurs.htm#tab-6](http://www.bls.gov/ooh/transportation-and-material-moving/taxi-drivers-and-chauffeurs.htm#tab-6).

“The Employment Situation - March 2020.” *US Department of Labor*, BLS, 3 Apr. 2020.

Trump, Donald J. *Twitter*, Twitter, 24 Feb. 2020,

[twitter.com/realDonaldTrump/status/1232058127740174339](https://twitter.com/realDonaldTrump/status/1232058127740174339).

“Unemployment Insurance Weekly Claims.” *US Department of Labor*, DOL, 23 Apr. 2020.

Whitaker, Bill. “Sick Doctors, Nurses and Not Enough Equipment.” *CBS News*, 12 Apr. 2020.

Zhu, Hengbo, et al. “The Novel Coronavirus Outbreak in Wuhan, China.” *Global Health Research and*

*Policy*, BioMed Central, 2 Mar. 2020, [www.ncbi.nlm.nih.gov/pmc/articles/PMC7050114/](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC7050114/).



