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# The Impact of COVID-19 on US Citizens' Healthcare by Restricting Surgery to Acute Emergencies

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## Abstract

September 25, 2021, hospitals in 29 states are experiencing Crisis Standards of Care (CSC), indicatingthat their healthcare system is overburdened and at a critical capacity limit in caring for COVID-19 patients, permitting rationing measures [1]. The need to ration care means that non-emergency surgery (also known as elective surgery) is prioritized and postponed until the crisis passes. Many states have limited elective surgery before reaching CSC once they reach certain hospitalizations or test positivity. Given the impact of the pandemic on patient medical treatment, this paper examines the impact of COVID-19 on surgical patients.

COVID-19 has highlighted that US healthcare remains profit-driven, emphasizing treatment over prevention, with administration accounting for more than 20% of healthcare spending [2]. Because public health in the United States has been grossly underfunded and unorganized, the country was ill-equipped to deal with a pandemic [3,4]. More than half of US states are functioning under crisis standardsof care, and the US has hit the grim milestone of 700,000 deaths surpassing any major conflict in US history, including the 1918 Spanish flu epidemic [5].

The breakdown of the healthcare system at this level, whether the municipal, tribal, state, or federal level, is catastrophic. It will require a significant redesign to shift the focus of the US healthcare system from minimizing cost/maximizing profit to improving medical care. Given the pandemic's impact on patient medical treatment, this paper examines the state of the US public health system and the impact of COVID-19 on surgical patients since its onset.

**Keywords:** Standard of care; Public health; COVID-19; Chronic disease; Elective surgical procedures; SARS-CoV-2; Non-emergency surgery; Delivery of health care

## Abbreviations & Acronyms:

BBC: British Broadcasting Corporation

CDC: Center for Disease Control

CMS: Centers for Medicare and Medicaid

CSC: Crisis standards of care

GDP: Gross Domestic Product

HEPA: High-efficiency particulate air

ICU: Intensive Care Unit

KHN: Kaiser Health News

MCPH: Marin County Public Health

NNU: National Nurses United

PPE: Personal Protective Equipment

R0: R-Naught

SNS: Strategic National Stockpile

TFAH: Trust for America's Health

## Introduction

COVID-19 has highlighted that the US healthcare system is predominantly profit-driven, focusing oncuring diseases rather than preventing them. Public health programs in the United States are underfunded and undervalued [3,4]. To define public health, the Centers for Disease Control and Prevention (CDC) quotes CEA Winslow, a pioneer in the creation of public health. "the science and art of preventing disease, prolonging life, and promoting health through the organized efforts and informed choices of society, organizations, public and private communities, and individuals [6]." Historically, the US public health system handles immigrants and specialized hospitals, while state and local governments operate and fund local programs.

All Americans, especially the underserved, benefit from public health programs. They assist in a variety of areas, including school food programs, senior meal programs, clean air and water, tobacco, drug, and alcohol education and cessation programs, community health access, immunizations, obesity prevention, food safety, sanitation, sexual disease, mental health, tuberculosis and education programs, and disease tracking and prevention, to mention a few [7].

While the United States surpasses other countries in preventive screenings such as flu vaccinations for adults ages 65 and up (68% compared to the 44% OECD average) and breast cancer screenings for women ages 50 to 69 (80% versus the OECD average of 60% Chronic diseases such as asthma, diabetes, hypertension, and heart disease, on the other hand, are not prevented in the United States) [8]. All of these chronic diseases are thought to be largely preventable if primary care is more widely available [8]. In the US, more than 25% of adults surveyed have at least two chronic diseases compared to only 22% or fewer in many other countries. Ndugga N and Artiga report that health disparities cost health systems $93 billion in medical costs and $42 billion in lost productivity each year [9].

Poorly served or underserved (often frontline necessary workers) Populations are susceptible and at higher risk of infection (COVID-19), illness, and disease due to a lack of adequately funded and staffed public health programs and agencies. As of October 2021, there have been five million deaths worldwide, with 700,000 deaths in the United States [10]. [5] Although the US only makes up around 4% of the global population, it accounts for roughly 14% [12] of all known deaths [11,12]. (Under reporting maybias these results in foreign countries)

The United States should recognize the benefits of public health programs and invest in the necessary health infrastructure to enhance the nation's health while simultaneously balancing illness cure with disease prevention.

## The State of Public Healthcare in the US as COVID Pandemic Started

According to the Centers for Medicare and Medicaid (CMS), "US health care spending grew 4.6 percent in 2019, reaching $3.8 trillion or $11,582 per person. As a share of the nation's Gross Domestic Product, health spending accounted for 17.7%" [13].

Trust for America's Health (TFAH), a Washington, DC-based non-profit health policy group, claims that Americans are not getting any healthier despite trillions spent by the US (likely due to a lack of preventive care). According to the data they provide, public health spending in 2018 was around $286 per person, while the CDC only had about "$3 per capita to spend on chronic disease prevention [4]".

TFAH also explains that public health programs can provide substantial returns on investment while also improving health outcomes. They emphasize three areas that can provide a positive return on health and justify the investment. Tobacco cessation programs return $2 to $3 for every dollar spent. Youth immunization programs can save $5 to $11 for every dollar spent. School drug and intervention programscan return up to $20 for every dollar spent [4]. According to TFAH, "A study of the impact of funding community health workers hired to address the social conditions found that every dollar invested in the intervention returned an average of $2.47 to the payer within the fiscal year [4]".

Tikkanen R, Abrams MK report that the US has the highest rates of obesity (US 40% versus the OECD average of 21%), and chronic diseases (US 28%, versus OECD average of 17.5%) are known factors contributing to the severity of symptoms and number of deaths among patients infected with

the corona virus [8].

The Strategic National Stockpile (SNS) is a vital part of public health preventative infrastructure. SNS contains "The supplies, medicines, and devices for life-saving care contained in the stockpile can be used as a short-term, stopgap buffer when the immediate supply of these materials may not be available or sufficient [14]".

Taddonio reports that when the H1N1 flu epidemic occurred in 2009, SNS supplied personal protective equipment such as N95 masks [15]. Still, after H1N1 eased, neither congress nor the Obama or Trump administrations worked to restock the stockpile adequately. The author further discusses that It was notmade a priority, despite attempts from people in and out of the government warning that this would leave the stockpile unreplenished and without needed protection in the event of an acute health emergency [15].

Taddonio's investigation revealed that SNS purchased personal protective equipment with funds allocated by the government in 2000 [15]. Consequently, SNS found that many of the masks were expiredand not suitable for use. SNS cannot restock without appropriated funds from the government. Ventilators were insufficient and old [15].

When COVID first ravaged the US (January 2020), Personal Protective Equipment (PPE) was difficult,if not impossible, to find, leaving healthcare workers exposed [16]. National Nurses United (NNU) represents over 150,000 nurses nationwide [17]. NNU polled 23,000 nurses, and of those who responded, 87% reported needing to reuse single-use disposable respirators or masks and 28% reusing respirators after decontamination processes on them, which NNU points out can reduce respirator effectiveness and could expose the wearer to toxic chemicals used to decontaminate them [17].

"Lost on the Frontline" was co-created by The Guardian and Kaiser Health News (KHN). They aim to capture the lives of US health workers who die as a result of COVID-19 and investigate why so many aredying as a result of the pandemic; they found that as of April 2021, more than 3,607 healthcare workers died between March 2020-April 2021 [18].

In addition to the incredible loss of lives among healthcare workers, many health workers, especiallynurses, are stressed and burned out and looking to change professions. Many decide to work for traveling nurse agencies, where nurses earn three times more than in a regular hospital setting [19].

According to the Wall Street Journal, one health institution in Texas has a 22% vacancy rate for 2,200 bedside nursing positions. They raised their pay to "$140 an hour until staffing levels stabilizes" in attempts to retain nurses [20]". The New York Times reports, one expert warns that approximately 640,000 nurses will soon be reaching retirement age [21]. About 4 million nurses nationwide, equating to roughly 16% of the nursing workforce [22].

Shortages in one area create a chain of events that affect hospitals' overall capacity to provide COVID and non-COVID treatment. Despite the demand, hospital beds remain unoccupied since hospitals must use required staffing to bed ratios. As the New York Times reported: Staffing shortages have a hospital-wide domino effect. When hospitals lack nurses to treat those who need less intensive care, emergency rooms and ICUs are unable to move out patients, creating a trafficjam that limits their ability to admit new ones [21].

There has been a significant loss of life due to COVID, both from inadequately protected health professionals placed in harm's way and from the American people who suffer from chronic illnesses that place them at a higher risk of complications or death if infected with COVID. The United States state and the federal government must learn from the mistakes made during this pandemic and take appropriate measures to prioritize and invest in public health infrastructure.

## Impact and Consequences of Delayed "Elective Surgeries"

Non-emergency surgeries are postponed, contributing considerably to US financial losses, and delaying gains in quality of life for millions of Americans. Walmsley et al. report that the net economic impact of COVID-19 on the United States is expected to be roughly $3.2 to $4.8 trillion and lower the US GDP by 22.3% to 60.6% [23]. Also increasing mortality according to the Israeli Cardiac study [24].

Early in the COVID-19 pandemic, countries worldwide canceled elective surgeries to conserve the needed bed space and resources needed to treat COVID patients, as well as

limited PPE resources and ventilators. The Lancet reports that the US will have an estimated backlog of over 1 million joint and spinal surgeries by the middle of 2022. The authors also explain that roughly 10 million people in the UK are waiting for surgery, and 100,000 patients are waiting for joint replacements [25].

According to the Lancet, osteoarthritis is one of the most prevalent causes of joint replacement surgery, affects around 250 million people globally, and is one of the top 10 debilitating illnesses in high-income nations [25]. The Lancet's data speaks to several consequences of postponing elective surgeries, including chronic pain, increased substance use, decreased mental health, and depression. The authors report, up to 90% of patients with axial pain due to orthopedic conditions and 60% of patients waiting for knee replacement surgery experience clinical depression [25].

According to Fu SJ et al. Certain malignancies can emerge "in as little as 4 weeks to 8 weeks, well within projected delays of elective surgical procedures" [26]. The authors also discuss that some diseases are treated without surgery due to elective surgery cancellations and delays, resulting in increased costs. The author's further stress that the medical implications of surgical delays would result in higher healthcare costs owing to the treatment of more advanced disorders, which typically need more intenseand expensive treatment.

According to Fu SJ et al., disease progression is associated with a $50,000 annual increase in breast, colorectal, and lung cancer cases, and delaying even low-acuity treatments like cataract surgery, joint replacements, or bariatric surgery will have a significant impact on patients in terms of limited activity, mobility, and quality of life [26]. The authors also foresee that health systems will see rises in cancer and cardiovascular illnesses as a result of postponed diagnostic procedures such as colonoscopies, mammograms, and biopsies [26].

Fu SJ et al. further discuss the financial implications that have resulted from the pandemic and report that due to the crisis, 30% of Americans have lost their jobs, been laid off, or had their hours reduced without compensation [26]. Many patients have also lost their health insurance, which has been linked to poor surgical outcomes. They also emphasize ensuring that all socioeconomic groups have access to timely surgical care and note that COVID will almost certainly exacerbate the challenges these vulnerable people face [26].

The COVID pandemic has strained health systems to the brink of collapse and prioritized treating and saving the lives of COVID patients ahead of patients needing non-emergency (elective) surgery.

According to data and analyses provided by Kaufman Hall to the American Hospital Association (AHA), US hospitals will lose "an estimated $54 billion in net income [27]." Furthermore, more than 33% are expected to sustain negative operating margins through the end of the year [27].

The examples above demonstrate that elective does not imply unimportant or unneeded. These examples also describe the pain and suffering patients endure the likely disease progression they face due to delayed surgery and the financial consequences for both health systems and the nation.

## The Etiology of the Pandemic

When COVID-19 first appeared in Wuhan, China, officials quarantined the city and placed it under strict lockdown to contain the virus and prevent it from spreading [28]. These countermeasures did effectively suppress the primary viral strain. To be precise, in China, masks, social distancing, and hand washing are used in addition to meticulous contact tracing. All contacts are immediately isolated to their homes and then confined if they get the virus (forcibly if necessary).

While the authorities targeted Chinese nationals, foreign visitors and Chinese citizens working or studying in other countries could travel outside China. These Travelers could have been incubating or asymptomatic. They were allowed to return to Europe and the United States, which infected other Americans directly or secondary through other travel.

It is unclear why China would impose restrictions on its citizens while permitting overseas travelers to return home and spread the illness. Of note, the US initially accepted China's claim that the virus did not travel by aerosol but rather by direct contact with human fluids and then failed to respond more firmly to the new COVID-19 virus using regular public health protocols. The Chinese did not properly report the outbreak to World Health Organization (WHO) and declined offers by CDC to assist initially. They have also hampered the

international investigation. Theories range from sinister intent to political interference to incompetence in containing the epidemic.

Since the pandemic's beginning, it has mutated into numerous variants: the Wuhan variant, the UK variant (alpha variant), the South African variant (beta variant), then mutated into the Brazil gamma, and finally, the delta plus variant of concern from India, with all variants more easily transmitted than the original virus. Lee explains four requirements for the rapid spread of respiratory viruses.

The first is asymptomatic hosts with viral shedding that peaks during the early stage of infection. The second is massive shedding of the virus from the infected cells of hosts in their respiratory fluids, which is a high viral load condition. The third is the stability of respiratory viruses in the outside air… The fourth isa strong binding affinity of viruses to human cells at the receptors of entry points such as the nose, mouth, and eyes [29].

Lee notes that people with the delta variant have had reported viral loads "1260 times higher than those in individuals infected with the non-Delta variants in China [29]". Lee states that due to delta's high viral loads, the delta variant has "high potential for spreading by aerosols" and introduces the hypothesis that high viral loads stemming from a poor immune response in fighting the virus could allow for the formation of "viral aerosol clouds". The viral aerosol clouds that Lee describes may explain the fast spread across India, the UK, and the US [29].

The upper respiratory, pulmonary, and gastrointestinal tracts are the primary targets of the corona virus (with vascular endothelium postulated inflammation in long COVID). As a result, a nose swab or a stool test can be used to detect it. The delta variant has comprised mostly all COVID cases the US is now experiencing. States with low vaccination rates have experienced higher volumes of hospitalizations anddeaths. The delta variant is "60% more transmissible than the Alpha variant [30]".

Data continues to support the importance of vaccinations. Dyer quoted data from the CDC that revealed unvaccinated people in the United States had an 11 times higher chance of dying from the delta variant than those vaccinated [31].

Compared to the original Wuhan variant, it is easy to see why the delta variant is so potent and lethal. Does the COVID-19 Delta variant cause more severe illness? Some evidence suggests that the delta variant may cause more severe disease in unvaccinated people than earlier variants. Those infected withthe delta variant were more likely to be hospitalized than patients infected with the alpha or original viral strains, according to two separate studies from Canada and Scotland [32]. Vaccination clinics, testing sites, and correct and timely information about COVID are essential to fighting the pandemic. This further underscores the importance of the US having robust public health programs.

## Contagion Variant Transmissibility

The number of people infected by a single person is known as the contagion. Gunderson A and Woskie L explain that R-Naught (R0) is used to measure this, and R0 is a tool for calculating the average number of people that an infected person has the potential to infect [33]. The authors explain that there are three main elements to calculate R0 "the infectious period of the disease, the mode of transmission, and the contact rate." The Wuhan strain, for example, has an R0 value of 1.5 to 3.5 indicating that eachsick person infects one to four persons on average. The R0 for the delta variant is around 7 [33,34].

Although the Chinese said the virus was initially thought to spread via droplets, it was later discovered to spread via aerosol, far more infectious. The CDC estimates that being exposed to the Wuhan variant's aerosol would take at least a minute (15 minutes, according to the CDC). In contrast, exposure to the delta plus variant takes half as long, resulting in a considerable increase in infectivity [35,36].

The delta variant's mutations have also made it less susceptible to several vaccines; It can spread cell to cell directly to avoid humoral antibodies [37]. According to Aldaais EA et al. SARS-CoV-2 is composed of four structural proteins. These proteins are the Spike (S) glycoprotein, small Envelope (E) glycoprotein, Membrane (M) protein, and Nucleocapsid (N) protein that is bound to a single-stranded, positive-sense viral Ribonucleic acid (RNA) genome [38].

Figure 1, created by the CDC, labels three of the four the envelope protein (E), spike protein (S), and the membrane

protein (M) [39]. The E protein aids in the virus's release and implantation into the host cell, and the protein affects several cellular processes [38]. Aldaais et al. explain the role of the E, M, and S proteins: the Membrane (M) protein has a critical role in the virus, and especially during the budding and assemble processes the M protein is a dominant structural protein that can combine with other structural proteins such as the Spike (S) and Envelope (E) proteins, making it crucial to understand the system of the new CoV [38]. As the M protein assists to the S protein, which is involved in the cell attachment and entry to the host cell, any mutation occurs on the M protein is expected to have a remarkable impact on the interactions with the infected cell [38].

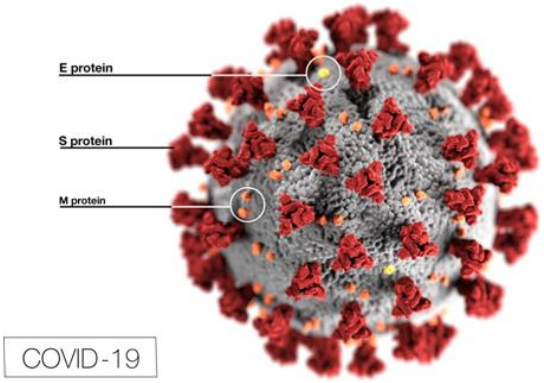



**Figure 1:** COVID-19 this illustration, created at the Centers for Disease Control and Prevention (CDC), reveals ultra structural morphology exhibited by corona viruses. Note the spikes that adorn the outer surface of the virus, which impart the look of a corona surrounding the virion, when viewed electron microscopically. In this view, the protein particles E, S, and M, also located on the outer surface of the particle, have all been labeled as well. A novel corona virus, named Severe Acute Respiratory Syndrome corona virus 2 (SARS-CoV-2), was identified as the cause of an outbreak of respiratory illness first detected in Wuhan, China in 2019. The illness caused by this virus has been named corona virus disease 2019 (COVID-19).

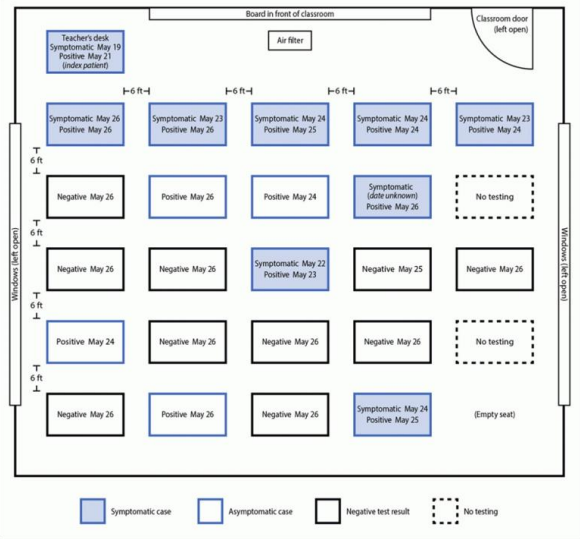
Patients (30%) may have long COVID syndrome; they may sustain long-term damage such as brain damage, heart injuries, peripheral nerve injuries, and even spinal cord injuries [40-43]. Many of the issues are identical to those during the 1918 Spanish flu, are clearly due to the body's immune response to the virus.

## Covid-19 Delta 4th Wave

The rapid spread of the delta variant can be seen worldwide. The BBC reports that "one in every 20 children of secondary school age in England is infected with the corona virus [44]. In the US, In Marin County Elementary School in California, an unvaccinated teacher who ignored symptoms for two days before being tested read stories aloud to his students and went against school protocols to mask while inside.

The school operates High-Efficiency Particulate Air (HEPA) filters. The windows were open, the students all wore masks, and were socially distanced. Two days after the teacher tested positive, additional staff, students, parents, and siblings tested positive for the delta variant of COVID-19 [45]. Figure two shows the classroom layout [46]. Twenty-two of the twenty-four students in the classroom were tested (all vaccine eligible due to their age), and twelve tested positive. Eight of the ten kids sat in the front row, closest to the teacher (80%). Four of fourteen students (28%) sat in the other three rows [45].

**Figure 2:** Classroom layout and seating chart for 24 students in index patient's class by SARS-CoV-2testing date, result or status, and symptoms – Marin County, California, May-June 2021




Created by Lam-Hine T, McCurdy SA, Santora L, et al. Outbreak Associated with SARS-CoV-2 B.1.617.2 (Delta) Variant in an Elementary School - Marin County, California, May–June 2021. MMWR Morb Mortal Wkly Rep 2021;70:1214–1219.

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Despite a courtyard (blocked from use) separating the two grades, six students from a younger grade tested positive (these students were ineligible for vaccination due to their age). The Marin County Department of Public Health (MCPH) investigated the outbreak. It revealed that one student in the lower grade held a sleepover with two other students from the same grade. In addition, there were eight cases where parents and siblings of these grades tested positive.[45] This is referred to as a breakthrough. There were 27 cases in total (including the teacher).This example of how efficiently the delta variant of COVID-19 spreads demonstrates the importance of public health programs such as vaccination, prevention protocols, contact tracing, and routine testing.

## Race against the Virus 4th Wave

Since half of the US hospital systems are in crisis standards of care, they have had to find space anywhere they can find it. They have had to utilize cafeterias, classrooms, parking garages, and even parking lots for make-shift operating rooms. Idaho hospitals are facing crisis standards of care. COVID patients occupy 123 of 200 beds at a hospital with 200 beds. They needed to increase their ICU capacity from 23 to 50 beds. All elective surgeries havebeen canceled. They are short on medical care professions, and the workforce is exhausted, particularly intensivists, respiratory therapists, and nurses. Surgeons and physicians who have not cared for ICU patients in years are being called in to staff the ICUs. There is a scarcity of PPE and medical supplies, and the national guard has been called in to assist. (Personal communication, October 2021).

The US needs to adapt response plans more rapidly than the virus. For example, US scientists are developing masks with nanoparticles with a surfactant that damages the phospholipid outer coating of the virus and de-activates the virus on contact. The US is also creating COVID-19 hospitals that re-circulates and cleans the air every two seconds to prevent medical workers from getting infected.

## Summary

This paper reviews some of the reasons the US was and still is so ill-prepared for the pandemic, the waysthe unprepared role public health systems have underperformed, and CSC, with the resulting impact both, have had on elective surgery.

Non-emergency surgery encompasses everything but life-preserving, acutely ill procedures. When a patient waits for a heart procedure or a knee replacement, a delay in elective surgery often ends in pain and suffering. This paper not only covers cancer and other life-improving surgery, including cardiac, but also touches upon hospital diversions where life-saving gallbladder surgery may be delayed, and patients die en route to a facility with an open and staffed bed.

There is much this paper skipped to focus on the impact COVID has had on non-emergency surgery, patient health care, and the race to be ready for more variants in the years ahead. We find that the impact has been catastrophic, with necessary surgery and care being delayed. We have a great deal of public health planning and preparedness to do in this race. We point out that the US has to refocus health care on quality and deepen our capacity to respond to pandemics. We recommend focusing onthe current race against COVID while investing more in our public health systems at the federal, state,and local levels.

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