Playing God:
Analyzing the Bioethics of Triage in the Face of the Climate Crisis through the lens of Hurricane Katrina and the 2010 Haiti Earthquake

By Kate Porterfield

This thesis has been submitted on this day of April 15, 2021 in partial fulfillment of the degree requirements for the NYU Global Liberal Studies Bachelor of Arts degree.
Acknowledgements

This thesis would not be possible without key friends, family, mentors, and others, who have provided endless support throughout this research process.

First and foremost, I want to thank Professor Peter Valenti for his guidance and mentorship as my thesis advisor this year. Since my first-year at NYU, Professor Valenti has been one of my biggest champions, constantly pushing me as an academic and global citizen of the world. His feedback throughout this thesis process has been, simply put, invaluable. He has taught me how to be adaptable as a researcher, becoming comfortable with saying yes to changing ideas and the beautiful simplicity of maybe not finding the answer you were looking for all along.

Thank you to my thesis cohort, who engaged with the editing of my thesis process in unexpected ways. Because of them, I have grown as a writer and creator, learning how to distill the most complex ideas into approachable language. I am so grateful for the time and effort each of you put into our thesis workshops.

To my family, without whom the NYU experience would not have been possible. I could not have asked for more supportive parents, who gave so much to get me to where I am today. Every “fingers crossed” text from mom, every grossly pixelated photo of Reggie from dad, every “I love you” -- they have been the best of motivators. Thank you to Kathryn for the undying enthusiasm, to Jim for instilling my love of academia, and to Alex for all the laughs. You are all my rocks.

To Marissa and Isabel, incredible friends who have spent years with me engaging in the topic of environmentalism and directly influenced the topic of this thesis -- I am so thankful for your dialogues, intelligence, and bountiful love. To Brooke, the best roommate and GLS partner-in-crime Chrystie Street ever saw, with whom I share so much throughout the GLS experience. To Ruthie, who provided invaluable encouragement and cups of coffee on the longest of days. And to Drew, who pushes me each day to be the best that I can be -- thank you for the endless support and many slices of cinnamon toast throughout this process.

Finally, thank you to the incredible panel of interviewers whose insights truly shaped the course of this research:
- Dr. Richard Berkowitz
- Dr. Gal Kober
- Michael Skovira
Thesis Abstract

As the world experiences more mass-casualty incidents, such as extreme weather events or pandemics, health systems are put under pressure to treat those in need, generating the problem of scarcity of vital resources. The allocation of scarce resources is done via triage, the assigning of priority order to persons on the basis of where resources can be best used, are most needed, or are most likely to achieve success. This thesis analyzes the ethics of three potential triage models — the survival model, social worth model, and lottery model — as a means of assessing the benefits and drawbacks of the models in relation to the United States healthcare system. Hurricane Katrina and the 2010 Haiti earthquake are utilized as case studies to present success and failures of past implementation of existing triage models, focusing on how models trade off between efficacy and efficiency. Interviews with medical professionals and ethics experts serve as a foundation for a comprehensive qualitative assessment of the bioethics of each model relative to the case studies, incorporating interprofessional perspectives. While the initial intent of this research was to determine if there is a superior form of triage that should be adopted to maximize health for U.S. communities in the face of future disasters, as a result of analyses conducted with health and ethics experts, it is apparent that superiority is not the answer. Instead, triage should be treated as a complex and changing system, one that should be evaluated on a case-by-case basis by different providers to create the most optimal solutions. The concluding analysis of this thesis is intended to best-serve the public health community in optimizing the preservation of life in the face of mass-casualty incidents.
# Table of Contents

## Chapter 1: Introduction

1.1 To *Trier* Is to Triage .................................................. 2
1.2 The Climate Crisis: A World on Fire .................................. 5
1.3 An Introduction to Hurricane Katrina and the 2010 Haiti Earthquake .................................................. 8
1.4 Utilitarianism: The Greater Good ...................................... 10
1.5 Methodology ..................................................................... 13

## Chapter 2: Time Crisis: Emergency Triage

2.1.1 Efficiency of Triage .................................................. 17
2.1.2 Efficacy of Triage ................................................... 19
2.2 The Lottery Model ....................................................... 22
2.3 The Quality of Life Model ............................................... 25
2.4 The Social Worth Model ................................................ 27

## Chapter 3: Don’t Let Them Leave Me Behind

3.1 Hurricane Katrina: A City in Ruins .................................. 28
3.2 Remembering Memorial Hospital ..................................... 29
3.3 A Fair and Equal Chance ................................................ 35
3.4 A Fatal Quake ............................................................. 36
3.5 The Luck of the Draw: Cholera Vaccines in Haiti .................. 38

## Chapter 4: Always Evolving, Always Changing

4.1 Evaluation of Triage Methods ......................................... 43
4.2 COVID-19 and the Future of Triage ................................. 47

## Bibliography ..................................................................... 51
Table of Images

Image 1: *START Model of Triage*, NIH, 2020


Image 3: *Inside Memorial During Hurricane Katrina*, EMS Solutions, 20

Image 4: *2010 Haiti Earthquake*, Britannica, 2010

Image 5: *Administration of Cholera Vaccine*, NPR, 2015
Table of Figures

**Figure 1:** Quality Adjusted Life-Years Between Two Patients, Ian Jacob,

Atlantic KET, 2019

[31]
Chapter 1: Introduction

On the morning of August 29, 2005, at 6:00am, Hurricane Katrina hit New Orleans. 175 mile per hour winds and 10 inches of rain swept through the city, wiping out all power.¹ At Memorial Medical Center (Memorial) in New Orleans, the buzz of the backup generators resounded throughout the hospital.² As the storm cleared, the medical staff breathed a sigh of relief, believing the worst was over. Then, the levees failed. Water rose around the hospital, trapping its 2000 inhabitants -- 250 of whom were patients.³ Two high-water trucks from the National Guard sat outside the hospital, waiting to transport patients to dry land. Doctors scrambled to evacuate the patients, starting with the 31 babies in the NICU, then moving onto those receiving critical care. Within two days, Memorial staff had evacuated about 60 of the most critical patients.⁴ After 38 hours of nonstop work, the staff finally laid down to rest for the night. Then at 2:00am, the buzz of the generators stopped. There was no more power. Critical medical equipment became unusable, and within the first ten minutes of the power outage, five of the nine patients on ventilators died.⁵ Suddenly the question went from“who should be evacuated first?” to “who should be left to die?” This thesis sets out to explain how extreme weather events like Hurricane Katrina are forcing healthcare workers to answer this question more frequently, and to propose which answers are superior.

This thesis analyzes the ethics of three potential triage models -- the survivability model, the social worth model, and the lottery model -- as a means of identifying the most effective model for the United States healthcare system. These models were selected from a 2013 ethics seminar hosted by Johns Hopkins University in response to the failures of Hurricane Katrina, which served to answer the questions: “How should we ration medical resources?”, “If something bad happens again, which patients do we prioritize first?”, and “Which patients don’t we prioritize?”. Drawing from interviews with public health and ethics experts, the ethics of the triage models are assessed, revealing how elements

² Sheri Fink, Five Days at Memorial: Life and Death in a Storm-Ravaged Hospital (Large Print Press, 2016), 54.
³ Fink, “Playing God”
⁴ Fink, Five Days at Memorial, 59
⁵ Fink, Five Days at Memorial, 59
including the possibility for racial, ethnic, and gender bias, as well as practitioner subjectivity, influence the assessment of quality of life. The success of the models are further explored in relation to the case studies of Hurricane Katrina and the 2010 Haiti earthquake. The application of these models in disasters is explored at the end of this thesis, using medical response to the COVID-19 pandemic as demonstration of how various triage methods are integrated in the response to scarcity of resources on a global health level. By way of the interviews, scholar reviews, and case studies discussed in this work, this thesis assesses the benefits and drawbacks of the three triage methods and their application in various health response settings. While the original intent of this research was to determine which of the three triage methods is superior for standardization of care in U.S. healthcare systems, exploration of these case studies, interviews, and journals proved that ranking the effectiveness of triage models is ineffective because of the nuance of health conditions. Instead, this thesis resolves in demonstrating how triage models can be blended to maximize their effectiveness in providing the greatest good for the greatest number of people.

1.1: To Trier Is to Triage

The term triage comes from the French verb *trier*, which means to separate, sort, or select something. Originally, it was a reference to sorting types of coffee. However, over the last few hundred years the word began to apply to people, largely as a side effect of increased human casualties in the wake of wars and natural disasters. Triage is an assignment of degrees of urgency to patients as a means of distributing resources in a way that most efficiently maximizes the amount of lives saved. Modern medical triage was coined by French surgeon Dominique Jean Larrey during the Napoleonic Wars, circa 1803-1815, who “treated the wounded according to the observed gravity of their injuries and the urgency for medical treatment, regardless of their rank or nationality.” As time went on, triage transitioned from a subset of battlefield operations to the model of emergency medical service (EMS) systems in

---

environments, such as emergency rooms and ambulance-based care. Modern triage focuses on the
evaluation of the severity of a patient’s condition or likelihood of recovery considering treatment. Patient
care is sought to be rationed efficiently, with the order and priority of emergency treatment existing as a
function of this outcome. As medical technology has advanced, so have approaches to triage, which are
more operative based on scientific models. Categorization of victims is generally derived from severity of
triage levels, numeric scores that note the severity of a patient’s condition based on physiological
findings, which will be discussed further on in section 1.2. Some models, such as the widely-used START
(Simple Triage and Rapid Treatment) model utilize an algorithm to evaluate a patient’s status; however,
START’s algorithm does not depend on the number of victims or available resources for treatment, so the
implementation of this model may vary among healthcare agencies. While models like START help to
automate the triage process, they do not serve as flawless systems when resource allocation becomes
critical, as seen with triage-intensive disasters like Hurricane Katrina and the COVID-19 pandemic.

According to the Pan-American Health Organization, there are three key types of triage that are
essential to understanding more complex models: simple triage, advance triage, and reverse triage. Simple triage is generally used on the scene of an accident or mass-casualty incidents (MCI) such as the 2011 Tohoku earthquake and tsunami or in 2017, Hurricane Maria. According to Linda Landesman’s guide, Public Health Management of Disasters, simple triage is used to sort patients into groups based on “those who need critical attention and immediate transport to [healthcare services] and those with less serious injuries.” Simple triage can be used before emergency transportation becomes available, making it easier for healthcare workers to identify patients later on for treatment.

Advanced triage is performed by trauma-specialized healthcare workers. While simple triage
assesses patient status based on physiological needs alone, advanced triage is used to divert limited
resources away from patients with little chance of survival as a means to increase the chance for others

---

10 Aacharya, Gastmans, and Denier, “Emergency Department Triage”
11 Pan-American Health Organization, “Triage: Prioritizing Care to Reduce Deaths”
12 Pan-American Health Organization, “Triage: Prioritizing Care to Reduce Deaths”
with higher likelihoods. The types of treatments prioritized include medical care, medical equipment (such as ventilators), and medication. Advanced triage is often practiced in disaster settings, such as mass shootings, terrorist attacks, and natural disasters. In these situations, it is understood that some percentage of patients will die regardless of medical care due to the severity of injuries. A recent natural disaster that operated on an advanced triage model was the 2011 Haiti earthquake. A patient’s category of triage can also change throughout a single advanced triage assessment; for example, if a treatment is successful, patients’ improvement can allow them to be re-categorized as a lower priority patient in the short term, and create more treatment opportunities for others. This does not typically occur during simple triage.

Reverse triage takes the traditional triage model of prioritizing a person’s admission to the healthcare system and applies it to the approach of discharging patients early under a stressed system. When a major wave of patients arrives at a healthcare facility, such as a hospital, hospital beds that are occupied by non-critical patients will need to be opened. Therefore, to treat the highest number of critical patients, existing patients may be triaged and discharged until a surge has dissipated, either through a decrease in treatment needs or with the creation of additional medical facilities. An example of this triage model in action is the COVID-19 pandemic, where hospitals have limited patient admission to keep intensive care unit beds open for extreme COVID cases.

For all triage models, a scoring system is used. In the United States, it is called the Injury Severity Score (ISS). ISS assigns a score from 0 to 75 based on the severity of an injury on the body, separated into three regions: A (face/head/neck), B (thorax, abdomen), and C (extremities/skin). Each category of region is scored from 0 to 5 using the Abbreviated Injury Scale, defined by the Association for the

---

14 Landesman, *Public Health Management of Disasters*
15 Fink, “Playing God”
16 Pan-American Health Organization, “Triage: Prioritizing Care to Reduce Deaths”
19 While other countries utilize triage models with their own titles, ISS will be the model addressed for this thesis for it was the model used by Red Cross workers in response to the events discussed in Chapter 3, Hurricane Katrina and the 2010 Haiti Earthquake.
20 Aacharya, Gastmans, and Denier, “Emergency Department Triage”
Advancement of Automotive Medicine (AAAM) as “an anatomically based consensus-derived global severity scoring system that classifies each injury in every body region according to its relative severity on a six point ordinal scale: 1) Minor; 2) Moderate; 3) Serious; 4) Severe; 5) Critical; and 6) Maximal (currently untreatable, creating a default score of 75).” A score of 75 may indicate either that patients are a first priority patient to receive critical care, or they will not receive treatment due to conditions being so critical that care should be conserved for more likely survivors. Triage, and incidentally the triage scoring system, is a derivation of the theory of distributive justice “which addresses how benefits and burdens should be distributed within a population.”

1.2: The Climate Crisis: A World on Fire

Strong triage practices are becoming more vital as humans face an increase of MCIs, with few factors threatening human health as much as climate change. Defined by the United Nations’ (UN) Intergovernmental Panel on Climate Change (IPCC), climate change includes both the global warming of Earth’s climates, induced by human emissions of greenhouse gases (GHG), and the resulting shifts in weather patterns. Earth has seen periods of climate change in its past; however, since the mid-20th century the rate of humanity’s impact on the planet’s climate system and the scale of that impact have been unprecedented. A significant result of climate change is a rise in the frequency of extreme weather events, such as hurricanes, floods, or wildfires -- which have a direct impact on human health and safety. Medical response to these extreme weather events serve as strong case studies on the implementation and success of triage models. For the purpose of this thesis, triage models will be discussed in relation to the response to climate-induced natural disasters, specifically Hurricane Katrina and the 2010 Haiti earthquake, which will be addressed further on in this chapter.

22 Camilloni, et al, “Triage and Injury Severity Scores…”
23 Aacharya, Gastmans, and Denier, “Emergency Department Triage”
The largest driver of global warming has been human activity catalyzing increased emissions of GHG, gases that trap heat in the atmosphere, including carbon dioxide (CO₂), methane, nitrous oxide (N₂O), and fluorinated gases. The burning of fossil fuels is the main source of these emissions, with additional contributions coming from agriculture practices, deforestation, and industrial processes. Subsequent temperature rise has been impacted by climate feedback loops, defined by NASA as “processes that can either amplify or diminish the effects of climate drivers,” with impactors of climate feedback loops including solar irradiance and GHG emissions. Climate change is directly contributing to changes in the geography of Earth’s ecosystems, and these climate events directly destroy local ecosystems and lead to health-related issues such as heat stroke, asthma, and cardiovascular failure.

Surface temperatures have increased most dramatically in the Arctic, which has led to the melting of permafrost, glaciers, and sea ice. As these structures melt, oceans experience a rise in sea level, increasing atmospheric energy and rates of evaporation, and in turn, extreme weather events. According to the Center for Disease Control (CDC), extreme weather events damage infrastructure and agriculture practices, and they have direct effects on human health and safety. Increasing wind speeds can generate and spread air pollution, causing asthma and cardiovascular disease. Forceful rain, wildfires, and heat waves cause changes in vector ecology, which can lead to an influx in diseases, such as malaria and lyme disease. Extreme heat waves can cause heat-related illness and death. Environmental degradation often leads to water and food supply shortages and forced migration, causing malnutrition and mental health impacts.

A number of these climate-related effects are already observed in our current state of global warming in 2020, in which global temperatures have increased approximately 1.1°C from pre-industrial levels. In 2018, the IPCC published its “Summary for Policymakers,” a compilation of the

---

27 “Summary for Policymakers,” 2018
28 “Summary for Policymakers,” 2018
30 Vector Ecology, the transmission of diseases between organisms in an ecosystem
organization’s reports intended to aid policy makers on climate policies that best respond to the current state of the environment, and how climate change is projected to continue. These reports are devised from climate assessments conducted by 150 international scientists who are divided into three working groups to assess three key elements of the climate crisis. “1) The Physical Science Basis; 2) Impacts, Adaptation and Vulnerability; and 3) Mitigation of Climate Change.” Over the course of the last three decades, the IPCC reports have provided continuous information on temperature thresholds the earth will reach for each stage of climate change, how human activities impact these temperatures, and how to reduce the impact of global warming. In the 2018 report, the IPCC projected that significant impacts of global warming will be seen if temperatures continue to increase to between 1.5 to 2°C above pre-industrial levels. Some governments have attempted to respond to this projection, signing accords such as the Paris Agreement, in which nations agreed to “limit the temperature increase even further to 1.5°C…[by creating] a new technology framework...and reducing levels of GHG in the atmosphere.” However, according to the United Nations Environment Program (UNEP), with these types of agreements, ones that center on limiting further global warming rather than reversing the warming that has already occurred, “global warming would reach about 2.8°C by the end of the 21st century.”

The impact of this continuous warming will result in more extreme weather patterns. As arctic ice melts, more water enters the Earth’s ecosystems. These particles become available to storm systems and create heavier rainfall, inducing weather events like floods and hurricanes. Conversely, higher global temperatures increase rates of evaporation, creating rapidly drying soil. Dry soil creates an influx in droughts, leaving an environment at risk for wildfires. These weather events will only become more intense as climate change continues, leaving significant impact on human health and safety. In 2020 alone, the world has already seen many environmental extremes. January marked the start of tornado

---

32 “Summary for Policymakers,” 2018
33 “Summary for Policymakers,” 2018
34 UNFCCC, “The Paris Agreement”, 2019. unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement
36 “Summary for Policymakers,” 2018
season in the U.S., with 88 occurring in the month alone.\textsuperscript{37} February saw 571 earthquakes in Puerto Rico, with 34 occurring over the span of 36 hours. May 2020 tied with May 2016 as the warmest May on record for the globe.\textsuperscript{38} Monsoon season displaced millions of people in South Asia, with rains destroying countries’ infrastructures, economies, and ultimately killing hundreds of citizens.\textsuperscript{39} October concluded with a continuation of the North American wildfire season, with 46,148 wildfires burning over 8.4 million acres of land as of November 1, 2020, and a record-breaking Atlantic hurricane season, with 26 tropical storms, eight hurricanes, and $30 billion in total reported damage from the storms.\textsuperscript{40} According to the WHO, “every year, natural disasters kill around 90,000 people and [cause injury and illness to] close to 160 million people worldwide.”\textsuperscript{41} The Centre for Research on the Epidemiology of Disasters (CRED) released a 2015 report summarizing the human impact of disasters. This report stated that of the world population annually, “2.4 billion are affected by floods; 1.1 billion are affected by drought; 660 million are affected by storms; 121 million are affected by earthquakes; 93 million are affected by extreme temperatures; and 13 million are affected by other factors such as wildfires and volcanic eruptions.”\textsuperscript{42}

Humans caught in the destructive paths of these weather events often need immediate access to medical attention. And in communities who are affected by extreme weather events, healthcare systems are inundated both by patients who require access to medical supplies, and personnel having been injured or incapacitated by the disasters. But what happens when the health needs of those affected exceed the available resources? This question introduces the concept of triage in the face of natural disasters.

\textbf{1.3: An Introduction to Hurricane Katrina and the 2010 Haiti Earthquake}

For this thesis, two extreme weather events, Hurricane Katrina and the 2010 Haiti earthquake, will serve as the case studies on the relationship between climate change and triage.\textsuperscript{43} Hurricane Katrina

\textsuperscript{38} Center for Disaster Philanthropy, “2020 Disasters.”
\textsuperscript{40} Center for Disaster Philanthropy, “2020 Disasters.”
\textsuperscript{41} World Health Organization, “Environmental Health in Emergencies”, 2020, www.who.int/environmental_health_emergencies/natural_events
\textsuperscript{43} Moving forward, the 2010 Haiti earthquake will be referred to as the Haiti earthquake for page-length purposes.
was a Category 5 Atlantic hurricane that swept through the Caribbean and southeastern U.S. from August 23rd - 31st, 2005. At the time, Katrina was one of the most destructive hurricanes in history, causing over 1,800 deaths and $125 billion in damage. While Katrina swept over a number of states, its impact was most severe in Louisiana and its largest city of New Orleans. The hurricane’s massive rains and winds lead to flooding throughout the city, further compounded by the failure of the city’s levees. Katrina destroyed a majority of the city, with 80% of New Orleans inundated with water for weeks, and left transportation and communication facilities in ruin. Tens of thousands of people who had not been evacuated from the city were displaced with little access to food, shelter, or other basic necessities. Emergency responses from federal, state, and local governments were highly ineffective, and lack of organized medical and relief action contributed to the unnecessarily high death toll from the hurricane. The details of this response will be outlined in Chapter 3 of this thesis, with a focus on the triage efforts executed by Memorial staff and interviews with local doctors.

A contrast analysis will be executed further in Chapter 3, juxtaposing the triage response to Hurricane Katrina with that of the Haiti earthquake. The Haiti earthquake was a catastrophic magnitude 7.0 earthquake that struck Haiti on January 12, 2010. The earthquake struck Léogâne, a town 25 kilometers west of Haiti’s capital, Port-au-Prince. The earthquake resulted in 52 aftershocks, with three million people affected in total. The earthquake’s fatality rate is estimated to be between 150,000 to 220,000 people. In the aftermath of the quake, Haiti was faced with the most severe cholera outbreak in recent history, with resulting injuries and deaths overwhelming Haiti’s public health systems. The extreme number of casualties forced first responders and doctors to execute triage operations without any formal guidance from local, national, or international healthcare leadership. The execution of triage efforts as

---

44 Fink, “Playing God”
45 Fink, *Five Days at Memorial*, 36; levees, a wall system intended to protect the community from flooding
46 Fink, “Playing God”
47 DesRoches et al, “Overview of the 2010 Haiti Earthquake”
48 Aftershock: a smaller earthquake that follows a larger earthquake in the same area as the main shock, caused as displaced crusts adjust to the effects of the event
49 Fink, “Playing God”; the certain death count is impossible to assess due to discrepancies in timelines of fatalities in the wake of the hurricane
50 Fink, “Playing God”
related to cholera vaccine distribution in the wake of the Haiti Earthquake will be discussed in Chapter 3, pulling from research studies conducted by Haitian healthcare workers.

Comparing triage efforts between Hurricane Katrina and the Haiti earthquake will allow for an analysis of triage efforts beyond just U.S. healthcare systems. To round out this analysis, there will be a discussion of how the triage efforts within New Orleans and Haiti parallel the U.S. response to the ongoing COVID-19 pandemic in Chapter 4, the most current triage operation example as of 2021. By comparing triage efforts among these events, this thesis accounts for how triage operations have changed over time, and how past MCIs have influenced how healthcare workers are approaching new incidents.

1.4: Utilitarianism: The Greater Good

As noted in section 1.1, distributive justice is a central element of triage systems. Distributive justice incorporates a variety of principles, but the one most relevant to triage, as supported by the International Association of Bioethics, is the principle of utilitarianism. This will serve as the guiding theory for the ethical evaluation of the three triage models.51 As laid out by Jeremy Bentham in the late 1700s, utilitarianism is a theory driven by the genuine desire for social reform. In Utilitarianism and Other Essays, Bentham’s theories of utilitarianism focus heavily on the concept of hedonism, the notion of deriving maximum pleasure from a situation.52 Bentham’s thesis of utilitarianism further draws off relativism, the understanding that an action is determined to be right or wrong relative to the situation in which the action takes place. Utilitarianism directly opposes the theory of absolutism, which holds that moral commands are true at all times. Bentham’s utilitarianism also draws from the theory of impartiality, which “avoids giving special preference regarding which people are supposed to have access to or share in, that total pleasure.”53 Bentham’s theories are transferable to the healthcare system, as is evident in “Emergency Department Triage: An Ethical Analysis” by Aacharya et al. This study equates the utilitarian value of ‘pleasure’ to survival and quality of life of a patient, connecting

---

51 Aacharya, Gastmans, and Denier, “Emergency Department Triage”
53 Dimmock and Fisher, "Utilitarianism"
The principle of utility, [which] holds that actions should be judged by their consequences and how far they produce the greatest net benefit among all those affected...Triage systems may seek to achieve the health benefits of survival, restoration or preservation of function (by maximizing quality-adjusted life-years or disability-adjusted life-years), relief or suffering, and so on.\textsuperscript{54}

Noting that triage involves accounting for not only survival in the moment but for the greatest preservation of function or life as mentioned above, the authors of the article prove a utilitarian lens is essential for this thesis. Utilitarianism is inextricably linked to the singular goal of triage: producing the greatest good for the greatest number of people by meeting human needs most effectively and efficiently under conditions of scarcity. The general utilitarian concerns of the system focus on the scarcity of a vital product/service, and consequently requires choosing between patients on the basis of abstract reasoning, seemingly colliding with the Hippocratic duty of care, which all doctors are bound to follow.\textsuperscript{55}

Because Bentham’s theories do not account for this abstract reasoning, English philosopher John Stuart Mill’s theory of qualitative utilitarianism is necessary in supplementing the theory of this thesis. Qualitative utilitarianism is a form of utilitarianism that considers both the quality and quantity of pleasure, and is also used in tandem with Bentham’s theories for an ethical assessment of the triage models, specifically in assessing quality of life of a patient relative to others.\textsuperscript{56} This thesis serves to not only explore the connection between utilitarianism and triage, but to determine how the utilitarian values of efficiency and maximization can contribute to improving triage procedures by eliminating bias.

Although utilitarian philosophy traces back to the 19th century, the application of utilitarianism in contemporary bioethics originated in the 1970s through the work of Australian philosopher Peter Singers, who specializes in applied ethics from a secular utilitarian approach.\textsuperscript{57} Singer’s branch of bioethics analyzes why and how living beings’ interests should be weighed. According to his work \textit{Practical Ethics}, Singer’s principle of equal consideration of interests “does not dictate equal treatment of all those

\begin{itemize}
\item \textsuperscript{54} Aacharya, Gastmans, and Denier, “Emergency Department Triage”
\item \textsuperscript{55} The Hippocratic Oath, or Hippocratic Duty of Care, is one of the oldest binding documents in medical history. The Hippocratic Oath is an oath of ethics taken by physicians, promising to treat the ill to the best of one’s ability, to preserve a patient’s privacy, and to continue the education of medicine for future generations. The most famous quote from the Hippocratic Oath is “First, do no harm,” which binds physicians to practicing medicine with only good intentions.
\item \textsuperscript{56} Dimmock and Fisher, "Utilitarianism"
\item \textsuperscript{57} Brian Duignan, “Peter Singer,” \textit{Encyclopedia Britannica}, 2019, https://www.britannica.com/biography/Peter-Singer
\end{itemize}
with interests, since different interests warrant different treatment.” Singer’s theories agree with Bentham and Mills on the grounds of providing the greatest amount of good; however, he argues that some lives may be worth more than others based on “concrete properties”, such as a person’s contribution to the greater society, or how their suffering could impact others. This principle justifies not only different treatment for different interests, but it further allows for different treatment for the same interest, drawing from the utilitarian concept of diminishing marginal utility. This principle is therefore transferable to the field of triage, where patients with different severity of conditions are vying for the same critical resources and must be assessed based on who will receive the greatest benefit from the treatment.

Utilitarian bioethics states that the distribution of critical resources is part of the economic theory of zero-sum game, in which no “wealth” is created or destroyed. As a result, medical decisions should be made on the basis of a person’s future value, their chances of survival, and the total resources required for their treatment. A central element of this distribution analysis is the cost-effective analysis, a tool that determines the best possible outcome, which leads to a benefit or increased net positive outcome for society as a whole. The most common manifestation of cost-effective analysis in healthcare is the concept of quality-adjusted life years (QALY), defined by Landesmans’ Public Health Management of Disasters as “a measure of benefit from treating or allocating resources to individuals based on each individual’s outcome.” These central measurements of equity within utilitarian bioethics are central to this thesis, for they provide context for the qualitative assessment component within triage, a fundamental element as noted further in Chapter 2. Singer’s work provides a guiding theory on the application of

---

58 Peter Singer, 1979, Practical Ethics, Cambridge: Cambridge University Press, 82.
59 The law of diminishing marginal utility states that as consumption increases, the marginal utility decreases with the consumption of each additional unit, with utility being an economic term representing satisfaction or happiness (see Singer’s Practical Ethics for more information). In the context of triage, as people consume more of a utility, such as a medication, they reach a peak level of benefit from the utility; as a result, the marginal utility decreases for others as they receive less of the utility, and in turn the effectiveness of the utility diminishes.
60 Singer, Practical Ethics, 91.
62 Aacharya, Gastmans, and Denier, “Emergency Department Triage.” This concept will be further discussed in Chapter 2, but the idea of a “person’s future value” relates to the contribution they provide to society in the form of labor, potential offspring, or cultural benefits.
63 John Broome, Ethics out of Economics, Cambridge, UK: Cambridge University Press (1999), 122
64 Landesman, Public Health Management of Disasters, 21
utilitarianism within limited resource circumstances, giving context to the decision-making process of healthcare providers in triage environments. In relation to this thesis, Chapter 4’s qualitative assessment involves determining which model components provide the "greatest good for the greatest number."

**Methodology**

In addition to utilitarian theories, a significant portion of the foundational research for this thesis is derived from a few main types of sources: IPCC reports on climate change, technical manuals used by healthcare professionals, journals and health reports by bioethicists on triage procedures and evaluations, and interviews with healthcare and ethics experts.

The IPCC’s “Summary for Policymakers” 2018 climate report is the strongest evaluation tool on the current state of the climate crisis, acclaimed by the UN, with international scientists' contributions eliminating bias in the assessment. Other primary sources include annual climate reports published by the National Wildlife Foundation, with the latest “Climate Change, Natural Disasters, and Wildlife” report providing definitions for climate-related terms that require explanation within this work, as well as examples of extreme weather events that will be used in Chapters 1 and 2. Technical manuals including Linda Landesman’s *Public Health Management of Disasters: The Practice Guide* and Pan-American Health Organization’s “Triage: Prioritizing Care to Reduce Deaths” describe current triage procedures used within U.S. healthcare systems; however, they focus on outlining triage efficacy rather than efficiency. A number of articles from premier journals are sourced to provide the framework for triage efficacy and efficiency. These articles include “Emergency Department Triage: An Ethical Analysis” by Aacharya et al from the *Journal of the American Medical Association* (JAMA), the premier journal for medical reviews, Jacqueline Wagner and Micahel Dahnke’s “Nursing and

65 “Summary for Policymakers,” 2018
68 Efficacy is the ability to produce a desired amount of the desired effect, such as achieving a given goal. Efficiency is the execution of a task in the most economical way, or a ratio of input to output within a system.
69 Aacharya, Gastmans, and Denier, “Emergency Department Triage”
Disaster Triage: Applying Utilitarian Ethical Theory” from the Journal of Emergency Nursing70, a journal for first responders, and reports such as the WHO’s “Climate Change and Human Health.” The success of triage is measured based on the work of Douglas White, Endowed Chair for Ethics in Critical Care Medicine at the University of Pittsburgh Medical Center and Director of Ethics at the CRISMA (Clinical Research, Investigation, and Systems Modeling of Acute Illness) Center. In White’s research study, “A Proposed Lottery System to Allocate Scarce COVID-19 Medications: Promoting Fairness and Generating Knowledge,” he discusses the implementation of triage in the face of the COVID-19 pandemic. In the study, White outlines three tenants of triage success: 1) Maximizing the number of lives saved; 2) Eliminating practitioner bias in the treatment of patients; and 3) Delivering the maximum quality of life possible.72 These tenants will be further discussed in Chapter 2 of this thesis.

A number of primary and secondary sources are essential to the case study of Hurricane Katrina. The severity of the hurricane will be explained using environmental journalist Sarah Gibbens’ National Geographic expose “Hurricane Katrina, Explained,” which provides an overview of conditions leading to the disaster.73 Sherri Fink’s work Five Days at Memorial provides comprehensive first-hand accounts of emergency room triage in the wake of the hurricane at Memorial, specifically regarding access to power and limited critical supplies.74 Interviews conducted by Sheri Fink with Dr. Ewing Cook and Cheri Landry, Memorial staff during Hurricane Katrina, provide primary accounts of how scarcity impacts healthcare during an extreme disaster, generating insight on unaccounted variables in triage models, including access to power, weather impacting the mobilization of patients, and the most severe question of what to do with patients that are not top priority for treatment and face impending death.75 Supporting Fink’s expansive work recounting events at Memorial is a 2015 Radiolab episode titled “Playing God,”

---

71 World Health Organization, “Climate Change and Human Health”
74 Fink, Five Days at Memorial
which explores triage efforts during Hurricane Katrina through interviews with Sheri Fink, Dr. Pou, Dr. Cook, and anonymous staffers who worked at Memorial at the time of the hurricane.

To contrast the case study of Hurricane Katrina, an analysis will be executed assessing differences in triage methods between Hurricane Katrina and the Haiti earthquake. The sources outlined below in corroboration with the Katrina case study are important, for they provide evidence of the execution of triage beyond a manual (i.e. theory) and allow for the analysis of successes and failures of models in action. A prospective research trial on triage is impossible, for it violates ethical guidelines surrounding Randomized Control Trials. Therefore, retrospective case studies, like those on Hurricane Katrina and the Haiti earthquake, are the most effective comparative analysis of the triage models.

Comparison between Katrina and the Haiti earthquake is critical to explore how triage efforts are impacted by access to aid and structural healthcare, with Haiti being a strong example of how a low income index country faces significantly more difficult challenges in responding to extreme weather events. Sources analyzing the fallout of the Haiti earthquake are used to assess which standardized triage methods were utilized in response to the cholera outbreak and how they impacted the country’s subsequent mortality rate. The sources include Adam Houston and Beatrice Lindstrom’s article assessing how COVID-19 emergency response in relation to Haiti has developed from the earthquake, as well as “Use of Oral Cholera Vaccine in Haiti: A Rural Demonstration Project” by Iver et al, the central case study on randomized vaccine distribution for the Haiti cholera outbreak.

An additional resource for assessment is the running summary of triage efforts within the U.S. throughout the ongoing COVID-19 pandemic, published by the New York Times. This compilation summarizes the various triage methods enacted by doctors during the pandemic from states around the

---

76 A Randomized Control Trial (RCT) is a study design that randomly assigns participants into an experimental group or control group. While RCTs eliminate bias within the study and allow for easier analysis, they are harder to execute due to expense and volunteer biases. In the context of triage, an RCT would not be permitted, for it would require patients to be sorted into ‘experimental and control’ triage groups, which implies that one group is potentially a better form of care, and would be unethical.


79 Baker and Fink, “At the Top of the Covid-19 Curve”
country, providing strong assessments on the current state of triage on a national level. The source also calls in the perspective of medical professionals on assessing the practices’ successes and failures.

The analysis of efficacy of the three triage models draws from interviews with health professionals and ethicists, conducted by the author. This thesis includes interviews with Dr. Richard Berkowitz, MD, MPH of Columbia University, and Michael Skovira, a PA at Greenwich Hospital. These interviewees were selected because of their diversity in experience with triage, from working with discussions on quality of life in clinical practice, to applying triage practices in ER departments.

Interviewees were asked questions, including:

- “What triage methods do you use in practice?”
- “Who/what institution determined these guidelines?”
- “In what ways, if any, have you seen biases impact the way healthcare professionals assign priority to patients?”

Additionally, interviewees were given overviews of the triage models and case studies used in this thesis, and then were asked more detailed questions, including:

- In a situation where a healthcare provider can assess a person’s triage status beyond an immediate injury (i.e. who is to receive a ventilator, a bed in a hospital, etc), what elements are assessed at the present?
- What triage model would you see as best fit for prioritizing patients in these specific disasters?
- Do you see any outstanding issues with the existing models that would make you hesitate to implement them in practice?

An additional interview was conducted by the author with Dr. Gal Kober, PhD of Bridgewater State University, whose research is centered on autonomy and informed consent. Questions included:

- “How do utilitarian values grapple with the idea of a doctor ‘playing God’ during triage?”
- “How can we assess ‘fairness’ with implicit bias?”
- “Are doctors required to not harm their patients (as per the Hippocratic Oath), or must they also actively work to make their patients’ lives better?”

These interviews are essential, for they allow for an academic analysis of the models, specifically of how well each model eliminates subjectivity and biases by healthcare practitioners and systems.

By employing the methodology above, this thesis assess the efficacy and efficiency of the three noted triage models, arguing in favor of a synthesis of those models by healthcare practitioners in response to future MCIs.
Chapter 2: Time Crisis: Emergency Triage

As stated in Chapter 1, this thesis assesses three triage models: the lottery model, quality of life model, and social worth model. These three models were selected because of their prevalence in response to scarce resource allocation, from hospital beds, to vaccines, to critical medication. This chapter provides an overview of each model and an example of its implementation pertaining to the condition of scarcity. It outlines the definitions of efficacy and efficiency, two key elements for the evaluation of triage response in emergency conditions. This chapter’s overall purpose is to provide a sense of understanding of the three models so that the case studies of Chapter 3 can be better understood from a triage perspective.

Section 2.1.1: Efficiency of Triage

When the demand for critical care and supplies exceeds availability, these necessities must be carefully allocated among the population in need. During such times, these decisions are made rapidly under a triage system. As discussed in Chapter 1, the ethical foundation for decision-making during triage is utilitarianism, with the most essential goal being to provide the greatest good for the greatest number of people. The success of triage models centers on two key concepts: efficiency and efficacy.

Efficiency is defined in the healthcare system as “the doing of things in the most economical way; the ratio of the output to the input of any system.” In other words, an efficient system is one that executes a higher level of performance relative to inputs. Inputs within the healthcare system include time, money, or resources, such as equipment or medicine. Achieving efficiency centers on the theory of utilitarianism, prioritizing maximization of utility of individuals and resources. Maximal efficiency is in the interest of stakeholders in the health sector, including national and state governments, for it reduces the burden of financial and labor practices within individual and overall community health systems.

Efficiency is a crucial component within a triage system, manifesting in various steps throughout the process. The following examples were sourced from the Agency of Healthcare Research and Quality’s *Improving Patient Flow and Reducing Emergency Department Crowding*, a toolkit used by hospitals.

---

81 Dimmock and Fisher, "Utilitarianism"
around the U.S. Uncoupling emergency care registration and triage processes reduces the wait time for a patient to be assessed by healthcare personnel, increasing their chance of survival. Secondly, reducing average time in triage by rapid medical evaluation allows for the redirection of “low acuity patients away from the emergency department to other care settings.” By redirecting patients to more appropriate treatment, healthcare workers are able to maximize the use of scarce resources, such as hospital beds, ventilators, or medications, which reduces stress on the hospital system as a whole.

Efficiency within triage means allocating resources in a manner that maximizes the number of lives saved. An example of this consideration appeared during the COVID-19 pandemic, when U.S. hospitals faced a critical shortage of ventilators needed to treat intensive care patients. In a *New York Times* article from March 2020, interviews by a cohort of U.S. emergency department doctors noted that “almost all of the [triage] plans give priority to otherwise healthy people who are most likely to fully recover.” By prioritizing patients more likely to recover, doctors concluded that they could preserve a higher number of life years among populations -- a key measure of treatment success. These plans were designed with the intention of executing the main goal of triage, producing the greatest good for the greatest number of people, with the success measured by the number of persons treated for and recovered from COVID-19.

While efficiency is an effective method to ensure the maximization of resources, it receives common critiques. Prioritizing patients with the highest likelihood of survival entails a range of ethical issues, including discussion of social equality. Likelihood of survival measurements are generally derived from QALYs and DALYs, whose algorithms assess the value of medical interventions based on a person’s predicted long-term health outcomes. Determinants of health that would account for a lower QALY or

---


83 McHugh et al, *Improving Patient Flow*; Low acuity patients, defined as patients with low triage scores who do not require immediate emergency care.

84 Reducing stress on a healthcare system is defined as reducing the amount of labor and resources required to maintain positive health on an individual and community level through proactive measures.

85 Baker and Fink, “At the Top of the Covid-19 Curve”

86 Quality-Adjusted Life Years; See Chapter 1 for full definition; Disability-Adjusted Life Years; a measure of overall disease burden, expressed as the number of years lost due to ill-health, disability, or early death.
DALY score include gender, age, pre-existing conditions, and mental health. This creates an inherent algorithmic bias against persons with negative markers.\textsuperscript{87} As testified in the \textit{New York Times} interviews, dictating the order of triage based on these algorithms makes it so that “people with underlying medical problems may get ranked lower, yet low-income people and people of color often have more health problems because they cannot afford top-notch care.”\textsuperscript{88} Additionally, QALYs and DALYs are criticized as being ableist in nature, with people with disabilities put at a disadvantage since they are seen as abnormalities in contrast to people with “baseline functional status,” requiring more resources to function than those who are not physically and/or mentally disabled.\textsuperscript{89} By prioritizing efficiency, triage systems inherently fail to protect a community’s most vulnerable populations. This critique is one that will appear further in this thesis relative to the three models in question, and is a key factor in determining how effectively the goals of triage are met within the greater realm of healthcare.

\textbf{Section 2.1.2: Efficacy of Triage}

Efficacy is defined within the healthcare sector as “the capacity for beneficial change of a given intervention under ideal or controlled conditions.”\textsuperscript{90} Efficacy is often used interchangeably with the term “effectiveness” in healthcare literature; however, there is a key difference between the two terms, as noted by clinical epidemiologist Archie Cochrane in his 1972 article, “Effectiveness and Efficiency: Random Reflection on Health Service”:

Efficacy is the extent to which an intervention does more harm than good under ideal circumstances. Effectiveness assesses whether an intervention does more good than harm when provided under usual circumstances of healthcare practice.\textsuperscript{91}

In healthcare, nearly all clinical trials assess efficacy. Throughout clinical trials, all modifiable elements of the healthcare system, from medications and treatments to physician response, are kept in uniform ideal

---

\textsuperscript{87} Luis Prieto and José Sacristán, “Problems and Solutions in Calculating Quality-Adjusted Life Years (QALYs),” \textit{Health and Quality of Life Outcomes}, December 19 2003, doi:10.1186/1477-7525-1-80
\textsuperscript{88} Baker and Fink, “At the Top of the Covid-19 Curve”
\textsuperscript{90} Burches and Burches, “Efficacy Effectiveness, and Efficiency in the Health Care”
condition -- if an intervention does not work in ideal conditions, it will not work under usual ones, or ones in which participants are experiencing outside factors that are otherwise controlled for in a study. These factors can include living conditions, diets, social circles, or resource availability. Interventions generally refer to treatments, such as experimental medication or procedure; however, interventions can also include standardized healthcare systems, such as triage models. For example, clinical trials have been conducted to evaluate the effect of START education, the triage method referenced in Section 1.1, on knowledge and practice of emergency medical technicians in disasters.\textsuperscript{92} While measuring efficacy determines the full potential scope of success of triage models, it leaves the glaring unanswered question of “how will a model work when applied to ‘usual conditions’, ones that remove the certainty of conditions as created during clinical trials?” This question is critical; however, it is impossible to answer over the scope of year-long research. For the purpose of this thesis, the three triage models will be evaluated on the basis of efficacy, rather than effectiveness, to allow room for discussion with medical and ethics experts on the benefits and drawbacks of each system in their ideal state.

\textbf{Section 2.2: The Lottery Model}

The lottery model of triage is an egalitarian approach, whose founding principle is the intent of giving every patient an equal chance at receiving access to scarce resources in the form of treatment, equipment, or care. The lottery model operates off of the Kantian concept of respect for persons, asserting that each person’s value is the same regardless of identifying characteristics, such as race, gender, or socioeconomic status (SES).\textsuperscript{93} In a traditional emergency department setting, lotteries for scarce resources are executed by pooling names of patients, and randomly selecting a predetermined number of patients, allocated based on the critical level of desired resources within a hospital. For a lottery to be properly executed, patients entered into the pool must have similar prognosis who cannot be separated.\textsuperscript{94}


\textsuperscript{94} White and Derek C. Angus, “A Proposed Lottery System”
There are a number of benefits associated with the lottery model. The first major advantage of the model is its ability to eliminate practitioner bias. As noted in the Methodology portion of Chapter 1, such biases include bias against types of race, gender, SES, and age. By removing the practitioner from the triage process, the lottery model reduces room for the influence of bias, leaving it up to chance. Elimination of practitioner bias appeals to the notion of justice within a triage system, ensuring that no person is given a higher chance of receiving treatment because of pre-existing circumstances when their chance of survival parallels others in the system. A second advantage of the lottery model is that it allows for a more efficient decision-making process, enabling healthcare workers to move patients into assessment and treatment phases of the emergency response.

The lottery model possesses a number of disadvantages as well. The lottery model potentially conflicts with the core goal of triage, as stated in Section 1.4: producing the greatest good for the greatest number of people. A lottery system in its purest form gives every eligible patient the same chance of receiving treatment, acting on the principle of justice. However, in practice, lotteries are often used as a means of allocating resources between those with most similar circumstances (i.e. prognoses), serving as a tie-breaker between thresholds. Individual prognoses are influenced by pre-existing conditions, including SES, genetics, and pre-existing medical conditions -- a majority of which are conditions out of the patients’ control and pre-determined by the family they were born into. A lottery model eliminates the direct influence of practitioner bias, but it shows the crack in the healthcare system, creating algorithmic biases against patients whose health was negatively impacted by factors that lie outside of their control. Additionally, the concept of chance is incredibly valuable, but it also creates inevitable losses. Bioethicist Joseph Millum argues that

When a patient with a low likelihood of benefit wins the lottery, a patient with a higher likelihood of benefit goes untreated. When a patient from a socially privileged group -- someone who has already had more chances in life -- wins the lottery, a patient from a disadvantaged group goes untreated.

---

95 Dr. Gal Kober (Professor of Ethics) in discussion with author, February 4, 2021.
These concerns are legitimate, and they bring to light the overarching issue of the lottery model: does it meet triage’s goal of producing the greatest good for the greatest number of people? By selecting patients at random, the lottery model potentially allocates scarce resources to high-risk, low-chance survival patients, resources that could have been better utilized by low-risk/high-chance survival patients. It can be argued that this flaw inherently prohibits the lottery model from meeting the greatest number of people component of the triage goal, for by allocating resources to low-chance survival patients, a limited number of preserved life years would be generated relative to what would be preserved should high-chance survival patients receive them.

Section 2.3: Quality of Life Model

The quality of life model of triage is one derived from the QALY assessment model, used as a generic measure of disease burden, including quality and quantity of life lived. The quality of life model assigns patients a triage score, which is calculated based on their immediate chance of survival, as well as a person’s quality of life post-treatment, calculated by using the QALY model. The assessment of a patient’s chance of survival is a cornerstone element of any triage mode, but the addition of a QALY score incorporates an assessment of factors outside the immediate health incident. The chance of survival is determined using the START model (see Image 1), with the immediacy of treatment assessed in tandem with the severity of condition.97

---

97 Pan-American Health Organization, “Triage: Prioritizing Care to Reduce Deaths”
The graph demonstrates how a quick assessment would be performed to determine the level of triage needed for a patient, with the flow chart originating at “Able to walk?” and ending with “Mental Status.” Depending on a patient’s condition, the chart directs a provider to the level of triage needed; expectant, immediate, delayed, or minor, and how to tag the condition accordingly. For example, a patient with just a fractured arm would be placed in Category 2: Delayed. A patient experiencing a heart attack would be placed in Category 3: Immediate, for the condition will likely worsen and requires rapid intervention.

QALYs are modeled assuming that health is a function of length of life and quality of life, combining these values into a single index number. Weinstein et al’s article “QALYs: The Basics,” outlines QALYs’ method of calculation.  

To determine QALYs, one multiplies the utility value associated with a given state of health by the years lived in that state. A year of life lived in perfect health is worth 1 QALY (1 year of life × 1 Utility value). A year of life lived in a state of less than perfect health is worth less than 1 QALY; for example, 1 year of life lived in a situation with utility 0.5 (e.g. bedridden, 1 year × 0.5 Utility) is assigned 0.5 QALYs. Similarly, half a year lived in perfect health is equivalent to 0.5 QALYs (0.5 years × 1 Utility). Death is assigned a value of 0 QALYs, and in some circumstances it is possible to accrue negative QALYs to reflect health states deemed “worse than dead.

The idea of a condition being considered “worse than dead” is one that would generate living conditions so unbearable that people would prefer to not live their lives at all. This view is subjective and calls to question “who is to decide what is and what is not worth living for?” For the sake of this research, an example of this view could be if an expecting parent discovered that their child would be born with Tay Sachs, a genetic disease that causes rapid destruction of nerve cells and the spinal cord. A parent could decide to terminate the pregnancy, deciding that the brief years of life for the child would be too physically painful to justify their birth. Through the quality of life model, QALYs extend this decision-making process to medical professionals, assessing a patient’s given conditions. QALYs are combined with data on medical costs for a cost-utility analysis, estimating the cost-per-QALY for an

---

intervention. This framework can be used as a cost-effectiveness analysis for any treatment, allowing for an incremental-cost-effectiveness ratio (ICER) to be used as a means of allocating healthcare resources.\(^9\)

The quality of life model has been controversial throughout the past few decades. The model centers on benefit maximization, allocating resources in a manner that would enable the largest number of lives to be saved. Healthcare workers generally agree that using QALYs helps eliminate direct practitioner bias from the patient selection process: the QALY model calculates the effect of each health factor in a predetermined weighted algorithm, which has been widely approved since the algorithm’s creation in 1968, removing the need for physicians to make subjective assessments on a case-by-case basis.\(^10\) Some critics state that the method of ranking interventions and their recipients on the grounds of ICERs is quasi-utilitarian and removes more nuanced consideration of resource allocation, “treating patients as purely numbers, rather than as people.”\(^11\) However, QALY supporters argue that, “since healthcare resources are inevitably limited, this method enables [resources] to be allocated in the way that is optimal for society, including most patients.”\(^12\) Furthermore, the use of QALYs enables the quality of life model to compare value benchmarks between different potential health outcomes: For instance, a healthcare worker would be able to assess who would have a longer life outcome if given access to a scarce resource such as a ventilator: a 45 year old patient who is a life-long smoker, or a 67 year old patient with diabetes. QALYs streamline this assessment process, and the ability to measure success of an intervention by life years creates a qualitative assessment of providing the greatest good to the greatest number of people.

As noted in section 2.1, there are major ethical critiques of QALYs. In a Value in Health article by Erik Nor et al, the authors note a key problem with QALYs and a quality of life model:

Valuing health gains in terms of QALYs means that life-years gained in full health—through, for instance, prevention of fatal accidents in people in normal health—are counted as more valuable

---

9\(^9\) “A statistic used in cost-effectiveness analysis to summarise the cost-effectiveness of a health care intervention. ICERs are defined by the difference in cost between two possible interventions, divided by the difference in their effect. It represents the average incremental cost associated with one additional unit of the measure of effect.” Weinstein et al, “QALYs: The Basics.”
10\(^10\) Weinstein et al, “QALYs: The Basics.”
12\(^12\) Schlander, *Measures of Efficiency in Healthcare*
than life-years gained by those who are chronically ill or disabled—for instance, by averting fatal episodes in people with asthma, heart disease, or mental illness.\textsuperscript{103}

These weighted evaluations assign lower scores to patients with chronic illnesses, including any mental or physical disabilities, operating under the definition of “quality” being equivalent to perfect health. This algorithm generates implicit bias against people with disabilities, assuming that quality can only be measured by length of life and cost it takes to maintain it, seeing a disabled state as one not worth living relative to a non-disabled state. Additionally, QALYs assign persons with higher ages a lower score, undervaluing treatments that benefit the elderly, for they generate fewer life years relative to treatments for younger patients. The weaknesses in the quality of life model are derived from quality’s quantitative definition, and to correct the flaws would require a re-evaluation of the weights associated with particular health states. In summation, the quality of life model aims at preserving the greatest number of QALYs for a person and community, but it comes at the expense of at-risk populations whose health is adversely impacted by underlying factors, such as SES, pre-existing conditions, race, and age.

\textit{Section 2.4: The Social Worth Model}

A social worth model is one that seeks to allocate resources based on patients’ “anticipated contribution to society were their lives saved.”\textsuperscript{104} The first major consideration of the use of the social model appeared in 1962 during a highly publicized instance from the Seattle Artificial Kidney Center, who appointed a committee to decide who would receive dialysis treatment. Components of social worth included a person’s occupation, education status, and their leadership within a community.\textsuperscript{105} In the experiment, individuals deemed valuable to society would receive life-sustaining treatment, allowing them to return to their jobs, families, and civic duties.\textsuperscript{106} Social worth, however, turned out to be as

\begin{thebibliography}{10}
\bibitem{104} Albert R. Jonsen and Kelly A. Edwards, “Resource Allocation,” \textit{UW Medicine, Department of Bioethics and Humanities}, 2018.
\bibitem{105} Jonsen and Edwards, “Resource Allocation,”
\end{thebibliography}
subjective as it sounds, and as noted in Dr. Will Ross’ review of the experiment, “bioethicists immediately condemned the practice as highly discriminatory and derided the committee as a ‘God Panel.’”

There is a modifiable algorithm in determining a person’s social worth, like there is for the quality of a person’s life, as explained in section 2.3. This algorithm accounts for the impact a person has on society as a whole, and whether more lives will be saved and improved should they receive treatment. At first glance, the social worth model is easy to condemn for its highly-subjective nature, allowing for implicit and explicit bias. However, the U.S. is currently witnessing a version of a social worth model in action through the rollout policies of the COVID-19 vaccine. With vaccine rollout plans created by each state rather than the federal government, the U.S. is engaging in what could arguably be a modified version of the 1962 Seattle Artificial Kidney Center experiment. While state governments are not vaccinating citizens based on education status, they are assessing people’s priorities relative to their occupation and leadership role in communities. In all states, healthcare workers were prioritized for the first round of vaccines, with leadership stating that efforts to stop the spread of the disease would be pointless without protecting healthcare workers, who are by nature of their work, the most at-risk for exposure to COVID-19. However, the order of priority becomes subjective to each state after that. The CDC has stated that U.S. essential workers are “those who conduct a range of operations and services in industries that are essential to ensure the continuity of critical functions in the U.S.” The definition of an essential worker has been published by the CDC, but the U.S. states are struggling to decide how to prioritize within the extensive list, which includes professions such as teachers, agriculture workers, childcare and retail employees, and public transit staff. In some states, such as Oregon, teachers have been prioritized over the elderly for vaccines, with leadership arguing that immunizing teachers would allow for schools and businesses to reopen faster, thus benefiting the health of students and parents. Oklahoma

---

107 Ross, “God Panels”
prioritized residents of nursing homes, stating that limiting the spread of COVID among high-risk populations would reduce the state’s death rate, giving the community a better chance at reopening businesses sooner.111 New York included transit workers in their earlier rollout, while Georgia excluded this demographic but included law enforcement and persons over 65 years of age.112 These differences in rankings reflect the SES and cultural values of individual states. The effect of individual states’ vaccine distribution plans, measured by the control of spread of COVID-19, will not be known for years; however, the community impact of vaccination on one person’s life versus another will never be understood. This is because value, as most modern economists agree, is not an objective fact, but rather a reflection of what a society needs at each instance in time.113 If a community’s needs are constantly evolving, it becomes near impossible to accurately predict the impact a person will have in the long-run, making the social worth model one that is prone to error. While a social worth model in a perfect simulation would meet the goal of maximizing benefit for the greater good, the allowance of subjectivity and error has made healthcare workers wary of pursuing it as a long-term evaluation method.114

Section 2.5: Implementation of Triage Models

The models discussed in this chapter are diverse in design, incorporating a range of contrasting conditions that must be met for treatment, as well as unique benefits and drawbacks to each model. Because not every MCI is the same, a range of triage models allows for each one to be applied under unique environments, accounting for differences in population demographics, geography, and types of illness or injury. In the following chapter, the implementation of the three models will be discussed in the context of the climate disasters of Hurricane Katrina and the Haiti earthquake. The success and failures of the models will be assessed thanks to interviews with healthcare professionals and bioethicists, with an evaluation of the models’ efficacy and efficiency when applied to these real-world scenarios.

114 Ross, “God Panels”
Chapter 3: Don’t Let Them Leave Me Behind

Climate change is the greatest threat to health in the 21st century. Each year, climate change kills a conservative estimate of 250,000 people, largely through extreme weather events and their fallout. These fallouts include destruction of resources, malnutrition, and injury, or illness. Destruction of infrastructure is one of the most threatening outcomes, with climate events having the potential to destroy a number of vital elements of a healthcare system. Complications that can arise from climate change include power failure, restricting use of technology, such as ventilators and water purifiers, and reduced access to roads and mass transit, prohibiting EMS access to patients. Destruction of heating or cooling sources can harm patients and staff from a physiological perspective, and potentially destroy supplies and medication. As noted in Chapter 1, as climate change progresses, extreme weather events become more prevalent, ultimately forcing healthcare workers to refine the way in which they allocate these scarce resources to patients in need: a central component of triage. The purpose of this chapter is to analyze the methods of triage outlined in Chapter 2 as applied in response to the climate events of Hurricane Katrina and the Haiti earthquake. The benefits and drawbacks to each model are assessed in real-world applications, evaluating the efficacy, efficiency, and the prevalence of bias in practice.

Section 3.1: Hurricane Katrina: A City in Ruins

Originally introduced in Section 1.3, Hurricane Katrina was a Category 5 hurricane that struck the United States in August 2005. Katrina originated as a tropical depression on August 23, 2005, a result of a merger of a tropical wave and the remnants Tropical Depression Ten. However, the depression developed into a tropical storm, and then a full hurricane. As Katrina moved from southern Florida to the Gulf of Mexico, it intensified into a Category 3 and then a Category 5 hurricane in only nine hours. Katrina swept through a large portion of the southeastern United States. The hurricane devastated the

---

115 World Health Organization, “Climate Change and Human Health.”
116 World Health Organization, “Climate Change and Human Health.”
117 EMS (Emergency Medical Services)
118 See Section 1.2
119 A tropical wave is an atmospheric trough, elongated area of low air pressure, which moves from east to west through the tropics, often causing thunderstorms. Tropical depressions are a result of thunderstorms grouping together under low pressure atmospheric conditions, creating an organized circulation in the center of the complex.
120 Gibbens, “Hurricane Katrina, Explained.”
coasts of Mississippi and Alabama, as well as the Florida Panhandle, with continuous beach erosion leading to high waves, which flooded roadways, and left 77,000 residents of the area without power. However, the most extreme damage occurred in Louisiana and specifically in the city of New Orleans.

On August 29, 2005, Katrina touched land near Buras-Triumph, Louisiana, a community on the southeastern tip of Louisiana. Because of the hurricane’s continuous proximity to the water source, it generated intensity as it moved up the state, bringing with it more than 15 inches of rain, flooding cities, leaving 900,000 people in Louisiana without power. As the hurricane gained momentum, the federal government declared a state of emergency, “calling for a mandatory evacuation of New Orleans, which had a population of 480,000 at the time.” While thousands of people fled, a large number of the city’s residents stayed behind -- largely the poorest and oldest residents, who were stranded due to restrictive access to transportation. New Orleans officials felt fairly confident in the city’s ability to survive the hurricane, expecting extensive damage occurring on the east coast. However, on the morning of August 29, more than 50 levees failed, and a surge of flood water poured into the city, destroying houses, roads, hospitals, and a majority of the city’s power grid. New Orleans itself is shaped like a bowl, with land sloping upwards from the central point of the city. This landscape made the city a prime candidate for flooding, giving the water no natural drainage point, and trapping infrastructure within the interior.

Section 3.2: Remembering Memorial Hospital

The destruction in New Orleans was vast, and hospitals were not spared any more than the rest of the city. One of the most famous hospitals in New Orleans is Memorial Medical Center, built in 1926 in one of the geographically lowest parts of the city. The building was sturdy: eight stories tall, stretching two city blocks. Interviews with New Orleans residents demonstrated that citizens thought of Memorial as a safe haven, the building perceived as being safer than their own homes. It was common practice for

123 Gibbens, “Hurricane Katrina, Explained”
125 Fink, “Playing God”
residents to shelter at the building when major storms passed through the city.\textsuperscript{126} When Katrina struck, Memorial was housing 2,000 people, 250 of which were patients.\textsuperscript{127} While the hospital remained stable during the city’s first power outage, thanks to a backup generator, the situation changed after the levees broke. As water swept through the city, it pooled around Memorial, situated in the center of New Orlean’s geographic bowl. Memorial’s backup generator was housed on the second floor of the building, but the circuitry ran throughout the hospital. So when the levees failed, so did the generator.

As the water pooled around Memorial, doctors knew they had to act fast. Two National Guard trucks were accessible to the hospital, and served as the first form of evacuation. Memorial doctors chose to evacuate patients who could walk via the trucks, since access required the use of stairs. The second evacuation option was via a helipad located at the top of the hospital, with helicopters taking one or two patients at a time. For the first 24 hours, Memorial staff worked endlessly to evacuate intensive care patients via helicopter, eventually evacuating 60 ICU and NICU\textsuperscript{128} patients. As darkness fell over Memorial, an exhausted staff laid down on cots to sleep for the night; but then at around 2:00am, water began leaking into the basement and “the buzz of the generators suddenly just….stopped.”\textsuperscript{129}

It was at this point that Memorial’s medical staff switched into full-blown triage mode. The head of the triage efforts was Dr. Anna Pou, a head and neck surgeon who was revered and respected by Memorial staff.\textsuperscript{130} The triage plan created by Dr. Pou is outlined below, as reported by Sheri Fink:

She and another doctor stationed themselves on the landing where the patients were brought down to on that second floor. And as the nurses would bring them, they would look quickly at the patient's chart, look at the patient, and decide on a number. And the nurses would take a magic marker and a piece of paper and write either "one," "two" or "three" on that paper. And then they

\textsuperscript{126} Fink, \textit{Five Days at Memorial}  
\textsuperscript{127} Fink, \textit{Five Days at Memorial}  
\textsuperscript{128} NICU: Neonatal Intensive Care Unit  
\textsuperscript{129} Fink, “Playing God”  
would tape that number ... onto the patient's gown. So the “ones” that were your relatively healthy patients...they could be discharged. The “ones” would be rescued by boat, presumably among the first. The “twos” were your more typical hospital patients. A patient who wasn't fully recovered, who would need ongoing care. They would go by helicopter, presumably second. And then the “threes” were those super-sick patients or anyone with a Do Not Resuscitate order.131

This triage method is a derivativation of the quality of life model outlined in Chapter 2. By establishing the severity of a patient’s current condition, Dr. Pou was quickly assessing their chance of survival, the first of two assessments in the model.132 In her interviews with Memorial staff, Fink asked a doctor, whose name was kept anonymous in publication, “Why did you choose the sickest patients to go last?” To which he replied, “Well, I figured anyone with a Do Not Resuscitate (DNR) order would have a terminal or irreversible condition…. I thought that that patient would have ‘the least to lose.’”133 The doctor’s connection between a DNR and a terminal or irreversible condition is false, as Fink notes in her interview; a DNR is appointed by a patient for a number of reasons, none of which are listed on the order form.134 This choice was derived from a utilitarian lens, one outlined in Chapter 1. While the doctor’s connection between the DNR and patient’s potential long-term condition may be false, the rationale behind it falls in line with the second element of the quality of life mode, QALYs. In this case, the doctor assigned DNR patients a lower QALY score based on his assessment that a chronic/terminal illness lowers the quality of life of a patient; and if this patient were to receive treatment over a non-DNR patient, they would have a lower quality of life. This judgement can be visualized in Figure 1, which shows the potential outcome between two patients receiving treatment. The x-axis measures the time remaining in a person’s life, and

---

131 Five Days at Memorial, authored by Sheri Fink, compiled interviews from staff members of Memorial Medical Center, chronicling their experiences
132 See section 2.3 for outline of full model
133 Fink, Five Days at Memorial
the y-axis measures the correlating quality of life, both relative to the patients’ infliction with an illness requiring the same intervention. Person A (who did not receive treatment) has fewer QALYs than Person B (who received treatment); Person A could have a number of conditions, including chronic illnesses or disabilities that would lower their QALY score, like DNR patients referenced by the doctor. The summation of QALYs for Person A is the blue region of the graph, and the summation of QALYs for Person B is the tan regions of the graph. Because Person B’s health-related quality of life was significantly higher than Person A’s at the time of the onset of illness, Person B retained a higher QALY score, and furthermore, duration of life, when receiving an intervention. The rationale of allocating scarce treatment and/or resources to Patient B in this scenario is rooted in the utilitarian principles discussed in section 1.4, with a goal of maximizing the greatest amount of “good” possible -- with the good being the quality and duration of life between two patients.

Memorial staff operated on a form of the quality of life model for their triage efforts during Hurricane Katrina, but the model transformed as staffers made decisions if people would be, for lack of better words, better off dead. Entering day three with no power, Memorial quickly descended into an unlivable state. Staff noted that the building was reaching 100°F, with the hurricane’s waters pushing sewage back into the building through toilets onto floors.135 As the hospital faced hellish conditions, the staff and patients were simultaneously isolated from the outside world, only receiving information about the state of New Orleans from hand-held radios. News stations broadcasted stories of looting, violence, and residents “walking like zombies, like Night of the Living Dead.”136 For the first part of the day, staffers were euthanizing Memorial’s residents pets, who were owned by on-call employees who would typically bring them to the hospital for shelter when extreme weather events were expected. The pets were experiencing and dying from seizures due to the extreme heat and lack of food and water, and the doctors opted to euthanize as a means of making their inevitable deaths as least-painful as possible.137 But at some point during the process, this idea of thinking began to transfer onto human patients. During interviews,

136 Fink, “Playing God”
137 Fink, “Playing God”
Memorial employees, they stated that essentially “You don't know how many rescue resources are going to come, it's night time. Your colleague walks up to you and says, you know, ‘We're euthanizing the pets to put them out of their misery. What about these suffering patients? Shouldn't we put some of them out of their misery?”

Responses to the proposal of selective euthanasia were split, with some staffers supporting the idea, seeing it as the most humane option to relieve suffering, and others deeming it unethical, seeing it as a form of homicide.

Regardless of the divisive nature of the proposal, people took action. Dr. Bryant King, a colleague of Dr. Pou, recalled in a CNN interview a scene in which “Anna's standing over there with a handful of syringes, talking to a patient. And the words that I heard her say were, ‘I'm going to give you something to make you feel better’...And nobody walks around with a handful of syringes and goes and gives the same thing to each patient. That's just not how we do it.” After the hurricane subsided, 45 bodies were found inside Memorial. 21 of these patients received “either morphine Versed, a powerful sedative, or a combination of the two in a short time period on September 1, 2005.” In a 2006 60 Minutes interview, Dr. Pou flatly denied euthanizing patients, stating that “It completely ripped my heart out because my entire life I have tried to do good...I have given everything that I have within me to take care of my patients.” But in an interview with Fink, Dr. Ewing Cook, another Memorial colleague who specializes in end-of-life-care, was much more open about the decisions made in Memorial during the disaster. Fink shares Dr. Cook’s experiences in an interview with Radiolab:

He had gone upstairs, visited Mrs. Burgess, [a cancer patient], to see how she was doing. And he was just thinking to himself, she's so, so sick. She's got advanced cancer, I can't imagine she would have more than maybe a week to live at the best of circumstances. She is weighted down

138 Fink, *Five Days at Memorial*
140 Fink, “Playing God”
with fluid, which can happen toward the end of life, so she weighs a lot. She's on the eighth floor, so we'd have to carry her downstairs. Plus there's four nurses up here taking care of her. Couldn't we use them somewhere else? So he literally turned to one of the nurses and said, "Can you give her enough morphine till she goes." And that nurse charted a huge increase in morphine for her and she died. And that was his thought...He said to me he thought it was desperate. He saw only two choices, quicken their deaths or abandon them. I mean, if that was the situation, there's some ethicists would say either of those choices would be, you know, not justified, but excusable.\footnote{Fink, “Playing God”}

Dr. Cook’s actions reflect the assessment style outlined in the quality of life model; however, his decision to terminate life shows the potential severity in outcome for when a QALY score is less than zero -- when the quality of life is worse than death itself. In a traditional setting, the termination of life without consent is viewed as overwhelmingly unethical, for it violates the hippocratic oath’s rule of “first, do no harm.”\footnote{See section 1.4 for further elaboration} But in a state of emergency like that at Memorial? These hard rules suddenly become malleable, with no singular agreed upon course of action. Dr. Cook’s decision to administer morphine was founded on the belief that he was giving his patient the most optimal outcome. In reviewing the reports of these Memorial patients, it became apparent that once the decision is made to essentially give up on one patient in the name of the greater good, it becomes easier to rationalize doing the same for more. One patient, Emmet Everett, was a 61-year old man who weighed 380 pounds. He was located on the seventh floor of Memorial when Katrina struck. In an interview with Fink, Cheri Landry, a Memorial ICU nurse, reported:

He was conscious, alert, fed himself breakfast, asked his nurses, "Are we ready to rock and roll?" He said to one nurse, who never forgot it, "Cindy, don't let them leave me behind. Don't let them leave me behind." But he had had a spinal cord stroke, he couldn't walk, he was on the seventh floor of a hospital with no working elevators. The staff told me they couldn't imagine how they would carry him down those flights of stairs, let alone would a helicopter take a man of his size. And he was one of the patients who was found with this drug combination in his body.\footnote{Fink, “Playing God”}

Interviews conducted during investigation into deaths at Memorial noted that a group of five employees were a part of the conversation to decide Everett’s fate -- “he had been designated a ‘3’ on the triage scale...and the group speculated that helicopters would not take him.”\footnote{Fink, “The Deadly Choices at Memorial”} Would Everett’s quality of life have truly been worse off than other patients had resources been allocated from treating other patients to transport his body? Would he have truly been left behind? Several medical staff members who led the
boat and helicopter transport efforts stated that “they would certainly have found a way to evacuate Everett…[but] they were never made aware of his presence.”

Everett’s case is a prime example of the subjective fallacies in the quality of life model. By not pooling a team to move Everett from the seventh floor the doctors decided to allocate resources to other patients who would require less care with higher chances of survival. This decision is derived from the first half of the quality of life model, assessment of chance of survival. However, the deciding factors against Everett were his weight and pre-existing condition, the spinal cord stroke. These are factors that reduce a person’s QALY score, both overtly through the model and through practitioner bias. Everett was a patient that could have been saved; however, this life was deemed less worth living than other patients because of health indicators that are influenced by factors outside of his control, such as SES, genetics, and healthcare services.

The choice to not save Everett, and 44 others in the bottom of the triage tier, allowed Memorial staff to evacuate and save 205 patients. In the eyes of the medical team and survivors, this was the right call: families of survivors have thanked staff for decisions made that day, arguing that the team was being persecuted for merely “trying to save lives,” with some stating that they would feel the same had their family member not survived the experience. But in a CNN interview, Carrie Everett, Emmett Everett’s widow, spoke out against the Memorial staff: “Who gave them the right to play God? Who gave them the right?”

Section 3.3: A Fair and Equal Chance

The triage decisions at Memorial were made out of necessity in an environment facing chaos. Katrina served as a wake-up call for the medical community to reconsider triage. A primary concern was the absence of some form of a standardized care, “a checklist, something doctors could follow in the case of future emergencies.” Research panels were held by a number of healthcare organizations, with a notable 2013 conference conducted by the state of Maryland in partnership with Johns Hopkins

---

146 Fink, “The Deadly Choices at Memorial”
147 Investigations and lawsuits were filed against Dr. Pou and co-workers, citing that euthanasia tactics were a form of homicide. However, the cases were thrown out after deliberation because of ambiguous evidence and the intent of actions being founded on harm-reduction. This thesis focuses on the internal events at Memorial, but for further information on the aftermath of events, refer to Fink’s Five Days at Memorial for a comprehensive overview.
148 Fink, “The Deadly Choices at Memorial”
150 Fink, “Playing God”
University. The conference consisted of randomly-selected non-healthcare workers from Baltimore City and Howard County, who were asked to help decide who gets life-saving resources when resources are scarce. The hypothetical scenario proposed was a pandemic influenza: “Millions of people are sick, some are dying. The only way that folks are going to get better is if they have a ventilator to help them breathe. But the problem is there just aren't enough.” This hypothetical scenario was an eerie preview to the COVID-19 pandemic. The panels considered a number of triage methods, including those explored in this thesis, and discussed ways in which resource allocation could be decided, considering factors like gender, race, health status, and contribution to society. The panels were thoughtful, with consideration given to how every person can be given a fair and equal chance at survival. A concern voiced in discussion centered on forcing one person to make the triage decisions. Participants thought that to ensure fairness, healthcare workers should have guidelines to follow, developed with input from a wide range of experts. Fink, who observed this panel, noted that a common sentiment among participants was “even if we don't like the choices that are made...overall, if you know that there's a protocol out there and this is the rule...here's why we had to adopt this rule, it's being applied to everybody and you're not going to be advantaged or disadvantaged over money or over all of these other things...it helps you accept it.” So what happens in an ideal system, in which a non-subjective rule is applied to everybody? The following section explores triage efforts in relation to the Haiti earthquake’s fallout: a cholera epidemic.

Section 3.4: A Fatal Quake

On January 12, 2010, four and a half years after Hurricane Katrina, a catastrophic 7.0 Mw earthquake struck Léogâne, the most populous city of Port-au-Prince. From January 12 to January 24, the country felt 52 aftershocks measuring 4.5Mw or greater, which struck within a 35 mile radius from Port-Au-Prince. The earthquake’s damage shocked the world -- at least three million people were impacted by the quake, one third of Haiti’s population. In 2010, the country was recovering from two

---

152 Fink, “Playing God”
153 Fink, “Playing God”
154 A smaller earthquake following a bigger earthquake occurring in the same area as the initial shock.
tropical storms and two hurricanes from 2008, and the needed repairs combined with Haiti’s lack of building codes left the country’s infrastructure vulnerable. The earthquake raised thousands of structures, including the National Palace, UN headquarters, and parliament building.\footnote{Richard Pallardy, “2010 Haiti Earthquake”} Vital structures were severely damaged, including "all of the capital’s hospitals; transport facilities; and communication systems."\footnote{Christian Fraser, “Haitians Show Fortitude in the Face of Disaster,” \textit{BBC News}, 24 January 2010.}

As buildings collapsed, hundreds of thousands of civilians were trapped in the ruins, left homeless and critically injured. In the aftermath of the earthquake, efforts by citizens and aid organizations were limited because of the collapse of the power system, destruction of roads, ports, and airports, and the leveling of Haiti’s central hospitals. One million Haitians were left homeless, an estimated 300,000 were killed in the aftermath of the earthquake, and hundreds of thousands were injured.\footnote{Richard Pallardy, “2010 Haiti Earthquake”; Because of the ensuing chaos, Haitian officials were unable to establish an official death and/or injury toll, and there are still disputes about reported numbers.} In the days following the earthquake, over a million people slept on the street or in shanty towns.\footnote{A settlement of improvised groups of buildings, generally made of mud and wood. Shanty towns generally lack basic infrastructure, including electricity, safe water supply, and adequate sanitation.} Morgues were overwhelmed, with thousands of bodies left on streets because there was physically no place where they could be relocated. In an interview with the \textit{Jewish Telegraphic Agency}, Mati Goldstein, the head of the Israeli ZAKA International Rescue Unit, present for relief efforts in Port-au-Prince, described the situation as "The Shabbat from hell. Everywhere, the acrid smell of bodies hangs in the air. It's just like the stories we are told of the Holocaust – thousands of bodies everywhere...in numbers that cannot be grasped. It is beyond comprehension."\footnote{Marcy Oster, “Israeli Medical, Rescue Workers Help Haitians,” \textit{Jewish Telegraphic Agency}, January 17, 2010, https://www.jta.org/2010/01/17/global/israeli-medical-rescue-workers-help-haitians} Because Haitian hospitals were destroyed, survivors were forced to wait for days for treatment, isolated from adequate food, water, and sanitation. The absence of medical staff and supplies worsened many survivor’s initial conditions, contributing to the death toll.\footnote{Pallardy, “2010 Haiti Earthquake”} In the following weeks, international
organizations were able to provide more aid, from food and water, to critical medical resources, to specialized recovery workers. Recovery progress was slow, with agencies characterized as dysfunctional and inexperienced. In October 2010, Refugees International, an independent humanitarian organization, stated that “The people of Haiti are still living in a state of emergency, with a humanitarian response that appears paralyzed.” The slow response to the earthquake left Haiti in an incredibly vulnerable position, one that would create a public health crisis of unprecedented proportion.

**Section 3.5: The Luck of the Draw: Cholera Vaccines in Haiti**

While the Haiti earthquake left communities at risk for injury from failed infrastructure, a more threatening outcome to human health was the revival of a cholera epidemic. Cholera is an acute diarrhoeal disease that has the capacity to kill its host within hours. According to the WHO, “Cholera is caused by ingestion of food or water contaminated with the bacterium *Vibrio cholerae*.” It is an extremely virulent disease, causing acute diarrhoea. It can take anywhere from 12 hours to five days to show symptoms after consuming contaminated food, giving cholera a large window for transmission within a community. The WHO notes that “cholera transmission is closely linked to inadequate access to clean water and sanitation facilities. Typical at-risk areas include peri-urban slums and camps for internally displaced persons or refugees, where minimum requirements of clean water and sanitation are not met.” Humanitarian crises -- including the disruption of water and sanitation systems or the displacement of populations into inadequate and overcrowded living conditions -- can increase risk of cholera transmission.

Prior to the earthquake, no cases of cholera had been reported in Haiti for more than a century; however, on October 20, 2010, nine months after the earthquake, officials confirmed the first outbreak of cholera. A UN panel was formed to “investigate and seek to determine the source of the 2010 cholera

---


Diarrhoeal diseases are generally associated with infections in the intestinal tract, which can be caused by a variety of bacterial, viral, and parasitic organisms

163 “Cholera,” *World Health Organization*

164 “Cholera,” *World Health Organization*

This panel found that the outbreak was caused by human activity: in the wake of the earthquake, waves of international workers came to Haiti to provide assistance in recovery efforts, with a number of them coming from countries where cholera is endemic. These workers regularly interacted with the Artibonite River, the longest river in Haiti that divides the country with the Dominican Republic. The spread of the disease was unintentional; it came as a result of contamination of the Meyère Tributary System of the Artibonite River. However, this river is central to Haitian life, and is used by thousands to bathe, wash clothes, source drinking water, and generally recreate. After the international workers contaminated the water source, Haitian communities unknowingly spread the disease.

Because cholera is a highly communicable disease that spreads through contaminated water, Haiti was in a prime position to see the onset of an epidemic thanks to the lack of sufficient infrastructure or sanitation supplies. Richard Knox, an NPR correspondent present for the onset of the outbreak described the disease as one that “struck with explosive force. Within two days of the first cases, a hospital 60 miles away was admitting a new cholera patient every 3½ minutes.” By the end of the first ten weeks, cholera spread to all ten of Haiti’s provinces. By March 2011, cholera had killed 4,672 people, and hospitalized thousands more. By August 2012, that number crept to 7,490 deaths, with 586,625 cases in total. In January 2020, the ten-year anniversary of the earthquake, Haiti reported 820,000 cases and 10,000 deaths -- the largest outbreak of the last century. Hundreds of thousands of dollars were dedicated towards eradicating cholera in Haiti since its introduction, but unsanitary conditions and further climate disasters have allowed for transmission to continue. While cholera spreads relatively fast, epidemiologists were stunned by this pace of transmission. Daniele Lantagne, an environmental engineer at Tufts University,

---

167 Endemic, the state of a species being native to a single defined geographic region. Cholera is endemic in approximately 50 countries, primarily those in Africa and Southeast Asia.
168 Latagne et al, “The cholera outbreak in Haiti”
170 Pallardy, “2010 Haiti Earthquake”
171 Pallardy, “2010 Haiti Earthquake”
172 Pallardy, “2010 Haiti Earthquake”
stated in a 2013 interview that “Part of the reason we think the outbreak grew so quickly was the Haitian population had no immunity to cholera...Like when the Europeans brought smallpox to the Americas and it burned through native populations.”\(^{173}\) While a smaller, more isolated outbreak of cholera could potentially have been controlled through sanitation measures, epidemiologists and infectious disease experts argued that response to Haiti’s cholera outbreak required addressing this lack of communal immunity. In response, the Haitian government launched its oral cholera vaccination campaign.

As Haiti attempted to quell the epidemic through sanitary measures, it became apparent that the lack of basic necessities made a vaccine necessary to combat the disease. By 2012, two cholera vaccines were developed for global use: Dukoral and Shanchol.\(^{174}\) Both are taken early in two doses, with immunity developing within a week and lasting for up to three years. The vaccines have 60 to 90% efficacy rates, which major health organizations, such as Partners in Health (PIH), say are comparable to a flu vaccine and superior to “the 0% effectiveness of drinking stool-laden water.”\(^{175}\) PIH collaborated with the Haitian NGO Gheskio to distribute Shanchol in the rural areas of Bocozel and Grand Saline in the Artibonite River Valley.\(^{176}\) These locations were selected because rural isolation combined with poor roads made access to health services difficult and reflected the risks faced by other Haitian communities. Additionally, the communities are located close to the Artibonite River, with inhabitants frequently interacting with contaminated water. These elements put the communities at an equal risk of contracting cholera, thereby creating a pool of patients with similar prognoses, a condition for the lottery model as discussed in section 2.2. This allowed PIH and Gheskio to distribute the vaccines at random, operating on a lottery model form of vaccination triage. The randomization process was selected because the Shanchol vaccine, manufactured in India, required refrigeration, and insurance of cold chain success.


\(^{174}\) Katherine Harmon, “Can a Vaccine Cure Cholera?” Scientific American, January 12, 2012

\(^{175}\) Harmon, “Can a Vaccine Cure Cholera?”

\(^{176}\) Louise C. Ivers et al, “Use of Oral Cholera Vaccine in Haiti”
proved difficult once vaccines reached Haiti. Prior to the vaccine’s administration, Gheskio staff in Bocozel performed a census, in which households were assigned unique numbers, and eligible residents over the age of 10 could register for the vaccine lottery. For distribution, vials were randomly selected and their paired households were called the morning of administration to meet at distribution sites. For persons who could not travel, mobile vaccination posts operated under the same system. Vaccine distribution lasted six weeks in total, with 90.8% of participants receiving a second dose of vaccine. At the end of the distribution, researchers measured community coverage in Bocozel and Grand Saline through census data and self-reporting surveys, producing an estimated community coverage of 79.2%.

In a number of ways, the cholera vaccination efforts were a success, and are a strong argument in favor of the lottery system of triage. By administering the vaccine via randomization, health officials effectively eliminated any major differences in the vaccine recipiency based on sex. Of those persons who received the initial dose, 49.4% were female and 50.5% were male, demonstrating no significant differences in distribution between the sample population’s two sexes. The distribution of the vaccine showed a limited difference between vaccine recipients’ ages and population demographics, with 43.9% of the population registered as under the age of 18 in a 2010 census, and 41.5% of vaccine recipients under the age of 18 at the time of administration. As discussed in section 2.2, the lottery model aims to eliminate practitioner bias in the selection of patients for access to limited interventions. The distribution of this cholera vaccine proved that mission to be effective, with randomization ensuring that a proportionate percentage of the communities’ demographics received access to the vaccine. Researchers stated in the Discussion section of their report that the vaccination coverage rates were successful “in synergy with continued support of the other important components of cholera control, such as case-finding treatment, access to potable water, and sanitation and hygiene education.”

177 Louise C. Ivers et al, “Use of Oral Cholera Vaccine in Haiti”; This age restriction was put in place because of the difference in doses required for adolescents versus adults
178 Louise C. Ivers et al, “Use of Oral Cholera Vaccine in Haiti”
179 Louise C. Ivers et al, “Use of Oral Cholera Vaccine in Haiti”
180 Statistically significant differences for the purpose of this thesis is defined by a p-value greater than .05.
182 Louise C. Ivers et al, “Use of Oral Cholera Vaccine in Haiti”
demonstrate that the efficacy of vaccination efforts was high, largely due to the extensive planning put in place to ensure fair and equal access to vaccines through the multi-step randomization process.

Conversely, there are some significant limitations within the lottery model rollout utilized for the cholera vaccine. The rollout for this vaccine took over two years of planning, from the onset of the cholera epidemic, to the creation of the vaccines, and lastly to the distribution of vaccines within Bocozel and Grand Saline. Because vaccines required refrigeration, public health officials were additionally tasked with creating reliable methods of transportation and storage that would ensure the most limited amount of vaccine wastage of less than .5%. The rollout time required for this effective triage strategy came with a cost -- with 586,625 cases and 7,490 deaths reported during the two year period prior to rollout. While the vaccine was distributed in an equitable manner, researchers stated that the slow pace of the rollout creates “a fear of scarcity” during an epidemic, potentially “preventing those who most need the [vaccine] from receiving it in a timely manner.” These concerns echo those outlined in section 2.2, with the lottery model potentially preventing healthcare workers from providing the greatest good for the greatest number of people. Could these deaths have been prevented had a different triage system been selected -- such as one that prioritized timeliness over equity, like that of Dr. Pou’s during Hurricane Katrina? The last chapter of this thesis will tackle this question through interviews with healthcare workers, bioethicists, and the evaluation of triage methods in the face of the ongoing COVID-19 pandemic.

Hurricane Katrina and the Haiti earthquake prove that implementation of different triage models produce varied outcomes, including discrepancies in patient selection, and tradeoffs between efficiency and efficacy. These outcomes are largely byproducts of the selected model and the range of triage environments. The aforementioned models on their own are not flawless, making it difficult to advocate for the standardization of a single model across all healthcare settings. However, the case studies demonstrate that there are significant benefits to each model, which could be blended by practitioners to optimize outcomes. This will be the focus of Chapter 4.

183 Louise C. Ivers et al, “Use of Oral Cholera Vaccine in Haiti”
184 Latagne et al, “The cholera outbreak in Haiti”
185 Louise C. Ivers et al, “Use of Oral Cholera Vaccine in Haiti”
Chapter 4: Always Evolving, Always Changing

The question of whether more deaths could have been prevented by changes in triage methods in cases like Hurricane Katrina and the Haiti earthquake is one that cannot be answered by formal investigative study, for they require a catalyst of extraordinary circumstances. Evaluation of triage methods cannot typically be done in randomized controlled trials (RCTs), the gold standard for health intervention studies, for triage requires the condition of scarce resources. To truly measure the effectiveness of one triage method versus another, researchers would have to create a condition of scarcity, which puts participants at an unnecessary risk, prohibited under clinical trial guidelines.\(^{186}\) For this reason, the case studies presented in Chapter 3, as well most general triage studies, are done by retrospective analysis, assessing the effectiveness of a system based on existing outcomes. As noted in section 3.3, there is a desire among healthcare workers and communities to establish a standardized form of triage for scarce resources within the U.S. healthcare systems that would maximize resources and lives saved. During the course of this research, interviews were conducted with healthcare professionals and bioethicists to discuss the implementation of these triage methods, and whether the desired standardized triage processes are possible. Interviewees included Dr. Richard Berkowitz, MD, MPH, current Professor of Obstetrics and Gynecology at Columbia University Medical School; Dr. Gal Kober, PhD, Professor of Applied Ethics at Bridgewater State University; and Michael Skovira, PA at Greenwich Hospital's Emergency Department. Interviews were conducted via zoom, with interviews lasting between 60-90 minutes in a single session. Responses from these participants are integrated throughout the conclusion of this thesis, serving as supporting analyses for the case studies presented in Chapter 3.

Section 4.1: Evaluation of Triage Methods

As discussed previously in this thesis, the style of triage method implemented in the wake of a MCI, like those of Hurricane Katrina and the Haiti earthquake, varies widely. This is largely because the

scarcity of resources manifest in a number of ways, from a lack of medications or vaccines, to a limited number of healthcare workers to provide treatment. Dr. Kober stated that “While these events are similar in a number of ways -- the scale of persons needing treatment, the need for time-sensitive responses -- they also vary widely because of the type of persons making triage decisions.”

In the case of Memorial, triage was dictated by a single team of workers from one hospital, led by Dr. Pou, with no guidance given from outside organizations with the exception of standard ethics training undergone by medical staff. In the face of the cholera epidemic, Haitian healthcare researchers followed guidelines created by stakeholders, including “local public health practitioners, the district health office, and leaders of NGOs with activity in the target communities.” These are two significantly different scales of leadership, determined by the time-sensitive nature of the triage practices.

In the case of Memorial, the power outage forced workers to triage without generating a consensus on practices from outside sources. In interviews given in the wake of the Katrina, Memorial staffers pleaded with the public to understand the troubles they faced in the hospital: “We couldn’t reach a single person...No phone lines [were working]...We were being turned away by the National Guard. So who could have helped make those decisions [but those inside Memorial]?” If Memorial staff were to wait until they could have received outside input on the process, how many more patients would have died? 100? 200? Faced with these potential death rates, the team opted for efficiency over efficacy by operating off of the quality of life model. Haiti experienced the inverse, trading efficiency for efficacy. Waiting to distribute vaccines until they could design a rollout plan that would maximize community coverage and immunity to cholera contributed to the vaccine’s notably high efficacy rate. This lottery-style triage plan was selected because of the large amount of input solicited from community leaders, but as discussed in section 3.5, it required a two-year rollout during which over 7,000 persons died of cholera in the country.

---

187 Dr. Gal Kober (Professor of Ethics) in discussion with author, February 4, 2021.
188 Fink, “Playing God”
189 Louise C. Ivers et al, “Use of Oral Cholera Vaccine in Haiti”
190 Fink, “Playing God”
Interviewees were asked if it would be possible to synthesize these two models, taking the best of each to create a standard system of triage that maximizes both efficacy and efficiency. The resounding answer was no, not because the systems cannot be combined, but because of the bureaucracy required to standardize healthcare. “Don’t get me wrong,” Mike Skovira said during a phone interview, driving back from a late shift at Greenwich Hospital, “bureaucracy does great when regulating things like procedures and treatment guidelines. But to let bureaucrats decide how triage happens in practice? It’s impossible.”

Skovira elaborated:

The U.S. is too large to have any nationalized triage systems in place. It works with [the START Method] in Emergency Departments for simple triage, but once you get into allocation [of scarce resources], you’re looking at issues with states’ financial resources, the populations who are affected, and pre-existing issues like how SES impacts health in a region.

Dr. Richard Berkowitz echoed Skovira’s concerns with bureaucracy: “The last place you want these decisions to be made is by administrators. If you leave these decisions up to them, they’re going to be decided based on ease. It’s hard to rationalize how these decisions can be made behind a desk, while doctors work with these patients on the front lines.” He stated that the concept of utilitarianism, while a driving force behind maximizing resource allocation, does not always manifest consistently in practice.

Dr. Berkowitz, a pioneer for decades in the OB/GYN field, shared an anecdote about a time that shifted his view on the implications of the quality of life model:

Through my work, I have had numerous conversations with expecting parents about whether or not they should carry their pregnancy to term. Oftentimes, mothers were faced with learning that their child would have a condition that would cause impairment and/or require long-term care. I never made the decision for the parents, I would merely consult and provide the potential outcomes of carrying the pregnancy to term versus not. For a while I had the internal perspective that in a majority of cases, not carrying the pregnancy to term was for the best, as a means of not burdening the child with these [severe health outcomes.] But one day I was walking back from work, and I happened to pass a woman giving a speech. She had [a condition], one that I’d consulted on with expecting parents in the past. And because of this condition, she was never able to develop the ability to walk. But she was up at a podium speaking about all the wonderful opportunities she had because of this condition, and how grateful she was to be leading this life.

191 Skovira, Interview.
192 Skovira, Interview.
And at that moment, I realized that we really have no way of knowing the full scope of a life someone will lead based on [potential health outcomes].

Dr. Berkowitz’s anecdote is strong evidence that existing triage methods that integrate quality of life objectify health conditions to a fault, assuming that anything that is not a “normal” health state is subpar in experience, and therefore is less worth living. Dr. Kober backed these concerns from a bioethics perspective, noting that “standardization of care will rely heavily on algorithms, such as QALYs, which are biased against persons with disabilities, pre-existing conditions, and lower socioeconomic statuses.”

Reliance on these algorithms are dangerous, for they potentially isolate a significant portion of patients from receiving care during scarce conditions if left entirely up to bureaucracy. That being said, these arguments are not ones in favor of abandoning the quality of life model in favor of a lottery model. Dr. Kober expressed support for consideration of the model, identifying the overlying issue that the lottery model “requires patients to have similar prognoses when executing triage measures,” which is impossible to ensure in the case of MCIs. Skovira notes that, “When you’re not in the field, standardization seems easy. But each case is so unique. It requires specialized consideration and evaluation by practitioners, which just cannot be done by a panel of administrators.” He does, however, address that administrative bureaucracy does not mean standardization is impossible on local levels: “I do think that hospitals, which are able to assess the health needs of local communities, can successfully create [standardized] care practices for staff to follow in the case of these extreme events, like natural disaster or epidemics.” If pursued, these standardizations would require extensive research by local health leaders to find ways to optimize community resources and maximize positive health. But ultimately, these efforts of standardization would rely heavily on the value of adaptability, for as this thesis’ case studies have demonstrated, no one can fully predict the health burdens a community will face as the world continues to shift. “There’s no one right answer,” Dr. Berkowitz stated at the end of his interview, “It’s about how these methods are applied to a situation, and the innovation required by healthcare workers to understand what

---

194 Dr. Berkowitz, Interview.
195 Dr. Kober, Interview
196 Skovira, Interview.
a crisis requires.” And as of March 2020, the world has watched healthcare workers do just that, frantically synthesizing an array of triage practices in response to the evolving COVID-19 pandemic.

**Section 4.2: COVID-19 and the Future of Triage**

Prior to 2020, the word “triage” was not one commonly heard in day-to-day life outside of the healthcare field. However, 2020 was a year for the history books, marking the onset of the COVID-19 global pandemic. COVID-19 is a contagious disease with various symptoms, including fever, cough, fatigue, breathing difficulties, and a loss of taste and smell. While approximately 81% of those who contract COVID-19 develop mild-to-moderate symptoms, the remaining 14% develop severe symptoms involving hypoxia and dyspnea, and 5% suffer from critical symptoms like respiratory failure. As the disease sweeps through the world at an alarming rate, healthcare workers have been faced with an ongoing fear of scarcity of resources, specifically pertaining to allocation of hospital beds, ventilators, and limited medications to treat the more severe cases of COVID-19 -- all of which must be allocated according to triage systems. As of March 2021, triage response to COVID-19 has varied by states within the U.S., demonstrating a fusion between triage methods discussed in this thesis.

Regarding the allocation of ventilators, a number of states took an approach that mirrored the quality of life model. In the state of Washington, doctors are allowed to “consider withholding advanced care for patients with ‘severe congestive heart failure,’ ‘severe chronic lung disease,’ as well as other major problems with a poor prognosis for recovery.” Louisiana dictated that patients with severe dementia may be excluded from receiving treatment. Maryland’s guidelines “would score patients with a combination of factors that largely seek to assess both short-term and long-term survivability. In the event that two patients have the same estimated survivability, the scoring protocols give younger people better odds of getting treatment, with the ‘lowest priority’ given to patients 85 and older.”

---

197 Dr. Berkowitz, Interview
198 Baker and Fink, “At the Top of the Covid-19 Curve”
199 Hypoxia, a condition in which the body or a region of the body is deprived of adequate oxygen supply at the tissue level. Dyspnea, shortness of breath, a feeling of not being able to breathe
200 Baker and Fink, “At the Top of the Covid-19 Curve”
201 Baker and Fink, “At the Top of the Covid-19 Curve”
202 Baker and Fink, “At the Top of the Covid-19 Curve”
203 Baker and Fink, “At the Top of the Covid-19 Curve”
guidelines draw from the quality of life model, combining measures of survivability with QALYs, as discussed in Chapters 2 and 3. Like Memorial during Hurricane Katrina, U.S. hospitals were faced with an overwhelming number of critical COVID-19 patients with an extremely limited time frame to determine who to treat. Mirroring Memorial staff, many U.S. states opted for an efficiency tactic that would maximize the number of life years saved, evident by younger patients and those without pre-existing conditions being given priority access to care. Like the triage efforts from Katrina, these strategies were met with opposition on behalf of persons with disabilities and the geriatric population, population groups who both would be systematically ranked lower for treatment with this standardization.

A lottery model of triage appeared during May and June of 2020 as doctors were forced to answer the question of how critical medication deemed effective in treating COVID would be distributed. Explained in Douglas White et al.’s publication “A Proposed Lottery System to Allocate COVID-19 Medications:”

On May 1, 2020, the U.S. Food and Drug Administration (FDA) issued an Emergency Use Authorization for the unapproved drug remdesivir to treat hospitalized patients with severe coronavirus disease 2019 (COVID-19). The authorization was based on a preliminary report from a randomized clinical trial in 1063 patients that found that remdesivir shortened the median time to recovery from 15 days to 11 days. Anticipating immediate worldwide demand, the maker of remdesivir, Gilead Sciences, donated 1.5 million doses of remdesivir to countries affected by the pandemic, including the U.S., which received 607,000 doses (enough to treat approximately 100,000 patients). However, the U.S. and other countries have 2 major problems related to this drug. First, the supply of remdesivir is insufficient to treat all eligible patients, which has required hospitals to ration the drug. Second, there remain major gaps in knowledge about the efficacy of remdesivir, including whether it reduces mortality and what subgroups of patients may benefit the most.

Various U.S. health leaders proposed a lottery-style allocation of remdesivir. The first defense of the proposition was that without careful planning, the rollout of an emergency drug like remdesivir risks being done in an unfair manner, with certain communities gaining access to the medication faster, due to influences like wealth. Additionally, because critical cases of COVID-19 require rapid treatment, a lottery system would allow for a faster rollout of the medication. Some critics of the proposal argue that this will reduce the efficacy of the drug, taking treatment opportunities from people who could gain more QALYs.

204 White and Angus, “A Proposed Lottery System...”
from it. However, defenders of the distribution proposal argue that random allocation gives healthcare workers the additional opportunity to assess the effectiveness of the drug outside of an RCT setting.

The ongoing distribution of the COVID-19 vaccine is a fusion of the quality of life model and social worth models, as explained in Chapter 2. As section 2.4 addressed, U.S. states are taking on various methods in rolling out the COVID-19 vaccine, creating various tiers of access based on pre-existing conditions, age, and occupations. The rollout models are integrating the quality of life model’s assessments of chance of survival and QALYs with those who would have a harder recovery from COVID-19 due to pre-existing conditions, like cancer or diabetes, given earlier access to the vaccine to increase their chance of recovery. Increasing chance of survival for at-risk individuals decreases the total death rate due to COVID-19 within a population, which increases quality of health for the population as a whole. The QALY model is used to identify those who are at-risk, based on conditions like obesity or coronary artery disease, with vaccine rollout designed guided by the understanding that a COVID-19 infection is “likely to result in severe life-threatening illness or death; or acquiring COVID-19 will limit the individual’s ability to receive ongoing care or services vital to their well-being and survival; or providing adequate and timely COVID care will be particularly challenging as a result of the individual’s disability.”

This element of the quality-of-life model manifests differently than it did for ventilator allocation or the case of Memorial, for vaccines are viewed by health officials as a mechanism to equalize the quality of health of at-risk individuals, for it benefits the greater good of the society through herd immunity. Conversely, vaccine distribution accounts for occupations, with states varying in what order they provide access to each professional group. As section 3.4 explained, this is reflective of the social worth model, which gives access to scarce resources based on people’s value in a society, either in how they contribute to the greater good, or how they affect the greater healthcare system. The social worth model is particularly unique in that it accounts for how a community would be altered should certain

---

205 White and Angus, “A Proposed Lottery System...”
206 Ryan Cart and Jess Horseman, “I’m high-risk for COVID-19 and eligible for a vaccine starting Monday. What do I need to know?” *East Bay Times*, March 14, 2021
207 For an overview of how different states are distributing based on occupation, see section 3.4
pockets of occupations be unable to work due to the burden of disease, such as teachers or grocery store employees. The COVID-19 vaccine rollout is a prime example of how triage models do not exist in isolation from one another; instead, they can be combined to create innovative systems that maximize access to essential resources.

The COVID-19 pandemic demonstrates how large-scale health events require a myriad of triage responses. The pandemic is additionally evidence that the triage case studies derived from climate disasters are not narrow in application; triage will be a regular part of healthcare conversations, with scarcity proving as a challenge in the face of future infectious diseases, extreme weather events, and changes in human production of resources. As discussed in the interviews from section 4.1, triage is a complex topic, with nuances that require adaptability and innovation on the part of healthcare workers. The initial intent of this research was to determine if there was a superior form of triage that should be adopted to maximize health for U.S. communities in the face of future disasters; however, drawing from the case studies of Chapter 3 and interviews of Chapter 4, it is apparent that superiority is not the answer. Instead, triage should be treated as a complex and changing system, one that should be evaluated on a case-by-case basis by different providers to create the most optimal solutions. These evaluations will require understanding of cultural and SES factors on local, national, and international levels, and an understanding of how these factors influence health outcomes. As health conditions continue to change, so do healthcare systems and structures within them. Triage is not a static system, meant to serve as a permanent fixture of healthcare response; rather, it is as dynamic as human health, intended to evolve as we do.
Bibliography

Primary Sources

I. Interviews
https://www.wnycstudios.org/podcasts/radiolab/articles/playing-god
Kober, Gal. (Professor of Ethics). In discussion with author. February 4, 2021.

II. Texts
Fink, Sheri. Five Days at Memorial: Life and Death in a Storm-Ravaged Hospital. Large Print Press, 2016.
https://www.colleaga.org/sites/default/files/attachments/ptflowguide.pdf
Richard Pallardy, “2010 Haiti Earthquake,” Encyclopedia Britannica, 2019

III. NGO/Government Reports
Center for Disaster Philanthropy, “2020 Disasters,” 2020,
disasterphilanthropy.org/our-approach/disasters/.
https://www.cdc.gov/climateandhealth/effects/default.htm
https://www.cdc.gov/vaccines/covid-19/categories-essential-workers.html
https://www.who.int/news-room/fact-sheets/detail/cholera
https://www.preventionweb.net/files/42895_cerdthehumancostofdisastersglobalpe.pdf
https://medlineplus.gov/ency/patientinstructions/000473.htm
https://www.epa.gov/ghgemissions/overview-greenhouse-gases
https://dph.georgia.gov/covid-19-vaccine-rollout-plan

Lindsay, Rebecca and LuAnn Dahlman. “Climate Change: Global Temperature”. NOAA Climate.
August 2020.

https://climate.nasa.gov/nasa_science/science/

UNFCCC. “The Paris Agreement”. 2019,
https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

https://www.who.int/globalchange/global-campaign/cop21/en/

https://www.who.int/environmental_health_emergencies/natural_events/en/

IV. Articles


https://www.npr.org/sections/thetwo-way/2016/08/18/490468640/u-n-admits-role-in-haiti-cholera-outbreak-that-has-killed-thousands


https://www.nationalgeographic.com/environment/article/hurricane-katrina

https://www.npr.org/sections/health-shots/2013/01/12/169075448/after-bringing-cholera-to-haiti-u-n-plans-to-get-rid-of-it

Thompson, Andrea. “Was There a Link between Climate Change and Hurricane Katrina?” Grist. 27 Aug. 2015.
grist.org/climate-energy/was-there-a-link-between-climate-change-and-hurricane-katrina/

V. Journals


**Secondary Sources**

I. **Histography**


II. **Theory**

http://www.jstor.org/stable/j.ctt1wc7r6j.5.
https://www.nwf.org/-/media/ Documents/PDFs/Environmental-Threats/Climate-Change-Natural-Disasters-fact-sheet.ashx
https://plato.stanford.edu/entries/implicit-bias
https://ssir.org/articles/entry/measuring_social_value